



**GENERAL REQUIREMENTS  
AND  
TECHNICAL SPECIFICATIONS  
FOR  
HARDEVILLE HAULING  
FACILITY**

**PREPARED FOR:  
WASTE MANAGEMENT OF SOUTH  
CAROLINA, INC.**

**J – 26810.0001**

**OCTOBER, 2017**

## TABLE OF CONTENTS

### PAGE NUMBERS

#### GENERAL REQUIREMENTS

|       |                                     |         |   |          |
|-------|-------------------------------------|---------|---|----------|
| 00710 | Special Conditions                  | 00710-1 | – | 00710-6  |
| 01012 | Soil Investigation Data for Bidders | 01012-1 | – | 01012-1  |
| 01300 | Submittals                          | 01300-1 | – | 01300-11 |
| 01400 | Quality Control                     | 01400-1 | – | 01400-3  |
| 01410 | Testing Services                    | 01410-1 | – | 01410-6  |
| 01702 | Contract Closeout                   | 01702-1 | – | 01702-4  |
| 01730 | Operation and Maintenance           | 01730-1 | – | 01730-5  |
| 01740 | Warranties                          | 01740-1 | – | 01740-2  |
| 01741 | Bonds                               | 01741-1 | – | 01741-2  |

#### TECHNICAL PROVISIONS

|         |                                                            |           |   |            |
|---------|------------------------------------------------------------|-----------|---|------------|
| 02110   | Site Clearing                                              | 02110-1   | – | 02110-3    |
| 02111   | Site Preparation                                           | 02111-1   | – | 02111-2    |
| 02204   | Earthwork                                                  | 02204-1   | – | 02204-6    |
| 02210   | Soil Erosion Control                                       | 02210-1   | – | 02210-5    |
| 02231   | Aggregate Base Course                                      | 02231-1   | – | 02231-7    |
| 02275   | Rip-Rap                                                    | 02275-1   | – | 02275-3    |
| 02511   | Asphaltic Concrete Base Course                             | 02511-1   | – | 02511-6    |
| 02512SC | Asphaltic Concrete Binder/Surface Courses (South Carolina) | 02512SC-1 | – | 02512SC-7  |
| 02570   | Traffic Control                                            | 02570-1   | – | 02570-3    |
| 02577   | Traffic Striping                                           | 02577-1   | – | 02577-4    |
| 02667SC | Water Distribution System (South Carolina)                 | 02667SC-1 | – | 02667SC-21 |
| 02720   | Storm Drainage                                             | 02720-1   | – | 02720-14   |
| 02731   | Wastewater Collection System                               | 02731-1   | – | 02731-27   |
| 02890   | Traffic Signs                                              | 02890-1   | – | 02890-3    |
| 02902   | Grassing                                                   | 02902-1   | – | 02902-8    |
| 03305   | Site Concrete                                              | 03305-1   | – | 03305-11   |

## **SECTION 01012**

### **SOIL INVESTIGATION DATA FOR BIDDERS**

| <b>Paragraph</b>        | <b>Title</b>            | <b>Page</b> |
|-------------------------|-------------------------|-------------|
| <b>PART 1 – GENERAL</b> |                         |             |
| 1.1                     | Description             | 01012–1     |
| 1.2                     | Soil Investigation Data | 01012–1     |

#### **PART 2 – PRODUCTS**

See attached report.

#### **PART 3 – EXECUTION**

None in this Section

**SECTION 01012****SOIL INVESTIGATION DATA FOR BIDDERS****PART 1 – GENERAL****1.1 DESCRIPTION**

- A. This section includes subsurface data logs for information only.

**1.2 SOIL INVESTIGATION DATA**

- A. Subsurface data logs are available for information only. Actual conditions may vary. If bidders are not satisfied with accuracy and completeness of all available data, they are at liberty to make borings or perform soil investigation work for their own use at its expense. If Contractor chooses to perform their own investigation, work shall be coordinated with the Engineer. Any results from Contractor's investigation shall be shared promptly with the Engineer. Owner reserves the right to share Contractor's investigation data with other potential bidders if information could affect bidding process.
- B. The boring logs and test results are for information of the Contractor. Owner and Engineer assume no responsibility for the information.

**PART 2 – PRODUCTS**

See attached report.

**PART 3 – EXECUTION**

None this Section.

**END OF SECTION**

**INDEX TO**  
**DIVISION I – GENERAL REQUIREMENTS**  
**SECTION 01300**  
**SUBMITTALS**

| <b>Paragraph</b>        | <b>Title</b>                    | <b>Page</b> |
|-------------------------|---------------------------------|-------------|
| <b>PART 1 – GENERAL</b> |                                 |             |
| 1.1                     | Section Includes                | 01300–1     |
| 1.2                     | Related Sections                | 01300–1     |
| 1.3                     | Submittal Procedures            | 01300–1     |
| 1.4                     | Construction Progress Schedules | 01300–2     |
| 1.5                     | Product Data                    | 01300–2     |
| 1.6                     | Shop Drawings                   | 01300–3     |
| 1.7                     | Samples                         | 01300–4     |
| 1.8                     | Design Data                     | 01300–4     |
| 1.9                     | Test Reports                    | 01300–4     |
| 1.10                    | Certificates                    | 01300–4     |
| 1.11                    | Manufacturer's Instructions     | 01300–5     |
| 1.12                    | Manufacturer's Field Reports    | 01300–5     |
| 1.13                    | Erection Drawings               | 01300–5     |
| 1.14                    | Reviewed Shop Drawings          | 01300–5     |
| 1.15                    | Submittal Checklist             | 01300–6     |

**PART 2 – PRODUCTS**

Not Used.

**PART 3 – EXECUTION**

Not Used.

**DIVISION I – GENERAL REQUIREMENTS****SECTION 01300 – SUBMITTALS****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Product Data.
- D. Shop Drawings.
- E. Samples.
- F. Design data.
- G. Test reports.
- H. Certificates.
- I. Manufacturer's instructions.
- J. Manufacturer's field reports.
- K. Erection drawings.

**1.2 RELATED SECTIONS**

- A. Section 01400 – Quality Control: Manufacturers' field services and reports.
- B. Section 01702 – Closeout Procedures: Contract warranties, manufacturers' certificates, closeout submittals.

**1.3 SUBMITTAL PROCEDURES**

- A. Transmit each submittal with Engineer accepted form.
- B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix. Resubmit as specified for initial submittal. Indicate on revised drawings all changes that have been made other than those requested by the Engineer.
- C. Identify Project, Contractor, Subcontractor, or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
- D. Apply Contractor's stamp, signed or initialed verifying review, approval, products required, field dimensions, adjacent construction Work, and coordination of

information is in accordance with the requirements of the Work and Contract Documents. Submittal without the Contractor's stamp will be returned to Contractor without Engineer's review.

- E. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for reviews, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal. Coordinate submission of related items. For each submittal for review, allow fifteen days (15) days excluding delivery time to and from the Contractor.
- F. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed Work.
- G. Provide space for Contractor and Architect/Engineer review stamps.
- H. When revised for resubmission, identify all changes made since previous submission.
- I. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

#### **1.4 CONSTRUCTION PROGRESS SCHEDULES**

- A. Submit initial schedule in duplicate within fifteen (15) days after date of Owner-Contractor Agreement.
- B. Revise and resubmit as required.
- C. Submit revised schedules as necessary identifying changes since previous version.
- D. Submit a computer generated or horizontal bar chart with separate line for each major portion of Work or operation identifying first work day of each week.
- E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.
- F. Indicate estimated percentage of completion for each item of Work at each submission.
- G. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by allowances.

#### **1.5 PRODUCT DATA**

- A. Product Data for Review:

1. Submitted to Engineer for review and conformance with information given in specifications and the design concept expressed in contract documents.
  2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article above.
- B. Submit the number of copies Contractor and Owner require, plus two copies retained by Engineer.
  - C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
  - D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
  - E. After review, distribute in accordance with the Submittal Procedures article above.

## 1.6 SHOP DRAWINGS

- A. Contractor shall submit a minimum six (6) copies of each shop drawing to the Engineer for review.
- B. Submitted to Engineer for review and conformance with information given in specifications and design concept expressed in contract documents. Review of shop drawings by Engineer shall not relieve Contractor of its responsibility for accuracy of shop drawings nor for furnishing of all materials and equipment required by the contract even though such items may not be indicated on shop drawings reviewed by Engineer.
- C. Shop drawings shall include applicable technical information, drawings, diagrams, performance curves, schedules, templates, calculations, instructions, measurements, and similar information as applicable to the specific item for which shop drawing is prepared.
- D. Do not use Engineer's Drawings for shop or erection purposes.
- E. Each shop drawing copy shall bear a Contractor's stamp showing they have been checked. Shop drawings submitted to the Engineer without Contractor's stamp will be returned to Contractor without review.

No review will be given to partial submittals of shop drawings for items which interconnect and/or are interdependent. It is the Contractor's responsibility to assemble shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to Engineer.

Schedule of Submittals: Within 30 days of Contract award and prior to any shop drawing submittal, Contractor shall submit a schedule showing the estimated submittal date and desired acceptance date for each shop drawing

anticipated. Time lost due to unacceptable submittals shall be the Contractor's responsibility.

## **1.7 SAMPLES**

- A. Samples for Review:
  - 1. Submitted to Engineer for review and conformance with information given in specifications and design concept expressed in contract documents.
  - 2. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article above.
- B. Samples for Information:
  - 1. Submitted for Engineer's knowledge as contract administrator or for the Owner.
- C. Include identification on each sample, with full product information.
- D. Submit the number of samples specified in individual specification sections; one (1) of which will be retained by Engineer.
- E. Reviewed samples which may be used in the Work are indicated in individual specification sections.
- F. Samples will not be used for testing purposes unless specifically stated in the specification section.

## **1.8 DESIGN DATA**

- A. Submit for Engineer's knowledge as contract administrator or for the Owner.
- B. Submit for information and conformance with information given in specifications and design concept expressed in contract documents.

## **1.9 TEST REPORTS**

- A. Submit for Engineer's knowledge as contract administrator or for the Owner.
- B. Submit test reports for information and assessing conformance with information given in specifications and design concept expressed in contract documents.

## **1.10 CERTIFICATES**

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or the Contractor to Engineer, in quantities specified for Product Data.
- 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.

#### **1.11 MANUFACTURER'S INSTRUCTIONS**

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for product Data.
- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- C. Refer to Section 01400 – Quality Control, Manufacturers' Field Services article.

#### **1.12 MANUFACTURER'S FIELD REPORTS**

- A. Submit reports for Engineer's benefit as contract administrator or for the Owner.
- B. Submit report in duplicate within thirty (30) days of observation to Engineer for information.
- C. Submit for information and assessing conformance with information given in specifications and design concept expressed in contract documents.

#### **1.13 ERECTION DRAWINGS**

- A. Submit drawings for Engineer's benefit as contract administrator or for the Owner.
- B. Submit for information and assessing conformance with information given in specifications and design concept expressed in contract documents.
- C. Data indicating inappropriate or unacceptable Work may be subject to action by the Engineer or Owner.

#### **1.14 REVIEWED SHOP DRAWINGS**

- A. Engineer Review.
  - 1. Acceptable submittals will be marked "No Exceptions Taken." A minimum of three copies will be retained by the Engineer for Engineer's and Owner's use and remaining copies will be returned to Contractor.
  - 2. Submittals requiring minor corrections before the product is acceptable will be marked "Furnish as Corrected." Contractor may order, fabricate, and ship items included in submittals, provided the indicated corrections are made.
  - 3. Submittals marked "Revise and Resubmit" must be revised to reflect required changes and the initial review procedure repeated.
  - 4. The "Rejected" notation is used to indicate products not acceptable. Upon return of a submittal so marked, Contractor shall repeat the initial review procedure utilizing acceptable products.

5. Only two copies of items marked "Revise and Resubmit" and "Rejected" will be reviewed and marked. One copy will be retained by Engineer and the other copy with all remaining unmarked copies will be returned to Contractor for resubmittal.
- B. No Work or products shall be installed without a drawing or submittal bearing the "No Exceptions Taken" or "Furnish as Corrected" notation. Contractor shall maintain at the job site a complete set of shop drawings bearing Engineer's stamp.
- C. Substitutions: In the event Contractor obtains Engineer's acceptance for use of products other than those listed first in Contract Documents, Contractor shall, at Contractor's own expense and using methods accepted by Engineer, make any changes to structures, piping and electrical work necessary to accommodate these products.
- D. Use of "No Exceptions Taken" or "Furnish as Corrected" notation on shop drawings or other submittals is general and shall not relieve Contractor of the responsibility of furnishing products of proper dimension, size, quality, quantity, materials, all performance characteristics, and to efficiently perform requirements and intent of Contract Documents. Engineer's review shall not relieve Contractor of the responsibility of errors of any kind on shop drawings. Review is intended only to assure conformance with design concept of the project and compliance with information given in Contract Documents.

#### 1.15 SUBMITTAL CHECKLIST

- A. This checklist is not necessarily complete. Contractor is responsible to submit all items and materials as specified in each section.

| Section                              | Submittal  | Date Received by T & H | Accepted Submittal Returned to Owner/Contractor | Submittal Rejected & Returned | Comments |
|--------------------------------------|------------|------------------------|-------------------------------------------------|-------------------------------|----------|
| <b>02204 – Earthwork</b>             |            |                        |                                                 |                               |          |
|                                      | Borrow     |                        |                                                 |                               |          |
| <b>02210 – Soil Erosion Control</b>  |            |                        |                                                 |                               |          |
|                                      | Silt Fence |                        |                                                 |                               |          |
| <b>02231 – Aggregate Base Course</b> |            |                        |                                                 |                               |          |
|                                      | Aggregate  |                        |                                                 |                               |          |
|                                      | Prime      |                        |                                                 |                               |          |
| <b>02275 – Rip-Rap</b>               |            |                        |                                                 |                               |          |
|                                      | Stone      |                        |                                                 |                               |          |

| Section                                                                                                          | Submittal                   | Date Received by T & H | Accepted Submittal Returned to Owner/Contractor | Submittal Rejected & Returned | Comments |
|------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------|-------------------------------------------------|-------------------------------|----------|
|                                                                                                                  | Sand-Cement Bag             |                        |                                                 |                               |          |
|                                                                                                                  | Filter Fabric               |                        |                                                 |                               |          |
| <b>02511 – Asphaltic Concrete Base Course</b>                                                                    |                             |                        |                                                 |                               |          |
|                                                                                                                  | Asphalt Cement              |                        |                                                 |                               |          |
|                                                                                                                  | Anti-Stripping Agent        |                        |                                                 |                               |          |
|                                                                                                                  | Mix Design                  |                        |                                                 |                               |          |
| <b>02512 – Asphaltic Concrete Binder/Surface Courses</b>                                                         |                             |                        |                                                 |                               |          |
|                                                                                                                  | Tack Coat                   |                        |                                                 |                               |          |
|                                                                                                                  | Asphalt Cement              |                        |                                                 |                               |          |
|                                                                                                                  | Anti-Stripping Agent        |                        |                                                 |                               |          |
|                                                                                                                  | Mix Designs                 |                        |                                                 |                               |          |
| <b>02667 – Water Distribution System 02667SC – Water Distribution System 02667BC – Water Distribution System</b> |                             |                        |                                                 |                               |          |
|                                                                                                                  | PVC Pipe – 4"Ø and Larger   |                        |                                                 |                               |          |
|                                                                                                                  | PVC Pipe – Smaller than 4"Ø |                        |                                                 |                               |          |
|                                                                                                                  | D.I. Pipe                   |                        |                                                 |                               |          |
|                                                                                                                  | Tubing for Service Lateral  |                        |                                                 |                               |          |
|                                                                                                                  | Fittings – PVC              |                        |                                                 |                               |          |
|                                                                                                                  | Fittings – Compact D.I.     |                        |                                                 |                               |          |
|                                                                                                                  | Gate Valve                  |                        |                                                 |                               |          |
|                                                                                                                  | 2" Ball Valves              |                        |                                                 |                               |          |
|                                                                                                                  | Air Release Valve           |                        |                                                 |                               |          |
|                                                                                                                  | Air/Vacuum Valve            |                        |                                                 |                               |          |

| Section                       | Submittal                                         | Date Received by T & H | Accepted Submittal Returned to Owner/Contractor | Submittal Rejected & Returned | Comments |
|-------------------------------|---------------------------------------------------|------------------------|-------------------------------------------------|-------------------------------|----------|
|                               | Combination Air Valve                             |                        |                                                 |                               |          |
|                               | Corporation Stops                                 |                        |                                                 |                               |          |
|                               | Curb Stops                                        |                        |                                                 |                               |          |
|                               | Magnetic Marking Tape                             |                        |                                                 |                               |          |
|                               | Valve Boxes                                       |                        |                                                 |                               |          |
|                               | Valve Box Collar                                  |                        |                                                 |                               |          |
|                               | Hydrant Tees                                      |                        |                                                 |                               |          |
|                               | Threaded Rod with Bitumastic Coating and Painting |                        |                                                 |                               |          |
|                               | Fire Hydrants                                     |                        |                                                 |                               |          |
|                               | Restrained Joint Fittings                         |                        |                                                 |                               |          |
|                               | Service Saddles                                   |                        |                                                 |                               |          |
|                               | Tapping Sleeves/Crosses                           |                        |                                                 |                               |          |
|                               | Tapping Valves                                    |                        |                                                 |                               |          |
|                               | Backflow Prevention Devices                       |                        |                                                 |                               |          |
|                               | Tracing Wire                                      |                        |                                                 |                               |          |
|                               | Service Pipe/Tubing                               |                        |                                                 |                               |          |
|                               | Casing Pipe                                       |                        |                                                 |                               |          |
| <b>02720 – Storm Drainage</b> |                                                   |                        |                                                 |                               |          |
|                               | Reinforced Concrete Pipe                          |                        |                                                 |                               |          |
|                               | Aluminum Pipe                                     |                        |                                                 |                               |          |
|                               | Polyethylene Pipe                                 |                        |                                                 |                               |          |

| Section                                     | Submittal                   | Date Received by T & H | Accepted Submittal Returned to Owner/Contractor | Submittal Rejected & Returned | Comments |
|---------------------------------------------|-----------------------------|------------------------|-------------------------------------------------|-------------------------------|----------|
|                                             | Gaskets                     |                        |                                                 |                               |          |
|                                             | Drainage Structures         |                        |                                                 |                               |          |
|                                             | Fiberglass Grating          |                        |                                                 |                               |          |
|                                             | Frames, Covers & Grates     |                        |                                                 |                               |          |
|                                             | Subgrade Drain pipe         |                        |                                                 |                               |          |
|                                             | Filter Fabric               |                        |                                                 |                               |          |
|                                             | Tracing Wire                |                        |                                                 |                               |          |
| <b>02731 – Wastewater Collection System</b> |                             |                        |                                                 |                               |          |
|                                             | Wetwell                     |                        |                                                 |                               |          |
|                                             | Manholes & Interior Coating |                        |                                                 |                               |          |
|                                             | Boots and S.S. Straps       |                        |                                                 |                               |          |
|                                             | Joint Wrap                  |                        |                                                 |                               |          |
|                                             | Joint Sealant               |                        |                                                 |                               |          |
|                                             | Steps                       |                        |                                                 |                               |          |
|                                             | Piping – PVC – Gravity      |                        |                                                 |                               |          |
|                                             | Piping – PVC – Force Main   |                        |                                                 |                               |          |
|                                             | Piping – DI – Gravity       |                        |                                                 |                               |          |
|                                             | Piping – DI – Force Main    |                        |                                                 |                               |          |
|                                             | Fittings – PVC – Gravity    |                        |                                                 |                               |          |
|                                             | Fittings DI – Force Main    |                        |                                                 |                               |          |
|                                             | Frames & Covers             |                        |                                                 |                               |          |
|                                             | Valve Pit and Steps         |                        |                                                 |                               |          |

| Section | Submittal                                          | Date Received by T & H | Accepted Submittal Returned to Owner/Contractor | Submittal Rejected & Returned | Comments |
|---------|----------------------------------------------------|------------------------|-------------------------------------------------|-------------------------------|----------|
|         | Valve Pit Hatch Cover                              |                        |                                                 |                               |          |
|         | Wetwell Hatch Cover                                |                        |                                                 |                               |          |
|         | Pumps and Controls                                 |                        |                                                 |                               |          |
|         | Control Panel Enclosure and Mounting Materials     |                        |                                                 |                               |          |
|         | Frost-Proof Hydrant                                |                        |                                                 |                               |          |
|         | Backflow Prevention Device                         |                        |                                                 |                               |          |
|         | Fencing and Gate Hardware                          |                        |                                                 |                               |          |
|         | Gate Valves/Plug Valves                            |                        |                                                 |                               |          |
|         | Check Valves                                       |                        |                                                 |                               |          |
|         | Air Release/Vacuum Valves                          |                        |                                                 |                               |          |
|         | Vent Pipe                                          |                        |                                                 |                               |          |
|         | Hoist and Hoist Sockets                            |                        |                                                 |                               |          |
|         | Lifting Chain/Cable                                |                        |                                                 |                               |          |
|         | Pumps Mounts/Intermediate and Upper Guide Brackets |                        |                                                 |                               |          |
|         | Quick Disconnect                                   |                        |                                                 |                               |          |
|         | Electrical W/Generator Hook-up                     |                        |                                                 |                               |          |
|         | Tracing Wire                                       |                        |                                                 |                               |          |
|         | Magnetic Tape                                      |                        |                                                 |                               |          |
|         | Force Main Gauges                                  |                        |                                                 |                               |          |

| Section                      | Submittal                    | Date Received by T & H | Accepted Submittal Returned to Owner/Contractor | Submittal Rejected & Returned | Comments |
|------------------------------|------------------------------|------------------------|-------------------------------------------------|-------------------------------|----------|
|                              | Signage (Emergency #'s etc.) |                        |                                                 |                               |          |
| <b>02902 – Grassing</b>      |                              |                        |                                                 |                               |          |
|                              | Seed Mix – Temporary         |                        |                                                 |                               |          |
|                              | Seed Mix – Permanent         |                        |                                                 |                               |          |
|                              | Fertilizer                   |                        |                                                 |                               |          |
|                              | Lime                         |                        |                                                 |                               |          |
| <b>03305 – Site Concrete</b> |                              |                        |                                                 |                               |          |
|                              | Mix Design                   |                        |                                                 |                               |          |
|                              | Curing Compounds             |                        |                                                 |                               |          |
|                              | Joint Filler                 |                        |                                                 |                               |          |
|                              | Reinforcing Steel            |                        |                                                 |                               |          |
|                              | Welded Wire Fabric           |                        |                                                 |                               |          |
|                              | Dowels                       |                        |                                                 |                               |          |
|                              | Fiber Reinforcement          |                        |                                                 |                               |          |

**PART 2 – PRODUCTS**

Not Used.

**PART 3 – EXECUTION**

Not Used.

END OF SECTION

**INDEX TO**  
**SECTION 01400 – QUALITY CONTROL**

| <b>Paragraph</b>          | <b>Title</b>                                | <b>Page</b> |
|---------------------------|---------------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                                             |             |
| 1.1                       | Section Includes                            | 01400–1     |
| 1.2                       | Related Sections                            | 01400–1     |
| 1.3                       | Quality Assurance – Control of Installation | 01400–1     |
| 1.4                       | Tolerance                                   | 01400–1     |
| 1.5                       | References and Standards                    | 01400–2     |
| 1.6                       | Testing Services                            | 01400–2     |
| 1.7                       | Manufacturer’s Field Services               | 01400–3     |
| <b>PART 2 – PRODUCTS</b>  |                                             |             |
|                           | Not Used                                    |             |
| <b>PART 3 – EXECUTION</b> |                                             |             |
| 3.1                       | Examination                                 | 01400–3     |
| 3.2                       | Preparation                                 | 01400–3     |

**SECTION 01400**  
**QUALITY CONTROL**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Quality assurance – control of installation.
- B. Tolerances
- C. References and standards.
- D. Testing laboratory services.
- E. Manufacturer's field services.

**1.2 RELATED SECTIONS**

- A. Section 01300 – Submittals: Submission of manufacturer's instructions and certificates.
- B. Section 01410 – Testing Services.

**1.3 QUALITY ASSURANCE – 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 manufacturer's instructions, including each step-in sequence.
- C. Should manufacturer's 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 the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

**1.4 TOLERANCES**

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

- B. Comply with manufacturer's tolerances. Should manufacturer's tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- C. Adjust products to appropriate dimensions and position before securing in place.
- D. Accessible routes shall not exceed maximum ADA allowable slopes.

## **1.5 REFERENCES AND STANDARDS**

- A. For products or workmanship specified by association, trade, or other consensus standards, complies with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current with date specified in the individual specification sections, except where a specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. Neither the contractual relationships, duties, nor responsibilities of the parties in Contract or those of the Architect/Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

## **1.6 TESTING SERVICES**

- A. Contractor will appoint and employ services of an independent firm to perform testing. Contractor shall pay for testing services required by the specifications.
- B. The independent firm will perform tests and other services specified in individual specification sections and as required by the Owner.
- C. Testing and source quality control may occur on or off the project site. Perform off-site testing as required by the Owner.
- D. Reports will be submitted by the independent firm to the Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
  - 1. Notify Architect/Engineer and independent firm 48 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.
- F. Testing does not relieve Contractor to perform Work to contract requirements.\
- G. Re-testing required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Engineer. Payment for re-testing will be made by the Contractor.

**1.7 MANUFACTURER'S FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect/Engineer fifteen (15) days in advance of required observations. Observer subject to approval of Owner.
- C. Report observations and site decisions or instructions given to applicators or installers supplemental or contrary to manufacturer's written instructions.
- D. Refer to Section 01300 – SUBMITTALS, MANUFACTURER'S FIELD REPORTS article.

**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 the correct characteristics, and in the 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 any new material or substance in contact or bond.

END OF SECTION

**INDEX TO**  
**SECTION 01410 – TESTING SERVICES**

| <b>Paragraph</b>        | <b>Title</b>                    | <b>Page</b> |
|-------------------------|---------------------------------|-------------|
| <b>PART 1 – GENERAL</b> |                                 |             |
| 1.1                     | Section Includes                | 01410–1     |
| 1.2                     | Related Sections                | 01410–1     |
| 1.3                     | References                      | 01410–1     |
| 1.4                     | Selection and Payment           | 01410–2     |
| 1.5                     | Quality Assurance               | 01410–2     |
| 1.6                     | Contractor Submittal            | 01410–2     |
| 1.7                     | Testing Agency Responsibilities | 01410–3     |
| 1.8                     | Testing Agency Reports          | 01410–3     |
| 1.9                     | Limits on Testing Authority     | 01410–3     |
| 1.10                    | Contractor Responsibilities     | 01410–4     |
| 1.11                    | Schedule of Tests               | 01410–4     |

**PART 2 – PRODUCTS**

Not Used.

**PART 3 – EXECUTION**

Not Used.

## **SECTION 01410**

### **TESTING SERVICES**

#### **PART 1 – GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Selection and payment.
- B. Contractor submittals.
- C. Testing agency responsibilities.
- D. Testing agency reports.
- E. Limits on testing authority.
- F. Contractor responsibilities.
- G. Schedule of tests.

##### **1.2 RELATED SECTIONS**

- A. Testing and approvals required by public authorities.
- B. Section 01300 – Submittals: Manufacturer's certificates.
- C. Section 01702 – Contract Closeout: Project record documents.
- D. Section 01400 – Quality Control

##### **1.3 REFERENCES (LATEST REVISION)**

- A. ASTM C 802 – Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction Materials.
- B. ASTM C 1077 – Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- C. ASTM C 1093 – Practice for Accreditation of Testing Agencies for Masonry.
- D. ASTM D 3740 – Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- E. ASTM D 4561 – Practice for Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials.
- F. ASTM E 329 – Specification for Agencies Engaged in Construction Inspection and/or Testing.
- G. ASTM E 543 – Practice for Agencies Performing Nondestructive Testing.

- H. ASTM E 548 – Guide for General Criteria Used for Evaluating Laboratory Competence.
- I. ASTM E 699 – Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.

#### **1.4 SELECTION AND PAYMENT**

- A. Employment and payment by Contractor for services of an independent testing agency or laboratory to perform specified testing.
- B. Employment of testing agency or laboratory in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

#### **1.5 QUALITY ASSURANCE**

- A. Comply with requirements of practices listed in paragraph 1.3.
- B. Laboratory: Authorized to operate in State in which project is located.
- C. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

#### **1.6 CONTRACTOR SUBMITTALS**

- A. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered Engineer and responsible officer.
- B. 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 any deficiencies reported by the inspection.

#### **1.7 TESTING AGENCY RESPONSIBILITIES**

- A. Test samples of mixes submitted by Contractor.
- B. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.
- C. Perform specified sampling and testing of products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.

- F. Perform additional tests required by Engineer.
- G. Attend preconstruction meetings and progress meetings.

#### **1.8 TESTING AGENCY REPORTS**

- A. After each test, promptly submit two (2) copies of report to Engineer and to Contractor.
- B. Include:
  - 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 the Project.
  - 7. Type of inspection or test.
  - 8. Date of test.
  - 9. Results of tests.
  - 10. Conformance with Contract Documents.
- C. When requested by Engineer, provide interpretation of test results.

#### **1.9 LIMITS ON TESTING AUTHORITY**

- A. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Agency or laboratory may not approve or accept any portion of the Work.
- C. Agency or laboratory may not assume any duties of Contractor.
- D. Agency or laboratory has no authority to stop the Work.

#### **1.10 CONTRACTOR RESPONSIBILITIES**

- A. Deliver to agency or laboratory at designated location, adequate samples of materials proposed to be used requiring testing, along with proposed mix designs.
- B. Cooperate with laboratory personnel, and provide access to the Work.
- C. Provide incidental labor and facilities:
  - 1. To provide access to Work to be tested.
  - 2. To obtain and handle samples at the site or at source of products to be tested.
  - 3. To facilitate tests.
  - 4. To provide storage and curing of test samples.
- D. Notify Engineer and laboratory 48 hours prior to expected time for operations requiring testing services.

- E. Employ services of an independent qualified testing laboratory and pay for additional samples and tests required by Contractor beyond specified requirements.

### 1.11 SCHEDULE OF TESTS

| Section                                                  | Test                           | Frequency                                                                                                                               | Date | Performed By | Notes |
|----------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------|--------------|-------|
| <b>02204 – Earthwork</b>                                 |                                |                                                                                                                                         |      |              |       |
|                                                          | Compaction                     |                                                                                                                                         |      |              |       |
|                                                          | Unpaved                        | 1 test per horizontal layer per 10,000 sf of fill area                                                                                  |      |              |       |
|                                                          | Paved                          | 1 test per horizontal layer per 5,000 sf of subgrade                                                                                    |      |              |       |
|                                                          | Building Pad                   | 1 test per horizontal layer per 1,500 sf of fill area                                                                                   |      |              |       |
|                                                          | Curb & gutter                  | 1 test per 300 lf                                                                                                                       |      |              |       |
|                                                          | Proof Rolling                  | As necessary                                                                                                                            |      |              |       |
| <b>02231 – Aggregate Base Course</b>                     |                                |                                                                                                                                         |      |              |       |
|                                                          | Base Density                   | 1 test per 5,000 sf                                                                                                                     |      |              |       |
| <b>02237 – Soil Cement Base Course</b>                   |                                |                                                                                                                                         |      |              |       |
|                                                          | Compressive Strength           | 1 test per 5,000 sf                                                                                                                     |      |              |       |
|                                                          | Base Density                   | 1 test per 5,000 sf                                                                                                                     |      |              |       |
| <b>02511 – Asphaltic Concrete Base Course</b>            |                                |                                                                                                                                         |      |              |       |
|                                                          | Asphalt Extraction & Gradation | 1 test per each 250 tons placed                                                                                                         |      |              |       |
|                                                          | Marshall Stability             | 1 test per each 250 tons placed                                                                                                         |      |              |       |
|                                                          | Core                           | 1 test for each 250 tons placed                                                                                                         |      |              |       |
|                                                          | Field Density                  | 1 test per 5,000 sf                                                                                                                     |      |              |       |
| <b>02512 – Asphaltic Concrete Binder/Surface courses</b> |                                |                                                                                                                                         |      |              |       |
|                                                          | Asphalt Extraction & Gradation | 1 test for each 250 tons placed                                                                                                         |      |              |       |
|                                                          | Marshall Stability             | 1 test for each 250 tons placed                                                                                                         |      |              |       |
|                                                          | Field Density                  | 1 test for each 250 tons placed                                                                                                         |      |              |       |
|                                                          | Cores                          | 1 test for each 250 tons placed                                                                                                         |      |              |       |
| <b>02667 – Water Distribution System</b>                 |                                |                                                                                                                                         |      |              |       |
|                                                          | Hydrostatic & Leakage          | 1.5 times the working pressure (no less than 150 psi). Conducted for 2 hours with maintained pressure of 150 psi (200 psi on fire main) |      |              |       |
|                                                          | Bacteriologic al Samples       | 2 taken 24 hours apart after disinfection                                                                                               |      |              |       |
|                                                          | Compaction                     |                                                                                                                                         |      |              |       |

| Section                                     | Test                            | Frequency                                                                         | Date | Performed By | Notes |
|---------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------|------|--------------|-------|
|                                             | Traffic Areas                   | 1 per 100 lf or less for each 4 ft. of depth                                      |      |              |       |
|                                             | Non-Traffic Areas               | 1 per 500 lf or less for each 4 ft. of depth                                      |      |              |       |
|                                             | Fire Flow                       | 1 per permit                                                                      |      |              |       |
| <b>02720 – Storm Drainage</b>               |                                 |                                                                                   |      |              |       |
|                                             | Compaction                      |                                                                                   |      |              |       |
|                                             | Traffic Areas                   | 1 per 100 lf or less for each 4 ft. of depth                                      |      |              |       |
|                                             | Non-Traffic                     | 1 per 500 lf or less for each 6 ft. of depth                                      |      |              |       |
| <b>02731 – Wastewater Collection System</b> |                                 |                                                                                   |      |              |       |
|                                             | Start-up                        | Prior to acceptance of Pump Station                                               |      |              |       |
|                                             | Drawdown                        | Prior to acceptance of Pump Station                                               |      |              |       |
|                                             | Certification                   | Completion                                                                        |      |              |       |
|                                             | Warranty                        | Completion                                                                        |      |              |       |
|                                             | Television Inspection of Sewers | As requested                                                                      |      |              |       |
|                                             | Leakage                         | As necessary                                                                      |      |              |       |
|                                             | Compaction                      |                                                                                   |      |              |       |
|                                             | Traffic Areas                   | 1 per 100 lf or less for each 4 ft. of depth                                      |      |              |       |
|                                             | Non-Traffic Areas               | 1 per 500 lf or less for each 6 ft. of depth                                      |      |              |       |
|                                             | Gravity – Air                   | All lines                                                                         |      |              |       |
|                                             | Hydrostatic – Force Main        | 100 psi for 2 hours                                                               |      |              |       |
|                                             | Deflection                      | 10% of system                                                                     |      |              |       |
| <b>03305 – Site Concrete</b>                |                                 |                                                                                   |      |              |       |
|                                             | Mix Designs                     | 1 per mix design                                                                  |      |              |       |
|                                             | Compressive Strength            | 3 test cylinders for every 50 cubic yards or less of each mix design placed daily |      |              |       |
|                                             |                                 | 1 cylinder broken at 7 days                                                       |      |              |       |
|                                             |                                 | 2 cylinders broken at 28 days                                                     |      |              |       |
|                                             | Slump                           | 1 test for each set of cylinders taken                                            |      |              |       |

## PART 2 – PRODUCTS

Not Used.

**PART 3 – EXECUTION**

Not Used.

END OF SECTION

**INDEX TO**  
**SECTION 01702 – CONTRACT CLOSEOUT**

| <b>Paragraph</b>          | <b>Title</b>                         | <b>Page</b> |
|---------------------------|--------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                                      |             |
| 1.1                       | Section Includes                     | 01702-1     |
| 1.2                       | Related Sections                     | 01702-1     |
| 1.3                       | Closeout Procedures                  | 01702-1     |
| 1.4                       | Final Cleaning                       | 01702-1     |
| 1.5                       | Adjusting                            | 01702-1     |
| 1.6                       | Project Record Documents             | 01702-2     |
| 1.7                       | Operation and Maintenance Data       | 01702-2     |
| 1.8                       | Spare Parts and Maintenance Products | 01702-3     |
| 1.9                       | Warranties and Bonds                 | 01702-3     |
| 1.10                      | Maintenance Service                  | 01702-4     |
| <b>PART 2 – PRODUCTS</b>  |                                      |             |
|                           | Not Used                             |             |
| <b>PART 3 – EXECUTION</b> |                                      |             |
|                           | Not Used                             |             |

**SECTION 01702**  
**CONTRACT CLOSEOUT**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Closeout procedures.
- B. Project record documents.
- C. Operation and maintenance data.
- D. Warranties and bonds.
- E. Maintenance service.

**1.2 RELATED SECTIONS**

- A. Section 01300 – Submittals
- B. Operation and Maintenance Data.
- C. Warranties.
- D. Bonds.

**1.3 CLOSEOUT PROCEDURES**

- A. Submit written verification Contract Documents being reviewed, Work has been observed at appropriate times, and Work is complete in accordance with Contract Documents and ready for Engineer's review.
- B. Provide submittals to Owner required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

**1.4 FINAL CLEANING**

- A. Execute final cleanup prior to final project assessment.
- B. Remove waste and surplus materials, rubbish, and construction facilities from the site.

**1.5 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

## 1.6 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.
- E. Equipment 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. Project Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 3. Where proposed and existing utilities cross, the Contractor shall measure and record the horizontal location and vertical separation between each crossing. Separation shall be measured between exteriors and pipes.
  - 4. Field changes of dimension and detail.
  - 5. Details not on original Contract drawings.
  - 6. Piling data locations, tip and cut-off elevations, and driving records.
- G. Submit documents to Engineer prior to final walkthrough.

### **INCLUDE:**

## 1.7 OPERATION AND MAINTENANCE DATA

- A. Submit data on 8-1/2 x 11 inch text pages, bound in 3 inch D ring binders with durable plastic covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," title of project [Indicate subject matter of binder when multiple binders are required].

- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a 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 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 special 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 of warranties.
- E. Submit one (1) draft copy of completed volumes 15 days with prior to final walk through. This copy will be reviewed and returned, with Engineer comments. Revise content of all document sets as required prior to final submission.
- F. Submit two sets of revised final volumes, within 10 days after final walk through.

## **1.8 SPARE PARTS AND MAINTENANCE PRODUCTS**

- A. Provide spare parts, maintenance, and extra products in quantities specified in individual specification sections.
- B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

## **1.9 WARRANTIES AND BONDS**

- A. Provide duplicate notarized copies.
- B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.

- C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.
- D. Submit prior to final Application for Payment.
- E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

#### **1.10 MAINTENANCE SERVICE**

- A. Furnish service and maintenance of components indicated in specification sections [during the warranty period.]
- B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Owner.

#### **PART 2 – PRODUCTS**

Not Used

#### **PART 3 – EXECUTION**

Not Used

END OF SECTION

**INDEX TO**  
**SECTION 02110 – SITE CLEARING**

| <b>Paragraph</b>          | <b>Title</b>            | <b>Page</b> |
|---------------------------|-------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                         |             |
| 1.1                       | Section Includes        | 02110–1     |
| 1.2                       | Related Sections        | 02110–1     |
| 1.3                       | Omitted                 | 02110–1     |
| 1.4                       | Regulatory Requirements | 02110–1     |
| <b>PART 2 – PRODUCTS</b>  |                         |             |
| 2.1                       | Materials               | 02110–1     |
| <b>PART 3 – EXECUTION</b> |                         |             |
| 3.1                       | Preparation             | 02110–1     |
| 3.2                       | Protection              | 02110–1     |
| 3.3                       | Clearing                | 02110–2     |
| 3.4                       | Removal                 | 02110–3     |
| 3.5                       | Disposal                | 02110–3     |
| 3.6                       | Grubbing                | 02110–3     |

**SECTION 02110****SITE CLEARING****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Removal of surface debris.
- B. Removal of trees, shrubs, and other plant life.
- C. Topsoil excavation.

**1.2 RELATED SECTIONS**

- A. Section 02204 – Earthwork.
- B. Section [02111-Site Preparation:

**1.3 OMITTED****1.4 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for [environmental requirements,] [disposal of debris,] and [burning debris on site.]
- B. Coordinate clearing Work with utility companies.

**PART 2 – PRODUCTS****2.1 MATERIALS**

- A. Provide tree protection materials as detailed on the construction drawings.

**PART 3 – EXECUTION****3.1 PREPARATION**

- A. Verify existing plant life designated to remain is tagged or identified.
- B. Identify a waste area for placing removed materials.

**3.2 PROTECTION**

- A. All trees on site will be saved except those marked specifically by the Owner's representative for removal during construction. No trees, including those marked for removal on site or any other tree, may be removed prior to the preconstruction conference. All trees not to be removed will be protected from

injury to their roots and to their top to a distance three feet beyond the drip-line and no grading, trenching, pruning, or storage of materials may go in this area except as provided by an Owner's representative stakeout. Contractor will pay a penalty for any tree removed from the site that has not been marked specifically for removal. Contractor also will pay for any tree that dies due to damage during construction. This applies to all trees on site whether or not they are shown on the plans.

- B. Contractor shall not be held accountable for damages to trees resulting from placement of fill or removal of soils where such action is required by the contract documents. Any tree, the trunk of which is within 10 feet of any footing or trench, shall be exempt from these penalties except Contractor shall exercise all reasonable precautions to preserve even these trees. Contractor agrees to pay fines as established below in the event he or any of his subcontractors causes loss or removal of trees designated to be saved under provisions of this contract.

The fines are as follows:

| <u>Caliper</u> | <u>Fine</u> |
|----------------|-------------|
| 1" – 2"        | \$ 150.00   |
| 2" – 3"        | 200.00      |
| 3" – 4"        | 250.00      |
| 4" – 5"        | 400.00      |
| 5" – 6"        | 500.00      |
| 6" – 7"        | 600.00      |
| 7" – 8"        | 750.00      |
| 8" – 11"       | 1,500.00    |
| 12" – 20"      | 2,000.00    |
| 21" & larger   | \$ 2,500.00 |

- C. Trees shall be graded by Owner's representative as to variety, condition, and site importance, with above figures acting as a maximum fine. Lowest assessment amount shall be no less than one-half of the above fine figures.
- D. Protect bench marks, survey control points, and existing structures from damage or displacement.
- E. Protect all remaining utilities.
- F. Clearing operations shall be conducted to prevent damage by falling trees to trees left standing, to existing structures and installations, and to those under construction, and to provide for the safety of employees and others.

### **3.3 CLEARING**

- A. Clear areas required for access to site and execution of work. Clearing shall consist of felling and cutting trees into sections, and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within area to be cleared. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be [burned or] removed completely from the site, except such trees and vegetation as may be indicated

or directed to be left standing. Trees designated to be left standing within cleared areas shall be trimmed of dead branches 1-1/2 inch or more in diameter. Limbs and branches to be trimmed shall be neatly cut close to the trunk of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an accepted treewound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations, by the erection of timber barriers or by such other means as circumstances require. Such barriers must be placed and be checked by the OWNER before construction observations can proceed (See 3.2). Clearing shall also include removal and disposal of structures obtruding, encroaching upon, or otherwise obstructing the work.

### **3.4 REMOVAL**

- A. Where indicated or directed, trees and stumps shall be removed from areas outside those areas designated for clearing and grubbing. Work shall include felling of such trees and removal of their stumps and roots. Trees shall be disposed of as hereinafter specified.
- B. Remove debris, rock, and other extracted plant life from site.

### **3.5 DISPOSAL**

- A. Disposal of trees, branches, snags, brush, stumps, etc., resulting from clearing and grubbing shall be the Contractor's responsibility and shall be disposed of by burning, removal from site, or a combination of both. All costs in connection with disposing of materials will be at the Contractor's expense. Material disposed of by burning shall be burned in a manner avoiding all hazards, such as damage to existing structures, construction in progress, trees, and vegetation. Contractor shall be responsible for compliance with all local and State laws and regulations relative to the building of fires. Disposal by burning shall be kept under constant attendance until fires have burned out or extinguished. All liability of any nature resulting from disposal of cleared and grubbed material shall become the Contractor's responsibility. Disposal of all materials cleared and grubbed will be in accordance with rules and regulations of the State of South Carolina. No material will be burned unless directed to do so by the OWNER. Contractor shall obtain a permit to burn on site from local fire department, before beginning the work.

### **3.6 GRUBBING**

- A. Grubbing shall consist of removal and disposal of stumps, roots larger than one inch in diameter, and matted roots from designated grubbing areas. This material, together with logs and other organic or metallic debris not suitable for building of pavement subgrade or building pads, shall be excavated and removed to a depth of not less than 18 inches below original surface level of the ground in embankment areas and not less than 2 feet below finished earth surface in excavated areas. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform to original adjacent ground.

END OF SECTION

**INDEX TO**  
**SECTION 02111 – SITE PREPARATION**

| <b>Paragraph</b>              | <b>Title</b>                                      | <b>Page</b> |
|-------------------------------|---------------------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>       |                                                   |             |
| 1.1                           | Summary                                           | 02111-1     |
| 1.2                           | Related Requirements                              | 02111-1     |
| 1.3                           | Protections                                       | 02111-1     |
| <br><b>PART 2 – PRODUCTS</b>  |                                                   |             |
|                               | Not Used                                          |             |
| <br><b>PART 3 – EXECUTION</b> |                                                   |             |
| 3.1                           | Clearing or Removal of Trees and Other Vegetation | 02111-2     |

**SECTION 02111**  
**SITE PREPARATION**

**Paragraph**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Protection or removal of trees and other vegetation.
  - 2. Topsoil stripping.
  - 3. Clearing and grubbing.
  - 4. Erosion control.

**1.2 RELATED REQUIREMENTS**

- A. Construction Drawings
- B. Section 02050 – Demolition

**1.3 PROTECTIONS**

- A. Provide protection necessary to prevent damage to existing improvements, trees, or vegetation indicated on the Contract Documents to remain.
- B. Protect improvements on adjoining properties and on Owner's property.
- C. Restore damaged improvements to original condition as acceptable to parties having jurisdiction.
- D. Conduct operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction and from Owner. Streets and roadways shall be thoroughly cleaned and/or swept on a daily basis or more frequently as required by the governing authority.
- E. Provide traffic control as required, in accordance with the U.S. Department of Transportation "Manual of Uniform traffic Control Devices" and the state highway department requirements.
- F. Provide necessary erosion control measures to prevent siltation of existing pavement or storm drainage facilities to remain.

**PART 2 – PRODUCTS**

Not Used

**PART 3 – EXECUTION****3.1 CLEARING AND REMOVAL OF TREES AND OTHER VEGETATION**

- A. Unless otherwise indicated on the drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction within the limits of work. Removal includes digging out stumps and roots. Do not remove items elsewhere on site or premises unless specifically indicated.
- B. Strip topsoil to whatever depths encountered to prevent intermingling with underlying subsoil or other objectionable material. Cut heavy growths of grass from areas before stripping. Topsoil shall consist of sandy clay surficial soil found in depth of not less than 6 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, weeds, roots, and other objectionable material.
- C. Stockpile topsoil in storage piles in areas shown or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust. Dispose of unsuitable or excess topsoil same as specified for waste material, unless otherwise specified by Owner.
- D. Completely remove stumps, roots, and other debris below proposed subgrade elevation. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is required. Place fill material in horizontal layers not exceeding 8-inches loose depth, and thoroughly compacted per fill requirements of this section.
- E. Remove existing above grade and below grade improvements and abandoned underground piping or conduit necessary to permit construction and other work.

END OF SECTION

**INDEX TO**  
**SECTION 02111 – SITE PREPARATION**

| <b>Paragraph</b>              | <b>Title</b>                                      | <b>Page</b> |
|-------------------------------|---------------------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>       |                                                   |             |
| 1.1                           | Summary                                           | 02111-1     |
| 1.2                           | Related Requirements                              | 02111-1     |
| 1.3                           | Protections                                       | 02111-1     |
| <br><b>PART 2 – PRODUCTS</b>  |                                                   |             |
|                               | Not Used                                          |             |
| <br><b>PART 3 – EXECUTION</b> |                                                   |             |
| 3.1                           | Clearing or Removal of Trees and Other Vegetation | 02111-2     |

**SECTION 02111**  
**SITE PREPARATION**

**Paragraph**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Protection or removal of trees and other vegetation.
  - 2. Topsoil stripping.
  - 3. Clearing and grubbing.
  - 4. Erosion control.

**1.2 RELATED REQUIREMENTS**

- A. Construction Drawings
- B. Section 02110-Site Clearing

**1.3 PROTECTIONS**

- A. Provide protection necessary to prevent damage to existing improvements, trees, or vegetation indicated on the Contract Documents to remain.
- B. Protect improvements on adjoining properties and on Owner's property.
- C. Restore damaged improvements to original condition as acceptable to parties having jurisdiction.
- D. Conduct operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction and from Owner. Streets and roadways shall be thoroughly cleaned and/or swept on a daily basis or more frequently as required by the governing authority.
- E. Provide traffic control as required, in accordance with the U.S. Department of Transportation "Manual of Uniform traffic Control Devices" and the state highway department requirements.
- F. Provide necessary erosion control measures to prevent siltation of existing pavement or storm drainage facilities to remain.

**PART 2 – PRODUCTS**

Not Used

**PART 3 – EXECUTION****3.1 CLEARING AND REMOVAL OF TREES AND OTHER VEGETATION**

- A. Unless otherwise indicated on the drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction within the limits of work. Removal includes digging out stumps and roots. Do not remove items elsewhere on site or premises unless specifically indicated.
- B. Strip topsoil to whatever depths encountered to prevent intermingling with underlying subsoil or other objectionable material. Cut heavy growths of grass from areas before stripping. Topsoil shall consist of sandy clay surficial soil found in depth of not less than 6 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, weeds, roots, and other objectionable material.
- C. Stockpile topsoil in storage piles in areas shown or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust. Dispose of unsuitable or excess topsoil same as specified for waste material, unless otherwise specified by Owner.
- D. Completely remove stumps, roots, and other debris below proposed subgrade elevation. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is required. Place fill material in horizontal layers not exceeding 8-inches loose depth, and thoroughly compacted per fill requirements of this section.
- E. Remove existing above grade and below grade improvements and abandoned underground piping or conduit necessary to permit construction and other work.

END OF SECTION

**INDEX TO**  
**SECTION 02204 – EARTHWORK**

| <b>Paragraph</b>          | <b>Title</b>                        | <b>Page</b> |
|---------------------------|-------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                                     |             |
| 1.1                       | Section Includes                    | 02204–1     |
| 1.2                       | Related Sections                    | 02204–1     |
| 1.3                       | Omitted                             | 02204–1     |
| 1.4                       | References                          | 02204–1     |
| 1.5                       | Submittals                          | 02204–2     |
| 1.6                       | Quality Assurance                   | 02204–2     |
| 1.7                       | Testing                             | 02204–2     |
| <b>PART 2 – PRODUCTS</b>  |                                     |             |
| 2.1                       | Materials                           | 02204–2     |
| 2.2                       | Source Quality Control              | 02204–3     |
| <b>PART 3 – EXECUTION</b> |                                     |             |
| 3.1                       | Topsoil                             | 02204–3     |
| 3.2                       | Excavation                          | 02204–3     |
| 3.3                       | Ground Surface Preparation for Fill | 02204–4     |
| 3.4                       | Fill                                | 02204–4     |
| 3.5                       | Finished Grading                    | 02204–4     |
| 3.6                       | Disposal of Waste Material          | 02204–5     |
| 3.7                       | Protection                          | 02204–5     |
| 3.8                       | Drainage                            | 02204–5     |
| 3.9                       | Field Quality Control               | 02204–5     |
| 3.10                      | Proof Rolling                       | 02204–6     |

**SECTION 02204****EARTHWORK****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Grading
- B. Excavation
- C. Backfilling
- D. Compaction
- E. Remove and Replace Topsoil
- F. Dressing of Shoulders and Banks
- G. Stone Drainage Filter
- H. Water Control
- I. Testing

**1.2 RELATED SECTIONS**

- A. Section 01400 – Quality Control
- B. Section 01410 – Testing Services
- C. Section 02110 – Site Clearing
- D. Section 02111 – Site Preparation
- E. Section 01012 – Soil Investigation Data

**1.3 OMITTED****1.4 REFERENCES (LATEST REVISION)**

- A. ASTM D 448 – Sizes of Aggregate for Road and Bridge Construction.
- B. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.
- C. ASTM D 2487 – Classification of Soils for Engineering Purposes (Unified Soil Classification System).

- D. ASTM D 6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- E. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- F. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.

## **1.5 SUBMITTALS**

- A. Section 01300 – Submittals: Procedures for submittals.
- B. Materials Source: Submit gradation analysis, proctor results, and soil classification for all borrow material.

## **1.6 QUALITY ASSURANCE**

- A. Perform work in accordance with Federal, State of South Carolina, City of Hardeeville, standards.

## **1.7 TESTING**

- A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).
- B. In place density tests in accordance with ASTM D 6938.
- C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- D. The testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any of the tests.
- E. Testing shall be Contractor's responsibility and performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.
- F. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- A. Borrow shall consist of sand or sand-clay soils capable of being readily shaped and compacted to the required densities, and shall be reasonably free of roots, trash, rock larger than 2 inches, and other deleterious material.

- B. All soils used for structural fills shall have a PI (plastic index) of less than 10, and a LL (liquid limit) of less than 30. Fill soils shall be dried or wetted to appropriate moisture contents prior to compaction. Additionally, fill soils used for the top 2 feet of fill beneath roads and parking lots shall have no more than 15% passing the # 200 sieve. Fill soils used for house lots shall have no more than 25% passing the # 200 sieve.
- C. Contractor shall furnish all borrow material.
- D. Contractor shall be responsible for and bear all expenses in developing borrow sources including securing necessary permits, drying the material, haul roads, clearing, grubbing, excavating the pits, placing, compaction and restoration of pits and haul roads to a condition satisfactory to property owners and in compliance with applicable federal, state, and local laws and regulations.

## **2.2 SOURCE QUALITY CONTROL**

- A. If tests indicate materials do not meet specified requirements, change material and retest.
- B. Provide materials of each type from same source throughout the Work.

## **PART 3 – EXECUTION**

### **3.1 TOPSOIL**

- A. Contractor shall strip topsoil and stockpile on site at a location determined by the Owner at the Contractor's expense.
- B. Topsoil shall be placed to a depth of 4 inches over all disturbed or proposed landscaped areas.
- C. Topsoil shall be provided at Contractor's expense if it is not available from site.
- D. Any remaining topsoil will be hauled off site at the Contractors expense.
- E. Do not excavate wet topsoil.

### **3.2 EXCAVATION**

- A. Suitable excavation material shall be transported to and placed in fill areas within limits of the work.
- B. Unsuitable material encountered in areas to be paved and under building pads, shall be excavated 2 feet below final grade and replaced with suitable material from site or borrow excavations. Contractor shall notify Engineer if more than 2 feet of excavation is needed to replace unsuitable material.
- C. Unsuitable and surplus excavation material not required for fill shall be disposed of off site.

- D. Proper drainage, including sediment and erosion control, shall be maintained at all times. Methods shall be in accordance with the National Pollutant Discharge Elimination System standards and other local, state, and federal regulations.
- E. Unsuitable materials as stated herein are defined as highly plastic clay soils, of the CH and MH designation, border line soils of the SC-CH description, and organic soils of the OL and OH description based on the Unified Soils Classification System. Further, any soils for the top two feet of pavement subbase shall have no more than 15% passing the # 200 sieve.

### **3.3 GROUND SURFACE PREPARATION FOR FILL**

- A. All vegetation, roots, brush, heavy sods, heavy growth of grass, decayed vegetable matter, rubbish, and other unsuitable material within the areas to be filled shall be stripped and removed prior to beginning the fill operation.
- B. Sloped ground surfaces steeper than 1 vertical to 4 horizontal, on which fill is to be placed shall be plowed, stepped, or benched, or broken up as directed, in such a manner where fill material will bond with the existing surface.
- C. Surfaces on which fill is to be placed and compacted shall be wetted or dried as may be required to obtain the specified compaction.

### **3.4 FILL**

- A. Shall be placed in successive horizontal layers 8 inches to 12 inches in loose depth for the full width of the cross-section and compacted as required.

### **3.5 FINISHED GRADING**

- A. All areas covered by the project including excavated and filled sections and adjacent transition areas shall be smooth graded and free from irregular surface changes.
- B. Degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, supplemented with hand raking and finishing, except as otherwise specified.
- C. Unpaved areas to within 0.1 feet of elevations shown on the drawings provided such deviation does not create low spots that do not drain.
- D. Paved Areas – Subgrade to within 0.05 feet of the drawing elevations less the compacted thickness of the base and paving.
- E. Building Pads – Subgrade to within 0.05 feet of the drawing elevations [less the thickness of the concrete slab].
- F. Ditches and lagoon banks shall be finished graded, dressed, and seeded within 14 calendar days of work to reduce erosion and permit adequate drainage.

### **3.6 DISPOSAL OF WASTE MATERIAL**

- A. All vegetation, roots, brush, sod, broken pavements, curb and gutter, rubbish, and other unsuitable or surplus material stripped or removed from limits of construction shall be disposed of by the Contractor.

### **3.7 PROTECTION**

- A. Graded areas shall be protected from traffic, erosion, settlement, or any washing away occurring from any cause prior to acceptance.
- B. Contractor shall be responsible for protection of below grade utilities shown on the drawings or indicated by the Owner at all times during earthwork operations.
- C. Repair or re-establishment of graded areas prior to final acceptance shall be at the Contractors expense.
- D. Site drainage shall be provided and maintained by Contractor during construction until final acceptance of the project. Drainage may be by supplemental ditching, or pumping if necessary, prior to completion of permanent site drainage.

### **3.8 DRAINAGE**

- A. Contractor shall be responsible for providing surface drainage away from all construction areas. This shall include maintenance of any existing ditches or those constructed in the immediate vicinity of the work. Contractor shall provide proper and effective measures to prevent siltation of wetlands, streams, and ditches on both the Owner's property, and those properties downstream.

### **3.9 FIELD QUALITY CONTROL**

- A. Compaction testing shall be performed in accordance with ASTM D 6938. Where tests indicate the backfill does not meet specified requirements, the backfill shall be reworked or removed and replaced, and then retested at the Contractor's expense.
- B. Unpaved areas – at least 90% of maximum laboratory density within 2% optimum moisture content unless otherwise approved by the Engineer.
- C. Paved Areas and Under Structures – top 6 inch layer of subbase to at least 98% of maximum laboratory density within 2% optimum moisture content. Layers below top 6 inches shall be compacted to 95% of maximum laboratory density within 2% optimum moisture content.
- D. Rolling and compaction equipment and methods shall be subject to acceptance by the Engineer. Acceptance in no way relieves Contractor of the responsibility to perform in correct and timely means.
- E. Number of Tests – Under paved areas, no less than one density test per horizontal layer per 5,000 square feet of subbase shall be made. In unpaved areas, no less than one density test per horizontal layer per 10,000 square feet of fill area shall

be made. Under curb and gutter, no less than one density test per every 300 linear feet. [On building pads, no less than one density test per horizontal layer per 1,500 square feet of fill area shall be made.]

### **3.10 PROOF ROLLING**

- A. Shall be required on the subbase of all curb and gutter and paved areas and on the base of all paved areas where designated by the Engineer. Proof rolling shall take place after all underground utilities are installed and backfilled. The operation shall consist of rolling the subbase or base with a fully loaded 10 wheeled dump truck. A full load shall consist of 10 to 12 cubic yards of soil or rock. The dump truck shall be capable of traveling at a speed of two to five miles per hour and be in sound mechanical shape with no exhaust leaks or smoking from burning oil. The Engineer shall determine number of passes and areas rolled.

END OF SECTION

**INDEX TO**  
**SECTION 02210 – SOIL EROSION CONTROL**

| <b>Paragraph</b>          | <b>Title</b>               | <b>Page</b> |
|---------------------------|----------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                            |             |
| 1.1                       | Related Documents          | 02210–1     |
| 1.2                       | Description of Work        | 02210–1     |
| 1.3                       | Purposes                   | 02210–1     |
| 1.4                       | Quality Assurance          | 02210–1     |
| 1.5                       | Submittals                 | 02210–2     |
| 1.6                       | Measurement and Payment    | 02210–2     |
| <b>PART 2 – PRODUCTS</b>  |                            |             |
| 2.1                       | Grassing Materials         | 02210–2     |
| 2.2                       | Hay Bales                  | 02210–2     |
| 2.3                       | Silt Fence                 | 02210–2     |
| 2.4                       | Chemicals for Dust Control | 02210–3     |
| 2.5                       | Rip–Rap                    | 02210–3     |
| 2.6                       | Product Review             | 02210–3     |
| <b>PART 3 – EXECUTION</b> |                            |             |
| 3.1                       | General                    | 02210–3     |
| 3.2                       | Grassing                   | 02210–3     |
| 3.3                       | Sediment Barriers          | 02210–3     |
| 3.4                       | Silt Fence                 | 02210–4     |
| 3.5                       | Dust Control               | 02210–4     |
| 3.6                       | Sediment Basin             | 02210–5     |
| 3.7                       | Rip–Rap                    | 02210–5     |
| 3.8                       | Construction Exit          | 02210–5     |
| 3.9                       | Inlet Protection           | 02210–5     |

**SECTION 02210**  
**SOIL EROSION CONTROL**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Special Conditions apply to this section.

**1.2 DESCRIPTION OF WORK**

- A. Extent of soil erosion control work includes all measures necessary to meet the requirements of this section.

Erosion and sediment control measures shall be installed prior to any construction activity.

Soil erosion and sediment control measures shall include all temporary and permanent means of protection and trapping soils of the construction site during land disturbing activity. Activity covered in this contract shall meet standards of NPDES General Permit for the state where work is performed.

**1.3 PURPOSES**

- A. Contractor is to achieve the following goals:
1. Minimize soil exposure by proper timing of grading and construction.
  2. Retain existing vegetation whenever feasible.
  3. Vegetate and mulch denuded areas as soon as possible.
  4. Divert runoff away from denuded areas.
  5. Minimize length and steepness of slopes when it is practical.
  6. Reduce runoff velocities with sediment barriers or by increasing roughness with stone.
  7. Trap sediment on site.
  8. Inspect and maintain erosion control measures.

**1.4 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of soil erosion control systems products of types and sizes required, whose materials have been in satisfactory use for not less than 5 years.

- B. Codes and Standards: Comply with all applicable Local, State and Federal Standards pertaining to soil erosion control.

## **1.5 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instruction for soil erosion control materials and products.

## **1.6 OMITTED**

# **PART 2 – PRODUCTS**

## **2.1 GRASSING MATERIALS**

- A. Refer to Section 02902 – Grassing.
  - 1. General: All grass seed shall be free from noxious weeds, grade A recent crop, recleaned and treated with appropriate fungicide at time of mixture. Deliver to site in original sealed containers with dealer's guarantee as to year grown, percentage of purity, percentage of germination and date of the test by which percentages of purity and germination were determined. All seed sown shall have a date of test within six months of the date of sowing.
  - 2. Type of Seed: Either Annual Rye or Common Bermuda Grass seed will be used depending on time of year in which seeding is to occur.
  - 3. Mulch: Straw.
  - 4. Fertilizer: Commercial balanced 4-12-12 fertilizer.

## **2.2 HAY BALES**

- A. Standard size, densely baled straw or hay, wrapped with synthetic or wire bands (two minimum per bale).

## **2.3 SILT FENCE**

- A. Silt fence shall be a woven geotextile fabric sheet. Fabric shall be a synthetic polymer composed of at least 85% by weight propylene, ethylene, amide, ester, or vinylidene chloride, and shall contain stabilizer and/or inhibitors added to the base plastic to make filaments resistant to deterioration due to ultra-violet and/or heat exposure. Fabric should be finished so the filaments will retain their relative position with respect to each other. Fabric shall be free of defects, rips, holes, or flaws.

Fabric shall meet the following requirements:

|                |         |
|----------------|---------|
| Woven Fabrics  |         |
| Grab Strength  | 90 lbs. |
| Burst Strength | 175 PSI |
| UV Resistance  | 80%     |

## **2.4 CHEMICALS FOR DUST CONTROL**

- A. Calcium Chloride, Anionic Asphalt Emulsion, latex Emulsion or Resin-in-Water Emulsion may be used for dust control.

## **2.5 RIP-RAP**

- A. Shall be hard quarry or field stone of such quality the pieces will not disintegrate on exposure to water, sunlight, or weather. Stone shall range in weight from a minimum of 25 pounds to a maximum of 125 pounds. At least 50 percent of the stone shall weigh more than 60 pounds. The stone shall have a minimum dimension of 12 inches.

## **2.6 PRODUCT REVIEW**

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products before they are ordered.

# **PART 3 – EXECUTION**

## **3.1 GENERAL**

- A. All disturbed soil areas except those to support paving shall be graded and protected from erosion by grassing. Disturbed areas must be grassed within 14 days of work ending unless work is to begin again before 21 days. Storm water conveyance systems shall have sediment barriers installed at all entrances, intersections, change in direction and discharge points.

## **3.2 GRASSING**

- A. Refer to Section 02902 – Grassing.

## **3.3 SEDIMENT BARRIERS**

- A. Hay Bales for Sheet Flow Applications:
  1. Excavate a 4 inch deep trench the width of a bale and length of proposed barrier. Barrier should be parallel to the slope. Place barrier 5 to 6 feet away from toe of slope, unless otherwise instructed.
  2. Place bales in the trench with their ends tightly abutting. Corner abutment is not acceptable. A tight fit is important to prevent sediment from escaping through spaces between the bales.

3. Backfill the trench with previously excavated soil and compact it. Backfill soil should conform to ground level on downhill side of barrier and should be built up to 4 inches above ground on uphill side of bales.
4. Inspect and repair or replace damaged bales promptly. Remove hay bales when uphill sloped areas have been permanently stabilized.

**B. Rock Ditch Check [USE WITH SOUTH CAROLINA SPECS]**

1. Excavate a 6 inch deep trench the width and length of proposed barrier. Install a non-woven geotextile fabric in the trench before placing rock for the ditch check.
2. The body of the ditch check shall be constructed of 12 inch rip-rap. The upstream face may be covered with 1-inch washed stone.
3. Ditch checks shall not exceed a height of 2 feet at centerline of the channel and have a minimum top flow length of 2 feet.
4. Rip-rap shall be placed over the channel banks to prevent water from flowing around ditch check. Rock must be installed by hand or mechanical placement (no dumping of rock) to achieve complete coverage of the ditch and ensure the center of the check is lower than the edges.
5. The maximum spacing between ditch checks shall be where the toe of the upstream check is at the same elevation as the top of the downstream check.
6. Contractor shall maintain ditch checks as required by State regulations.

### **3.4 SILT FENCE**

- A. Silt fence shall be placed at approximate location shown and installed in accordance with the detail on the construction drawings. Contractor shall maintain silt fence as required by state regulations.

### **3.5 DUST CONTROL**

- A. Dust raised from vehicular traffic will be controlled by wetting down access road with water or by the use of a deliquescent chemical, such as calcium chloride, if relative humidity is over 30%. Chemicals shall be applied in accordance with manufacturer's recommendations.
- B. Contractor shall use all means necessary to control dust on and near the work, or off-site borrow areas when dust is caused by operations during performance of work or if resulting from the condition in which any subcontractor leaves the site. Contractor shall thoroughly treat all surfaces required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of work on site.

**3.6 SEDIMENT BASIN**

- A. A sediment basin equal in volume to 3,600 cubic feet per disturbed acre is required. The sediment basin/lagoon adjacent to the outfall for the site shall be constructed and stabilized prior to any additional land disturbed activity.

**3.7 RIP-RAP**

- A. Rip-Rap shall be placed at the locations shown and installed in accordance with the detail on the construction drawings.

**3.8 CONSTRUCTION EXIT**

- A. Construct exit at the location shown per detail on the construction drawings. Contractor shall maintain construction exit as required by state regulations.

**3.9 INLET PROTECTION**

- A. Install inlet protection per detail on the construction drawings. Contractor shall maintain inlet protection as required by state regulations until all disturbed surfaces are stabilized.

END OF SECTION

**INDEX TO**  
**SECTION 02231 – AGGREGATE BASE COURSE**

| <b>Paragraph</b>          | <b>Title</b>            | <b>Page</b> |
|---------------------------|-------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                         |             |
| 1.1                       | Section Includes        | 02231-1     |
| 1.2                       | Related Sections        | 02231-1     |
| 1.3                       | Measurement and Payment | 02231-1     |
| 1.4                       | References              | 02231-1     |
| 1.5                       | Quality Assurance       | 02231-2     |
| 1.6                       | Testing                 | 02231-2     |
| <b>PART 2 – PRODUCTS</b>  |                         |             |
| 2.1                       | Materials               | 02231-2     |
| <b>PART 3 – EXECUTION</b> |                         |             |
| 3.1                       | Examination             | 02231-3     |
| 3.2                       | Preparation             | 02231-3     |
| 3.3                       | Aggregate Placement     | 02231-4     |
| 3.4                       | Prime Coat              | 02231-4     |
| 3.5                       | Tolerances              | 02231-4     |
| 3.6                       | Field Quality Control   | 02231-5     |

**SECTION 02231**  
**AGGREGATE BASE COURSE**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Aggregate base course.

**1.2 RELATED SECTIONS**

- A. Section 01025 – Measurement and Payment: Requirements applicable to unit prices for the work of this section.
- B. Section 01400 – Quality Control.
- C. Section 02204 – Earthwork
- D. Section 02512 – Asphaltic Concrete Binder/Surface Courses: Binder and finish asphalt courses.

**1.3 MEASUREMENT AND PAYMENT**

- A. Aggregate Base Course: Payment will be made at the contract unit price. Payment will include supplying all material, labor, and equipment, stockpiling, scarifying substrate surface, placing where required, and compacting.
- B. Prime Coat: Bituminous prime coat will not be measured for separate payment. All costs connected with applying prime coat will be included in the unit price bid for Aggregate Base Course.

**1.4 REFERENCES (LATEST REVISION)**

- A. ASTM C 131 – Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
- B. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.
- C. ASTM D 6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- D. ASTM D 3740 – Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock Used in Engineering Design and Construction.
- E. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.

## 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.

## 1.6 TESTING

- A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).
- B. In place density tests in accordance with ASTM D 6938.
- C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- D. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any tests.
- E. Testing shall be Contractor's responsibility and performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Aggregate shall consist of processed and blended crushed stone. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material and shall be durable and sound. Coarse aggregate shall have a percentage of wear not to exceed 65% after 500 revolutions as determined by ASTM C 131. Aggregate shall meet applicable requirements of Section 305.2 in the South Carolina Department of Transportation Standard 2007 Specifications for Highway Construction. Material shall meet the following gradation and other requirements:

| Granite Stone or Recycled Concrete |                           |
|------------------------------------|---------------------------|
| Sieve Size                         | Percent by Weight Passing |
| 2"                                 | 100                       |
| 1-1/2"                             | 95 – 100                  |
| 1"                                 | 70 – 100                  |
| 1/2"                               | 48 – 75                   |
| # 4                                | 30 – 60                   |
| # 30                               | 11 – 30                   |
| #200                               | 0 – 12                    |
| Liquid Limit                       | 0 to 25                   |
| Plasticity Index                   | 0 to 6                    |

| Marine Limestone |                           |
|------------------|---------------------------|
| Sieve Size       | Percent by Weight Passing |
| 2"               | 100                       |

|                  |          |
|------------------|----------|
| 1-1/2"           | 95 – 100 |
| 1"               | 70 – 100 |
| 1/2"             | 50 – 85  |
| # 4              | 30 – 60  |
| # 30             | 17 – 38  |
| #200             | 0 – 20   |
| Liquid Limit     | 0 to 25  |
| Plasticity Index | 0 to 6   |

- B. Prime Coat: Shall be EA-P Special, Emulsified asphalt, conforming to Section 407 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.

### PART 3 – EXECUTION

#### 3.1 EXAMINATION

- A. Verify subbase has been tested, is dry, and slopes and elevations are correct.
- B. ON SITE OBSERVATIONS OF WORK: The Owner's Representative or Engineer will have the right to require any portion of the work be completed in their presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation at no additional cost to the Owner. However, if the Contractor notifies the Owner such work is scheduled, and the Owner fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Owner, Engineer or Project Representative. Improper work shall be reconstructed, and all materials, which do not conform to the requirements of the specifications, shall be removed from the work upon notice being received from the Engineer for the rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Owner, Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

#### 3.2 PREPARATION

- A. Subbase shall be graded and shaped conforming to the lines, grades, and cross sections required and cleaned of all foreign substances prior to constructing base course. Do not place base on soft, muddy or frozen surfaces. Correct irregularities in subbase slope and elevation by scarifying, reshaping, and recompact.
- B. At the time of base course construction, subbase shall contain no frozen material.
- C. Surface of subbase shall be checked by the Engineer or Project Representative for adequate compaction and surface tolerances. Ruts or soft yielding spots appearing in areas of subbase course having inadequate compaction, and areas not smooth or which vary in elevation more than 3/8 inch above or below required grade established on the plans, shall be corrected to the satisfaction of

the Engineer or Project Representative. Base material shall not be placed until subbase has been properly prepared and test results have so indicated.

### **3.3 AGGREGATE PLACEMENT**

- A. Aggregate shall be placed in accordance with South Carolina Department of 2007 Transportation Standard Specifications for Highway Construction Section 305 and in accordance with all terms included in these specifications.
- B. Level and contour surfaces to elevations and slopes indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- F. While at optimum moisture ( $\pm 1-1/2\%$ ), compact base course with rollers capable of obtaining required density. Vibratory, flatwheel, and other rollers accepted by the Engineer may be used to obtain required compaction. Rolling shall continue until base is compacted to 98% of the maximum laboratory dry density as determined by ASTM D 1557. In-place density of the compacted base will be determined in accordance with ASTM D 6938.

### **3.4 PRIME COAT**

- A. Bituminous material for the prime coat shall be applied uniformly and accurately in quantities of not less than 0.15 gallons per square yard nor more than 0.30 gallons per square yard of base course. All irregularities in the base course surface shall be corrected prior to application of prime coat. Clean the base course of all mud, dirt, dust, and caked and loose material
- B. Do not apply prime to a wet surface nor when temperature is below 40°F in the shade. Do not apply prime when rain threatens nor when weather conditions prevent proper construction and curing of prime coat.
- C. The primed base should be adequately cured before the binder or surface course is laid. In general, a minimum of 48 hours should be allowed for complete curing. Ordinarily, proper surface condition of the prime is indicated by a slight change in the shiny black appearance to a slightly brown color.

### **3.5 TOLERANCES**

- A. Flatness: Maximum variation of 1/4 inch measured with an acceptable 10-foot straight edge.
- B. Scheduled Compacted Thickness: Within 3/8 inch.
- C. Variation from Design Elevation: Within 3/8 inch.

- D. Depth measurements for compacted thickness shall be made by test holes through the base course. Where base course is deficient, correct such areas by scarifying, adding base material and recompact as directed by the Engineer.

### **3.6 FIELD QUALITY CONTROL**

- A. Section 01400 – Quality Assurance: Field inspection.
- B. Density and moisture testing will be performed in accordance with ASTM D 1557 and ASTM D 6938.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.
- D. Frequency of Tests:
  - 1. Base Density and Thickness – One test per 5,000 square feet.

END OF SECTION

**INDEX TO**  
**SECTION 02275 – RIP-RAP**

| <b>Paragraph</b>          | <b>Title</b>         | <b>Page</b> |
|---------------------------|----------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                      |             |
| 1.1                       | Section Includes     | 02275–1     |
| 1.2                       | Related Sections     | 02275–1     |
| 1.3                       | Allowable Tolerances | 02275–1     |
| 1.4                       | Omitted              | 02275–1     |
| 1.5                       | References           | 02275–1     |
| <b>PART 2 – PRODUCTS</b>  |                      |             |
| 2.1                       | Materials            | 02275–1     |
| 2.2                       | Product Review       | 02275–2     |
| <b>PART 3 – EXECUTION</b> |                      |             |
| 3.1                       | Preparation          | 02275–2     |
| 3.2                       | Placement            | 02275–2     |

**SECTION 02275****RIP-RAP****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Material placed as bank protection and erosion control.

**1.2 RELATED SECTIONS**

- A. Section 02210 – Soil Erosion Control

**1.3 ALLOWABLE TOLERANCES**

- A. Depth of rip-rap blanket as shown on the drawings and in these specifications is a minimum depth.

**1.4 OMITTED****1.5 REFERENCES (LATEST REVISION)**

- A. ASTM C 150 – Portland Cement.

**PART 2 – PRODUCTS****2.1 MATERIALS**

- A. Stone Rip-Rap: Shall be hard quarry or field stone of such quality the pieces will not disintegrate on exposure to water, sunlight or weather. Stone shall be solid and non-friable and range in weight from a minimum of 25 pounds to a maximum of 150 pounds. At least 50 percent of the stone pieces shall weigh more than 60 pounds. The stone pieces shall have a minimum dimension of 12 inches. Documents indicating stone analysis, source and other pertinent data (i.e. – filter fabric) shall be submitted for review by the Engineer prior to delivery.
- B. Sand-Cement Bag Rip-Rap:
  - 1. Bags: Shall be of cotton, burlap, or fiber-reinforced paper capable of containing the sand-cement mixture without leakage during handling and placing. Bags previously used for any purpose shall not be used. Capacity shall be not less than 0.75 cubic foot nor more than two cubic feet.
  - 2. Cement: Portland cement shall be Type I meeting requirements of ASTM C 150. Cement which has been damaged, or which is partially set, lumpy, or caked shall not be used.

- 3. Fine Aggregate: Shall be composed of hard, durable particles, free from injurious amounts of organic impurities and shall contain, in the material passing the No. 10 sieve, not more than 7 percent clay, and not more than 20 percent passing the No. 200 sieve.
- C. Filter Fabric: Shall be a woven fabric of monofilament and multifilament yarn equivalent to Mirafi FW700. Fabric shall be finished so the filaments will retain their relative position with respect to each other. Fabric shall contain stabilizers and/or inhibitors added to make filaments resistant to deterioration due to ultraviolet and/or heat exposure. Fabric shall be free of flaws, rips, holes or defects.

## **2.2 PRODUCT REVIEW**

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products before they are ordered.

## **PART 3 – EXECUTION**

### **3.1 PREPARATION**

- A. The surface to receive rip-rap shall be prepared to a relatively smooth condition free of obstruction, depressions, debris, rises, and soft or low-density pockets of material. Contours and elevations on construction drawings are to the surface of rip-rap material.

### **3.2 PLACEMENT**

- A. Filter fabric shall be placed with the long dimension running up slope. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. Fabric shall be anchored in place with securing pins of the type recommended by fabric manufacturer. Pins shall be placed on or within 3 inches of the overlap. Place fabric so upstream strip will overlap the downstream strip. Fabric shall be placed loosely to give and avoid stretching and tearing during placement of the stones.
- B. Minimum depth or thickness of stone blanket shall be 12 inches with no under tolerance. Stones shall be dropped no more than three feet during construction. Placing shall begin at bottom of slope. Provide a toe trench if required as detailed on the construction drawings. Entire mass of stone shall be placed to conform with lines, grades, and thickness shown on the plans. Rip-rap shall be placed to its full course thickness at one operation and in such a manner as to avoid displacing the underlying material. Placing of rip-rap in layers, or by dumping into chutes, or by similar methods likely to cause segregation, will not be permitted.

Larger stones shall be well distributed and the entire mass of stone shall conform to gradation specified. All material used in rip-rap protection shall be placed and distributed so there will be no large accumulations of either the larger or smaller sizes of stone.

It is the intent of these specifications to produce a fairly compact rip-rap protection in which all sizes of material are placed in their proper proportions. Hand placing or rearranging of individual stones by mechanical equipment may be required to secure the results specified.

- C. Sand-Cement Bag Rip-Rap: Bags shall be uniformly filled. Bagged rip-rap shall be placed by hand with tied ends facing the same direction, with close, broken joints. After placing, bags shall be rammed or packed against one another to produce the required thickness and form a consolidated mass. The top of each bag shall not vary more than 3 inches above or below required plane. When directed by the Engineer or required by construction drawings, header courses shall be placed.

END OF SECTION

**INDEX TO**  
**SECTION 02511 – ASPHALTIC CONCRETE BASE COURSE**

| <b>Paragraph</b>          | <b>Title</b>                     | <b>Page</b> |
|---------------------------|----------------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                                  |             |
| 1.1                       | Section Includes                 | 02511-1     |
| 1.2                       | Related Sections                 | 02511-1     |
| 1.3                       | Omitted                          | 02511-1     |
| 1.4                       | References                       | 02511-1     |
| 1.5                       | Quality Assurance                | 02511-1     |
| 1.6                       | Environmental Requirements       | 02511-2     |
| 1.7                       | Testing                          | 02511-2     |
| <b>PART 2 – PRODUCTS</b>  |                                  |             |
| 2.1                       | Materials                        | 02511-2     |
| 2.2                       | Source Quality Control and Tests | 02511-3     |
| <b>PART 3 – EXECUTION</b> |                                  |             |
| 3.1                       | Examination                      | 02511-3     |
| 3.2                       | Preparation                      | 02511-3     |
| 3.3                       | Placement                        | 02511-4     |
| 3.4                       | Tolerances                       | 02511-4     |
| 3.5                       | Field Quality Control            | 02511-4     |

**SECTION 02511****ASPHALTIC CONCRETE BASE COURSE****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Asphaltic Concrete Base Course

**1.2 RELATED SECTIONS**

- A. Section 01025 - Measurement and Payment
- B. Section 01400 - Quality Control
- C. Section 02204 - Earthwork
- D. Section 02512 - Asphaltic Concrete Binder/Surface Courses
- E. Section 02231 – Aggregate Base Course

**1.3 OMITTED****1.4 REFERENCES (LATEST REVISION)**

- A. ASTM D 946 – Penetration-Graded Asphalt Cement for Use in Pavement Construction.
- B. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.
- C. ASTM D 2726 – Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
- D. ASTM D 2950 – Density of Bituminous Concrete in Place by Nuclear Methods.
- E. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock Used in Engineering Design and Construction.
- F. AASHTO T 245 – Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
- G. AASHTO T 179 – Effect of Heat and Air on Asphalt Materials (Thin-Film Oven Test).
- H. AASHTO M 226 – Viscosity Graded Asphalt Cement.

**1.5 QUALITY ASSURANCE**

- A. Perform work in accordance with South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.

- B. Mixing Plant: Conform to South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt mixture when ambient air temperature is less than that indicated in the Table nor when the surface is wet or frozen.

| Lift Thickness | Min. Air Temperature, Degrees F. |
|----------------|----------------------------------|
| 1" or Less     | 55                               |
| 1.1" to 2"     | 45                               |
| 2.1" to 3"     | 35                               |
| 3.1" to 4"     | 30                               |
| 4.1" to 8"     | Contractor's Discretion          |

- B. Place bitumen mixture when mixture temperature is not more than 15 degrees F below bitumen supplier's bill of lading and not more than the maximum specified temperature.

## 1.7 TESTING

- A. Testing laboratory shall operate in accordance to ASTM D 3740 and E 329 and shall be acceptable to the Engineer.
- B. The testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any tests.
- C. Testing shall be the responsibility of the Contractor and shall be performed at the Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph A above.
- D. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Asphalt Cement: PG64-22 (SC).
- C. Anti-Stripping: Anti-stripping agents or other additives required shall be acceptable to the Engineer prior to their use. Additive delivery systems shall be acceptable to the Engineer.
- C. Aggregate shall consist of processed and blended crushed stone and be free of lumps and balls of clay, organic matter, objectionable coatings and other foreign material, and shall be durable and sound. Material shall meet applicable requirements of Section 310 of the South Carolina Department of Transportation Standard Specifications.

- D. Base Mixture: Shall meet Section 310 of the South Carolina State Highway Department Standard Specifications.

## **2.2 SOURCE QUALITY CONTROL AND TESTS**

- A. Section 01400 - Quality Control, 01410 - Testing Laboratory Services. Provide mix design for asphalt.
- B. Submit proposed mix design for review prior to beginning of work.
- C. Test samples in accordance with the requirements of these specifications.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Verify subbase has been tested, is dry, and gradients and elevations are correct.
- B. ON-SITE OBSERVATIONS OF WORK: Owner's Representative or Engineer will have the right to require any portion of work be completed in their presence. If the work is covered up after such instruction, it shall be exposed by the Contractor for observation at no additional cost to Owner. However, if Contractor notifies Owner such work is scheduled, and Owner fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Owner, Engineer, or Project Representative. Improper work shall be reconstructed. All materials, which do not conform to requirements of specifications, shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Owner, Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

### **3.2 PREPARATION**

- A. Subbase shall be leveled to lines and grades of plans and cleaned of all foreign substances prior to constructing the base course.

Do not place base on soft, muddy, or frozen surfaces.

Correct irregularities in subbase gradient and elevation by scarifying, reshaping, and recompact.

- B. At the time of base course construction, the subbase shall contain no frozen material.
- C. The surface of subbase shall be checked by Engineer or Project Representative for adequate compaction and surface tolerances. Ruts or soft yielding spots appearing in areas of the subbase course having inadequate compaction, and areas not smooth or which vary in elevation more than 3/8 inch above or below

required grade established on plans shall be corrected to satisfaction of Engineer or Project Representative. Base material shall not be placed until subbase has been properly prepared and test results have so indicated.

### **3.3 PLACEMENT**

- A. Construction shall be in accordance with Sections 310 and 401 of the South Carolina Department of Transportation Standard Specifications.

### **3.4 TOLERANCES**

- A. General: All paving shall be subject to visual and straightedge checking during construction operations and thereafter prior to final acceptance. A 10-foot straightedge shall be maintained in the vicinity of paving operation at all times for measuring surface irregularities on all paving courses. The straightedge and labor for its use shall be provided by Contractor. The surface of all courses shall be checked with a straightedge as necessary to detect surface irregularities. Irregularities such as ripping, tearing or pulling, which in the judgment of Engineer indicate a continuing problem in equipment, mixture or operating technique, will not be permitted to recur. The paving operation shall be stopped until appropriate steps are taken by Contractor to correct problem.
- B. Flatness: Maximum variation of 1/4 inch measured with an acceptable 10-foot straight edge.
- C. Scheduled Compacted Thickness: Within 3/8 inch under tolerance.
- D. Variation from Design Elevation: Within 3/8 inch.
- E. Base Deficient in Thickness: When measurement of any core indicates base is deficient in thickness, additional cores will be drilled 10 feet either side of the deficient core along centerline of lane until cores indicate thickness conforms to above specified requirements. A core indicating thickness deficiencies is considered a failed test. Base deficient in thickness shall be removed and replaced with the appropriate thickness of materials. If Contractor believes cores and measurements taken are not sufficient to indicate fairly the actual thickness of base, additional cores and measurements will be taken, provided Contractor will bear extra cost of drilling cores and filling holes in roadway as directed.

### **3.5 FIELD QUALITY CONTROL**

- A. Section 01400 - Quality Assurance: Field Observation.
- B. Density Testing: Performed in accordance with ASTM D-2726 and ASTM D-2950. Core samples for each day's operation shall be taken, tested and results reported to Engineer the following day. The areas sampled shall be properly restored by Contractor at no additional cost to Owner. Compaction must be accomplished when the temperature of mix is above 185 degrees F and below 300 degrees F. Nuclear gauge tests shall be taken during the asphaltic concrete placement.
  - 1. The pavement core and nuclear gauge densities shall range between 94% and 96% of the theoretical maximum density.

C. Temperature:

1. Asphaltic concrete shall not exceed 325 degrees F at any time.
2. Temperature at time of loading shall be recorded on the truck delivery ticket.

D. Frequency of Tests:

1. Asphaltic Concrete - One test for each 250 tons placed.
  - a. Asphalt extraction and gradation test.
  - b. Core Sample
2. Field determination of density by nuclear method every 5,000 square feet during construction of the base course.

END OF SECTION

## INDEX TO

### SECTION 02512SC – ASPHALTIC CONCRETE BINDER/SURFACE COURSES

| Paragraph                 | Title                            | Page      |
|---------------------------|----------------------------------|-----------|
| <b>PART 1 – GENERAL</b>   |                                  |           |
| 1.1                       | Section Includes                 | 02512SC-1 |
| 1.2                       | Related Sections                 | 02512SC-1 |
| 1.3                       | Omitted                          | 02512SC-1 |
| 1.4                       | References                       | 02512SC-1 |
| 1.5                       | Quality Assurance                | 02512SC-2 |
| 1.6                       | Environmental Requirements       | 02512SC-2 |
| 1.7                       | Guarantee                        | 02512SC-2 |
| 1.8                       | Testing                          | 02512SC-2 |
| <b>PART 2 – PRODUCTS</b>  |                                  |           |
| 2.1                       | Tack Coat                        | 02512SC-3 |
| 2.2                       | Asphaltic Binder and Additives   | 02512SC-3 |
| 2.3                       | Aggregates                       | 02512SC-3 |
| 2.4                       | Source Quality Control and Tests | 02512SC-4 |
| <b>PART 3 – EXECUTION</b> |                                  |           |
| 3.1                       | Examination                      | 02512SC-4 |
| 3.2                       | Preparation                      | 02512SC-5 |
| 3.3                       | Placement                        | 02512SC-5 |
| 3.4                       | Tolerances                       | 02512SC-6 |
| 3.5                       | Field Quality Control            | 02512SC-6 |

**SECTION 02512SC****ASPHALTIC CONCRETE BINDER/SURFACE COURSES****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Surface Course
- B. Binder Course

**1.2 RELATED SECTIONS**

- A. Section 01025 – Measurement and Payment
- B. Section 01400 – Quality Control
- C. Section 02204 – Earthwork
- D. Section 02231 – Aggregate Base Course
- E. Section 02511 – Asphaltic Concrete Base Course

**1.3 OMITTED****1.4 REFERENCES (LATEST REVISION)**

- A. ASTM D 946 – Penetration–Graded Asphalt–Cement for Use in Pavement Construction.
- B. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.
- C. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock Used in Engineering Design and Construction.
- D. ASTM D 2726 – Bulk Specific Gravity and Density of Non–Absorptive Compacted Bituminous Mixtures.
- E. ASTM D 2950 – Density of Bituminous Concrete in Place by Nuclear Methods.
- F. ASTM D 1188 – Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
- G. ASTM D 1754 – Effect of Heat and Air on Asphaltic Materials (Thin–film Oven Test).

**1.5 QUALITY ASSURANCE**

- A. Perform work in accordance with South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.
- B. Mixing Plant: Conform to South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.

**1.6 ENVIRONMENTAL REQUIREMENTS**

- A. Do not place asphalt mixture when ambient air temperature is less than that indicated in the Table nor when the surface is wet or frozen.

| Lift Thickness | Min. Air Temperature, Degrees F. |
|----------------|----------------------------------|
| 1" or Less     | 55                               |
| 1.1" to 2"     | 45                               |
| 2.1" to 3"     | 40                               |
| 3.1" to 4.5"   | 35                               |

- B. Mixture shall be delivered to the spreader at a temperature between 250 degrees F and 325 degrees F.

**1.7 GUARANTEE**

- A. Contractor shall guarantee the quality of materials, equipment, and workmanship for a period of 12 months after acceptance. Defects discovered during this period shall be repaired by the Contractor at no cost to the Owner.

**1.8 TESTING**

- A. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- B. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any tests.
- C. Testing shall be Contractor's responsibility and shall be performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph A above.
- D. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

## **PART 2 – PRODUCTS**

### **2.1 TACK COAT**

- A. Shall consist of asphalt binder (asphalt cement) or emulsified asphalt, conforming to Section 401 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction. Asphalt binder shall be PG64-22. The acceptable grades of emulsified asphalt are RS-1, MS-1, MS-2, HFMS-1, HFMS-2, SS-1, CRS-1, CRS-2, CMS-2, and CSS-1.

### **2.2 ASPHALT BINDER AND ADDITIVES**

- A. Shall be PG64-22 and conform to Section 401 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.
- B. Anti-Stripping: Shall conform to requirements of Section 401 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.

### **2.3 AGGREGATES**

- A. General: Mineral aggregate shall be composed of fine aggregate or a combination of fine and coarse aggregate. Coarse aggregate shall be that portion of the material retained on a No. 4 sieve.

Fine aggregate shall be considered that portion passing the No. 4 sieve. Fine aggregate, coarse aggregate, and any additives in combination with the specified percentage of asphalt cement shall meet the requirements of tests specified, before acceptance may be given for their individual use. Marine (Fossiliferous) limestone shall not be used.

- B. Fine Aggregate: Shall conform to the requirements of Section 401 of the South Carolina Department of Transportation Standard Specifications for Highway Construction.
- C. Coarse Aggregate: Shall be granite stone and conform to the requirements of Section 401 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.
- D. Surface Course: The surface course shall consist of fine and coarse aggregate and mineral filler uniformly mixed with hot asphalt binder in an acceptable mixing plant. The plant shall conform to South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction. The gradations, asphalt content and air voids shall be the following:

| TYPE C           |           |
|------------------|-----------|
| Square Sieve     | % Passing |
| 3/4 inch         | 100       |
| 1/2 inch         | 97 – 100  |
| 3/8 inch         | 83 – 100  |
| No. 4            | 58 – 80   |
| No. 8            | 42 – 62   |
| No. 30           | 20 – 40   |
| No. 100          | 8 – 20    |
| No. 200          | 3 – 9     |
| % Asphalt Binder | 5.0 – 6.8 |
| Air Voids, %     | 3.5 – 4.5 |

- E. Intermediate or Binder Course: The mineral aggregates and asphalt binder shall be combined in such proportions the composition by weight of the finished mixture shall be within the following range limits:

| TYPE B            |                              |
|-------------------|------------------------------|
| Sieve Designation | Percentage by Weight Passing |
| 1 inch            | 100                          |
| 3/4 inch          | 90 – 100                     |
| 1/2 inch          | 75 – 90                      |
| 3/8 inch          | 64 – 80                      |
| No. 4             | 38 – 54                      |
| No. 8             | 22 – 36                      |
| No. 30            | 8 – 22                       |
| No. 100           | 3 – 10                       |
| No. 200           | 2 – 8                        |
| % Asphalt Binder  | 4 – 6                        |
| Air Voids, %      | 3.5 – 4.5                    |

## 2.4 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01400 – Quality Control and Section 01410 – Testing Laboratory Services.
- B. Submit proposed mix design for review prior to beginning of work.
- C. Test samples in accordance with the requirements of these specifications.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. On-Site Observations: Owner's Representative or Engineer will have the right to require any portion of work be completed in their presence. If work is covered up after such instruction, it shall be exposed by the Contractor for observation at no additional cost to Owner. However, if

Contractor notifies Engineer such work is scheduled, and Engineer fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Engineer or Project Representative. Improper work shall be reconstructed. All materials, which do not conform to requirements of specifications, shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Owner, Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

- B. Contractor shall verify base has been tested, is dry, and slopes and elevations are correct.

### **3.2 PREPARATION**

- A. Apply tack coat in accordance with Section 401 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction. Rate of application shall be 0.05 to 0.15 gallons per square yard of surface.
- B. Work shall be planned so no more tack coat than is necessary for the day's operation is placed on the surface. All traffic not essential to the work should be kept off the tack coat.
- C. Apply tack coat to contact surfaces of curbs and gutters. Apply in manner so exposed curb or gutter surfaces are not stained.
- D. Coat surfaces of manhole frames and inlet frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

### **3.3 PLACEMENT**

- A. Construction shall be in accordance with Sections 401, 402, and 403 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.
- B. Asphaltic concrete shall not be placed on a wet or frozen surface.
- C. Compaction shall commence as soon as possible after the mixture has been spread to the desired thickness. Compaction shall be continuous and uniform over the entire surface. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks. Compaction rolling shall be complete before material temperature drops below 175° F.

- D. Areas of pavement with deficient thickness or density shall be removed and replaced at no additional cost to the Owner.

### **3.4 TOLERANCES**

- A. General: All paving shall be subject to visual and straightedge evaluation during construction operations and thereafter prior to final acceptance. A 10-foot straightedge shall be maintained in the vicinity of the paving operation at all times for the purpose of measuring surface irregularities on all paving courses. The straightedge and labor for its use shall be provided by the Contractor. The surface of all courses shall be checked with the straightedge as necessary to detect surface irregularities. Irregularities such as rippling, tearing or pulling, which in the judgment of the Engineer indicate a continuing problem in equipment, mixture or operating technique, will not be permitted to recur. The paving operation shall be stopped until appropriate steps are taken by the Contractor to correct the problem.
- B. Flatness: All irregularities in excess of 1/8 inch in 10 feet for surface courses and 1/4 inch in 10 feet for intermediate courses shall be corrected.
- C. Variation from Design Elevation:
  - 1. General Paving: Less than 1/4 inch.
  - 2. Accessible Routes: Shall not exceed 1/4 inch. However, accessible routes shall not exceed maximum ADA allowable slopes. Contractor shall remove and replace any and all portions of the accessible route that exceed maximum ADA allowable slopes.
- D. Scheduled Compacted Thickness: Within 1/4 inch per lift.
- E. Pavement Deficient in Thickness: When measurement of any core indicates the pavement is deficient in thickness, additional cores will be drilled 10 feet either side of the deficient core along the centerline of the lane until the cores indicate the thickness conforms to the above specified requirements. A core indicating thickness deficiencies is considered a failed test. Pavement deficient in thickness shall be removed and replaced with the appropriate thickness of materials. If the Contractor believes the cores and measurements taken are not sufficient to indicate fairly the actual thickness of the pavement, additional cores and measurements will be taken, provided the Contractor will bear the extra cost of drilling the cores and filling the holes in the roadway as directed.

### **3.5 FIELD QUALITY CONTROL**

- A. Acceptance of the in-place density of the binder and surface courses shall be in accordance with the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.

- B. Density Testing: Performed in accordance with ASTM D-2726 and ASTM D-2950. Core samples for each day's operation shall be taken, tested and results reported to the Engineer the following day. The areas sampled shall be properly restored by the Contractor at no additional cost to the Owner. Nuclear gauge tests shall be taken during the asphaltic concrete placement.
1. The pavement core and nuclear gauge densities shall range between 94% and 96% of the theoretical maximum density.
- C. Temperature:
1. Asphaltic concrete shall not exceed 325 degrees F at any time.
  2. Asphaltic concrete shall not be placed once the temperature of the mix falls below 250 degrees F or the delivered temperature is more than 15 degrees F below the batch plant's delivery ticket.
  3. Temperature at time of loading shall be recorded on the truck delivery ticket.
- D. Frequency of Tests:
1. Asphaltic Concrete – One test for each 250 tons placed.
    - a. Asphalt extraction and gradation test.
    - b. Core Sample
  2. Field determination of density by nuclear method every 5,000 square feet during construction of the asphaltic concrete binder/surface course.

END OF SECTION

**INDEX TO**  
**SECTION 02570 – TRAFFIC CONTROL**

| <b>Paragraph</b>          | <b>Title</b>            | <b>Page</b> |
|---------------------------|-------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                         |             |
| 1.1                       | Description             | 02570–1     |
| 1.2                       | Omitted                 | 02570–1     |
| 1.3                       | Responsibility          | 02570–1     |
| 1.4                       | Omitted                 | 02570–1     |
| <b>PART 2 – PRODUCTS</b>  |                         |             |
| 2.1                       | Materials               | 02570–1     |
| <b>PART 3 – EXECUTION</b> |                         |             |
| 3.1                       | Erection                | 02570–1     |
| 3.2                       | Delays to Traffic       | 02570–2     |
| 3.3                       | Temporary Traffic Lanes | 02570–2     |
| 3.4                       | Signs and Barricades    | 02570–2     |

**SECTION 02570**  
**TRAFFIC CONTROL**

**PART 1 – GENERAL**

**1.1 DESCRIPTION**

- A. This section covers furnishing, installation, and maintenance of all traffic control devices, portable signal equipment, warning signs, and temporary traffic lanes used during construction of the project.

**1.2 OMITTED**

**1.3 RESPONSIBILITY**

- A. The Contractor shall furnish, install, and maintain all necessary automated signals, barricades, concrete traffic barriers, warning signs, traffic barriers, traffic lanes, and other protective devices. Ownership of these temporary warning devices shall remain with the Contractor provided devices are removed promptly after completion and acceptance of work to which devices pertain. If such warning devices are left in place for more than 30 days after specified time for removal, Owner shall have the right to remove such devices and to claim possession thereof.

**1.4 OMITTED**

**PART 2 – PRODUCTS**

**2.1 MATERIALS**

- A. All barricades signs, and traffic control signal devices shall conform to requirements of the current South Carolina Manual on Uniform Traffic Control Devices except as may be modified in these project specifications.
- B. Portable traffic control signal devices, barricades, signs and other Control Devices shall be either new or in acceptable condition when first erected on Project and shall remain in acceptable condition throughout the construction period.
- C. All signs shall have a black legend and border on an orange reflectorized background and will be a minimum of engineering grade reflective.

**PART 3 – EXECUTION**

**3.1 ERECTION**

- A. Prior to commencement of any actual construction on the project, Contractor shall erect appropriate advance warning signs and place concrete traffic barriers where necessary. Subsequently, as construction progresses and shifts from one side of road to the other, temporary lanes must be installed to provide continuous two way traffic and bike thoroughfare. All appropriate signs and traffic control devices pertinent to the work shall be erected ahead of construction site to advise and warn travelling

public of activity and any necessary detours.

### **3.2 DELAYS TO TRAFFIC**

- A. Except in rare and unusual circumstances, two-way traffic shall be maintained at all times by temporary and/or permanent roads. There are to be no traffic delays during the hours between 7 AM – 10 AM and 4 PM – 10 PM. Between the hours of 10 AM and 4 PM the maximum delay is to be 15-minutes.
- B. When traffic is halted temporarily due to transition procedures including the ingress and egress of construction vehicles, Contractor shall provide necessary flagging personnel with proper equipment and clothing to hold such traffic.
- C. If Contractor's proposed traffic control plan involves more than occasional disruption to alternating one way traffic through the work, then temporary, signalized control equipment will be required.

### **3.3 TEMPORARY TRAFFIC LANES**

- A. Two-lane traffic shall be maintained at all times unless prior written permission has been given and all necessary flagging personnel and/or signage has been installed. Temporary lane line stripes shall be applied to the detour paving, as agreed to by Engineer and Owner's representative. The no-passing double center-line stripes shall be yellow. Such stripes shall be a temporary, degradable, reflectorized tape strip. All temporary striping shall be maintained throughout the period traffic control is needed.
- B. Contractor is responsible for installation and removal of all temporary roads and trails throughout the construction process. These detour roads are to be in accordance with the Pavement Specifications herein.

### **3.4 SIGNS AND BARRICADES**

- A. Contractor shall provide a detailed map showing location and verbiage of all traffic control signs and methods for the project. All critical warning signs for the project will be a minimum of engineering grade reflective material and include appropriate flashing lights.
- B. Appropriate Safety Barricades shall be installed between bicycle trails, sidewalks, and the temporary traffic lanes. These barricades shall be impact resistant for passenger vehicles with a travelling speed of 40 mph.
  - 1. Advance warning signs: These signs shall be placed approximately 500 feet in advance of the construction site and detour on each approach to the construction area with subsequent warning signs every 250 feet, until construction site is met.
  - 2. Road Construction Signs: Before and during construction of the detour, advance road construction signs shall be located as already stated above. The construction site detour lanes will have reflective trestle type barricade with flashing lights spaced a maximum of 25 feet apart to delineate each side of any temporary roadway. Additional signage shall be placed to

indicate a reduced speed limit of 15 mph for the entire construction area. Other signs as appropriate to a particular activity in the work area shall be erected in advance of that activity.

3. Barricades: While detour is open to traffic, a line of concrete traffic barricades shall be placed across the closed roadway to channelize traffic onto detour. They shall be spaced across the blocked roadway end to end so no vehicle will be able to pass between any two adjacent barricades.
4. Barriers: Shall be wooden having a minimum of 3 horizontal 6 inch rails spaced 20 inches on center. Markings for barrier rails shall be 6 inches wide alternate orange and white reflectorized stripes sloping downward at 45 degrees in the direction traffic is to pass.

During hours of darkness, the Contractor shall place and maintain flashing warning lights on tops of all barriers.

5. Direction Arrow Signs: At each change in traffic direction along the detour, Contractor shall install a sign with an arrow indicating change in traffic direction. This sign is to be located across the pavement from and facing on-coming traffic.
6. End Construction Sign: This sign shall be 60 inches x 24 inches and erected approximately 200 feet beyond end of construction area on the right-hand side.

END OF SECTION

**INDEX TO**  
**SECTION 02577 – PAINTED TRAFFIC STRIPING**

| <b>Paragraph</b>          | <b>Title</b>             | <b>Page</b> |
|---------------------------|--------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                          |             |
| 1.1                       | Work Included            | 02577-1     |
| 1.2                       | Quality Assurance        | 02577-1     |
| 1.3                       | Guarantee                | 02577-1     |
| 1.4                       | Omitted                  | 02577-1     |
| <b>PART 2 – PRODUCTS</b>  |                          |             |
| 2.1                       | Paint                    | 02577-1     |
| 2.2                       | Equipment                | 02577-1     |
| 2.3                       | Glass Beads              | 02577-2     |
| 2.4                       | Product Review           | 02577-2     |
| <b>PART 3 – EXECUTION</b> |                          |             |
| 3.1                       | Construction Observation | 02577-2     |
| 3.2                       | Striping                 | 02577-2     |

**SECTION 02577****PAINTED TRAFFIC STRIPING****PART 1 – GENERAL****1.1 WORK INCLUDED**

- A. Striping shall consist of furnishing and applying traffic line paint in accordance with the contract drawings and specifications, and the requirements of the [South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction.]

**1.2 QUALITY ASSURANCE**

- A. Material and equipment shall be standard product of a manufacturer who has manufactured them for a minimum of 2 years and who provides published data on quality and performance of the product.

**1.3 GUARANTEE**

- A. Contractor shall guarantee the quality of materials and workmanship for a period of 12 months after acceptance. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

**1.4 OMITTED****PART 2 – PRODUCTS****2.1 PAINT**

- A. Paint shall be in conformance with [Section 625 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction].

**2.2 EQUIPMENT**

- A. The traveling traffic stripe painter shall be adaptable to traveling at a uniform, predetermined rate of speed both uphill and downhill in order to produce a uniform application of paint. Paint machine shall be of the spray type, capable of satisfactorily applying paint under pressure with a uniformity of feed through nozzles spraying directly upon pavement. Each machine shall be capable of applying three separate stripes, either solid or skip, in any specified pattern by utilizing three adjacent spray nozzles at the same time. Each paint tank shall be equipped with a mechanical agitator. Each nozzle shall be equipped with satisfactory cutoff valves which will apply broken or skip lines automatically. Each nozzle shall have a mechanical bead dispenser operating simultaneously with spray nozzle and distribute beads in a uniform pattern at the rate specified. Each nozzle shall also be equipped with suitable line guides consisting of metallic shrouds or air blasts.

Hand painting equipment shall consist of suitable brushes, templates and guides necessary to produce satisfactory results.

Cleaning equipment shall consist of necessary brushes, brooms, scrapers, grinders, high pressure water jets and air blasters required to satisfactorily remove all foreign matter, from surfaces to be painted, without damage to the underlying pavement.

The traveling traffic stripe painter shall also be equipped with paint meters which will indicate amount of paint dispensed from each tank. Small, portable applicators or other special equipment may also be required.

### **2.3 GLASS BEADS**

- A. Glass beads shall be in conformance with [Section 625 of the South Carolina Department of Transportation 2007 Standard Specifications for Highway Construction].

### **2.4 PRODUCT REVIEW**

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

## **PART 3 – EXECUTION**

### **3.1 CONSTRUCTION OBSERVATION**

- A. Engineer or Project Representative will have the right to require any portion of the work be completed in their presence. If the work is covered up after such instruction, it shall be exposed by Contractor for observation. However, if Contractor notifies Engineer, or Project Representative such work is scheduled and they fail to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Engineer. Improper work shall be reconstructed. All materials which do not conform to requirements of specifications shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such. Contractor shall give Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

### **3.2 STRIPING**

- A. Cleaning of Surface – Surfaces to be painted shall be thoroughly cleaned of all dust, dirt, grease, oil and other foreign matter before application of the paint.
- B. Alignment – Traffic stripes shall be of the length, width and placement specified. On sections where no previously applied markings are present, Contractor shall establish control points, satisfactory to Engineer, spaced at intervals insuring accurate locations of the stripe.

- C. Application – Traffic Stripe paint shall be applied by machine except for special areas and markings not adaptable to machine application, in which case, hand application will be permitted.

No paints shall be applied to areas of pavement when:

1. Any moisture or foreign matter is present on the surface;
2. The air temperature in the shade is below 50° F; or
3. Wind conditions are such as might cause dust to be deposited on prepared areas or to prevent satisfactory application of the paint and beads.

Painting shall be completed only during daylight hours and all painted areas shall be dry enough, before sunset, to permit crossing by traffic. All protective devices shall be removed not later than sunset to allow free movement of traffic at night.

Traffic stripe paint shall be thoroughly mixed in the shipping container before placing in machine tank. The paint machine tanks, connections and spray nozzles shall be thoroughly cleaned with thinner before starting each day's work.

The minimum wet film thickness for all painted areas shall be 15 mils.

Place a layer of glass beads immediately after laying the paint. Apply beads at a minimum rate of 6 pounds per gallon of paint.

- D. Protective Measures – When painting is completed around traffic, Contractor shall furnish and place all warning and directional signs necessary to direct, control, and protect traffic during the striping operations. Warning signs shall be set up before the beginning of each operation and extra signs shall be kept well ahead of painting equipment. When necessary, a pilot car shall be used to protect both traffic and the painting operation. The freshly painted stripe shall be protected by cones or other satisfactory devices. All stripe damaged by traffic, or pavement marked by traffic crossing wet paint, shall be repaired or corrected as specified below.

- E. Tolerance and Appearance – No stripe shall be less than the specified width. No stripe shall exceed the specified width by more than 1/2 inch. Alignment of the stripe shall not deviate from intended alignment by more than one inch on tangents and on curves up to and including one degree. On curves exceeding one degree, alignment of the stripe shall not deviate from the intended alignment by more than 2 inches.

Continued deviation from stated dimensions will be cause for stopping the Work and removing nonconforming stripe.

All stripes and segments of stripes shall present a clean cut, uniform and workmanlike appearance. All markings which fail to have a uniform, satisfactory appearance, either day or night, shall be corrected at the Contractor's expense.

- F. Corrective Measures – All traffic stripe which fails to meet the Specifications, permissible tolerances and appearance requirements, or is marred or damaged by traffic or from other causes, shall be corrected at Contractor's expense. All misted

areas, drip and spattered paint shall be removed to the satisfaction of Engineer. In all instances, when it is necessary to remove paint, it shall take place by means satisfactory to Engineer, which will not damage the underlying surface of pavement. When necessary to correct a deviation which exceeds permissible tolerance in alignment, the portion of stripe so affected shall be removed plus an additional 25 feet in each direction, and a new stripe then painted in accordance with these specifications.

- G. Acceptance – All sections of painted stripe, words and symbols which have dried to the extent paint will not be picked up or marred by tires of vehicles, and which have been placed in reasonably close conformity with Plans and Specifications, will be accepted, and Contractor will be relieved of responsibility of maintenance on such sections.

END OF SECTION

## INDEX TO

### SECTION 02667SC – WATER DISTRIBUTION SYSTEM

| Paragraph                 | Title                                                     | Page       |
|---------------------------|-----------------------------------------------------------|------------|
| <b>PART 1 – GENERAL</b>   |                                                           |            |
| 1.1                       | Section Includes                                          | 02667SC–1  |
| 1.2                       | Related Sections                                          | 02667SC–1  |
| 1.3                       | Options                                                   | 02667SC–1  |
| 1.4                       | References                                                | 02667SC–1  |
| 1.5                       | Quality Assurance                                         | 02667SC–3  |
| 1.6                       | Requirements of Regulatory Agencies                       | 02667SC–4  |
| 1.7                       | Product Delivery, Storage & Handling                      | 02667SC–5  |
| 1.8                       | Sequencing and Scheduling                                 | 02667SC–6  |
| 1.9                       | Alternatives                                              | 02667SC–6  |
| 1.10                      | Guarantee                                                 | 02667SC–6  |
| 1.11                      | Existing Utilities                                        | 02667SC–6  |
| 1.12                      | Connect New Main to Existing System                       | 02667SC–6  |
| 1.13                      | Damage to Existing Water System                           | 02667SC–6  |
| 1.14                      | Omitted                                                   | 02667SC–6  |
| 1.15                      | Testing                                                   | 02667SC–7  |
| <b>PART 2 – PRODUCTS</b>  |                                                           |            |
| 2.1                       | General Requirements                                      | 02667SC–7  |
| 2.2                       | Pipe                                                      | 02667SC–7  |
| 2.3                       | Joints                                                    | 02667SC–8  |
| 2.4                       | Fittings                                                  | 02667SC–9  |
| 2.5                       | Gate Valves                                               | 02667SC–9  |
| 2.6                       | Butterfly Valves                                          | 02667SC–10 |
| 2.7                       | Air Release, Air/Vacuum and Combination Air Valves        | 02667SC–11 |
| 2.8                       | Fire Hydrants                                             | 02667SC–11 |
| 2.9                       | Service Connections                                       | 02667SC–12 |
| 2.10                      | Tapping Sleeves                                           | 02667SC–13 |
| 2.11                      | Curb Stops                                                | 02667SC–13 |
| 2.12                      | Backflow Preventer Assembly                               | 02667SC–13 |
| 2.13                      | Casing                                                    | 02667SC–14 |
| 2.14                      | Casing Spacers                                            | 02667SC–14 |
| 2.15                      | Metal Detector Tape                                       | 02667SC–14 |
| 2.16                      | Tracing Wire                                              | 02667SC–14 |
| 2.17                      | Product Review                                            | 02667SC–14 |
| <b>PART 3 – EXECUTION</b> |                                                           |            |
| 3.1                       | On-Site Observation                                       | 02667SC–14 |
| 3.2                       | Installation                                              | 02667SC–15 |
| 3.3                       | Air Release, Air/Vacuum and Combination Air Valves        | 02667SC–19 |
| 3.4                       | Connections of Water Mains                                | 02667SC–19 |
| 3.5                       | Disinfection                                              | 02667SC–19 |
| 3.6                       | Partial Acceptance of the Work                            | 02667SC–20 |
| 3.7                       | Grassing                                                  | 02667SC–20 |
| 3.8                       | Separation Between Water and Sanitary Sewer or Force Main | 02667SC–20 |
| 3.9                       | Remove and Replace Pavement                               | 02667SC–21 |
| 3.10                      | Field Quality Control                                     | 02667SC–21 |

**SECTION 02667SC**  
**WATER DISTRIBUTION SYSTEM**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Piping
- B. Valves
- C. Fittings
- D. Connect to Existing System
- E. All necessary appurtenances to convey potable water from the existing system to the location shown on the plans.

**1.2 RELATED SECTIONS**

- A. Section 02110 – Site Clearing
- B. Section 02204 – Earthwork
- C. Section 02902 – Grassing

**1.3 OPTIONS**

- A. The bid form and specifications describe several pipe materials. Owner will select the one to be used. Where manufacturers of material or equipment are named in the specifications, Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by Engineer as meeting specifications prior to ordering such equipment or materials.

**1.4 REFERENCES (Latest Revision)**

- A. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.
- C. ANSI/AWWA C 153/A-21.53 – Ductile Iron Compact Fittings for Water Service.
- D. ANSI/AWWA C 110/A21.10 – Ductile Iron and Gray Iron Fittings,
- E. ANSI/AWWA C 150/A-21.50 – Thickness Design of Ductile Iron Pipe.
- F. ANSI/AWWA C 151/A-21.51 – Ductile Iron Pipe, Centrifugally Cast, for Water, or other liquids.

- G. ANSI/AWWA C 104/A-21.4 – Cement–Mortar Lining for Ductile Iron Pipe and Fittings for Water.
- H. ASTM D 1784 – Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- I. ASTM D 2241 – Poly (Vinyl Chloride) (PVC) Pressure–Rated Pipe (SDR – Series).
- J. ANSI/AWWA C 901 – Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3–inches for Water Service.
- K. ASTM D 2737 – Polyethylene (PE) Plastic Tubing.
- L. ANSI/AWWA C 115/A21.15 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.
- M. ANSI/AWWA C 111/A21.11 – Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- N. ASTM D 3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- O. ANSI/AWWA C 900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inches through 12 inches, for Water Transmission and Distribution.
- P. ANSI/AWWA C 500 – Metal–Seated Gate Valves for Water Supply Service.
- Q. ANSI/AWWA C 509 – Resilient–Seated Gate Valves for Water Supply Service.
- R. ANSI/AWWA C 502 – Dry–Barrel Fire Hydrants.
- S. ANSI/AWWA C 800 – Underground Service Line Valves and Fittings.
- T. ANSI/AWWA C 600 – Installation of Ductile Iron Water Mains and Their Appurtenances.
- U. ANSI/AWWA C 605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
- V. ASTM D 2774 – Underground Installation of Thermoplastic Pressure Piping.
- W. ASTM D 6938 – In–Place Density and Water Content of Soil and Soil–Aggregate By Nuclear Methods (Shallow Depth).
- X. ANSI/AWWA C 651 – Disinfecting Water Mains.
- Y. ASTM D 1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.
- Z. ANSI/AWWA C 504 – Rubber–Seated Butterfly Valves.
- AA. ANSI B–18.2.2 – Square and Hex Bolts and Screws.

- BB. ANSI B-18.2.2 – Square and Hex Nuts.
- CC. ANSI/NSF Standard 61.
- DD. ANSI/AWWA C200 – Steel Water Pipe – 6 inch (150 mm) and Larger.
- EE. ASTM A 53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- FF. ANSI/AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14-inch through 48-inch (350 mm through 1,200 mm), for Water Transmission and Distribution.
- GG. ANSI/AWWA C 512 – Air Release, Air/Vacuum, and Combination Valves for Waterworks Service.
- HH. ANSI/AWWA C 515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
- II. ASTM A 139 – Electric-Fusion (Arc) – Welded Steel Pipe (NPS4 and Over).

## 1.5 QUALITY ASSURANCE

- A. Materials – Contractor will furnish the Engineer and Owner a description of all material before ordering. Engineer will review the Contractor's submittals and provide in writing an acceptance or rejection of material.
- B. Manufacturer – Material and equipment shall be standard products of a manufacturer who has manufactured them for a minimum of 2 years and who provides published data on quality and performance of the products.
- C. Subcontractor – A subcontractor for any part of the work must have experience on similar work, and if required, furnish Engineer with a list of projects and Owners or Engineers who are familiar with its competence.
- D. Design – If Contractor wishes to furnish devices, equipment, structures, and systems not designed by Engineer, these items shall be designed by either a Professional Engineer registered in the state of this project, or by someone Engineer accepts as qualified. If required, complete design calculations and assumptions shall be furnished to the Engineer or Owner before acceptance.
- E. Testing Agencies – Soil testing shall be conducted by a testing laboratory which operates in accordance with ASTM D 3740 and E 329 latest revision and be acceptable to the Engineer prior to engagement. Mill certificates of tests on materials made by manufacturers will be accepted provided manufacturer maintains an adequate testing laboratory, makes regularly scheduled tests that are spot checked by an outside laboratory, and furnishes satisfactory certificates with name of entity making the test.
- F. Hydrostatic tests on pipe shall be made by Contractor with equipment qualified by the Engineer. The Engineer or Project Representative reserves the right to

accept or reject testing equipment. Hydrostatic testing shall be conducted in the presence of Engineer or Project Representative and a representative of Water Supplier.

- G. All pipe, fittings, packing, jointing materials, valves, and fire hydrants shall conform to Section C of the American Water Works Association (AWWA) Standards.
- H. All materials and products which contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61.

## **1.6 REQUIREMENTS OF REGULATORY AGENCIES**

- A. Water mains shall be sterilized to meet requirements of the appropriate Health Department. Sterilization shall be in accordance with AWWA Standards C-651, latest revision.
- B. Fire line sprinkler systems and dedicated fire lines shall be protected by an acceptable double check valve assembly. Water lines in high hazard categories shall be protected by an acceptable Reduced Pressure Zone (RPZ) Backflow Preventer.
- C. Any pipe, solder, or flux which is used in the installation or repair of any public water system or in any plumbing in a residential or nonresidential facility which provides water, through connection to a public water system, for human consumption shall be lead free. Lead free is defined as not more than 0.2% lead with respect to solder and flux and not more than 8.0% lead with respect to pipes and pipe fittings. Lead joints necessary for repair of cast iron pipes shall be exempt from the lead free requirement.
- D. No water pipe shall pass through or come in contact with any part of a sewer manhole. Water lines may come in contact with storm sewers or catch basins if there is no practical alternative, provided ductile iron is used, no joints of water line are within the storm sewer or catch basin, and joints are located as far as possible from storm sewer or catch basin.
- E. Potable water lines shall not be laid less than 25 feet horizontally from any portion of a wastewater tile field or spray field, or shall be otherwise protected by a method acceptable to DHEC.
- F. Where the minimum cover of 30 inches cannot be provided, pipe shall be steel, concrete, ductile iron, or other material and method acceptable to DHEC, and, when necessary, insulated to prevent freezing.
- G. Air relief valves shall be provided in accordance with sound engineering practices at high points in water mains as required. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.
- H. The open end of an air relief pipe from automatic valves or from a manually operated valve shall be extended to the top of pit and provided with a screened downward facing elbow.

- I. Chambers, pits, or manholes containing valves, blow-off, meters, air release valves, or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer.
- J. There shall be no connection between distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminated materials may be discharged or drawn into the system.
- K. Asbestos cement pipe shall not be used in potable water system except in the repair of existing asbestos cement lines.
- L. Thermoplastic pipe shall not be used above grade.
- M. Steel pipe shall not be allowed in water systems unless specified as in AWWA C200 or ASTM A53.
- N. Water mains shall be installed out of contaminated areas, unless using piping materials protecting the system (i.e., Ductile Iron Pipe with chemical resistant gaskets). Route lines out of contaminated areas if possible.
- O. Cross Connection Control (Backflow Prevention Devices):
  - 1. There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminated materials may be discharged or drawn into the system.
  - 2. No-by-passes shall be allowed, unless the bypass is also equipped with an acceptable backflow prevention device.
  - 3. Reduced pressure principal backflow prevention assemblies shall not be installed in any area location subject to possible flooding. This includes pits or vaults not provided with a gravity drain to the ground's surface capable of exceeding discharge rate of relief valve. Generally, if installed in a pit, drain line shall be 2 times the size of line entering backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or sewer, which could flood water back into pit.
  - 4. All piping up to inlet of the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved. Black steel pipe cannot be used on inlet side of the device.

## **1.7 PRODUCT DELIVERY, STORAGE & HANDLING**

- A. Material shall be unloaded in a manner avoiding damage and shall be stored where it will be protected and will not be hazardous to traffic. The Contractor shall repair any damage caused by the storage. Material shall be examined before installation and neither damaged nor deteriorated material shall be used in the work.

**1.8 SEQUENCING AND SCHEDULING**

- A. Contractor shall arrange work so sections of mains between valves are tested, sterilized, pavement replaced, and the section placed in service as soon as reasonable after installation.

**1.9 ALTERNATIVES**

- A. The intention of these specifications is to produce the best system for the Owner. If Contractor suggests alternative material, equipment or procedures will improve the results at no additional cost, Engineer and Owner will examine suggestion, and if it is accepted, it may be used. The basis upon which acceptance of an alternative will be given is its value to the Owner, and not for Contractor's convenience.

**1.10 GUARANTEE**

- A. Contractor shall guarantee the quality of materials, equipment, and workmanship for a period of 12 months after acceptance. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

**1.11 EXISTING UTILITIES**

- A. All known utility facilities are shown schematically on plans, and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown on plans will not relieve the Contractor of responsibility under this requirement. "Existing Utilities Facilities" means any utility existing on the project in its original, relocated, or newly installed position. Contractor will be held responsible for the cost of repairs to damaged underground facilities; even when such facilities are not shown on plans
- B. The Contractor shall call for underground utility locations before starting work. Underground utilities location service can be contacted at 811 or 1-888-721-7877.

**1.12 CONNECT NEW MAIN TO EXISTING SYSTEM**

- A. Contractor shall furnish necessary pipe and perform all excavation, dewatering, shoring, backfilling, etc., necessary to make the connection of a new main to existing water system. Contractor shall contact the Superintendent of Water Utility a minimum of 48 hours in advance of construction. Contractor shall be responsible for coordinating construction with the utility operator.

**1.13 DAMAGE TO EXISTING WATER SYSTEM**

- A. Damage to any part of the existing water system by Contractor or Subcontractors, repaired by Utility Owner's forces, shall be charged to Contractor on basis of time and material, plus 30% for overhead and administration.

**1.14 OMITTED**

**1.15 TESTING**

- A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).
- B. In place density tests in accordance with ASTM D 6938.
- C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- D. The testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any of the tests.
- E. Testing shall be the responsibility of the Contractor and shall be performed at the Contractor's expense by a commercial testing laboratory that operates in accordance with subparagraph C above.
- F. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

**PART 2 – PRODUCTS**

Products and materials used in the work shall conform to the following:

**2.1 GENERAL REQUIREMENTS**

- A. All material or products that come into contact with drinking water shall be third party certified as meeting the specifications of the American National Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The American National Standards Institute shall accredit the certifying party.
- B. All pipe, fittings, packing, jointing materials, valves, and fire hydrants shall conform to Section C of the AWWA Standards.

**2.2 PIPE**

- A. Ductile Iron Pipe – Shall conform to ANSI A-21.50 (AWWA C-150) and ANSI A-21.51 (AWWA C-151). All pipe shall be Pressure Class 350 unless otherwise noted. It shall be cement lined in accordance with ANSI A-21.4 (AWWA C-104).
- B. P.V.C. – All pipe shall be blue in color with factory marked homing lines. Pipe 4 inches through 12 inches shall conform to all requirements of AWWA C-900, DR 18, pressure class of 235 p.s.i. and shall have the following minimum wall thickness:

|          |              |
|----------|--------------|
| 4 inches | 0.267 inches |
| 6 inches | 0.383 inches |
| 8 inches | 0.503 inches |

|           |              |
|-----------|--------------|
| 10 inches | 0.617 inches |
| 12 inches | 0.733 inches |

Pipe 14 inches through 18 inches in diameter shall conform to all the requirements of AWWA C 905, DR 18, pressure rating of 235 p.s.i.

Pipe with diameter less than 4 inches shall conform to all requirements of ASTM D-1784 and D-2241 (SDR 21). The pipe shall have a minimum pressure rating of 200 p.s.i. Certificates of conformance with the foregoing specifications shall be furnished with each lot of pipe supplied. All P.V.C. pipe shall bear the National Sanitation Foundation Seal of Approval.

- C. Plastic Tubing – Tubing for service lines shall be:

Polyethylene Tubing: CTS PE 3408 conforming to all requirements of AWWA C-901 and ASTM D-2737 (SDR9). The tubing shall be copper tubing size and rated for a minimum working pressure of 200 p.s.i. Marking on the tubing shall include: nominal tubing pipe size; type of tubing material – PE 3408; SDR 9; pressure rating – 200 p.s.i.; ASTM D-2737; manufacturer's name and seal of the National Sanitation Foundation.

## 2.3 JOINTS

- A. Flanged Joints – Shall conform to ANSI A-21.15 (AWWA C-115). Bolts shall conform to ANSI B-18.2.1 and nuts shall conform to ANSI B-18.2.2. Gaskets shall be rubber, either ring or full face, and shall be 1/8 inch thick. Gaskets shall conform to the dimensions recommended by AWWA C-115 latest revision.
- B. Mechanical Joints – In ductile iron pipe shall conform to ANSI A-21.11 (AWWA C-111).
- C. Push-On-Joints – In ductile iron pipes shall conform to ANSI A-21.11 (AWWA C-111).
- D. Plastic Pipe – Joints in plastic pipe 4 inches and larger shall meet all requirements of AWWA C-900. Joints in plastic pipe 14 inches through 18 inches shall meet all requirements of AWWA C905. Joints in plastic pipe with a diameter less than 4 inches shall conform to ASTM D-3139.
- E. Restrained Joints – Restrained joints for pipe, valves and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push-on type joints equivalent to "Lok-Ring," "TR Flex," or "Super Lock" and shall have a minimum rated working pressure of 250 p.s.i. for ductile iron pipe and 100 p.s.i. with a minimum safety factor of 2:1 for PVC pipe. The joints shall be in accordance with the applicable portions of AWWA C-111. The manufacturer of the joints shall furnish certification, witnessed by an independent laboratory, that the joints furnished have been tested without signs of leakage or failure. Restrained joints shall be capable of being deflected after assembly.
- F. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, o-rings, and other products used for jointing pipes,

setting meters and valves or other appurtenances which will expose such material to water.

## 2.4 FITTINGS

- A. Fittings for Ductile Iron or Plastic Pipe – Shall be ductile iron, manufactured in accordance with ANSI A-21.53 (AWWA C-153). They shall be cement lined in accordance with ANSI A-21.4 (AWWA C-104). Fittings shall be designed to accommodate the type of pipe used.
- B. Fittings for Flanged Pipe – Shall be manufactured in accordance with ANSI A-21.10 (AWWA C-110), Class 125 flanges.
- C. Fittings for Plastic Pipe – Less than 4 inches shall be PVC with ring tite rubber joints conforming to ASTM D-3139.

## 2.5 GATE VALVES

- A. Two Inches and Larger – Shall be cast iron or ductile iron body, bronze mounted, double disc or resilient wedge design, with non-rising stems, conforming to AWWA C-500, C-509, or C-515. Valves shall have a working pressure of 200 p.s.i. and be tested at 400 p.s.i.

Valves shall be furnished with "O" ring packing. Two "O" rings shall be located above the thrust collar and one "O" ring below. The thrust collar shall be permanently lubricated and have an anti-friction washer on top of the thrust collar.

Valves installed in pits or above ground shall be furnished with hand wheels. Buried valves shall be furnished with square operating nuts.

- B. Smaller than 2 Inches – Shall be all brass, ball valve type. The pressure rating shall be 175 p.s.i.
- C. Valve Boxes – Underground valves shall be installed in acceptable valve boxes. The valve boxes shall have a suitable base which does not damage the pipe, and shaft extension sections to cover and protect the valve and permit easy access and operation. The box, cover, and any extensions needed shall be cast or ductile iron having a crushing strength of 1,500 pounds per linear foot. Valve boxes shall conform to the detail shown.
- D. Valve Manholes –
  - 1. Masonry – Shall be new whole brick of good quality laid in masonry mortar or cement mortar made of 1 part Portland cement and 2 parts clean sharp sand. Every brick shall be fully bedded in mortar. Manholes shall conform to the locations and details shown on the plans.
  - 2. Precast Concrete – Shall be reinforced concrete constructed in accordance with ASTM C 478 and the details shown on the plans "Precast Concrete Manholes." The joints shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O-Ring or equivalent

to Type A or B "Tylox" conforming to ASTM C 443. Mastic shall be equivalent to "Ram-nek" with primer. The primer shall be applied to all contact surfaces of the manhole joint at the factory in accordance with the manufacturer's instructions.

3. Frames and Covers – Shall be cast iron equivalent to the following:

**Neenah Foundry Co. R-1668 Type "C" Lid**

- E. Flush valves – Shall conform to the details shown.

## **2.6 BUTTERFLY VALVES**

- A. All butterfly valves shall be of the tight-closing, rubber seated type, with rubber seat positively locking in place sealing against flow from either direction. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction. Butterfly valves shall conform to ANSI/AWWA C504, Class 150B. Butterfly valves shall not be used on pipe smaller than 14-inches unless otherwise specified.
  1. Valve body end connections for buried valves shall be installed using restrained joints equivalent to those manufactured by EBAA Iron, Inc.
  2. Valve shafts shall be stainless steel and may consist of a one-piece unit or may be the "Stub Shaft" type. A stub shaft comprises two separate shafts inserted into the valve disc hubs. Each stub shaft shall be inserted into the valve disc hubs for a distance of at least 1-1/2 shaft diameters.
  3. Valve discs shall be solid ductile iron with an epoxy coating making it corrosion resistant. The thickness of the discs shall not exceed 2-1/4 times the shaft diameter.
  4. Valve seats shall be natural or synthetic rubber providing 360 degrees uninterrupted seating. The resilient seat shall be adjustable or replaceable in the field without burning or grinding. The seat shall be molded over a stainless steel ring for support and secured to the disc by corrosion resistant, self locking stainless steel screws.
  5. All internal ferrous metal surfaces in the waterway shall be factory coated with a non-toxic, to-component, holiday-free, thermosetting epoxy to a nominal thickness of 4 mils.
  6. All butterfly valves shall be manually operated. Operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position without creeping or fluttering. Operators shall be furnished with externally adjustable mechanical stop limiting devices. Valves shall have a 2 inch square operating nut and shall be installed with extension stem to extend the operating nut in accordance with the project details. The operator shall be integrally mounted on the valve mounting flange and shall have a gearing totally enclosed for buried service. Maximum force for operating nut shall be 40 pounds.

- B. Valve Boxes – Underground valves shall be installed in approved valve boxes. The valve boxes shall have a suitable base that does not damage the pipe, and shaft extension sections to cover and protect the valve and permit easy access and operation. The cover, box, and any extensions needed shall be cast or ductile iron having a crushing strength of 1,500 pounds per linear foot. Valve boxes shall conform to the detail shown.
- C. Valve Manholes –
  - 1. Masonry – Shall be new whole brick of good quality laid in masonry mortar or cement made of one part Portland cement and two parts clean sharp sand. Every brick shall be fully bedded in mortar. Manholes shall conform to the locations and details shown on the plans.
  - 2. Precast Concrete – Shall be reinforced concrete constructed in accordance with ASTM C 478 and the details shown on the plans “Precast Concrete Manholes.” The joints shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O-Ring or equivalent to Type A or B “Tylox” conforming to ASTM C 443. Mastic shall be equivalent to “Ram-nek” with primer. The primer shall be applied to all contact surfaces of the manhole joint at the factory in accordance with the manufacturer’s instructions.
  - 3. Frames and Covers – Shall be cast iron equivalent to the following:

**Neenah Foundry Co. R-1668 Type “C” Lid**

## **2.7 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES**

- A. Shall be designed for water service with a minimum working pressure of 100 p.s.i. The valve shall be constructed of a cast iron body, stainless steel or bronze trim, and stainless steel float. The inlet shall be 2 inches, 5/16 inch orifice, and a minimum venting capacity of 35 c.f.f.a.m. It shall conform to the detail shown on the drawings. Valves shall conform to AWWA C 512 and equivalent to Crispin or Valmatic.

## **2.8 FIRE HYDRANTS**

- A. General – Hydrants shall be manufacturer's current model design and construction. All units to be complete including joint assemblies. Physical characteristics and compositions of various metal used in the hydrant components shall meet the requirements as specified in AWWA C-502 latest revision. Hydrants shall be suitable for working pressure of 150 p.s.i.
- B. Bonnet – Bonnet may have oil filled or dry reservoir. If oil filled, bonnet must have "O" ring packing so all operating parts are enclosed in a sealed oil bath. Oil filler plug shall be provided in bonnet to permit checking of oil level and adding oil when required. If dry type, hydrant top must have lubricating hole or nut for ease of lubrication. All parts must be removed through top of hydrant without moving entire barrel section from safety flange.

- C. Nozzles and Caps – The hydrant shall have 2–1/2 inch connections and 4–1/2 inch steamer connection, National standard threads. Nozzles shall be bronze and have interlocking lugs to prevent blowout.
- D. Seat Ring – Seat ring shall be bronze.
- E. Drain Valves and Openings – Positive operating drain valves shall be provided to assure drainage of fire hydrant when the main valve is closed. Drain openings shall have bronze bushings.
- F. Main Valve – Valve shall be designed to close with the pressure and remain closed. Valve shall be made from material resisting damage from rocks or other foreign matter. Valve shall have a full 5–1/4 –inch opening.
- G. Barrel and Safety Flanges – Hydrants shall have a safety–type vertical barrel with 3 1/2 foot bury and be designed with safety flanges and/or bolts to protect the barrel and stem from damage and to eliminate flooding when hydrant is struck. Bury depth shall be cast on barrel of hydrant.
- H. Operating Stop and Nut – Hydrant shall have a positive stop feature to permit opening of hydrant without over travel of stem. Operating nut shall be bronze, 1–1/2–inch, point to flat, pentagon.
- I. Bolts and Nuts – Bolts, washers and nuts shall be corrosion resistant.
- J. Inlet – Bottom inlet of hydrant shall be provided with mechanical joint connection as specified and shall be 6 inch nominal diameter.
- K. Direction of Opening – Hydrant shall be designed to close ["right" or clockwise and open "left" or counter–clockwise].
- L. Coatings – All inside and outside portions of hydrant shall be coated in accordance with AWWA C–502. The exterior portion of hydrant above ground level shall be painted with two coats of best grade zinc chromate primer paint and with two coats of approved hydrant enamel. Color shall be Factory Safety Yellow unless otherwise designated by Owner.
- M. Joint Assemblies – Complete joint assemblies consisting of gland, gasket, bolts, and nut shall be furnished for mechanical joint inlets.

## 2.9 SERVICE CONNECTIONS

- A. Taps in pipe larger than 3 inches shall be made with a tapping machine. A corporation stop shall be installed at the connection to the main. The corporation stop shall be brass manufactured in conformance with AWWA C–800. Inlet and outlet threads shall conform to AWWA C–800.

Corporation stops shall be 1 inch equivalent to Mueller H–15008 or B–25008 with a stainless steel stiffener. Service saddles shall have 1 inch AWWA taps, equal to Ford Styles 202B or S70. Contractor shall adhere to pipe manufacturer's recommendations on maximum tap sizes for each main size.

- B. Taps for services in PVC pipe 3 inches and smaller shall be equivalent to Romac Industries Style 306 Saddle or a PVC Tee. The connection shall be capable of withstanding internal water pressure continuously at 150 p.s.i. House service lines will be 1-inch polyethylene tubing with a curb stop at the property line. The end of the service lateral at the property line shall be marked with a 2 x 4 stake, 36 inches long with the top 6 inches above the ground and painted blue. The depth of the pipe shall be marked on the back of the stake. Location of service line must appear on the "as-built" information and record drawings.

## **2.10 TAPPING SLEEVES**

- A. Shall be mechanical joint type sized to fit the intercepted pipe. They shall have duck-tipped end gaskets and shall be equal to Mueller H-615/715 with a tapping valve attached. The outlet end of the valve shall have a joint suitable for the type of pipe to be used in the new branch. Sleeve shall be sized to fit the intercepted pipe without leaking.

## **2.11 CURB STOPS**

- A. At the end of the service line, where the meter is to be installed, a 1 inch brass ball valve shall be installed. The unconnected end shall be closed inside I.P. thread. All ball valves shall be ¼ turn valves and the full open and closed position shall be controlled by check lugs. The pressure rating shall be 175 p.s.i. The ball valves shall be equivalent to Ford Ball Valve No. B41-444W.

## **2.12 BACKFLOW PREVENTER ASSEMBLY**

- A. Reduced Pressure – Shall consist of two independently operating check valves, one differential relief valve located between the two check valves, two resilient seat gate valves, and four properly placed resilient seated test cocks. Backflow preventer 2 inches and smaller shall have a bronze valve body. Backflow preventer greater than 2 inches shall be ductile iron or stainless steel. All internal parts in the check and relief valves shall be made of series 300 stainless steel or polymer materials suitable for potable water and rated for 175 p.s.i. working pressure. The assembly shall be constructed so all internal parts can be serviced or removed while in line. Assembly must be factory assembled and tested. Backflow preventer shall be equivalent to Febco Model 860 or Ames Model 4000 SS.
- B. Double Check – Shall consist of two independently operating check valves, two resilient seat gate valves, and four properly placed resilient seated test cocks. Backflow preventer 2 inches and smaller shall have a bronze valve body. Backflow preventer greater than 2 inches shall be ductile iron or stainless steel. All internal parts in the check valves shall be made of Series 300 stainless steel or polymer materials suitable for potable water and rated for 175 p.s.i. working pressure. The assembly shall be constructed so all internal parts can be serviced or removed while in line. Assembly must be factory assembled and tested. Backflow preventer shall be equivalent to Febco Model 805 YD or Ames Model 2000 SS.

**2.13 CASING**

- A. Casing pipe shall be steel conforming to ASTM A 139, yield point of 35,000 p.s.i., of the diameter shown on the contract drawings for each crossing. The minimum wall thickness shall be 0.25 inches.

**2.14 CASING SPACERS**

- A. Casing spacers shall be bolt on style with a shell made in two sections of a minimum 14 gauge T-304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner. All nuts and bolts shall be T-304 Stainless Steel. Runners shall be made of Ultra High Molecular Weight Polymer with inherently high abrasion resistance and a low coefficient of friction. The combined height of supports and runners shall keep carrier pipe a minimum of 0.75 inches from casing pipe at all times. Casing Spacers shall be as manufactured by Cascade Waterworks Manufacturing Company, or accepted equivalent.

**2.15 METAL DETECTOR TAPE**

- A. The tape shall consist of 0.35 mils thick solid foil core encased in a protective plastic jacket resistant to alkalis, acids, and other destructive elements found in the soil. The lamination bond shall be strong enough the layers cannot be separated by hand. Total composite thickness to be 5.0 mils. Foil core to be visible from unprinted side to ensure continuity. The tape shall have a minimum 3-inch width and a tensile strength of 35 lbs. per inch.

A continuous warning message indicating "potable water" repeated every 16 inches to 36 inches shall be imprinted on the tape surface. The tape shall contain an opaque color concentrate designating the color code appropriate to the line being buried (Water Systems – Safety Precaution Blue).

**2.16 TRACING WIRE**

- A. Tracing wire shall be # 12 gauge insulated single strand copper wire.

**2.17 PRODUCT REVIEW**

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

**PART 3 – EXECUTION****3.1 ON-SITE OBSERVATION**

- A. Owner's Representative or Engineer shall have the right to require any portion of work be completed in their presence. If any work is covered up after such instruction, it shall be exposed by the Contractor for observation. However, if Contractor notifies Engineer such work is scheduled, and Engineer fails to appear within 48 hours, the Contractor may proceed. All work completed and materials

furnished shall be subject to review by the Engineer or Project Representative. Improper work shall be reconstructed. All materials which do not conform to requirements of specifications shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Project Engineer or Project Representative a minimum of 48-hours notice for all required observations or tests.

It will also be required of Contractor to keep accurate, legible records of the location of all water lines, service laterals, valves, fittings, and appurtenances. These records will be prepared in accordance with the paragraph on "Record Data" in Special Conditions. Final payment to the Contractor will be withheld until all such information is received and accepted.

### 3.2 INSTALLATION

- A. Ductile iron pipe shall be laid in accordance with AWWA C-600; Plastic pipe shall be laid in accordance with AWWA C 605, ASTM D 2774, UNI-Bell UNI-B 3 and the pipe manufacturer's recommendations. The standards are supplemented as follows:
  - 1. Depth of Pipe – Contractor shall perform excavation of whatever substances are encountered to a depth providing a minimum cover over top of pipe of 36 inches from the existing or proposed finished grade, unless pipe material is steel, concrete, ductile iron, or other accepted material, and if exposed, should be insulated to prevent freezing.
  - 2. Alignment and Grade – Water mains shall be laid and maintained to lines and grades established by the plans and specifications, with fittings, valves, and hydrants at required locations unless otherwise accepted by Owner. Valve-operating stems shall be oriented in a manner to allow proper operation. Hydrants shall be installed plumb.
    - a. Prior Investigation – Prior to excavation, investigation shall be made to the extent necessary to determine location of existing underground structures, utilities, and conflicts. Care shall be exercised by the Contractor during excavation to avoid damage to existing structures and utilities. Pipe manufacturer's recommendations shall be used when the watermain being installed is adjacent to a facility cathodically protected.
    - b. Unforeseen Obstructions – When obstructions not shown on plans are encountered during progress of work, and interfere so an alteration of the plans is required, Owner will alter plans, or order a deviation in line and grade, or arrange for removal, relocation, or reconstruction of obstructions.
    - c. Clearance – When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the acceptance of Engineer, to provide clearance as required by federal,

state, and local regulations or as deemed necessary by Engineer to prevent future damage or contamination.

3. Trench Construction – The trench shall be excavated to alignment, depth, and width specified or shown on plans and shall be in conformance with all federal, state, and local regulations for protection of workers.
4. Joint Restraint – All hydrants, bends, plugs, valves, caps and tees on 2 inch pipe and larger, shall be provided with stainless steel tie rods or joint restraints equivalent to Megalugs. Additional restraint shall be as indicated on the drawings.
5. Anchorage for Hydrants – A concrete block 1 foot x 1 foot x 2 feet shall be poured between back of hydrant and undisturbed earth of the trench side without covering weep holes and bolts. Joint restraints equivalent to Megalugs manufactured by EBAA Iron may be used in lieu of concrete blocking.
6. Hydrostatic and Leakage Tests – Ductile iron pipe shall be tested in accordance with AWWA Standard C 600, Section 5.2 – Hydrostatic Testing. Allowable leakage shall not exceed the formula  $L = \frac{SDP^{1/2}}{148,000}$ , in which L is allowable leakage in gallons per hour; S is length of pipe in feet tested; D is nominal diameter of pipe in inches; and P is average test pressure during leakage test in pounds per square inch gauge. Test shall be conducted for at least 2 hours and a pressure of 150 p.s.i. shall be maintained during the test. Fire lines shall be tested at 225 p.s.i. for the same duration.

P.V.C. pipe shall be tested in accordance with AWWA Standard C 605, Section 7.3 – Hydrostatic Testing. Allowable leakage shall not exceed formula  $Q = \frac{LDP^{1/2}}{148,000}$ , in which Q is allowable leakage in gallons per hour; L is length of pipe in feet tested; D is nominal diameter of the pipe in inches; and P is average test pressure during leakage test in pounds per square inch gauge. Test shall be conducted for at least 2 hours and a pressure of 150 p.s.i. shall be maintained during the test. Fire lines shall be tested at 225 p.s.i. for the same duration.

Should any test of pipe laid disclose leakage greater than the above specified, Contractor shall, at its own expense, locate and repair defective joints until leakage is within specified allowance. Contractor is responsible for notifying the Engineer 48 hours (minimum) prior to applying pressure for testing. Pressure test will be witnessed by Engineer or Project Representative. All visible leaks shall be repaired regardless of the leakage amount.

7. Bedding, Backfilling, and Compaction – Continuous and uniform bedding shall be provided for all buried pipe. All trenches and excavation shall be backfilled immediately after pipes are laid therein, unless other protection of the pipe line is directed. The backfilling material shall be selected and deposited with special reference to future safety of the pipes. The material shall be completely void of rocks, stones, bricks, roots, sticks, or any other debris causing damage to pipe and tubing or preventing

proper compaction of backfill. Except where special methods of bedding and tamping are provided for, clean earth or sand shall be solidly tamped about pipe up to a level at least 2 feet above top of pipes, and shall be carefully deposited to uniform layers, each layer solidly tamped or rammed with proper tools to not injure or disturb the pipeline. The remainder of trench backfilling shall be carried on simultaneously on both sides of pipe in such manner preventing injurious side pressure. Material used shall be selected from excavations anywhere on site if any of the soil is suitable. Stones, other than crushed bedding, shall not come in contact with the pipe and shall not be within 6 inches of any pipe.

Under traffic areas, the top 24 inches of backfill material shall be compacted to a density of not less than 98% of maximum laboratory density at optimum moisture as determined by ASTM D 6938. Below the 24 inch line, and including area around pipe, density shall not be less than 95% of maximum laboratory density, at optimum moisture. In areas other than traffic areas, the backfill shall be compacted to 90% of maximum laboratory density at optimum moisture.

Whenever trenches have not been properly filled, or if settlement occurs, they shall be refilled, smoothed off, and finally made to conform to the ground surface. Backfilling shall be carefully performed, and the original surface restored to full satisfaction of Engineer immediately after installation.

Where thermoplastic (PVC) pipe is installed, Contractor shall take precautions, in accordance with ASTM D-2774, during backfilling operations, not to create excessive side pressures, or horizontal or vertical deflection of the pipe, nor impair flow capacity.

8. New Service Connections – Contractor shall tap the main and install a service connection to each vacant lot or as directed by Engineer in accordance with detail shown on plans for Water Service Connections. Plastic tubing for service lines shall be installed in a manner preventing abrupt changes or bends in any direction. Contractor shall exercise extreme caution to prevent crimping of the tubing during handling, storage, and installation. Tubing shall have an absolute positive connection to the water main to prevent leakage. Taps shall be made perpendicular to the main. A water service connection shall be marked on the curb with a “W.” The mark shall be made with a branding iron on vertical face of curb and shall be a minimum of 1/4-inch in depth.
9. Detection Tape – Detection tape will be used over all pipe and tubing. The tape shall be laid 18 inches below finished grade.
10. Tracing Wire – Tracing wire will be installed on all water mains and water service laterals directly on top of the water line. The wire shall be secured to the pipe with tape or other acceptable methods at spacings of no more than 36 inches apart. Where water service laterals connect to water mains, the wire insulation shall be stripped so bare wires can and shall be jointed securely together and wrapped with a rubberized insulation tape. The insulated wire must maintain electrical continuity. The

tracing wire shall also be stubbed up into each valve box and at each fire hydrant. Stub up connections shall be stripped, joined and wrapped as previously described for water service laterals. This tracing wire system shall be checked and tested by Contractor, in the presence of Engineer or water department, prior to acceptance of water main installation. All equipment, meters, detectors, etc., needed for testing shall be furnished by the Contractor.

11. Jacking and Boring – Steel casing of diameter shown on the plans shall be jacked and bored in location indicated. Joints between sections of the steel casing shall be of a continuous weld made by a certified welder. Jacking and boring shall be in accordance with the State Department of Transportation Standard Specifications. Carrier pipe shall be installed as shown on the detail. After carrier pipe has been installed, ends of the casing shall be sealed using a rubber enclosure and stainless steel straps or brick and mortar.

Where work involves a highway, Resident Engineer of the State Department of Transportation shall be notified 3 days before crossing is started. Where the work involves a railroad, installation shall conform to requirements of AREA specifications. Division Superintendent of the Railroad shall be notified three days prior to beginning work. Before commencing work within right-of-way of railroads or highways, Contractor shall verify the Owner has obtained required permits.

12. Lubricants – Lubricate pipe before jointing per manufacturer's recommendations using acceptable lubricants. Lubricants that will support microbiological growth shall not be used. Vegetable shortening shall not be used to lubricate joints.
13. Hydrant drains shall not be connected to or located within 10-feet of sanitary sewers. No flushing device shall be directly connected to any sewer.
14. Pipe for above water crossings shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.
15. Underwater line crossings shall have a minimum 2 feet of cover over the pipe. When crossing water courses greater than fifteen 15 feet in width, the following shall be provided:
  - a. The pipe material and joints shall be designed appropriately.
  - b. Valves shall be located on both sides of crossing so the section can be isolated for testing or repair. Valves shall be easily accessible and not subject to flooding.
  - c. A blow-off shall be provided on the side opposite the supply, sized in accordance with State Drinking Regulation Section R.61-58.4(D)(7). Direct blow-off away from streams, over ground.

- d. Provide ductile iron pipe with mechanical joints for any lines installed in rock.

### **3.3 AIR RELEASE, AIR/VACUUM AND COMBINATION AIR VALVES**

- A. Valves shall be installed in locations as shown on the contract drawings. The Contractor shall verify high points in the water line and notify Engineer of differing conditions from the drawings.
- B. Valves shall be opened during initial filling of the water main. Valves shall be closed during hydrostatic testing. Once tested and the system is accepted for operation, valves shall be opened when water lines are put on line.

### **3.4 CONNECTIONS OF WATER MAINS**

- A. Any physical connection of untested water mains with existing water mains is prohibited except when acceptable backflow prevention devices have been installed and checked by Engineer or Engineer's Representative.
  - 1. Any new water main to be tested must be capped and restrained with retaining glands or thrust blocks to prevent blow out or leakage during the pressure testing.
  - 2. Water for filling or flushing a new water main will be obtained through a Temporary Jumper Connection to the existing main. Appropriate taps of sufficient size must be made at the end of new system to allow air to escape during filling sequence.
  - 3. This physical tie-in with the existing system must be physically disconnected after sufficient water for hydrostatic testing and disinfection has been obtained.
  - 4. Once the new water system has demonstrated adequate hydrostatic testing and has been flushed and chlorinated in accordance with paragraph 3.5, the new system or main will then be subjected to bacteriological testing.
  - 5. Permanent connection to the new system must be made with clean materials. The connection may be made with either solid or split ductile iron sleeves. Any connection with stainless steel or similar metal full circle clamps is prohibited. Once connection has been made, the new system must be flushed using water from existing system to insure adequate flow and velocity into new water system.

### **3.5 DISINFECTION**

- A. After the hydrostatic and leakage tests have been completed, water pipes shall be disinfected in accordance with AWWA C 651 and Regulations of the local Health Department.

All new mains shall be thoroughly flushed then chlorinated with not less than fifty parts per million (50 ppm) of available chlorine. Chlorine gas or 70% high-test

calcium hypochlorite can be used. Water from existing distribution system or other source of supply should be controlled to flow slowly into the newly laid pipeline during application of chlorine. The solution shall be retained in pipeline for not less than 24 hours and a chlorine residual of 25 ppm shall be available at this time. Then system shall be flushed with potable water and the sampling program started. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating. Normal system residual should be between 0.2 and 0.8 ppm. The chlorine residual shall be measured and reported. If the membrane filter method of analysis is used for coliform analysis, non-coliform growth must also be reported. If non-coliform growth is greater than eighty colonies per one hundred milliliters, the sample result is invalid and must be repeated.

A minimum of two samples from each sampling site shall be collected for total coliform analysis. The number of sites depends on amount of new construction, but must include all dead end lines, be representative of water in newly constructed mains, and shall be collected a minimum of every 1,200 linear feet. Each set of samples shall be taken at least 24 hours apart after disinfection and tested by a State approved lab and shall indicate bacteriological satisfactory water. Contractor shall submit the results to the Engineer.

### **3.6 PARTIAL ACCEPTANCE OF THE WORK**

- A. Owner reserves right to accept and use any portion of the work. Engineer shall have power to direct on what line Contractor shall work and the order thereof.

### **3.7 GRASSING**

- A. Grassing of areas disturbed during construction shall be in accordance with the Section 02902 "Grassing."

### **3.8 SEPARATION BETWEEN WATER AND SANITARY SEWER OR FORCE MAIN**

- A. Water mains shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer or force main. Deviation may be allowed for installation of the water main closer to a sanitary sewer or force main, provided water main is laid in a separate trench, where bottom of water main is at least 18-inches above top of sanitary sewer or force main. Water mains crossing sanitary sewers or force mains shall be laid to provide a minimum vertical distance of 18 inches between the invert of water main and top of sanitary sewer or force main line; both water and sanitary sewer or force main lines must be ductile iron when laid in violation of separation requirements. At all water and sanitary sewer or force main crossings, one full length of water pipe shall be located so both joints will be as far from the sanitary sewer or force main as possible.
- B. When it is impossible to obtain distances specified in Section R.61-58.4(D)(12)(a) and (b) of the State Primary Drinking Water Regulations, an alternate, SCDHEC accepted design may be allowed. The alternate design must:
  - 1. maximize distances between the water main and sewer line and joints of each;

2. use materials which meet requirements cited in Section R.61-58.4(D)(1) of the State Primary Drinking Water Regulations for sewer line; and
3. Allow enough distance to make repairs to one of the lines without damaging other.

### 3.9 REMOVE AND REPLACE PAVEMENT

- A. Pavement shall only be removed after prior written authorization by the Owner. Pavement removed and replaced shall be constructed in accordance with latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled per State Department of Transportation regulations.

Edges of the pavement shall be cut to a neat straight line with a masonry saw. Backfill shall be compacted and tested and a concrete base course of 5,000 p.s.i. placed on compacted fill as shown in the details. The concrete base shall be placed within 24 hours after water line is installed. A temporary wearing surface may be used provided it presents a smooth surface. The final wearing surface shall be 1-1/2 inches asphaltic concrete, Type C.

### 3.10 FIELD QUALITY CONTROL

- A. Soil and density tests shall be made by a testing laboratory acceptable to Engineer. Laboratory tests of the soil shall be made in accordance with ASTM D 1557. In-place density tests shall be made in accordance with ASTM D 6938. Results of tests shall be furnished to the Engineer.

The minimum number of tests required shall be:

Backfill over pipe

in traffic areas. . . . . 1 per 100 linear feet or less for each 4 feet of depth or portion thereof.

Backfill over pipe

in non-traffic areas. . . .1 per 500 linear feet or less for each 4 feet of depth or portion thereof.

The minimum percent of backfill compaction, in accordance to ASTM D1557, shall be the following:

In traffic Areas. . . . . 98% of maximum laboratory density.

In non-traffic Areas. . .90% of maximum laboratory density, unless otherwise accepted by the Engineer.

END OF SECTION

**INDEX TO**  
**SECTION 02720 – STORM DRAINAGE**

| <b>Paragraph</b>          | <b>Title</b>                                    | <b>Page</b> |
|---------------------------|-------------------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                                                 |             |
| 1.1                       | Section Includes                                | 02720–1     |
| 1.2                       | Related Sections                                | 02720–1     |
| 1.3                       | Options                                         | 02720–1     |
| 1.4                       | References                                      | 02720–1     |
| 1.5                       | Quality Assurance                               | 02720–2     |
| 1.6                       | Product Delivery, Storage, and Handling         | 02720–3     |
| 1.7                       | Sequencing and Scheduling                       | 02720–3     |
| 1.8                       | Alternatives                                    | 02720–3     |
| 1.9                       | Guarantee                                       | 02720–3     |
| 1.10                      | Existing Utilities                              | 02720–3     |
| 1.11                      | Omitted                                         | 02720–4     |
| 1.12                      | Testing                                         | 02720–4     |
| <b>PART 2 – PRODUCTS</b>  |                                                 |             |
| 2.1                       | Pipe                                            | 02720–4     |
| 2.2                       | Drainage Structures                             | 02720–5     |
| 2.3                       | Filter Fabric                                   | 02720–6     |
| 2.4                       | Omitted                                         | 02720–6     |
| 2.5                       | Soils and Stone Aggregates                      | 02720–6     |
| 2.6                       | Product Review                                  | 02720–7     |
| <b>PART 3 – EXECUTION</b> |                                                 |             |
| 3.1                       | On Site Observations of Work                    | 02720–8     |
| 3.2                       | Excavation for Pipe and Structures              | 02720–8     |
| 3.3                       | Trenching for Pipe                              | 02720–8     |
| 3.4                       | Protection of Utility Lines                     | 02720–9     |
| 3.5                       | Foundation and Bedding                          | 02720–9     |
| 3.6                       | Haunching, Initial Backfill, and Final Backfill | 02720–10    |
| 3.7                       | Placing Pipe                                    | 02720–11    |
| 3.8                       | Joints in Pipes                                 | 02720–11    |
| 3.9                       | Field Quality Control                           | 02720–13    |
| 3.10                      | Drainage Structures                             | 02720–14    |
| 3.11                      | Remove and Replace Pavement                     | 02720–14    |
| 3.12                      | Connect Pipe to Existing Structures             | 02720–14    |

**SECTION 02720**  
**STORM DRAINAGE**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Construction of pipes, drainage inlets, manholes, headwalls, and various drainage structures.

**1.2 RELATED SECTIONS**

- A. Section 02731 – Wastewater Collection System
- B. Section 03305 – Site Concrete

**1.3 OPTIONS**

- A. The bid form and specifications describe several pipe materials. Owner will select the one to be used. Where manufacturers of material or equipment are named in the specifications, Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by Engineer as equivalent to those specified.

**1.4 REFERENCES (Latest Revision)**

- A. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.
- C. ASTM C 76 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- D. ASTM C 443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- E. ASTM B 745/B 745M – Corrugated Aluminum Pipe for Sewers and Drains.
- F. ASTM D 1056 – Flexible Cellular Materials – Sponge or Expanded Rubber.
- G. ASTM F 2306/F 2306M – 12 to 60-Inch (300 to 1,500 mm) Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.
- H. ASTM D 1751 – Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- I. ASTM D 1752 – Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

- J. ASTM D 2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
- K. ASTM C 150 – Portland Cement.
- L. ASTM C 144 – Aggregate for Masonry Mortar.
- M. ASTM C 207 – Hydrated Lime for Masonry Purposes.
- N. ASTM C 62 – Building Brick (Solid Masonry Units Made From Clay or Shale).
- O. ASTM C 55 – Concrete Brick.
- P. ASTM C 478 – Precast Reinforced Concrete Manhole Sections.
- Q. ASTM C 1433 – Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers.
- R. ASTM D 1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- S. ASTM D 6938 – In Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- T. ASTM F 405 – Corrugated Polyethylene (PE) Tubing and Fittings.
- U. ASTM C 913 – Precast Concrete Water and Wastewater Structures.
- V. ASTM D 3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- W. ASTM F 477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- X. AASHTO M 294 – Corrugated Polyethylene Pipe, 300 to 1500-mm Diameter.
- Y. ASTM F667 – Large Diameter Corrugated Polyethylene Pipe and Fittings.

## **1.5 QUALITY ASSURANCE**

- A. Material Review – Contractor will furnish the Engineer and Owner a description of all material before ordering. Engineer will review the Contractor's submittals and provide in writing an acceptance or rejection of material.
- B. Manufacturer – Material and equipment shall be standard products of a manufacturer who has manufactured them for a minimum of 2 years and provides published data on their quality and performance.
- C. Subcontractor – A subcontractor for any part of the work must have experience on similar work, and if required, furnish Engineer with a list of projects and Owners or Engineers who are familiar with their competence.

- D. Design – Devices, equipment, structures, and systems not designed by Engineer and Contractor wishes to furnish, shall be designed by either a Registered Professional Engineer or by someone the Engineer accepts as qualified. If required, complete design calculations and assumptions shall be furnished to the Engineer or Owner before ordering.
- E. Testing Agencies – Soil tests shall be taken by a testing laboratory operating in accordance to ASTM D-3740 and E-329 and be acceptable to the Engineer prior to engagement. Mill certificates of tests on materials made by manufacturers will be accepted provided the manufacturer maintains an adequate testing laboratory, makes regularly scheduled tests, spot checked by an outside laboratory and furnishes satisfactory certificates.

#### **1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Material shall be unloaded in a manner avoiding damage and shall be stored where it will be protected and will not be hazardous to traffic. Contractor shall repair any damage caused by the storage. Material shall be examined before installation. Neither damaged nor deteriorated material shall be used in the work.

#### **1.7 SEQUENCING AND SCHEDULING**

- A. Contractor shall arrange work so sections of pipes between structures are backfilled, checked, pavement replaced and the section placed in service as soon as reasonable after installation.

#### **1.8 ALTERNATIVES**

- A. The intention of these specifications is to produce the best system for the Owner. If Contractor suggests alternate material, equipment or procedures will improve results at no additional cost, the Engineer and Owner will examine suggestion, and if accepted, it may be used. The basis upon which acceptance of an alternate will be given is its value to Owner and not for Contractor's convenience.

#### **1.9 GUARANTEE**

- A. Contractor shall guarantee quality of materials, equipment, and workmanship for a minimum period of 12 months or as required by the local governing agency after acceptance. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

#### **1.10 EXISTING UTILITIES**

- A. All known utility facilities are shown schematically on the construction drawings, and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown, will not relieve the Contractor of responsibility under this requirement. "Existing Utilities Facilities" means any utility existing on the project in its original, relocated, or newly installed position. Contractor will be held responsible for cost of repairs to damaged underground facilities; even when such facilities are not shown on the drawings.

- B. The Contractor shall call for underground utility locations before starting work. Underground utilities location service can be contacted at 1-888-721-7877 (SC) or 811.

#### **1.11 OMITTED**

#### **1.12 TESTING**

- A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).
- B. In place density tests in accordance with ASTM D 1556 or ASTM D 6938.
- C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- D. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48-hours notice prior to taking any tests.
- E. Testing shall be the Contractor's responsibility and shall be performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.
- F. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

### **PART 2 – PRODUCTS**

#### **2.1 PIPE**

- A. Concrete Pipe – Shall be reinforced Class III, Class IV, or Class V and shall conform to ASTM Specification C-76. Pipe less than 48 inch inside diameter shall be manufactured without lifting holes. Joints shall be either 'O' ring watertight flexible rubber, or tongue and groove as indicated on the plans. Gasketed single offset joints may be used in lieu of 'O' ring joints if acceptable to the Engineer.
  - 1. 'O' Ring Joints – Shall be water tight flexible rubber gasket and shall meet ASTM Specification C-443.
  - 2. Gasketed single offset joint shall be soil tight and shall meet ASTM Specification C-443.
  - 3. Tongue and groove joints shall utilize mastic sealant and the exterior shall be wrapped with geotextile material.
- B. Corrugated Aluminum Alloy Pipe – Shall conform to ASTM B745. Pipe may be annular or helical.
  - 1. Joints – Coupling bands shall be one piece lap-type, having a width conforming to the pipe manufacturer's recommendations. They shall be of the angle lug, rod and lug, or U-bolt type. The type, size and gauge of bands and size of angles, bolts and rods shall be as specified in

applicable standards or specifications for pipe. Exterior rivet heads in the longitudinal seam under coupling band shall be countersunk or rivets shall be omitted and the seam welded.

2. Gaskets – Gaskets shall be made of 3/8 inch thick by 6-1/2 inch minimum width closed cell expanded synthetic rubber, fabricated in the form of a cylinder with a diameter approximately 10% less than nominal pipe size. The gasket material shall conform to requirements of ASTM D1056, Grade Number SBE-43.
  3. Bends – Where specified, shall be shop fabricated to angles and dimensions shown on the construction drawings.
- C. Polyethylene – Shall be high density polyethylene corrugated pipe having an integrally formed smooth interior, equivalent to Advanced Drainage Systems N-12WT, N-12STIB or Hancor Blue Seal or Sure-Lok ST. Pipe shall conform to ASTM F667 and F2306.
1. Joints – Pipe shall be joined using an integral bell and spigot joint meeting ASTM F2306 specifications. The joint shall be soil and water tight and gaskets, when applicable, shall meet requirements of ASTM F477. A joint lubricant supplied by manufacturer shall be used on the gasket and bell during assembly.
- D. Subgrade Drain – Shall be heavy duty corrugated polyethylene perforated pipe manufactured by Advanced Drainage Systems (ADS) or equivalent and shall conform to ASTM F-405.

## 2.2 DRAINAGE STRUCTURES

- A. Details – See plans.
- B. Concrete – Reinforced and non-reinforced.
1. Minimum compressive strength = 3,000 p.s.i. at 28 days.
  2. Reinforcing shall be covered by a minimum 1 inch of concrete for top slabs and 1-1/2 inches for walls and bases and 3 inches where concrete is deposited directly against the ground.
  3. Expansion joint filler materials shall conform to ASTM D 1751 or D 1752.
- C. Mortar – Connection of pipe and drainage structures shall be composed of one part by volume of Portland cement and two parts of sand. The Portland cement shall conform to ASTM C-150, Type I or II. The sand shall conform to ASTM C-144 and shall be of an accepted gradation. Hydrated lime may be added to the mixture of sand and cement in an amount equal to 25% of cement volume used. Hydrated lime shall conform to ASTM C-207, Type S. Quantity of water in the mixture shall be sufficient to produce a workable mortar, but shall in no case exceed 7 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes from time ingredients are mixed with water.

- D. Brick Masonry – Brick shall conform to ASTM Specification C-62, Grade SW or C-55, Grade S. Mortar for jointing and plastering shall consist of one part Portland cement and two parts fine sand. Lime may be added to the mortar in an amount not more than 25% of the cement volume used. Joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of structure. Brick structures shall be plastered with 1/2 inch of mortar over entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course, and for round structures, brick shall be laid radially with every sixth course a stretcher course.
- E. Precast – Shall be constructed in accordance with ASTM C-478, C-913, or C-1433 and conform to details on the project drawings.
  - 1. Joints – Shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O-Ring or Type A or B “Tylox” conforming to ASTM C443 and mastic shall be “Ram-nek” or equivalent with primer. Primer shall be applied to all contact surfaces of manhole joints at the factory in accordance with manufacturer's instructions.
  - 2. Steps – Shall be polypropylene equivalent to M.A. Industries, Type PS-1 or PS-1-PF. Steps shall be installed at the manhole factory and in accordance with recommendations of step manufacturer. Manholes will not be acceptable if steps are not installed accordingly.
  - 3. Leaks – No leaks in the manhole will be acceptable. All repairs made from inside the manhole shall be made with mortar composed of one part portland cement and two parts clean sand; mixing liquid shall be straight bonding agent equivalent to “Acryl 60.”
- F. Frame, cover & grating shall conform to details shown on the project drawings. Grates in pavement and in other flush-mounted type surfaces shall be of a "bicycle-safe" configuration consisting of 45 degree diagonal bars or slotted grates with a maximum clear opening of 1 inch and a maximum length of 9-inches. In any case, the long dimension of openings should be located transverse to direction of traffic when possible.

### **2.3 FILTER FABRIC**

- A. Shall be a non-woven heat-bonded fiber of polypropylene and nylon filaments equivalent to Mirafi 140 N. The fabric shall be finished so filaments will retain their relative position with respect to each other. Fabric shall contain stabilizers and/or inhibitors added to the base plastic to make filaments resistant to deterioration due to ultraviolet and/or heat exposure. The product shall be free of flaws, rips, holes, or defects.

### **2.4 OMITTED**

### **2.5 SOILS AND STONE AGGREGATES**

- A. Stone aggregate shall be clean crushed granite or concrete meeting the gradation requirements of grade No. 57.

- B. Soils used for bedding, haunching, and initial backfill shall be as shown in the following table and shall meet requirements and classifications of ASTM D2321 and ASTM D2487.

| Class | Type                                                     | Soil Group Symbol<br>D 2487 | Description                                                                                                                                                                | Percentage Passing Sieve Sizes |                           |                       |
|-------|----------------------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------|-----------------------|
|       |                                                          |                             |                                                                                                                                                                            | 1-1/2 inch<br>(40 mm)          | No. 4<br>(4.75 mm)        | No. 200<br>(0.075 mm) |
| IB    | Manufactured, Processed Aggregates; dense-graded, clean. | None                        | Angular, crushed stone (or other Class 1A materials) and stone/sand mixtures with gradations selected to minimize migration of adjacent soils; contain little or no fines. | 100%                           | ≤50%                      | <5%                   |
| II    | Coarse – Grained Soils, clean                            | GW                          | Well-graded gravels and gravel-sand mixtures; little or no fines.                                                                                                          | 100%                           | <50% of “Coarse Fraction” | <5%                   |
|       |                                                          | GP                          | Poorly-graded gravels and gravel-sand mixtures; little or no fines.                                                                                                        |                                |                           |                       |
|       |                                                          | SW                          | Well-graded sands and gravelly sands; little or no fines.                                                                                                                  |                                | >50% of “Coarse Fraction” |                       |
|       |                                                          | SP                          | Poorly-graded sands and gravelly sands; little or no fines.                                                                                                                |                                |                           |                       |
|       | Coarse-Grained Soils; borderline clean to w/fines.       | Eg. GW–GC, SP–SM.           | Sands and gravels that are borderline between clean and with fines.                                                                                                        | 100%                           | Varies                    | 5% to 12%             |
| III   | Coarse-Grained Soils with Fines                          | GM                          | Silty gravels, gravel-sand-silt mixtures.                                                                                                                                  | 100%                           | <50% of “Coarse Fraction” | 5%                    |
|       |                                                          | GC                          | Clayey gravels, gravel-sand-clay mixtures.                                                                                                                                 |                                |                           |                       |
|       |                                                          | SM                          | Silty sands, sand-silt mixtures.                                                                                                                                           |                                | >50% of “Coarse Fraction” |                       |
|       |                                                          | SC                          | Clayey sands, sand-clay mixtures.                                                                                                                                          |                                |                           |                       |
| IVA   | Fine-grained soils (inorganic)                           | ML                          | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts with slight plasticity.                                                                 | 100%                           | 100%                      | >50%                  |
|       |                                                          | CL                          | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.                                                                         |                                |                           |                       |

## 2.6 PRODUCT REVIEW

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products by the submittal of shop drawings before they are ordered.

## PART 3 – EXECUTION

### 3.1 ON SITE OBSERVATIONS OF WORK

- A. The line, grade, deflection, and infiltration of storm sewers shall be tested by Contractor under direction of Engineer. Owner's Representative or Engineer will have the right to require any portion of work be completed in their presence and if work is covered up after such instruction, it shall be exposed by Contractor for observation. However, if Contractor notifies Engineer such work is scheduled and the Engineer fails to appear within 48-hours, Contractor may proceed. All work completed and material furnished shall be subject to review by the Engineer or Project Representative. All improper work shall be reconstructed. All materials not conforming to requirements of specifications shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Project Engineer or Project Representative a minimum of 48-hours notice for all required observations or tests. Storm sewers shall be dry for observation by the Engineer. Lines under water shall be pumped out by Contractor prior to observation, at no additional cost to the Owner.

It will also be required of Contractor to keep accurate, legible records of the location of all storm sewer lines and appurtenances. These records will be prepared in accordance with paragraph on "Record Data and Drawings" in the Special Conditions. Final payment to the Contractor will be withheld until all such information is received and accepted.

### 3.2 EXCAVATION FOR PIPE AND STRUCTURES

- A. Excavated material shall be piled a sufficient distance from the trench banks to avoid overloading to prevent slides or cave-ins.
- B. Remove from site all material not required or suitable for backfill.
- C. Grade as necessary to prevent water from flowing into excavations.
- D. Remove all water accumulating in the excavation, from surface flow, seepage, or otherwise, by pumping or other acceptable method.
- E. Sheet piling, bracing or shoring shall be used as necessary for protection of the work and safety of personnel.

### 3.3 TRENCHING FOR PIPE

- A. Trenching for Pipe – The width of trenches at any point below top of pipe shall be not greater than outside diameter of pipe plus 4 feet to permit satisfactory jointing and thorough bedding, haunching, backfilling and compacting under and around pipes. Sheet piling and bracing where required shall be placed within the trench width as specified. Care shall be taken not to over-excavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this re-design

and increased cost of pipe or installation shall be borne by Contractor without additional cost to the Owner. When installing pipe in a positive projecting embankment installation, the embankment shall be installed to an elevation of at least 1 foot above top of pipe for a width of five pipe diameters on each side of pipe before installation of pipe.

- B. Removal of Unsuitable Material – Where wet or otherwise unstable soil, incapable of supporting the pipe is encountered in bottom of trench, such material shall be removed to depth required and replaced to proper grade with stone or sand foundation as determined by Engineer. This foundation shall be compacted to 95% modified proctor.

### **3.4 PROTECTION OF UTILITY LINES**

- A. Existing utility lines shown on drawings or locations of which are made known to the Contractor prior to excavation, and are to be retained, as well as utility lines constructed during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired at Contractor's expense. If the Contractor damages any existing utility lines not shown on drawings or locations of which are not known to Contractor, report thereof shall be made immediately. If Engineer determines repairs shall be made by Contractor, such repairs will be ordered under the clause in GENERAL CONDITIONS of contract entitled "CHANGES." When utility lines to be removed are encountered within the area of operations, Contractor shall notify Engineer in ample time for necessary measures taken to prevent interruption of service.

### **3.5 FOUNDATION AND BEDDING**

- A. Stone Foundation – Where the subgrade of pipe is unsuitable material, Contractor shall remove unsuitable material to a depth determined by Engineer or Geotechnical Consultant and furnish and place stone foundation in trench to stabilize subgrade.
- B. Sand Foundation – Where the character of soil is unsuitable, even though dewatered, additional excavation to a depth determined by Engineer or Geotechnical Consultant shall be made and replaced with clean sand furnished by Contractor.
- C. Bedding for pipe shall provide a firm surface of uniform density throughout the entire length of pipe. Before laying pipe, trench bottom shall be de-watered by the use of well points. Where well points will not remove the water, Contractor shall construct sumps and use pumps to remove all water from bedding surface. Pipe shall be carefully bedded in stone accurately shaped and rounded to conform to lowest 1/3 outside portion of circular pipe, or lower curved portion of arch pipe for the entire length of pipe. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making the particular type joint.
- D. Concrete Pipe:
  - 1. Materials for bedding concrete pipe shall be either Class II, Class III, or Class IB if processed, to minimize migration of adjacent material.

2. Depth of bedding shall be equal to 1/24 the outer diameter of pipe or 3 inches, whichever is greater.
  3. Bedding area under the center of pipe, for a width 1/3 outer diameter of pipe, known as middle bedding, shall be loosely placed. Remainder of bedding for full width of the trench shall be compacted to a minimum density of 85% for Class II bedding and 90% for Class III bedding as determined by ASTM D1557.
- E. Polyethylene and Corrugated Aluminum Alloy Pipe
1. Materials for bedding polyethylene and corrugated aluminum alloy pipe shall be either Class II, Class III, or Class IB if processed to minimize migration of adjacent materials.
  2. Depth of bedding shall be equal to 1/10 the outer diameter of pipe or a minimum of 6 inches, whichever is greater.
  3. Bedding area under the center of pipe, for a width 1/3 outer diameter of pipe, known as middle bedding, shall be loosely placed. Remainder of bedding for full width of the trench shall be compacted to a minimum density of 90% for Class II bedding and 95% for Class III bedding.

### **3.6 HAUNCHING, INITIAL BACKFILL, AND FINAL BACKFILL**

- A. Haunching – After the bedding has been prepared and pipe is installed, Class II or Class III soil shall be placed along both sides of pipe, in layers not exceeding 6 inches in compacted depth. Care shall be taken to insure thorough compaction and fill under haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers and rammers. Haunching shall extend up to the spring line of pipe and be compacted to following densities:
1. RCP: Minimum density shall be 90% as determined by ASTM D1557.
  2. HDPE and Corrugated Aluminum Alloy Pipe: Minimum density shall be 95% as determined by ASTM D1557.
- B. Initial Backfill – HDPE and corrugated aluminum alloy pipe require initial backfill material of either Class II or Class III soils to be placed from the spring line to a minimum of 6 inches above top of pipe in 6 inch lifts. This initial backfill shall be compacted to a minimum density of 95% as determined by ASTM D1557. Reinforced concrete pipe does not specifically require initial backfill. Initial backfill for reinforced concrete pipe can be the same as final backfill.
- C. Final Backfill – For all pipes, it should extend to the surface and shall be select materials compacted to a minimum of 98% as determined by ASTM D1557 if pipe is under pavement. If pipe is in grassed areas final backfill may be native materials compacted to a minimum density of 90% as determined by ASTM D155

### 3.7 PLACING PIPE

- A. Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipe lines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall have been checked before backfilling. When storm drain pipe terminates in a new ditch, headwall or end section, together with ditch pavement, if specified, shall be constructed immediately as called for on the plans. Ditch slopes and disturbed earth areas shall be grassed and mulched as required. Contractor will be responsible for maintaining these newly constructed ditches and take immediate action subject to acceptance, keeping erosion of the ditch bottom and slopes to a minimum during life of contract. No additional compensation will be given to Contractor for the required diversion of drainage and/or dewatering of trenches. Grassing the trench backfill shall conform to requirements of Section 02902 – “Grassing.”
- B. Concrete Pipe: Laying shall proceed upgrade with spigot ends of bell and spigot pipe and tongue ends of tongue and groove pipe pointing in the direction of flow. Place pipe in trench with the invert conforming to required elevations, slopes, and alignment. Provide bell holes in pipe bedding in order to insure uniform pipe support. Fill all voids under the pipe by working in backfill material.
- C. Corrugated Aluminum Pipe: Shall be laid with separate sections joined firmly together, with outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Lifting lugs, where used, shall be placed to facilitate moving the pipe without damage to exterior or interior coatings. Place pipe in trench with the invert conforming to required elevations, slopes and alignment. Fill all voids under the pipe by working in backfill material.
- D. Polyethylene Pipe – Laying shall proceed upgrade with spigot ends of bell and spigot pipe pointing in the direction of flow. Place pipe in trench with the invert conforming to required elevations, slopes, and alignment. Provide bell holes in pipe bedding in order to ensure uniform pipe support. Fill all voids under the pipe by working in bedding material. Pipe shall be installed in accordance with ASTM D-2321.
- E. Subgrade Drain Tubing – Shall be laid as detailed on construction drawings with the invert conforming to required elevations and alignment.

### 3.8 JOINTS IN PIPES

- A. Concrete Pipe – Joints in concrete pipe shall be either ‘O’ ring watertight flexible rubber or tongue and groove as indicated on the plans. Gasketed, single offset joints may be used if accepted by the Engineer. Maintain pipe alignment and prevent infiltration of fill material at joints during installation.
  - 1. ‘O’ ring and single offset joints shall meet the requirements of ASTM C443. They shall utilize either a rubber gasket with a circular cross section or a rectangular cross section. Gaskets shall have no more than one splice,

except two splices of the gasket will be permitted if nominal diameter of pipe exceeds 54 inches. Manufacturer's recommendations and requirements shall be followed.

2. Tongue and groove joints shall utilize a bituminous mastic such as Ram-Nek or accepted equivalent. The joint surfaces shall be primed according to manufacturer's recommendations. Care shall be taken to insure mastic material completely and uniformly seals the joint.
  3. All tongue and groove joints shall receive one layer of filter fabric completely around exterior of the joint. Filter fabric shall be a minimum of 2 feet wide, centered on the joint, and overlapped a minimum of 1 foot.
- B. Corrugated Aluminum Pipe – Maintain pipe alignment and prevent infiltration of fill material at joints during installation.
1. Installation of Gaskets – Shall be in accordance with recommendations of the manufacturer in regard to use of lubricants and cements and other special installation requirements. Gasket shall be placed over one end of a section of pipe for half the width of a gasket. The other half shall be doubled over end of same pipe. When adjoining section of pipe is in place, the double-over half of gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so gasket covers ends of pipe sections equally. Connecting bands shall then be centered over the adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. The band shall be tightened evenly. Tension shall be kept on rods or bolts and gasket shall be closely observed to see it is seating properly in the corrugations.
  2. Installation of Filter Fabric at Joint – After the connecting band has been tightened; Contractor shall place one layer of filter fabric completely around exterior of joint, a minimum of 2 feet wide, centered on joint, and overlapped a minimum of 1 foot.
- C. Polyethylene Pipe – Maintain pipe alignment and prevent infiltration of fill material at joints during installation
1. Joints shall be gasketed soil-tight and water-tight bell and spigot meeting ASTM F2306. Gaskets shall meet the requirements of ASTM F477. A joint lubricant supplied by manufacturer shall be used on the gasket and bell during assembly. Spigot end of pipe shall be inserted into bell using methods recommended by the manufacturer. Pipe shall be kept true to line and grade during assembly.
  2. Installation of Filter Fabric at Joint – All polyethylene pipe joints shall receive one layer of filter fabric completely around exterior of the joint. Filter fabric shall be a minimum of 2 feet wide, centered on the joint, and overlapped a minimum of 1 foot.
- D. Subgrade Drain Tubing – Joints shall be joined using snap couplings. When installing sock wrapped pipe, overlap sock ends over coupling and secure with polyethylene tape.

### 3.9 FIELD QUALITY CONTROL

- A. Soil and density tests shall be made by a testing laboratory acceptable to the Engineer. Laboratory tests of the soil shall be made in accordance with ASTM D 1557. In-place density tests shall be made in accordance with ASTM D 6938. Results of tests shall be furnished to the Engineer.

The minimum number of tests required shall be:

Haunching and Initial

Backfill in all areas.... 1 per 100-linear feet of pipe, minimum of one per run of pipe for both the haunching and initial backfill zones.

Final Backfill over pipe  
in traffic areas.....

1 per 100-linear feet or less for each 4-feet of depth or portion thereof.

Final Backfill over pipe  
in non-traffic areas.....

1 per 500-linear feet or less for each 6-feet of depth or portion thereof.

The minimum percent of compaction of the backfill material (in accordance to ASTM D1557) shall be the following:

In traffic Areas. . . . . 98% of maximum laboratory density.

In non-traffic Areas . . . 90% of maximum laboratory density, unless otherwise accepted by the Engineer.

- B. It is the Contractor's responsibility to assure backfill is sufficient to limit pipe deflection to no more than 5%. When flexible pipe is used, a deflection test shall be made by the Contractor on entire length of installed pipeline, not less than 30-days after completion of all backfill and placement of any fill. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 95% the inside pipe diameter. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface brinell hardness of not less than 150. The device shall be center bored and through bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of 70,000 p.s.i. or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer; a pull exerted on opposite end of shaft shall produce compression throughout remote end of ball, cylinder, or circular section. Circular sections shall be spaced so the distance from external faces of front and back sections shall equal or exceed diameter of circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through by hand or by being flushed through with water, shall be cause for rejection of a run. When a deflection device is used for the test in lieu of a ball, cylinder, or circular sections described, such device shall be given acceptance prior to use. Device shall be sensitive to 1.0% of pipe diameter being measured and shall be accurate to 1.0% of the

indicated dimension. Installed pipe showing deflections greater than 5% of normal pipe diameter shall be retested by a run from the opposite direction. If retest also fails, the suspect pipe shall be repaired or replaced at no cost to Owner.

- C. 50% of pipes under roadways shall be televised and video recorded. The video observation shall include a complete pan view of each joint. If the video observation indicates problems, further televising may be required. Additional televising and video recording will be at no additional cost to the Owner.

### **3.10 DRAINAGE STRUCTURES**

- A. Drainage structures shall be constructed of materials specified for each type and in accordance with details shown on the drawings.

### **3.11 REMOVE AND REPLACE PAVEMENT**

- A. Pavement shall only be removed after prior written authorization by the Owner. Pavement removed and replaced shall be constructed in accordance with latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled per State Department of Transportation regulations.

### **3.12 CONNECT PIPE TO EXISTING STRUCTURES**

- A. Contractor shall connect pipe to the existing structure where indicated. For brick or precast structures, a hole not more than 4 inches larger than outside diameter of new pipe shall be cut or cored neatly in the structure, new pipe laid so it is flush with inside face of structure, and annular space around pipe filled with a damp, expanding mortar or grout to make a watertight seal.

END OF SECTION

**INDEX TO**  
**SECTION 02731 – WASTEWATER COLLECTION SYSTEM**

| <b>Paragraph</b>         | <b>Title</b>                          | <b>Page</b> |
|--------------------------|---------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>  |                                       |             |
| 1.1                      | Section Includes                      | 02731–1     |
| 1.2                      | Related Sections                      | 02731–1     |
| 1.3                      | Options                               | 02731–1     |
| 1.4                      | References                            | 02731–1     |
| 1.5                      | Omitted                               | 02731–3     |
| 1.6                      | Quality Assurance                     | 02731–3     |
| 1.7                      | Product, Delivery, Storage & Handling | 02731–4     |
| 1.8                      | Job Conditions                        | 02731–4     |
| 1.9                      | Sequencing and Scheduling             | 02731–4     |
| 1.10                     | Alternatives                          | 02731–4     |
| 1.11                     | Guarantee                             | 02731–4     |
| 1.12                     | Existing Utilities                    | 02731–5     |
| 1.13                     | Testing                               | 02731–5     |
| <b>PART 2 – PRODUCTS</b> |                                       |             |
| 2.1                      | Sewer Pipe                            | 02731–5     |
| 2.2                      | Joints – Gravity System               | 02731–6     |
| 2.3                      | Force Main                            | 02731–6     |
| 2.4                      | Casing                                | 02731–7     |
| 2.5                      | Casing Spacers                        | 02731–7     |
| 2.6                      | Manholes                              | 02731–7     |
| 2.7                      | Tees                                  | 02731–8     |
| 2.8                      | Laterals                              | 02731–8     |
| 2.9                      | Stone Backfill                        | 02731–8     |
| 2.10                     | Sand Backfill                         | 02731–8     |
| 2.11                     | Borrow                                | 02731–9     |
| 2.12                     | Air Release Valve                     | 02731–9     |
| 2.13                     | Metal Detector Tape                   | 02731–9     |
| 2.14                     | Tracing Wire                          | 02731–9     |
| 2.15                     | Submersible Sewage Pumping Station    | 02731–9     |
| 2.16                     | Check Valves                          | 02731–16    |
| 2.17                     | Gate Valves                           | 02731–16    |
| 2.18                     | Plug Valves                           | 02731–16    |
| 2.19                     | Product Review                        | 02731–17    |

| <b>Paragraph</b>          | <b>Title</b>                              | <b>Page</b> |
|---------------------------|-------------------------------------------|-------------|
| <b>PART 3 – EXECUTION</b> |                                           |             |
| 3.1                       | Construction Observation                  | 02731–17    |
| 3.2                       | Location and Grade                        | 02731–17    |
| 3.3                       | Sewer Excavation                          | 02731–17    |
| 3.4                       | Trench Wall Support                       | 02731–18    |
| 3.5                       | Laying Pipe                               | 02731–19    |
| 3.6                       | Separation Between Water & Sanitary Sewer | 02731–20    |
| 3.7                       | Backfilling                               | 02731–21    |
| 3.8                       | Manholes                                  | 02731–21    |
| 3.9                       | Stone Bedding                             | 02731–22    |
| 3.10                      | Sand Bedding                              | 02731–22    |
| 3.11                      | Deflection                                | 02731–22    |
| 3.12                      | Leakage                                   | 02731–23    |
| 3.13                      | Cleaning and Acceptance                   | 02731–24    |
| 3.14                      | Closing Pipe                              | 02731–24    |
| 3.15                      | Partial Acceptance of the Work            | 02731–24    |
| 3.16                      | Grassing                                  | 02731–24    |
| 3.17                      | Record Data                               | 02731–24    |
| 3.18                      | Remove and Replace Pavement               | 02731–24    |
| 3.19                      | Metallic Detector Tape                    | 02731–25    |
| 3.20                      | Tracing Wire                              | 02731–25    |
| 3.21                      | Connect Sewers to Existing Structures     | 02731–25    |
| 3.22                      | Field Quality Control                     | 02731–25    |
| 3.23                      | Air Release Valve                         | 02731–25    |
| 3.24                      | Sewage Pumping Station                    | 02731–26    |
| 3.25                      | Force Main                                | 02731–26    |
| 3.26                      | Bypassing                                 | 02731–27    |

**SECTION 02731**  
**WASTEWATER COLLECTION SYSTEM**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Sewer Pipes.
- B. Manholes.
- C. Connect to existing system.
- D. All necessary appurtenances to collect the wastewater and deliver it to the existing system.
- E. Pumping Station
- F. Force Main

**1.2 RELATED SECTIONS**

- A. Section 02204 – Earthwork.
- B. Section 02667 – Water Distribution System.

**1.3 OPTIONS**

- A. The specifications describe several materials. The Owner will select ones to be used. Where manufacturers and models of equipment are named in the specifications, it is intended these are to describe quality and function required. Contractor may use equipment or materials of other manufacturers provided they are reviewed and accepted by the Engineer and Owner as equivalent to those specified.

**1.4 REFERENCES (Latest Revision)**

- A. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.
- C. ASTM D 3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- D. ASTM D 2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- E. ANSI/AWWA C 150/A 21.50 – Thickness Design of Ductile Iron Pipe.

- F. ANSI/AWWA C 151/A 21.51 – Ductile Iron Pipe, Centrifugally Cast, for Water, or other liquids.
- G. ASTM A 746 – Ductile Iron Gravity Sewer Pipe.
- H. ASTM D 3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- I. ASTM F 477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- J. ASTM D 2241 – Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- K. ASTM D 3139 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- L. ASTM A 139 – Electric-Fusion (Arc) Welded Steel Pipe (NPS 4 and Over).
- M. ASTM C 478 – Precast Reinforced Concrete Manhole Sections.
- N. ASTM C 443 – Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- O. ACI 318 – Building Code Requirements for Structural Concrete.
- P. ASTM C 39/C 39M – Compressive Strength of Cylindrical Concrete Specimens.
- Q. ASTM C 890 – Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
- R. ASTM C 891 – Installation of Underground Precast Concrete Utility Structures.
- S. ASTM C 913 – Precast Concrete Water and Wastewater Structures.
- T. ASTM A 615/A 615 M – Deformed and Plain Carbon – Steel Bars for Concrete Reinforcement.
- U. ANSI/AWWA C-500 – Metal-Seated Gate Valves for Water Supply Service.
- V. ANSI/AWWA C-509 – Resilient-Seated Gate Valves for Water Supply Service.
- W. ASTM D-6938 – In-Place Density and Water Content of Soil and Soil-Aggregate By Nuclear Methods (Shallow Depth).
- X. ASTM D-1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort.
- Y. ASTM D 714 – Evaluating Degree of Blistering of Paints.
- Z. ASTM D 2794 – Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- AA. ASTM E 96 – Water Vapor Transmission of Materials.

- BB. ASTM G 154 – Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
- CC. ANSI/AWWA C 111/A 21.11 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- DD. ASTM A 377 – Index of Specifications for Ductile Iron Pressure Pipe.
- EE. ANSI/AWWA C 600 – Installation of Ductile Iron Water Mains and their appurtenances.
- FF. ANSI/AWWA C115/A21.15 – Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.
- GG. ASTM D 2774 – Underground Installation of Thermoplastic Pressure Piping.
- HH. ASTM F 1417 – Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
- II. ANSI/AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches through 12 inches, for Water Transmission and Distribution.
- JJ. ANSI/AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches through 48 inches, for Water Transmission and Distribution.

## **1.5 OMITTED**

## **1.6 QUALITY ASSURANCE**

- A. Contractor will furnish the Engineer and Owner a description of all material before ordering. Engineer will review the Contractor's submittals and provide in writing an acceptance or rejection of material.
- B. Where ductile iron pipe is indicated on the plans, or required by Engineer, it shall be used.
- C. Material and equipment shall be the standard products of a manufacturer who has manufactured them for a minimum of two years and provides published data on their quality and performance.
- D. A subcontractor for any part of the work must have experience on similar work, and if required, furnish Engineer with a list of projects and Owners or Engineers who are familiar with its competence.
- E. If Contractor wishes to furnish devices, equipment, structures, and systems not designed by Engineer, these items shall be designed by either a Professional Engineer registered in the project state or by someone Engineer accepts as qualified. If required, complete design calculations and assumptions shall be furnished to the Engineer or Owner before acceptance.

- F. Testing shall be by a testing laboratory which operates in accordance to ASTM D 3740 or E 329 and shall be acceptable to Engineer prior to engagement. Mill certificates of tests on materials made by manufacturers will be accepted provided the manufacturer maintains an adequate testing laboratory, makes regularly scheduled tests, spot checked by an outside laboratory, and furnishes satisfactory certificates with name of entity making test.
- G. Infiltration, line and grade of sewer, pump performance, and hydrostatic tests on force mains shall be made by Contractor with equipment qualified by Engineer and in the presence of Engineer. Engineer or Project Representative reserves the right to accept or reject testing equipment.

#### **1.7 PRODUCT DELIVERY, STORAGE & HANDLING**

- A. Material shall be unloaded in a manner avoiding damage and shall be stored where it will be protected and will not be hazardous to traffic. If stored on private property, Contractor shall obtain permission from property owner and shall repair any damage caused by the storage. Material shall be examined before installation. Neither damaged nor deteriorated material shall be used in the work.

#### **1.8 JOB CONDITIONS**

- A. Installation of the wastewater collection system must be coordinated with other work on site. Generally, wastewater pipes will be installed first and shall be backfilled and protected so subsequent excavating and backfilling of other utilities does not disturb them. Contractor shall replace or repair any damaged pipe or structure at no additional expense to the Owner.

#### **1.9 SEQUENCING AND SCHEDULING**

- A. Contractor shall arrange the work so sections of sewers between manholes are backfilled and tested, lateral sewers connected, pavement replaced, and placed in service as soon as reasonable after installation.

#### **1.10 ALTERNATIVES**

- A. The intention of these specifications is to produce the best system for the Owner. If the Contractor suggests alternate material, equipment or procedures will improve results at no additional cost, Engineer and Owner will examine suggestion, and if accepted, it may be used. The basis upon which acceptance of an alternate will be given is its value to Owner, and not for Contractor's convenience.

#### **1.11 GUARANTEE**

- A. Contractor shall guarantee quality of materials, equipment, and workmanship for 12 months after acceptance of the completed Project. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

**1.12 EXISTING UTILITIES**

- A. All known utility facilities are shown schematically on the construction drawings, and are not necessarily accurate in location as to plan or elevation. Utilities such as service lines or unknown facilities not shown will not relieve the Contractor of responsibility under this requirement. "Existing Utilities Facilities" means any utility existing on the project in its original, relocated, or newly installed position. Contractor will be held responsible for cost of repairs to damaged underground facilities, even when such facilities are not shown on the drawings.
- B. The Contractor shall call for underground utility locations before starting work. Underground utilities location service can be contacted at 1-888-721-7877 (SC) or 811.

**1.13 TESTING**

- A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 1557, (Modified Proctor).
- B. In place density tests in accordance with ASTM D 2922.
- C. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- D. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48-hours notice prior to taking any tests.
- E. Testing shall be Contractor's responsibility and shall be performed at the Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph C above.
- F. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

**PART 2 – PRODUCTS**

Materials used in the work shall be those named in Bid Form. In multiple type bids, selection of material types will be at the opinion of Owner. Materials and products used shall conform to one of the following:

**2.1 SEWER PIPE**

- A. PVC Pipe – Shall be polyvinyl chloride plastic (PVC) and shall meet all requirements of ASTM D 3034 SDR 26, except for depths less than 3 feet where ductile iron pipe must be installed. All pipe shall be suitable for use as a gravity sewer conduit. Provisions must be made for contraction and expansion at each joint with a rubber gasket. Pipe sizes and dimensions shall be as shown below. All pipe shall be green or white in color with factory marked homing lines. Fittings shall meet the same specification requirements as pipe.

| Nom.<br>Size | Outside Diameter |           | Min. Wall Thickness<br>SDR-26 |
|--------------|------------------|-----------|-------------------------------|
|              | Average          | Tolerance |                               |
| 4            | 4.215            | ± 0.009   | .162                          |
| 6            | 6.275            | ± 0.011   | .241                          |
| 8            | 8.400            | ± 0.012   | .323                          |
| 10           | 10.500           | ± 0.015   | .404                          |
| 12           | 12.500           | ± 0.018   | .481                          |

Tests on PVC Pipe – Pipe shall be designed to pass all tests at 73 ° F. (± 3° F.).

- B. Ductile Iron – Shall conform to ANSI A 21.50 (AWWA C 150), ANSI A 21.51 (AWWA C 151) and ASTM A 746. All pipe shall be Pressure Class 350 unless otherwise noted. All ductile iron pipes and fittings shall be bituminous coated on the outside and lined with Protecto 401 Ceramic Epoxy or equivalent on inside.
- Coating on the outside shall be an asphaltic coating approximately 1 mil thick. Finished coating shall be continuous, smooth, neither brittle when cold or sticky when exposed to sun, and shall be strongly adherent to the iron.
  - Protecto 401 Ceramic Epoxy or equivalent interior lining shall conform to ASTM E 96, ASTM D 714, ASTM D 2794 and ASTM G 53. Interior of the pipe shall receive 40 mils nominal dry film thickness of epoxy. Lining application, inspection, certification, handling, and surface preparation of area to receive the protective coating shall be in accordance with manufacturer's specifications and requirements.

## 2.2 JOINTS – GRAVITY SYSTEM

- A. Joints for Ductile Iron Pipe – Shall be slip-on rubber equivalent to "Fastite," "All-tite," or "Tyton."
- B. Joints for PVC Pipe – Shall be integral wall bell and spigot with a rubber ring gasket. Joints shall conform to ASTM D 3212 and gaskets to ASTM F 477.

## 2.3 FORCE MAIN

- A. P.V.C. – All pipe shall be green in color with factory marked homing lines. Pipe with diameter less than 4 inches shall conform to all requirements of ASTM D 2241, SDR 26, Class 160. Pipe 4 inches through 12 inches shall conform to all requirements of AWWA C900, DR 25, Pressure Class of 165 p.s.i. Pipe 14 inches through 18-inches shall conform to all requirements of AWWA C905 with C1 outside diameter, DR 25, with a pressure rating of 165 p.s.i. Joints shall be in accordance with ASTM D 3139.
- B. Ductile Iron pipe shall be in accordance with Paragraph 2.1-B and conform to ASTM A 377. Push-on-Joints shall be slip-on rubber equivalent to "Fastite," "All-tite," or "Tyton." Flanged joints shall conform to AWWA C 115. Gaskets shall conform to AWWA C 111.

- C. Thrust blocking shall be sized as detailed on the construction drawings of 3,000 p.s.i. concrete. Blocking shall be provided at all bends deflecting 11-1/4° degrees or more and bear directly against the undisturbed trench wall.
- D. Restrained Joints – Restrained joints for pipe, valves and fittings shall be mechanical joints with ductile iron retainer glands equivalent to "Megalug" or push-on type joints equivalent to "Lok-Ring," "TR Flex," or "Super Lock" and shall have a minimum rated working pressure equal to the item restrained with a minimum safety factor of 2:1. Joints shall be in accordance with the applicable portions of AWWA C-111. Manufacturer of joints shall furnish certification, witnessed by an independent laboratory, stating joints furnished have been tested without signs of leakage or failure. Restrained joints shall be capable of being deflected after assembly.

## **2.4 CASING**

- A. Casing pipe shall be steel conforming to ASTM A 139, yield point of 35,000 p.s.i., of the diameter shown on drawings at each crossing. The minimum wall thickness shall be 0.25 inches.

## **2.5 CASING SPACERS**

- A. Casing spacers shall be bolt on style with a shell made in two sections of a minimum 14 gauge T-304 Stainless Steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner. All nuts and bolts shall be T-304 Stainless Steel. Runners shall be made of Ultra High Molecular Weight Polymer with inherently high abrasion resistance and a low coefficient of friction. The combined height of supports and runners shall keep carrier pipe a minimum of 0.75-inches from casing pipe at all times. Casing Spacers shall be as manufactured by Cascade Waterworks Manufacturing Company, or accepted equivalent.

## **2.6 MANHOLES**

- A. Masonry – Shall be new whole brick of good quality laid in masonry mortar or cement mortar made of one part Portland cement and two parts clean sharp sand. Every brick shall be fully bedded in mortar. Manholes shall conform to locations and details shown on the plans.
- B. Precast Concrete – Shall be reinforced concrete constructed in accordance with ASTM C 478 and details shown on the plans "Precast Concrete Manholes." Coarse aggregate shall be granite stone. The joints shall be tongue and groove sealed with flexible gaskets or mastic sealant. Gaskets shall be O-Ring or equivalent to Type A or B "Tylox" conforming to ASTM C 443. Mastic shall be equivalent to "Ram-nek" with primer. Primer shall be applied to all contact surfaces of manhole joint at the factory in accordance with manufacturer's instructions.
- C. Frames and Covers – Shall be cast iron equivalent to the following:

Neenah Foundry Co. R-1668 Type "C" Lid

- D. Manhole Steps – Shall be equivalent to M.A. Industries, Type PS-1 or PS-2-PF. Steps shall be installed at the manhole factory and in accordance with recommendations of step manufacturer. Manholes will not be acceptable if steps are not installed accordingly.
- E. Pipe Connections – Shall have flexible watertight joints at sewer main point of entry into the manhole. The joint shall be an EPDM or polyisoprene sleeve equivalent to "Kor-N-Seal."
- F. Coatings – New manholes shall have all interior surfaces coated with a factory applied acrylic polymer-base coating and sealant. The coating shall be ConSeal CS-55 manufactured by Concrete Sealants, New Carlisle, Ohio or an accepted equivalent. The coating shall be applied in three coats to achieve a total dry film thickness of at least 3.5 mils in accordance with manufacturer's recommendations. Surfaces shall be cleaned of all dust, form oils, curing compounds and other foreign matter prior to the coating application.

New or existing manholes requiring a force main tie-in and the next downstream manhole shall be coated with 125 wet film mils of Raven 405 ultra high build epoxy or an accepted equivalent. The interior surfaces shall be cleaned and prepared according to manufacturer's recommendations.

## 2.7 TEES

- A. Gravity sewer tees shall be four or six inches and same diameter as the run of pipe. They shall be of same material as the sewer main.

## 2.8 LATERALS

- A. Shall be Ductile Iron Pipe conforming to paragraph 2.1-B, with push-on joints or Polyvinyl Chloride pipe with bells and rubber gaskets for jointing, conforming, to Paragraph 2.1-A, PVC Pipe.

## 2.9 STONE BACKFILL

- A. Shall be graded crushed granite with the following gradation:

| Square Opening Size | Percent Passing |
|---------------------|-----------------|
| 1 inch              | 100%            |
| 3/4 inch            | 90 to 100%      |
| 3/8 inch            | 0 to 65%        |
| No. 4               | 0 to 25%        |

## 2.10 SAND BACKFILL

- A. Shall be clean sand free from clay and organic material. Not more than 10% shall pass the No. 100 sieve.

**2.11 BORROW**

- A. Where it is determined sufficient suitable material is not available from the site to satisfactorily backfill pipe to at least two feet above top of pipe, Contractor shall furnish suitable sandy borrow material to accomplish requirements. Material shall not have more than 60% passing the No. 100 sieve, nor more than 20% passing a No. 200 sieve.

**2.12 AIR RELEASE VALVE**

- A. Shall be designed for sewage service. The valve shall be constructed of a cast iron body, stainless steel or bronze trim, and stainless steel float. The inlet shall be 2 inches, 5/16 inch orifice, and a venting capacity of 35 c.f.f.a.m. The working pressure shall be 0 to 50 p.s.i. It shall conform to detail shown on the drawings.

**2.13 METAL DETECTOR TAPE**

- A. Will be installed above all pipe. Tape shall consist of 0.35 mils thick solid foil core encased in a protective plastic jacket resistant to alkalis, acids, and other destructive elements found in the soil. The lamination bond shall be strong enough so layers cannot be separated by hand. Total composite thickness shall be 5.0 mils. Foil core to be visible from unprinted side to ensure continuity. The tape shall have a minimum 3 inch width and a tensile strength of 35 lbs. per inch.

A continuous warning message indicating "sewer line" repeated every 16 inches to 36 inches shall be imprinted on the tape surface. Tape shall contain an opaque color concentrate designating color code appropriate to the line being buried (Sewer Line – Green).

**2.14 TRACING WIRE**

- A. Will be used over all force main, [sanitary sewer and service lateral] lines. The wire will be #12 gauge insulated single strand copper wire.

**2.15 SUBMERSIBLE SEWAGE PUMPING STATION**

- A. Shall be dual submersible pumps installed in a concrete wet well. Pumps shall be equivalent to Flygt or ABS conforming to characteristics shown on the drawings.
- B. Wet Well – Shall be precast reinforced concrete sections. The product design, performance, materials, manufacturing, handling, and installation shall conform to following references and project specifications:

ACI 318 – Building Code Requirements for Reinforced Concrete

ASTM C 39 – Compressive Strength of Cylindrical Concrete Specimens

ASTM C-478 – Precast Reinforced Concrete Manhole Sections

ASTM C 890 – Minimal Structural Design Loading for Precast Concrete Water and Wastewater Structures

ASTM C 891 – Installation of Underground Precast Concrete Utility Structures

ASTM C 913 – Precast Concrete Water and Wastewater Structures

Contractor or supplier shall provide for design of the precast structure. Each section of the structure shall be designed and manufactured for its individual depth, loading conditions (lateral, surcharge and hydrostatic), and opening requirements. All concrete in the precast structure shall have a minimum compressive strength of 4,500 p.s.i. after 28 days. Reinforcing steel shall comply with ASTM A 615 Grade 60 (min. fy = 60,000 p.s.i.). Bar bending and placement shall comply with the ACI latest standards.

Precast structure manufacturer shall have necessary equipment and facilities for proper manufacture of the sections and to perform compressive strength tests on concrete tests specimens. Test cylinders shall be made for each structure and test conducted in accordance with ASTM C 39, except compressive strength shall be equal to or greater than design of the concrete. Structure design computations, concrete mix design, and test reports certifying design strength has been achieved at the 28 day break shall be submitted to Engineer. Design of structure shall be performed by a Professional Engineer registered in the state of installation at Contractor's expense. The design parameters for a precast structure shall include:

Lateral load based on a water table at the surface using equivalent fluid pressure of 80 p.c.f. from surface grade down and a vehicle wheel load designation of HS20-44. Design live load for the top slab shall be 300 p.s.f. The precast concrete sections shall have a minimum wall thickness of 6 inches and minimum top and bottom slab thicknesses of 8 inches. Actual thicknesses greater than minimum shall be as required by the loading conditions.

Access hatches in the top slab of wet-well structure shall be for clear opening dimensions indicated and have a load capacity of 300 p.s.f. The material shall be Aluminum Alloy 6063-T5 and T6, minimum 1/4 inch thick plate, flush-type lock with inside spoon handle. The frame shall be complete with hinged and hasp-equipped cover, upper guide holders, chain holders and cable holder. Chain and cable holders shall be stainless steel or aluminum. Frame shall be securely mounted above the pumps. The hatch covers shall be torsion-bar loaded for ease of lifting and shall have a safety-locking handle in open position.

Contractor shall furnish and install guide bars for each pump to permit raising and lowering the pump. Guide bars shall be stainless steel and of adequate length and strength to extend from lower guide holders on the pump discharge connection to upper guide holder mounted on access frame.

The wet well shall be provided with sleeves, 24 inches below finished grade, for access of power and control conduits. The sleeves shall be of proper size and number to accommodate all necessary power and control conduits.

All interior concrete surfaces shall have either a minimum 125 mils coating of Raven 405, factory installed 5 mm Agru Sure Grip HDPE Liner, or an accepted equivalent. When using the liner, all seams shall be sealed with welded HDPE material and all penetrations shall be sealed with a welded HDPE boot.

The structure manufacturer shall prepare and submit six sets of shop drawings showing wall and slab thicknesses, structural reinforcing and opening locations. The manufacturer shall also provide design analyses and calculations to show all sections have been designed for burial depths shown on construction drawings as well as stresses incurred during transport, handling and installation. Calculations and analyses must be performed and sealed by a Licensed Professional Engineer from the state project is located and submitted for review. All shop drawings and design calculations shall be submitted to the Contractor for review. Contractor shall forward these documents to the Engineer. Such documents shall bear the stamp or written statement of Contractor indicating Contractor's review for completeness and receipt. Contractor shall be responsible for the accuracy of shop drawings and for their conformity to plans and specifications. Shop drawings with insufficient or incomplete data required to indicate compliance with these specifications are not acceptable and will be returned to the Contractor. Rejected shop drawings shall not relieve Contractor from completing the project within time allowed by Contract Documents.

- C. Pump Design – Pumps shall be capable of handling raw, unscreened sewage with the capacity to pass 3 inch diameter spheres. Pumping units shall be automatically connected to discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts or other fastening to be removed for this purpose, and no need for personnel to enter wet well. Each pump shall be fitted with a stainless steel chain of adequate strength and length to permit raising the pump for inspection and removal.
- D. Pump Construction – The pump(s) shall be designed to pump sewage, storm water, heavy sludge and other fibrous materials without injurious damage during operation. The lifting cover, stator housing and volute casing shall be of gray iron construction with all nuts, bolts, washers and other fastening devices coming into contact with sewage, constructed of stainless steel and protected by primer coat and a coat of rubber-asphalt or epoxy paint. The impeller shall be hard alloy gray iron construction, dynamically balanced, double shrouded, non-clogging design with a long thoroughfare and no acute angles.

The pump motor shall be of Class F Insulation, NEMA B design, watertight and positively oil cooled, filled with a transformer oil, equivalent to BP JS-HA, Shell Diala D, or housed in an air-filled watertight chamber. The pump motor shall be guaranteed to run in a totally, partially or non-submerged condition continuously for a period of 24 hours without injurious damages. Water cooled pumps shall not be considered equal. Before final acceptance, a field running test at job site demonstrating the ability to operate continuously for 24 hours under a non-submerged condition, shall be performed for all pumps being supplied, if required. The pump shall be provided with a tandem double mechanical seal running in an oil bath. The seals shall be of lapped tungsten carbide and welded to stainless steel retainers and held in contact by separate springs. Conventional double mechanical seals with a spring assembly between the rotating faces, requiring constant differential pressure to effect sealing and subject to penetration and opening by pumping forces shall not be considered equal to tandem seal specified and required. The pump shaft shall be of stainless steel and supported by a double row inboard bearing for axial thrust and a single row outboard bearing for radial thrust. The impeller shall be connected to a short

sturdy shaft in order to minimize shaft deflection. Shaft shall not extend more than 2-1/2 times its diameter below the nearest support bearing.

The pump cable shall be of proper length to reach from pumps in wet well to control panel without any splices. Cable shall be the "SO" or hypalon jacketed SPC type and in compliance with industry standards for loads, resistance against sewage and of stranded construction. Cable shall enter the pump through a heavy duty entry assembly, which shall be provided with an internal grommet assembly to protect against leakage once secured and must have a strain relief assembly as part of standard construction. Power cable shall connect to a terminal board separating incoming service from pump motor, where if leakage occurs, terminal board will short out and not cause damage to the motor.

Each pump shall be supplied with a universal coupling which bolts to pump discharge flange and shall accept the discharge elbow provided by pump manufacturer. Seal of the pump at discharge flange shall be accomplished by a single downward linear motion of pump with entire weight of pump guided to and pressing against discharge connection. No part of pump shall bear directly on the sump floor and no rotary motion of pump shall be required for sealing. Sealing at the discharge shall be designed to insure a positive leakproof system and for ease of removal. Pump shall be guaranteed not to leak at the discharge flange.

- E. Pump Test – Pump manufacturer shall perform following tests on each pump before shipment from the factory:
  1. Megger the pump for insulation breaks or moisture.
  2. Prior to submergence, the pump shall be run dry and be checked for correct rotation.
  3. Pump shall be run for 30 minutes in a submerged condition.
  4. Pump shall be removed from test tank, meggered immediately for moisture; oil plugs removed for checking of upper seal and possible water intrusion of stator housing.
  5. A written certified test report giving above information shall be supplied with each pump at the time of shipment.
  6. All pump cable ends will then be fitted with a rubber shrink fit boot to protect cable prior to electrical installation.
  
- F. Pump Controls – To synchronize the operation of pumps with variations of sewage level in wet well, Contractor shall provide a liquid level sensor system equivalent to ITT Flygt MultiTrobe. The system shall utilize a single piece multi-sensored probe to determine pump-on, lag pump on, pump-off, and high-level alarm conditions. Probe shall be constructed from PVC 1.25 inch tubing with molded sensor units at regular intervals along the probe. Each sensor unit will be PVC injected to prohibit ingress of moisture, and the sensor material shall be Avesta SMO 254 stainless steel.

Mounting – Probe will be mounted in a turbulent area of wet well, suspended on its own cable and connected to a 0.23 inch stainless steel hook which will be hooked to a 1.18 inch stainless steel angle containing a polyurethane squeegee pad positioned in the opening into wet well, so probe can be removed without entering wet well. The squeegee will have a 1.18 inch hole and slot, enabling probe to be pulled through and cleaned.

This installation will be in accordance with the manufacturer's instructions.

Probe shall be covered by the manufacturer's two-year warranty.

Probe and Sensors – 10 sensors will be spaced along the length of probe assembly, and each will be individually connected to a correspondingly numbered PVC/PVC 0.03 inch flexible cable.

The molded sensor unit will contain two Avesta sensors mounted on opposing sides of sensor unit. Each Avesta sensor will be 0.94 inches high and no wider than 0.08-inches, and will protrude from surface of the PVC.

The probe shall be pressure injected with an epoxy resin to encapsulate all internal components and connections to form a rigid, homogenous unit.

Each sensor unit containing the two Avesta sensors will be rotated 90 degrees to previous sensor unit to eliminate tracking between sensors.

Cable – The cable will be numbered (number and text) along entirety of cable and at intervals not greater than 7.5 inches for identification. This cable will be dark blue in color, with the cores light blue.

Flexible cables shall be capable of supporting the weight of probe and cable, without need for additional support.

The cable shall be secured to top of probe by a synthetic rubber compression fitting.

MTR Relay – The conductance level control relay shall be a Din rail mounted device with supply and activation LEDs, eight programmable activation delays, charge/discharge settable and four sensitivity settings (2k, 4k, 20k, 80k) all easily carried out while installed. A green LED shall be provided on front of relay and shall remain lit while power is connected to the unit. A red LED shall be provided on front of device and shall remain lit while the output relay is active. Each output shall be capable of a five amp resistance load at 250 VAC.

Floats – Furnish one high-level alarm float and one low-level shut off float. The low level float shall be capable of over-riding the Multi Trode Controller.

An alternator shall also be provided to change operation sequence of pumps at the completion of each pumping cycle. Provisions shall also be made for pumps to operate in parallel if level in wet well continues to rise above the "pump-on" cycle. Contractor shall furnish and install one automatic control center, equipped with individual disconnects, across-the-line magnetic starters, 3 phase, overload and phase protection, electrical alternator, automatic transfer to non-

operating pump in event of overload in operating pump, overload reset, hand-off-automatic pump operation selector switch, 24 volt control circuit transformer, and terminal board with connections for high-level alarm. All components shall be housed in a NEMA 4X enclosure. Control center shall be installed on a treated timber rack next to the station. Cables provided for pump feeders and pump controls shall be installed in conduit from control center to entrance point in wet well. See detail sketch on construction drawings.

- G. Alarm – A high water alarm shall be supplied. A red flashing light shall be supplied in separate NEMA 4X enclosure for mounting at the control box. An audible alarm consisting of a weatherproof bell with automatic reset silencer switch and signal light shall be installed in addition to the flashing red light alarm.

- H. Submersible Pump Station Valve Pit – The valve pit shall be precast concrete of dimensions shown on construction drawings. Valve pit design shall meet the requirements for precast concrete specified in section 2.15, paragraph B. Each pit shall have a hatch cover. The covers shall be:

|                      |                                                                                            |
|----------------------|--------------------------------------------------------------------------------------------|
| <b>Clear Opening</b> | <b>[3-feet-0-inches x 4-feet-0-inches]</b>                                                 |
| Capacity             | 300 lbs/sq. ft.                                                                            |
| Material             | Aluminum Alloy 6063-T5 & T6 1/4 inch plate with a Neoprene gasket to make hatch watertight |

- I. Hydrants – Shall be frost-proof with 36 inch bury, 1 inch male outlet, and 1 inch male inlet, with outlet 36 inches above the ground. Water line from the main to hydrant shall be 1 inch diameter, rated for a minimum working pressure of 200 p.s.i.
- J. Backflow Preventer – Shall be a 1 inch reduced pressure zone assembly mounted in a plastic meter box. Backflow preventer shall be equivalent to Watts Regulator Model No. 009.
- K. Fencing – A new fence shall be installed at pump station site where shown on the drawing and shall be in accordance with Section 02831 – “Chain Link Fences and Gates.”

A 3 inch x 5 inch, 7 gauge, stainless steel plate with an emergency phone number shall be furnished and installed at a conspicuous location on the fence or control panel.

- L. Access Road – Access road to station shall be as shown on the drawing. Stabilization shall be accomplished by constructing a base using granite crusher run stone aggregate composed of 50% screenings and 50% stone, compacted to 6-inch thickness.
- M. Shop Drawings – Contractor shall submit for review by Engineer a complete schedule and data of materials and equipment to be incorporated in the work. Submittals shall be supported by descriptive material, such as catalogs, diagrams,

performance curves, and charts published by the manufacturer, to show conformance to specification and drawing requirements. Model numbers alone will not be acceptable. Complete electrical characteristics shall be provided for all equipment.

All shop drawings shall be completely checked and marked accordingly with Contractor's stamp prior to submitting drawings to the Engineer for review. Shop drawings with insufficient or incomplete data required to indicate compliance with these specifications are not acceptable and will be returned to the Contractor. Where shop drawings are "Furnished as Corrected," the reviewer has noticed deficiencies in compliance with contract specifications and drawings. It is understood corrections indicated will be incorporated by Contractor in the final product, operation and maintenance manuals and shop drawings submitted at completion of project. Rejected shop drawings shall not relieve Contractor from completing the project within time allowed by contract documents.

- N. Pump Warranty – The pump manufacturer shall warrant pumps being supplied to Owner against defects in workmanship and materials for a period of 5-years under normal use, operation, and service. In addition, manufacturer shall replace certain parts which become defective through normal use and wear on a progressive schedule of cost for a period of 5-years. Parts included are the mechanical seal, impeller pump housing, wear ring, and ball bearings. The warranty shall be in published form and apply to all similar units.
- O. Operation and Maintenance Manual – The pump manufacturer shall furnish Owner with a minimum of six manuals for pumps installed.
- P. Electrical Service – Service to the pumping station shall be [3 phase, 4W, 230 volts]. Service shall be underground originating in weatherhead on a service pole at site and terminating in the main breaker.

Conduits below grade shall be Schedule 40 PVC and above grade shall be rigid galvanized. Conduits shall be sealed to prevent sewer gases entering the control panel. Sealing shall be accomplished by stuffing both ends of the conduit with duct-seal, or other accepted material.

Conductor shall be copper.

The neutral conductor of each service shall be grounded to a ground rod system. Grounding conductor shall be sized in accordance with Article 250 of the N.E.C. and shall be installed in non-metallic conduit to points of ground connection.

Ground rod system shall consist of three 3/4 inch x 10 foot copper weld ground rods. Ground rods shall be installed 3 feet apart with top of rods 12 inches below grade and shall be interconnected with a bare copper grounding conductor. Connections to ground rods shall be with chemical weld connectors.

1. Running Time Meters – Shall be installed for measuring the elapsed running time for each pump. Meters shall be installed on the face of control panel with counter visible when door or panel is opened. One meter shall be provided for each starter, and shall be connected to operate simultaneously with the starter it is monitoring. Meters shall be non-reset type, hermetically

sealed, 115 volts, 60 hertz, with a five digit counter registering 1/10 hour and a total range of 99,999-hours.

## **2.16 CHECK VALVES**

- A. Shall be designed for sewage service. The valve shall be cast iron and bronze fitted. The valve shall be a spring and lever type with neoprene seat and O-Ring seals on a stainless steel valve pin, for pipes 3 inches and larger in diameter. For check valves smaller than 3 inches, the valve shall be a fully ported 150 p.s.i. rated ball check valve with a corrosion resistant phenolic base and a rubber seat. Check valve shall be of full waterway design for quiet operation and with a flow area through the valve equal to or exceeding flow area of pipe to which it is installed.

## **2.17 GATE VALVES**

- A. Two Inches and Larger – Shall be cast iron or ductile iron body, bronze mounted, double disc or resilient wedge design, with non-rising stems, conforming to AWWA C 500, C 509, or C 515. Valves shall have ends to match the pipe to which they are attached. Attachment to plastic pipe shall be made by special adapters. Valves shall have a working pressure of 200 p.s.i. and be tested at 400 p.s.i.

Valves shall be furnished with "O" ring packing. One "O" ring shall be located above the thrust collar and one below. Thrust collar shall be permanently lubricated and have an anti-friction washer on top of the thrust collar.

- B. Smaller Than 2 inches – Shall be all brass, ball valve type. The pressure rating shall be 175 p.s.i.
- C. Valve Boxes – Underground valves shall be installed in acceptable valve boxes. Valve boxes shall have a suitable base which does not damage valve or pipe, and shaft extension sections to cover and protect the valve and permit easy access and operation. The box, cover, and extensions shall be cast or ductile iron having a crushing strength of 1,500 pounds per linear foot.

## **2.18 PLUG VALVES**

- A. Shall be fully ported and of the same diameter as pipes to which they are attached. They shall have semi-steel bodies, all metal plugs, stainless steel bearings, and be equivalent to DeZurik Series 100 eccentric valves, lever operated. All valves 6 inches and larger shall be equipped with gear actuator and handwheel.

## **2.19 PRODUCT REVIEW**

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. Engineer will review all products before they are ordered by Contractor.

## **PART 3 – EXECUTION**

### 3.1 CONSTRUCTION OBSERVATION

- A. The line, grade, deflection, and infiltration of sewers and pump station operation shall be tested by Contractor under the direction of Engineer. Engineer or Project Representative will have the right to require any portion of work be completed in their presence. If work is covered up after such instruction, it shall be exposed by Contractor for observation. However, if Contractor notifies Engineer such work is scheduled and Engineer fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Engineer or Project Representative. All improper work shall be reconstructed. All materials not conforming to requirements of specifications shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

Contractor shall give the Project Engineer or Project Representative a minimum of 48 hours notice for all required observations or tests.

It will also be required by Contractor to keep accurate, legible records of the location of all sanitary lines, service laterals, manholes, force mains, valves, bends, and appurtenances. These records will be prepared in accordance with "Record Data and Drawings" paragraph in the Special Conditions. Final payment to the Contractor will be withheld until all such information is received and accepted.

### 3.2 LOCATION AND GRADE

- A. Line and grade of sewers and position of all manholes and other structures are shown on the drawings. Grade line as given on the profile or mentioned in these specifications means invert or inside bottom of pipe. Price for trenching shall include trench for depth below this line necessary to lay sewer to grade, but measurements for payment will be made only to grade line. Master control lines and bench marks have been provided by the Engineer. The Contractor shall be responsible for proper locations and grades of sewers.

### 3.3 SEWER EXCAVATION

- A. Contractor shall perform all excavations of every description and of whatever substance encountered to the depth shown on the plans or specified for all sewers, manholes, and other appurtenances. All excavations shall be properly dewatered before installations are made, by the use of well points, pumping, or other methods accepted by Engineer. Trenches shall be excavated in conformance with the Occupational and Safety Health Administration's (OSHA) Regulations.

Where the character of soil is unsuitable for pipe bedding as determined by Engineer or Geotechnical Consultant, additional excavation will be authorized. Engineer or Geotechnical Consultant shall determine the depth needed for additional bedding and whether material will be sand or stone. The unsuitable material shall be disposed of at Contractor's expense in a proper manner. Bottom of all trenches shall be rounded to conform to the bottom of pipe, to afford full bearing on pipe barrel. Excavation in excess of depths and widths required for sewers, manholes, and other structures shall be corrected by pouring

subfoundations of 3,000 p.s.i. concrete and half cradle at the Contractor's expense.

- B. Trenches shall not be excavated more than 400 feet in advance of pipe laying.

### **3.4 TRENCH WALL SUPPORT**

- A. Bracing and Sheeting – The sides of all trenches shall be securely held by stay bracing, or by skeleton or solid sheeting and bracing, as required by soil conditions encountered, to protect adjoining property and for safety. Where shown on drawings or where directed by Engineer, the Contractor must install solid sheeting to protect adjacent property and utilities. Sheeting shall be steel or timber and Contractor shall submit design data, including the section modulus of members and arrangement for bracing at various depths, to Engineer for review before installing sheeting. It shall penetrate at least 3-feet below the pipe invert. Contractor shall ensure support of pipe and its embedment is maintained throughout installation and ensure sheeting is sufficiently tight to prevent washing out of the trench wall from behind sheeting.
- B. Sheeting Removal – Sheeting shall be removed in units and only when backfilling elevation has reached the level necessary to protect pipe, adjoining property, personnel, and utilities. Removal of sheeting or shoring shall be accomplished in a manner to preclude loss of foundation support and embedment materials. Fill voids left on removal of sheeting or shoring and compact all materials to required densities.
- C. Movable Trench Wall Supports – Do not disturb installed pipe and its embedment when using movable trench boxes and shields. Movable supports should not be used below top of pipe zone unless acceptable methods are used for maintaining the integrity of embedment material. Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. As supports are moved, finish placing and compacting embedment.
- D. When sheeting or shoring cannot be safely removed, it shall be left in place. Sheeting left in place shall be cut off at least 2 feet below the surface. No separate payment shall be made for bracing and sheeting except where shown on drawings or authorized by the Engineer.

### **3.5 LAYING PIPE**

- A. All sewer pipe shall be laid upgrade with spigots pointing downgrade and in accordance with ASTM D 2321. The pipe shall be laid in a ditch prepared in accordance with Paragraph 3.3 "Sewer Excavation." When sewer is complete, the interior surface shall conform on bottom accurately to grades and alignment fixed or given by Engineer. Special care shall be taken to provide a firm bedding in good material, select borrow, stone backfill or 3,000 p.s.i. concrete, as authorized, for length of each joint and 1/2 of the circumference. Holes shall be provided to relieve bells from bedding strain, but not so large to allow separation of the bell from barrel by settlement after backfilling. All pipe shall be cleaned out, and left clean. Every third joint shall be filled around immediately after being properly placed.

- B. Jointing – Comply with manufacturer's recommendations for assembly of joint components, lubrication, and making joints. When pipe laying is interrupted, secure piping against movement and seal open ends to prevent the entrance of water, mud, or foreign material.
- C. Placing and Compacting Pipe Embedment – Place embedment materials by methods which will not disturb or damage the pipe. Work in and tamp haunching material in area between the bedding and underside of pipe before placing and compacting remainder of embedment in pipe zone. Do not permit compaction equipment to contact and damage the pipe. Use compaction equipment and techniques compatible with materials used and location in the trench. Before using heavy compaction or construction equipment directly over the pipe, place sufficient backfill to prevent damage, excessive deflections, or other disturbance of the pipe.
- D. Rock or Unyielding Materials in Trench Bottom – If ledge rock, hard pan, shale, or other unyielding material, cobbles, rubble, debris, boulders, or stones larger than 1.5-inches are encountered in the trench bottom, excavate a minimum depth of 6-inches below pipe bottom and replace with proper embedment material.
- E. Vertical Risers – Provide support for vertical risers as commonly found at service connections, cleanouts, and drop manholes to preclude vertical or lateral movement. Prevent the direct transfer of thrust due to surface loads and settlement, and ensure adequate support at points of connection to main lines.
- F. Exposing Pipe for Making Service Line Connections – When excavating for a service line connection, excavate material from above the top of main line before removing material from sides of pipe. Materials and density of service line embedment shall conform to specifications for the main line.
- G. Manhole Connections – Use flexible water stops, resilient connectors, or other flexible systems acceptable to the Engineer making watertight connections to manholes and other structures.
- H. Jacking and Boring – Steel casing of diameter shown on the plans shall be jacked and bored in location indicated. Joints between sections of the steel casing shall be of a continuous weld made by a certified welder. Jacking and boring shall be in accordance with South Carolina Department of Transportation Standard Specifications. Carrier pipe shall be installed as shown on the detail. After carrier pipe has been installed, ends of the casing shall be sealed using a rubber enclosure and stainless steel straps or brick and mortar.

Where work involves a highway, a Resident Engineer of the State Department of Transportation shall be notified 3 days before crossing is started. Where work involves a railroad, the work shall conform to requirements of AREA specifications.

Division Superintendent of the Railroad shall be notified 3 days prior to beginning work. Before commencing work within the right-of-way of railroads or highways, Contractor shall verify Owner has obtained required permits.

### **3.6 SEPARATION BETWEEN WATER & SANITARY SEWER**

A. Parallel Installation:

1. Water mains shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer, storm sewer, or sewer manhole. The distance shall be measured edge-to-edge.
2. When conditions prevent a horizontal separation of 10 feet, water main may be laid closer to a sewer (on a case-by-case basis) provided the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation where bottom of water main is at least 18 inches above top of sewer. It is advised the sewer be constructed of materials and with joints equivalent to water main standards of construction and be pressure tested to assure water-tightness prior to backfilling.

B. Crossing:

1. Water mains crossing house sewers, storm sewers, or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of water main and top of sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
2. When conditions prevent a vertical separation of 18 inches, the sewer passing over or under water mains shall be constructed of materials and with joints equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.
3. When water mains cross under sewers, additional measures shall be taken by providing:
  - a. a vertical separation of at least 18 inches between bottom of the sewer and top of water main;
  - b. adequate structural support for sewers to prevent excessive deflection of joints settling on and breaking the water mains;
  - c. length of water pipe be centered at the point of crossing so joints will be equidistant and as far as possible from sewer; and
  - d. both sewer and water main shall be constructed of water pipe and subjected to hydrostatic tests, as prescribed in this document. Encasement of the water pipe in concrete shall also be considered.
  - e. crossings shall conform to South Carolina Department of Health and Environmental Control's Bureau of Water Standards for Wastewater Facility Construction: Regulation 61-67.

### 3.7 BACKFILLING

- A. All trenches and excavation shall be backfilled immediately after pipes are laid therein, unless other protection of the pipe line is directed. Backfilling material shall be selected and deposited with special reference to the future safety of pipes. Except where special methods of bedding and tamping are provided for, clean earth or sand shall be solidly tamped about pipe up to a level at least 2 feet above top of pipes, and shall be carefully deposited to uniform layers, each layer solidly tamped or rammed with proper tools to not injure or disturb the pipeline. Remainder of the trench backfilling shall be carried on simultaneously on both sides of pipe in such a manner preventing injurious side pressure. The material used shall be selected from excavations anywhere on site if any of this soil is suitable. Backfill material shall be clean and free of rock, organic and other deleterious matter.

Under traffic areas, the top 24 inches of backfill material shall be compacted to a density of not less than 98% of maximum laboratory density at optimum moisture. Below the 24 inch line and to and including area around pipe, density shall not be less than 95% of maximum laboratory density at optimum moisture. In non-traffic areas, the backfill material shall be compacted to a density of not less than 90% of maximum laboratory density at optimum moisture unless otherwise accepted by Engineer. Compaction tests shall be conducted in accordance with ASTM D 6938 by an independent testing laboratory. Tests are to be taken at the direction of Engineer.

Whenever trenches have not been properly backfilled, or if settlement occurs, they shall be refilled, smoothed off and finally made to conform to the ground surface. Backfilling shall be carefully performed, and original surface restored to the full satisfaction of Engineer immediately after installation.

Where thermoplastic (PVC) pipe is installed, Contractor shall take precautions in accordance with ASTM D 2321, during backfilling operations so not to create excessive side pressures, or vertical or horizontal deflection of the pipe nor impair flow capacity.

### 3.8 MANHOLES

- A. Manholes shall be constructed where shown on the drawings or where directed by Engineer. The channel in bottom of manholes shall be smooth and properly rounded. Special care must be exercised in laying the channel and adjacent pipes to grade. Manhole top elevations shall be greater than or equal to the 50 year flood elevation, unless watertight covers are provided. Tops of manholes outside of roads shall be built to grades 1-inch above ground surface in developed areas and 6 inches above ground surface in undeveloped areas unless otherwise shown on the plans. Manholes in roads shall be built to grades designated by the Engineer. Manhole sections with either honeycomb defects; exposed reinforcing; broken/fractured tongue or groove; or cracked walls will be subject to rejection by Engineer for use on the project. When mastic sealant is used, improperly applied primer will also be cause for rejection.

No leaks in any manhole will be acceptable. All repairs made from inside the manhole shall be made with mortar composed of one part Portland cement and two parts clean sand. The mixing liquid shall be straight bonding agent equivalent to "Acryl 60."

### **3.9 STONE BEDDING**

- A. Where, in the Engineer's or Geotechnical Consultant's opinion, subgrade of pipe trench is unsuitable material, Contractor shall remove unsuitable material to a depth determined by Engineer or Geotechnical Consultant and furnish and place stone backfill in trench to stabilize subgrade. Presence of water does not necessarily mean stone backfill is required. If well points or other types of dewatering will remove the water, Contractor shall be required to completely dewater trench in lieu of stone backfill. Stone bedding will be limited to areas where well pointing and other conventional methods of dewatering will not produce a dry bottom. Stone shall be placed 4 feet wider than the outside diameter of pipe. The pipe shall be carefully bedded in stone as specified, or in accordance with manufacturer's recommendations.

### **3.10 SAND BEDDING**

- A. Where, in the Engineer's or Geotechnical Consultant's opinion, character of soil is unsuitable for pipe bedding, even though dewatered, additional depth of excavation as determined by Engineer or Geotechnical Consultant shall be made and replaced with clean sand furnished by Contractor.

### **3.11 DEFLECTION**

- A. It is the Contractor's responsibility to assure backfill is sufficient to limit pipe deflection to no more than 5%. When flexible pipe is used, a deflection test shall be made by Contractor on the entire length of installed pipeline, not less than 30-days after completion of all backfill and placement of any fill. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 95% the inside pipe diameter. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface brinell hardness of not less than 150. The device shall be center bored and through bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of 70,000 p.s.i. or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer; a pull exerted on opposite end of shaft shall produce compression throughout remote end of ball, cylinder, or circular section. Circular sections shall be spaced so distance from the external faces of front and back sections shall equal or exceed diameter of circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through by hand or by being flushed through with water, shall be cause for rejection of individual run. When a deflection device is used for the test in lieu of a ball, cylinder, or circular sections described, such device shall be acceptable to Engineer prior to use. Device shall be sensitive to 1.0% of diameter of pipe being measured and shall be accurate to 1.0% of indicated dimension. Installed pipe showing deflections greater than 5% of the normal diameter of pipe shall be retested by a run from opposite direction. If retest also fails, the suspect pipe shall be repaired or replaced at no cost to Owner.

### **3.12 LEAKAGE**

- A. In no stretch of sewer between any two adjoining manholes shall infiltration/exfiltration exceed 25 gallons/day/inch of pipe diameter per mile of pipe. In case leakage exceeds this amount, the sewer shall not be accepted until such repairs and replacements are made to comply with above requirements. Such corrections will be made at the Contractor's expense. All visible leaks shall be repaired, regardless of the amount of leakage.
- B. Lines shall be tested for leakage by low pressure air testing, infiltration tests, or exfiltration tests, as appropriate. Low pressure air testing for PVC pipe shall be as prescribed in ASTM F 1417. Prior to infiltration or exfiltration tests, trench shall be backfilled up to at least the lower half of pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When water table is 2 feet or more above top of pipe at the upper end of pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to Engineer. When Engineer determines infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so a head of at least 2 feet is provided above both water table and top of pipe at upper end of pipeline to be tested. The filled line shall be allowed to stand until pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2 hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 25 gallons per inch diameter per mile of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Owner.
- C. The Contractor shall furnish equipment and plugs and subject force mains to hydrostatic tests at 100 p.s.i. for a period of two hours. Any leaks shall be located and repaired. Each section tested shall be slowly filled with water, care being taken to expel all air from the pipes. No pipe installation will be accepted until leakage during pressure test is less than the number of gallons listed for each 1000-feet of pipe tested:

|                               |                          |
|-------------------------------|--------------------------|
| 6 inches & less – 0.9 gallons | 12 inches – 1.80 gallons |
| 8 inches – 1.20 gallons       | 14 inches – 2.10 gallons |
| 10 inches – 1.50 gallons      | 16 inches – 2.40 gallons |

### 3.13 CLEANING AND ACCEPTANCE

- A. Before acceptance of sewer system, it shall be tested and cleaned to the satisfaction of Engineer. Where any obstruction is met, Contractor will be required to clean sewers by means of rod and swabs or other instruments. The

pipe line shall be straight and show a uniform grade between manholes. The Engineer shall check lines by lamping or other methods to determine final acceptance.

### **3.14 CLOSING PIPE**

- A. When work or pipe installation is suspended, either for the night or at other times, end of sewer must be closed with a tight cover. Contractor will be held responsible for keeping the sewer free from obstruction.

### **3.15 PARTIAL ACCEPTANCE OF THE WORK**

- A. Owner reserves right to accept and use any part of the work. Engineer shall have power to direct on what line the Contractor shall work and order thereof.

### **3.16 GRASSING**

- A. Grassing of areas disturbed during construction shall be in accordance with Section 02902 – "Grassing."

### **3.17 RECORD DATA**

- A. It will be required of the Contractor to keep accurate, legible records, locating all sewers, force mains, tees, and laterals. These records will be made available to Engineer before final review for incorporation into the Engineer's Record Drawings. Final payment to the Contractor will be withheld until all such information is received and accepted.

### **3.18 REMOVE AND REPLACE PAVEMENT**

- A. Pavement shall only be removed after prior written authorization by the Owner. Pavement removed and replaced shall be constructed in accordance with latest specifications of the State Department of Transportation. Traffic shall be maintained and controlled per State Department of Transportation regulations.

Edges of the pavement shall be cut to a neat straight line with a masonry saw. Backfill shall be compacted and tested and a concrete base course of 5,000 p.s.i. placed on the fill as shown on details. The concrete base shall be placed within 24 hours after pipeline is installed. A temporary wearing surface may be used provided it presents a smooth surface. The final wearing surface shall be 1-1/2 Type C asphaltic concrete.

### **3.19 METALLIC DETECTOR TAPE**

- A. Contractor shall place metallic detector tape, suitably coded, directly over all installed pipes at a depth of 18 inches below the finished surface.

### **3.20 TRACING WIRE**

- A. Tracing wire will be installed on all force mains, [sanitary sewer and service laterals] directly on top of the pipe. Wire shall be secured to the pipe with tape or other acceptable methods at spacings of no more than 36-inches apart.

Where sections of wire are jointed together, the wire insulation shall be stripped so bare wires can be wrapped with a rubberized insulation tape. The insulated wire must maintain electrical continuity. This tracing wire system shall be checked and tested by the Contractor, in presence of Engineer or Owner prior to acceptance of force main [sanitary sewer and service laterals]. All equipment, meters, detectors, etc., needed for testing shall be furnished by the Contractor.

### **3.21 CONNECT SEWERS TO EXISTING STRUCTURES**

- A. Contractor shall connect the system to existing structures where indicated. For brick structures, a hole not more than 4 inches larger than the outside diameter of new pipe shall be cut neatly in structure, new pipe laid so it is flush with inside face of structure, and annular space around pipe filled with a damp, expanding mortar or grout to make a watertight seal. For precast structures, core proper size hole in structure for pipe being connected, attach flexible sleeve into cored hole and connect new pipe into flexible sleeve with a stainless steel band.

### **3.22 FIELD QUALITY CONTROL**

- A. Soil and density tests shall be made by a testing laboratory acceptable to the Engineer. Laboratory tests of the soil shall be made in accordance with ASTM D 1557. In-place density tests shall be made in accordance with ASTM D 6938. Results of the tests shall be furnished to the Engineer.

The minimum number of tests required shall be:

Backfill over sewer in traffic areas..... 1 per 100 linear feet or less for each 4 feet of depth or portion thereof.

Backfill over sewer in non-traffic areas... 1 per 500 linear feet or less for each 6 feet of depth or portion thereof.

### **3.23 AIR RELEASE VALVE**

- A. The manhole and installation of valve shall be in accordance with detail on drawings. Prior to deciding on the location of any air release valve, Contractor shall provide Engineer with an accurate profile of installed force main so high points in system can be determined.

### **3.24 SEWAGE PUMPING STATION**

- A. The precast sections shall be carefully handled and placed in position undamaged. Spalled areas, cracks, or exposed reinforcing in any section shall be cause for rejection of a section. Damaged elements shall be promptly removed from the job-site.

The structure shall be installed plumb and level by Contractor on a prepared, evenly distributed and level, minimum 12 inch thick crushed-stone bed. Joints between sections shall be sealed with butyl-rubber or neoprene sealant. Asphaltic-based material or similar products shall not be used. The sealant shall be applied in accordance with sealant manufacturer's recommendation. Leakage through joints or around pipes will not be acceptable. Grout used at

construction joints and around pipes shall be Five Star brand non-shrink grout or an acceptable equivalent.

Excavation shall be accomplished in a manner as required to protect adjacent property and utilities and for safety. Backfilling shall be accomplished as soon as practicable after the structure has been placed and sealed. Backfilling shall be achieved by placing material in equal lifts (max. 2 feet) and compacting each lift to maintain stability and plumbness of the structure. Backfill material shall be a select granular material with a maximum plasticity index (P.I.) of 12. Compaction shall be accomplished by means of mechanical tamping to 98% of maximum laboratory density at optimum moisture when tested by ASTM D 6938. During backfilling operation and until its completion, the wet well sections shall be maintained in an absolute plumb position. To prevent structure from possibly becoming buoyant in hydrostatic or flooded conditions, the Contractor shall take necessary steps to avoid flotation of the structure.

Pumping station site shall be graded to drain to conform to the drawings. The fence, access road, and grassing shall be constructed after the site has been graded.

Contractor shall connect to the water main with a saddle or tee and lay water line to the hydrant per location on drawings. The hydrant shall be set in a gravel pocket with a 12 inch x 12 inch x 4 inch concrete collar at ground level. Connection shall be disinfected and tested in accordance with AWWA C 651. Water shall not be used until favorable written test results have been furnished to the Engineer.

Drawings indicate the general arrangement and location of electrical equipment, conduit, piping, transformer, and generator. Installation and location of these items shall be coordinated with the pump station operating personnel.

### **3.25 FORCE MAIN**

- A. Ductile Iron Force Main shall be installed in accordance with AWWA C 600.
- B. PVC Force Main shall be installed in accordance with ASTM D 2774.
- C. Crossings with water mains shall conform to South Carolina Department of Health and Environmental Control's Bureau of Water Standards for Wastewater Facility Construction: Regulation 61-67.

### **3.26 BYPASSING**

- A. Bypassing of raw wastewater onto the ground or into a receiving stream is prohibited.
- B. Bypassing shall be accomplished with pumping equipment sufficient to maintain the flow of wastewater. Contractor shall provide pump, hoses, materials, and labor to operate and maintain the bypassing operation. A backup pump shall also be made available by the Contractor. Bypassing operations shall be reviewed and acceptable to the sewer system operator before being implemented.

END OF SECTION

**INDEX TO**  
**SECTION 02890 – TRAFFIC SIGNS**

| <b>Paragraph</b>          | <b>Title</b>            | <b>Page</b> |
|---------------------------|-------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                         |             |
| 1.1                       | Work Included           | 02890-1     |
| 1.2                       | References              | 02890-1     |
| 1.3                       | Submittals              | 02890-1     |
| 1.4                       | Quality Assurance       | 02890-1     |
| 1.5                       | Guarantee               | 02890-1     |
| <b>PART 2 – PRODUCTS</b>  |                         |             |
| 2.1                       | Uniformity              | 02890-2     |
| 2.2                       | Materials & Workmanship | 02890-2     |
| 2.3                       | Product Review          | 02890-2     |
| <b>PART 3 – EXECUTION</b> |                         |             |
| 3.1                       | General                 | 02890-2     |
| 3.2                       | Location                | 02890-2     |
| 3.3                       | Erection                | 02890-3     |

## **SECTION 02890 – TRAFFIC SIGNS**

### **PART 1 – GENERAL**

#### **1.1 WORK INCLUDED**

- A. Signs.
- B. Posts.
- C. Fabricating and installing traffic signs in accordance with details shown on construction plans and the Manual on Uniform Traffic Control Devices.

#### **1.2 REFERENCES (LATEST REVISION)**

- A. ASTM A 123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ASTM A 153 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM A 193 – Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
- D. ASTM A 307 – Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- E. ASTM A 615 – Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- F. ASTM B 209 – Aluminum and Aluminum-Alloy Sheet and Plate.
- G. ASTM B 211 – Aluminum and Aluminum-Alloy Bar, Rod, and Wire.

#### **1.3 SUBMITTALS**

- A. A sample of all signs and posts to be placed shall be submitted to the Engineer for review prior to ordering.

#### **1.4 QUALITY ASSURANCE**

- A. Material and equipment shall be the standard product of a manufacturer who has manufactured them for a minimum of 2 years and provides published data on quality and performance.

#### **1.5 GUARANTEE**

- A. Contractor shall guarantee the quality of materials and workmanship for a period of 12 months after acceptance. Defects discovered during this period shall be repaired by Contractor at no cost to the Owner.

## **PART 2 – PRODUCTS**

### **2.1 UNIFORMITY**

- A. All signs shall be uniform in shape, color, dimensions, legends, and illumination or reflectorization.

### **2.2 MATERIALS AND WORKMANSHIP**

- A. Signs: Shall be aluminum 0.08 inch minimum thickness and shall conform to ASTM B 209, Alloy 6061-T6 or 5053-H38. Finished sign shall be clear cut, the lines of all letters and details true, regular and free from waviness, unevenness, furry edges, or lines and shall be free from all scaling, cracking, blistering, pitting, dents, or blemishes of any kind.
- B. Sign Posts: Shall be galvanized steel flanged "U" channel section with a minimum (before punching or drilling) of two (2) pounds per foot and shall conform to the minimum yield point and tensile strength specified in ASTM A 615 Grade 60. Galvanizing shall be in accordance with ASTM A 123. Length as specified on the plans. Holes may be punched or drilled 3/8 inch in diameter and spaced one (1) inch center to center beginning one (1) inch from the top and extending the full length of post.
- C. Hardware: Bolts shall be 5/16 inch diameter with hexagonal heads and of sufficient length to extend at least 1/4 inch beyond the nut when installed. Nuts shall be hex nuts of the self-locking plastic insert type. The thread fit for nuts shall be ANSI, Class 2B. The washers shall be flat and 25/64 inch ID by 3/4 inch OD by 0.091 inch thick. These washers are to be placed between head of bolt and sign face. Bolts, nuts, washers and spacers may be aluminum, stainless steel or galvanized steel. Galvanized steel bolts and washers shall conform to ASTM A 307, galvanized in accordance with ASTM A 153. Aluminum shall conform to ASTM B 211, Alloy 2024-T4 for bolts, Alloy 2017-T4 for nuts, and ASTM B 209, Alloy 2024-T4 for washers. Stainless steel shall conform to ASTM A 193, Type B8.

### **2.3 PRODUCT REVIEW**

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Sign posts and their foundations and sign mountings shall be constructed to hold signs in a proper and permanent position, to resist swaying in the wind or displacement by vandalism.

### **3.2 LOCATION**

- A. Signs are to be placed as shown on the plans. Signs shall conform to height and lateral locations as shown in the Manual on Uniform Traffic Control Devices.

### 3.3 ERECTION

- A. Drive type posts may either be driven in place or placed in prepared holes. Driven posts will be limited to locations where the surrounding soil is firm and stable. When sandy or unstable soils are present, each drive post shall be placed in a prepared dry hole minimum six (6) inches in diameter. Whenever posts are placed in prepared holes, the holes shall be backfilled with a mixture of Portland Cement and sand. The resultant mixture shall be mixed with water to a moist consistency and placed around posts. All posts shall be erected in a vertical and plumb position to a depth of three (3) feet and at an angle to the roadway as shown on plans or directed by Engineer.

END OF SECTION

**INDEX TO**  
**SECTION 02902 - GRASSING**

| <b>Paragraph</b>                                     | <b>Title</b>                                 | <b>Page</b> |
|------------------------------------------------------|----------------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>                              |                                              |             |
| 1.1                                                  | Section Includes                             | 02902-1     |
| 1.2                                                  | Related Work                                 | 02902-1     |
| 1.3                                                  | Delivery, Storage & Handling                 | 02902-1     |
| 1.4                                                  | Planting Dates                               | 02902-1     |
| <b>PART 2 – PRODUCTS</b>                             |                                              |             |
| 2.1                                                  | Seed                                         | 02902-2     |
| 2.2                                                  | Seeding Schedule                             | 02902-2     |
| 2.3                                                  | Fertilizer                                   | 02902-2     |
| 2.4                                                  | Lime                                         | 02902-2     |
| 2.5                                                  | Sprig                                        | 02902-2     |
| 2.6                                                  | Sprigging Schedule                           | 02902-3     |
| 2.7                                                  | Sod                                          | 02902-3     |
| 2.8                                                  | Accessories                                  | 02902-3     |
| 2.9                                                  | Product Review                               | 02902-4     |
| <b>PART 3 – EXECUTION</b>                            |                                              |             |
| 3.1                                                  | Preparation                                  | 02902-4     |
| 3.2                                                  | Stand of Grass                               | 02902-4     |
| 3.3                                                  | Seeding and Sprigging Dates                  | 02902-4     |
| 3.4                                                  | Applying Lime and Fertilizer                 | 02902-5     |
| 3.5                                                  | Seeding                                      | 02902-5     |
| 3.6                                                  | Seed Protection (Straw Mulch)                | 02902-5     |
| 3.7                                                  | Seed Protection (Excelsior Mulch)            | 02902-5     |
| 3.8                                                  | Seed Protection (Wood Cellulose Fiber Mulch) | 02902-6     |
| 3.9                                                  | Sprigging                                    | 02902-6     |
| 3.10                                                 | Sodding                                      | 02902-6     |
| <b>PART 4 – MAINTENANCE, WARRANTY AND ACCEPTANCE</b> |                                              |             |
| 4.1                                                  | Maintenance                                  | 02902-7     |
| 4.2                                                  | Warranty                                     | 02902-7     |
| 4.3                                                  | Acceptance                                   | 02902-8     |

**SECTION 02902****GRASSING****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Seeding, planting grass, and fertilizing graded areas behind the structures, pipeline rights-of-way, roadway shoulders and other disturbed areas.
- B. Seed protection.
- C. Maintaining seeded areas until final acceptance.

**1.2 RELATED WORK**

- A. Civil and Landscape plans and specifications.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages are not acceptable. Store in cool, dry locations away from contaminants.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer. Damaged bags are not acceptable. Store in cool, dry locations away from contaminants.
- C. Deliver sod on pallets.
- D. All material shall be acceptable to Engineer prior to use.

**1.4 PLANTING DATES**

- A. This specification provides for establishment of a permanent grass cover between the dates of March 1 and September 30. If finished earth grades are not completed in time to permit planting and establishment of permanent grass during the favorable season between dates specified above unless otherwise accepted, Contractor will be required to plant a temporary cover to protect new graded areas from erosion and to keep windborne dust to a minimum. The temporary cover shall be planted between October 1 and February 28 unless otherwise permitted.

**PART 2 – PRODUCTS**

- A. Contractor shall submit source and species certification documents to Engineer and Owner's Representative for review prior to installation. Supply complete information on all analysis/test methodologies and results; laboratory certifications, manufacturer's specifications, and agency approvals to the Landscape Architect/Project Engineer prior to placement of soil mixtures. In

addition, provide the Landscape Architect/Project Engineer with thoroughly mixed sample of soil mixes for acceptance prior to placement. Landscape Contractor shall make modifications and improvements to soil mixes deemed necessary by the soil analysis to meet requirements specified here in before, and to ensure proper growing medium for plant material.

## **2.1 SEED**

- A. All seed shall conform to State Laws and requirements and regulations of the State Department of Agriculture.
- B. The varieties of seed, as specified in Section 2.2, shall be individually packaged or bagged, and tagged to show name of seed, net weight, origin, germination, lot number, and other information required by the State Department of Agriculture.
- C. Engineer reserves the right to test, reject, or accept all seed before seeding.

## **2.2 SEEDING SCHEDULE**

| A. | <u>SEED</u> | <u>RATE</u> | <u>PLANTING DATES</u>   |
|----|-------------|-------------|-------------------------|
|    | Bermuda     | 50-lbs/acre | March 1 – September 30  |
|    | Rye         | 75-lbs/acre | October 1 – February 28 |

## **2.3 FERTILIZER**

- A. Commercial fertilizer of accepted type, conforming to State fertilizer laws at the rate as recommended by soils test.

## **2.4 LIME**

- A. Agricultural grade, ground limestone at the rate as recommended by soils test.

## **2.5 SPRIG**

- A. Healthy living stems, stolons, or rhizomes and attached roots of locally adapted grass without adhering soil, including two to three nodes and from 4 to 6 inches long. Obtain from heavy, dense certified sod. Provide sprigs which have been grown under climatic conditions similar to those in the locality of project. Coordinate harvesting and planting operations to prevent exposure of sprigs to the sun for more than 30 minutes before covering and moistening. Sprigs showing signs of wilt, mold, containing weeds or other detrimental material or are heat damaged will be rejected.
- B. Varieties of sprig, as specified in section 2.6, shall be individually packaged or bagged, and tagged to show name of sprig, net weight, origin, and other information required by the State Department of Agriculture.
- C. Sprigs shall be pure to variety specified and shall be free of other grass species, weeds or foreign matter.
- D. Sprigs shall be harvested by digging (not collected above soil level), shredding

sod, rototilling sod and raking, vericutting, or with a sprig harvester. Sprigs shall consist of mostly rhizomes and crowns with only a few green leaves.

## 2.6 SPRIGGING SCHEDULE

| A. | <u>SPRIG</u>                                                                                                                   | <u>RATE</u>                                     | <u>PLANTING DATES</u>                       |
|----|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------|
|    | 'Tifway 419'<br>Bermuda                                                                                                        | 1,000 bushels/acre<br>(Maximum 12 week grow-in) | April 1 – August 31                         |
|    | Stabilize site with temporary grass seed                                                                                       |                                                 | September 1 – March 31<br>(See section 2.2) |
| B. | In areas where existing grass is to be matched, Contractor shall sprig at the rate and dates recommended by sprig distributor. |                                                 |                                             |

## 2.7 SOD

- A. Sod shall be premium grade, densely rooted, good quality grass of the species and certified variety as shown on the plans, free from noxious weeds with no surface soil being visible. The sod shall be obtained from areas where the soil is reasonably fertile. Sod of specified species shall be grown from seed or sprig with not less than 95 percent germination, 85 percent pure seed, and not more than 0.5 percent weed seed. The sod shall be machine cut to a uniform soil thickness that shall contain practically all of the dense root system and not be less than 1-inch thick.
- B. Before cutting, sod shall be mowed to a height of not less than 1-1/2-inches or more than 2-inches. Sod shall be cut in minimum uniform widths of 12-inches and lengths of 24 inches.
- C. Sod shall be delivered to site in a fresh, moist condition with healthy green foliage. It shall be unloaded from delivery trucks on pallets or in rolls and placed in final position within 24 hours of delivery. Sod shall be protected from wind and sun and shall not be allowed to dry out before planting.
- D. Sod shall be strong enough to support its own weight and retain its size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.

## 2.8 ACCESSORIES

- A. Straw Mulch: Oat or wheat straw, reasonably free from weeds, foreign matter detrimental to plant life, and in dry condition.
- B. Excelsior Mulch: Excelsior mulch shall consist of wood fibers cut from sound, green timber. The average length of fibers shall be 4 to 6 inches. Cut shall be made in such a manner as to provide maximum strength of fiber, but at a slight angle to natural grain of the wood to cause splintering of fibers when weathering in order to provide adherence to each other and to soil.

- C. Wood cellulose fiber shall be made from wood chip particles manufactured particularly for discharging uniformly on the ground surface when dispersed by a hydraulic water sprayer. It shall remain in uniform suspension in water under agitation and blend with grass seed and fertilizer to form a homogenous slurry. Mulch fibers shall intertwine physically to form a strong moisture holding mat on the ground surface and allow rainfall to percolate into underlying soil. The mulch shall be heat processed to contain no germination or growth-inhibiting factors. It shall be dyed (non-toxic) an appropriate color to facilitate metering of material.

## **2.9 PRODUCT REVIEW**

- A. Contractor shall provide the Engineer with a complete description of all products before ordering. The Engineer will review all products before they are ordered.

## **PART 3 – EXECUTION**

### **3.1 PREPARATION**

- A. Areas to be seeded shall be made smooth and uniform and shall conform to the finished grade indicated on plans.
- B. Remove foreign materials, plants, roots, stones, and debris from surfaces to be seeded.
- C. Grassing areas, if not loose, shall be loosened to a minimum depth of 3 inches before fertilizer, seed or sod is applied.
- D. Amendments to soils shall be incorporated into loosened 3-inch top soil layer as recommended by soils tests.
- E. Contractor shall provide Topsoil Analysis Tests performed by a State Agricultural Experiment Station, Soil and Water Conservation District, State University, or other qualified private testing laboratory, as acceptable to Landscape Architect/Project Engineer. Soils test shall identify existing pH and nutrient levels, as well as recommended adjustments based on the type of grass to be installed.

### **3.2 STAND OF GRASS**

- A. Before acceptance of seeding, sodding, or sprigging is performed for the establishment of permanent vegetation, Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and winter weather and be capable of re-establishment in spring.
- B. Before acceptance of seeding is performed for the establishment of temporary vegetation, Contractor will be required to produce a stand of grass sufficient to control erosion for a given area and length of time before the next phase of construction or establishment of permanent vegetation is to commence.

### **3.3 SEEDING AND SPRIGGING DATES**

- A. Seeding and sprigging shall be performed during periods and at rates specified in their respective schedules. Seeding and sprigging work may, at discretion of Contractor, be performed throughout the year using schedule prescribed for given

period. Seeding and sprigging work shall not be conducted when the ground is frozen or excessively wet. Contractor will be required to produce a satisfactory stand of grass regardless of the period of year work is performed.

### **3.4 APPLYING LIME AND FERTILIZER**

- A. Following advance preparation and placing selected material for shoulders and slopes, lime and fertilizer, if called for based on soil tests, shall be spread uniformly over the designated areas, and shall be thoroughly mixed with the soil to a depth of approximately 2 inches. Fertilizer and lime shall be applied at the rate recommended by required soils test. Unless otherwise provided, lime will not be applied for temporary seeding. In all cases where practicable, acceptable mechanical spreaders shall be used for spreading fertilizer. On steep slopes subject to slides and inaccessible to power equipment, the slopes shall be adequately scarified. Fertilizer may be applied on steep slopes by hydraulic methods as a mixture of fertilizer and seed. When fertilizer is applied with combination seed and fertilizer drills, no further incorporation will be necessary. The fertilizer and seed shall be applied together when Wood Cellulose Fiber Mulch is used. Any stones larger than 2-1/2 inches in any dimension, larger clods, roots, or other debris brought to the surface shall be removed.

### **3.5 SEEDING**

- A. Seed shall be sown within 24 hours following application of fertilizer and lime and preparation of the seedbed as specified in Section 3.4. Seed shall be uniformly sown at rate specified by the use of acceptable mechanical seed drills. Rotary hand seeders, power sprayers or other satisfactory equipment may be used on steep slopes or on other areas inaccessible to seed drills.
- B. Seeds shall be covered and lightly compacted by means of cultipacker or light roller if the drill does not perform this operation. On slopes inaccessible to compaction equipment, the seed shall be covered by dragging spiked chains, by light harrowing or by other satisfactory methods.
- C. Apply water with fine spray immediately after each area has been sown.
- D. Do not sow seed when ground is too dry, during windy periods or immediately following a rain.
- E. If permitted by the special provisions, wood cellulose fiber mulch or excelsior fiber mulch may be used.

### **3.6 SEED PROTECTION (STRAW MULCH)**

- A. All seeded areas seeded with permanent grasses shall be uniformly mulched in a continuous blanket immediately following seeding and compacting operations, using at least 2 tons of straw per acre.

### **3.7 SEED PROTECTION (EXCELSIOR MULCH)**

- A. Seed shall be sown as specified in Section 3.5. Within 24 hours after covering of seed, excelsior mulch shall be uniformly applied at the rate of 2 tons per acre. The mulch may be applied hydraulically or by other acceptable methods. Should the

mulch be placed in a dry condition, it shall be thoroughly wetted immediately after placing. Engineer may require light rolling of the mulch to form a tight mat.

### **3.8 SEED PROTECTION (WOOD CELLULOSE FIBER MULCH)**

- A. After the lime has been applied and ground prepared as specified in Section 3.4, wood cellulose fiber mulch shall be applied at a rate of 1,500 pounds per acre in a mixture of seed and fertilizer. Hydraulic equipment shall be used for application of fertilizer, seed, and slurry of the prepared wood pulp. This equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, and water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which will provide an even distribution of slurry on various areas to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons.

Seed, fertilizer, wood pulp mulch, and water shall all be combined into the slurry tank for distribution of all ingredients in one operation by hydraulic seeding method specified herein. Materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be regulated so amounts and rates of application shall result in a uniform application of all materials at rates not less than amount specified. Using the color of wood pulp as a guide, equipment operator shall spray prepared seedbed with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream to fall like rain, allowing wood fibers to build upon each other until an even coat is achieved.

### **3.9 SPRIGGING**

- A. Sprigs shall be placed at the date and rates as shown in section 2.6. The sprigging method shall be by broadcast sprigging, hydroplanting or row planter. Sprigging procedure shall ensure even coverage.
- B. Sprigs applied by broadcast over the site with a distributor or hydroseeder shall be planted at the rates listed in section 2.6. Cover broadcast sprigs with straw mulch immediately after broadcast and water in immediately (within 2 hours).
- C. Sprigs installed by row planter creating a narrow furrow that covers 50 to 80% of the sprig with soil may use less sprig material. Rate shall be as recommended by sprig supplier to provide a solid stand of turf within the time required in Section 2.6. Water in immediately (within 1 hour).

### **3.10 SODDING**

- A. Sod shall be placed between March 1st and December 1st. However, if sod is to be placed during periods of temperatures over 90 degrees F., the Contractor shall take extra care for quick placement of sod with adequate, consistent watering necessary to ensure sod thrives as planted.
- B. Sod shall be placed within 24 hours of cutting.
- C. Place top elevation of sod 1/2 inch below adjoining paving or curbs.
- D. All areas to be sodded shall be brought to the proper line grade or cross section as was existing prior to construction. Sod shall be placed so, upon completion,

edges of sodded areas will be smooth and will conform to the proposed finished grade. Sod shall be laid smooth, edge to edge, with staggered joints. Sod shall be immediately pressed firmly into contact with the sod bed by tamping or rolling, to eliminate any air pockets. A true and even surface shall be provided, to insure knitting without displacement of the sod or deformation of the sodded areas surfaces. Do not stretch or overlap sod pieces. Following compaction, screened soil of good quality shall be used to fill all cracks. Excess soil shall be worked into the grass with rakes or other suitable equipment. On slopes steeper than 3 to 1, sod shall be fastened in place with suitable wood or metal pins to hold the sod in place. Any damage by erosion or other causes occurring after completion of grading operations shall be repaired, before commencing with the sodding operations.

- E. Immediately before sodding, moisten topsoil with a fine spray to a minimum 1-inch depth. Sod shall not be laid on dry or powdery soil.
- F. Sod shall be moist when laid and placed on moist ground. The sod shall be carefully placed by hand, beginning at the toe of slopes and working upwards. The length of strips shall be at right angles to flow of surface water. All joints shall be tightly butted and end joints shall be staggered at least 12 inches. Sod shall be immediately pressed firmly into the ground by tamping or rolling. Fill all joints between strips with fine screened soil. Sod on slopes shall be pegged with sod pegs to prevent movement.
- G. Within two hours after sod has been placed, thoroughly water to a minimum depth of 4-inches. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove depressions and irregularities. Roll sodded areas with a roller not exceeding 150 lbs. per foot of roller width.

## **PART 4 – MAINTENANCE, WARRANTY AND ACCEPTANCE**

### **4.1 MAINTENANCE**

- A. Maintain grassed surfaces until final acceptance.
- B. Maintenance shall consist of providing protection against traffic, watering to ensure uniform seed germination and to keep surface of soil damp, and repairing any areas damaged as a result of construction operations or erosion. Maintenance shall also include, but is not limited to, watering, weeding, cultivating, removal of dead material, lawn mowing, fertilizing, and other necessary operations.
- C. The Contractor shall maintain all proposed plantings until the date of substantial completion issued by the Owner.

### **4.2 WARRANTY**

- A. All grassed areas shall be guaranteed by Contractor to be alive and healthy for a one year period from date of substantial completion issued by the Owner. A final walk through with the Owner shall be conducted at end of warranty period to determine if any areas require replanting. At end of warranty period, sod shall show evidence of rooting to underlying soil and shall have no competitive weed growth from either the sod or from between sod joints.

- B. Any grassed area which is dead or not showing satisfactory growth shall be replaced at Contractor's expense at the end of warranty period. All replacement shall be of original quality. Replacement required because of vandalism, excessive use, or other causes beyond the control of Contractor are not part of this contract.

#### **4.3 ACCEPTANCE**

- A. Before acceptance of seeding performed for the establishment of permanent vegetation, Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and winter weather and be capable of reestablishment in spring.
- B. A minimum coverage of 80% density over 100% of the disturbed area is required for seeded areas before project acceptance. Sprig and sod areas shall have 95% coverage over 100% of the disturbed area prior project acceptance.

END OF SECTION

**INDEX TO**  
**SECTION 03305 – SITE CONCRETE**

| <b>Paragraph</b>          | <b>Title</b>                           | <b>Page</b> |
|---------------------------|----------------------------------------|-------------|
| <b>PART 1 – GENERAL</b>   |                                        |             |
| 1.1                       | Section Includes                       | 03305–1     |
| 1.2                       | Related Sections                       | 03305–1     |
| 1.3                       | Omitted                                | 03305–1     |
| 1.4                       | References                             | 03305–1     |
| 1.5                       | Performance Requirements               | 03305–2     |
| 1.6                       | Submittals for Review                  | 03305–2     |
| 1.7                       | Quality Assurance                      | 03305–2     |
| 1.8                       | Regulatory Requirements                | 03305–4     |
| 1.9                       | Environmental Requirements             | 03305–4     |
| 1.10                      | Guarantee                              | 03305–4     |
| 1.11                      | Testing                                | 03305–4     |
| <b>PART 2 – PRODUCTS</b>  |                                        |             |
| 2.1                       | Form Materials                         | 03305–5     |
| 2.2                       | Reinforcement                          | 03305–5     |
| 2.3                       | Concrete Materials                     | 03305–5     |
| 2.4                       | Accessories                            | 03305–5     |
| 2.5                       | Concrete Mix – By Performance Criteria | 03305–5     |
| 2.6                       | Source Quality Control and Tests       | 03305–6     |
| <b>PART 3 – EXECUTION</b> |                                        |             |
| 3.1                       | Examination                            | 03305–6     |
| 3.2                       | Construction Observation               | 03305–6     |
| 3.3                       | Subgrade                               | 03305–7     |
| 3.4                       | Preparation for Placing                | 03305–7     |
| 3.5                       | Forming                                | 03305–7     |
| 3.6                       | Reinforcement                          | 03305–7     |
| 3.7                       | Placing Concrete                       | 03305–7     |
| 3.8                       | Joints                                 | 03305–8     |
| 3.9                       | Finishing                              | 03305–8     |
| 3.10                      | Joint Sealing                          | 03305–8     |
| 3.11                      | Tolerances                             | 03305–8     |
| 3.12                      | Curb and Gutter Sections               | 03305–9     |
| 3.13                      | Concrete Curing                        | 03305–9     |
| 3.14                      | Field Quality Control                  | 03305–10    |
| 3.15                      | Protection                             | 03305–11    |

**SECTION 03305****SITE CONCRETE****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Concrete sidewalks, curbs, gutters, parking areas, and roads.

**1.2 RELATED SECTIONS**

- A. Section 02204 – Earthwork: Preparation of site for paving and base.
- B. Section 02231 – Aggregate Base Course.
- C. Section 02512SC – Asphaltic Concrete Binder/Surface Courses.

**1.3 OMITTED****1.4 REFERENCES (LATEST REVISION)**

- A. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
- B. ACI 301 – Specifications for Structural Concrete.
- C. ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
- D. ACI 318 – Building–Code Requirements for Structural Concrete and Commentary.
- E. ACI 330R – Guide for the Design and Construction of Concrete Parking Lots.
- F. ASTM A 185 – Steel Welded Wire Reinforcement, Plain, for Concrete.
- G. ASTM A 497 – Steel Welded Wire Reinforcement, Deformed, for Concrete.
- H. ASTM A 615 – Deformed and Plain Carbon–Steel Bars for Concrete Reinforcement.
- I. ASTM C 31 – Making and Curing Concrete Test Specimens in the Field.
- J. ASTM C 33 – Concrete Aggregates.
- K. ASTM C 39 – Compressive Strength of Cylindrical Concrete Specimens.
- L. ASTM C 94 – Ready–Mixed Concrete.
- M. ASTM C 150 – Portland Cement.
- N. ASTM C 172 – Sampling Freshly Mixed Concret.
- O. ASTM C 260 – Air–Entraining Admixtures for Concrete.

- P. ASTM C 309 – Liquid Membrane-Forming Compounds for Curing Concrete.
- Q. ASTM C 494 – Chemical Admixtures for Concrete.
- R. ASTM C 920 – Elastomeric Joint Sealants.
- S. ASTM E 1155 – Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
- T. ASTM C 1116 – Fiber-Reinforced Concrete.
- U. ASTM D 1751 – Preformed Expansion Joint Filler for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Type).
- V. ASTM D 3740 – Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- W. ASTM E 329 – Agencies Engaged in Construction Inspection and/or Testing.

## **1.5 PERFORMANCE REQUIREMENTS**

- A. Paving: Designed for movement of trucks up to 30,000 lbs.

## **1.6 SUBMITTALS FOR REVIEW**

- A. Section 01300 – Submittals: Procedures for submittals.
- B. Product Data: Provide data on joint filler, admixtures, and curing compounds.
- C. Concrete Design Mix.

## **1.7 QUALITY ASSURANCE**

- A. Perform work in accordance with ACI 301, ACI 318, and ACI 330R.
- B. Obtain cementitious materials from same source throughout.
- C. Conform to ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
- D. Method of measurement for accessible route with a 24" digital smart-level will be used to measure points along the accessible route. Line of measurement shall be parallel to the long edge of ramp or accessible route, whether straight or curved. Longitudinal measurement lines shall be spaced 3 feet apart, but in no case shall fewer than two lines be used. The horizontal measurement [cross-slope] will be measured every [6] feet. Engineer reserves the right to gather additional measurements if further investigation is necessary. The 24" Smart-level slope readings greater than specified tolerance within contract documents will be identified as non-compliant and not accepted.
- E. Engineer reserves the right to mark and reject portions of concrete not within tolerance as specified.

- F. Accessible Route Tolerance by measuring Floor Flatness and Levelness. Traffic floors [All Accessible Routes] shall conform to the following surface profile tolerances:
- a. Floor Designation: All floor areas not specified to be part of the "defined traffic floor" [Accessible Routes] shall be part of a "random traffic floor" [Non-accessible Route]. Any floor slab comprising part of the traffic floor shall be designated a "traffic slab" [Accessible Route].
  - b. Flatness and Levelness Tolerances: A traffic floor shall conform to the following surface profile tolerances:  
  
 Floor Flatness Number:  $F_F$   
 Specified Overall Value = [38]  
 Minimum Local Value = [25]  
 Floor Levelness Number:  $F_L$   
 Specified Overall Value = [25]  
 Minimum Local Value = [17]
  - c. Floor Tolerance Measurements:  $F_F$  and  $F_L$  tolerances shall be tested in accordance with ASTM E 1155. Actual overall F-numbers shall be calculated using the inferior / superior area method.
  - d. Timeliness of Floor Profile Tests & Reports: All floor tolerance measurements shall be made within [48] hours after slab installation. In all cases, tolerance measurements shall precede the removal of shores and forms. Results of all floor profile tests (including a running tabulation of overall  $F_F$  and  $F_L$  values for all traffic slabs installed to date) shall be provided to the Contractor within [72] hours after each slab installation.
  - e. Remedy for Out-of-Tolerance Work: For purposes of flatness and levelness control, minimum floor section boundaries shall coincide with the control joints. Profile test compliance requirements apply to the time period specified above only. Contractor shall remedy any floor section measuring below either the minimum local  $F_F$ , or  $F_L$  number. Any floor section measuring at or above both the minimum local  $F_F$  and  $F_L$  number shall be accepted. If actual overall  $F_F$  or  $F_L$  number for entire random-traffic floor installation measures less than its specified value, then Contractor shall undertake remedial measures acceptable to the Engineer.
- G. Defined random traffic floors [Non-accessible Routes] shall conform to the following surface profile tolerances:
- a. Floor Designation: All floor areas specified as "defined random traffic floor" include only the [Non-accessible route].
  - b. Flatness and Levelness Tolerances: The defined traffic floor shall conform to the following surface profile tolerances:  $F_{min} = [25]$
  - c. Floor Tolerance Measurements:  $F_{min}$  tolerances shall be tested in accordance with ASTM E 1486.

- d. Timeliness of Floor Profile Tests & Reports: All floor tolerance measurements shall be made by the Contractor within [24] hours after slab installation and before saw cutting of control joints. In all cases, tolerance measurements shall precede the removal of shores and forms. Results of all floor profile tests including a running tabulation of overall  $F_{min}$  values for all of defined-traffic slabs installed to date shall be provided to the Contractor within [48] hours after each slab installation.

- H. Remedy for Out-of-Tolerance Work: For purposes of flatness and levelness control, minimum floor section boundaries shall coincide with the construction joints. Profile test compliance requirements apply to time period specified above only. Contractor shall remedy any floor section measuring below the  $F_{min}$  number, in accordance with recommendations of the Engineer. Any floor section measuring at or above the  $F_{min}$  number shall be accepted. If actual overall  $F_{min}$  number entire defined-traffic floor installation measures less than its specified value, then Contractor shall undertake remedial measures acceptable to the Engineer.

If a portion of a floor does not meet specified F-number, the following remedies are recommended:

- a. Local value is out of spec – grind or replace floor.
- b. Overall value is out of spec – Contractor shall pay the Owner per square foot for portion of floor not meeting F-number spec. This can be obtained by specifying a figure in project specifications in conjunction with square footage obtained from reading taken in the field.

## **1.8 REGULATORY REQUIREMENTS**

- A. Conform to SCDOT standards for paving work on public property.

## **1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

## **1.10 GUARANTEE**

- A. Contractor shall guarantee the quality of materials and workmanship for a period of 12 months after acceptance. Defects discovered during this period shall be repaired by the Contractor at no cost to the Owner.

## **1.11 TESTING**

- A. Testing laboratory shall operate in accordance with ASTM D 3740 and E 329 and be acceptable to the Engineer.
- B. Testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any tests.
- C. Testing shall be the Contractor's responsibility and shall be performed at Contractor's expense by a commercial testing laboratory operating in accordance with subparagraph A above.

- D. Test results shall be furnished to the Engineer prior to continuing with associated or subsequent work.

## **PART 2 – PRODUCTS**

### **2.1 FORM MATERIALS**

- A. Wood or steel form material, profiled to suit conditions.
- B. Joint Filler: ASTM D1751 type; 1/2 inch thick.

### **2.2 REINFORCEMENT**

- A. Reinforcing Steel: ASTM A 615, Grade 60 billet steel deformed bars; uncoated finish.
- B. Welded Steel Wire Fabric: Plain type, ASTM A 185; uncoated finish.
- C. Fiber reinforcement: Shall conform to ASTM C 1116 as manufactured by Fibermesh Company or equivalent. Concrete mix design shall utilize between 0.5% and 1.0% fiber content.

### **2.3 CONCRETE MATERIALS**

- A. Cement: ASTM C 150, Type I – Normal.
- B. Fine and Coarse Mix Aggregates: ASTM C 33. Coarse aggregate shall consist of granite stone.
- C. Water: Potable, not detrimental to concrete.
- D. Air Entrainment: ASTM C 260.
- E. Chemical Admixture: ASTM C 494, Type A – Water Reducing.

### **2.4 ACCESSORIES**

- A. Curing Compound: ASTM C309, clear with fugitive dye.
- B. Sealant: Joints shall be sealed per detail on project drawings, conforming to ASTM C 920, Type S or M, Grade P or NS, Class 25.

### **2.5 CONCRETE MIX – BY PERFORMANCE CRITERIA**

- A. Provide concrete to the following criteria:
  - 1. Flexible Strength: 700 psi.

- 2. Compressive Strength: 4,000 psi @ 28 days for paving curb, gutter, and sidewalks.
- 3. Slump: 4 to 5 inches.
- B. Use accelerating admixtures in cold weather only when accepted by Engineer. Use of admixtures will not relax cold weather placement requirements.
- C. Use calcium chloride only when accepted by Engineer.
- D. Use set retarding admixtures during hot weather only when accepted by Engineer.

## **2.6 SOURCE QUALITY CONTROL AND TESTS**

- A. All sampling and testing services shall be performed, at Contractor's expense, by a testing agency that operates in accordance to ASTM D 3740 and E 329 latest edition and accepted by the Engineer.
- B. Contractor shall submit to the Engineer a design mix on each class of concrete proposed for use. The mix shall be prepared by an accepted testing laboratory. Compressive strength of at least four specimens of the design mix shall indicate 15% higher than 28 days strengths specified. During the work, Contractor shall make three test cylinders for each 50 cubic yards, or fraction thereof, of concrete placed each day. One cylinder shall be tested at 7 days and the other two at 28 days in accordance with ASTM C 39. Copies of all test reports shall be furnished to the Engineer.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Verify subgrade conditions under provisions of Section 02204 – Earthwork.
- B. Verify compacted subgrade is acceptable and ready to support concrete and imposed loads.
- C. Verify gradients and elevations of subgrade are correct.

### **3.2 CONSTRUCTION OBSERVATION**

- A. The Engineer or Project Representative will have the right to require any portion of the work be completed in their presence and if the work is covered up after such instruction, it shall be exposed by the Contractor for observation. However, if Contractor notifies the Engineer such work is scheduled, and Engineer fails to appear within 48 hours, the Contractor may proceed. All work completed and materials furnished shall be subject to review by the Engineer or Project Representative. Improper work shall be reconstructed. All materials, which do not conform to the requirements of the specifications, shall be removed from the work upon notice being received from Engineer for rejection of such materials. Engineer shall have the right to mark rejected materials to distinguish them as such.

**3.3 SUBGRADE**

- A. Prepare subgrade in accordance with Section 02204 – Earthwork.

**3.4 PREPARATION FOR PLACING**

- A. Water shall be removed from excavations before concrete is deposited. Hardened concrete debris and other foreign materials shall be removed from the interior of forms and inside of mixing and conveying equipment. The reinforcement shall be made secure in position and shall be subject to examination and acceptance.
- B. Moisten subgrade to minimize absorption of water from fresh concrete.
- C. Coat surfaces of manhole, inlet, and catch basin frames with oil to prevent bond with concrete pavement.
- D. Notify Engineer minimum 48 hours prior to commencement of concreting operations.

**3.5 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 in position, in straight lines. Secure to formwork during concrete placement.
- D. Forms shall be constructed to the shape, line, and grade required and shall be maintained sufficiently rigid to prevent deformation under load. Form work and details of construction joints shall conform to ACI-318, Chapter 6.

**3.6 REINFORCEMENT**

- A. Place reinforcement as indicated.
- B. Interrupt reinforcement at expansion joints.

**3.7 PLACING CONCRETE**

- A. Placing of concrete shall conform to Chapter 5 of the American Concrete Institute Standard A.C.I. 318. Concrete having attained initial set or having contained water for more than 45 minutes shall not be used in the work. Concrete shall not be dropped freely more than 5 feet. Concrete shall be mixed and placed only when the temperature is at least 40 degrees F and rising. Concrete shall be placed only upon surfaces free from frost, ice, mud and other detrimental substances or conditions. When placed on dry soil or pervious material, water proof paper or polyethylene sheeting shall be laid over surfaces to receive the concrete.

- B. Ensure reinforcement, inserts, embedded parts, formed joints and forms are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours so cold joints will not occur.
- D. Place concrete to elevations indicated on the contract drawings.

### **3.8 JOINTS**

- A. Place expansion joints at 50 foot intervals and radius points.
- B. Place contraction joints at 10 foot intervals. Align curb, gutter, and sidewalk joints.
- C. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/8 inch.
- D. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

### **3.9 FINISHING**

- A. Paving: Provide coarse, non-slip finish by scoring surface with a stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugation's not over 1/16 of an inch deep.
- B. Sidewalk Paving: [Light broom, radius to 1/2 inch radius, and trowel joint edges.]
- C. Wood float. Exposed aggregate.
- D. Curbs and Gutters: Light broom parallel to gutter.
- E. Inclined Vehicular Ramps: Broomed perpendicular to slope.
- F. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

### **3.10 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 1/8 inch of finished surface.

### **3.11 TOLERANCES**

- A. Section 01400 – Quality Assurance: Tolerances.
- B. General Site Concrete:

1. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.
  2. Maximum Variation From True Position: 1/4 inch.
- C. Accessible Routes: Variation from design elevation shall not exceed 1/4 inch; however, accessible routes shall not exceed maximum ADA allowable slopes. Contractor shall remove and replace any and all portions of the accessible route that exceeds maximum ADA allowable slopes.

### **3.12 CURB AND GUTTER SECTIONS**

- A. Shall be constructed as shown on the drawings and in accordance with applicable details. Subgrade below the curb and gutter sections shall be compacted to 98% density. Curb and gutter sections shall be constructed in sections of uniform length and shall not exceed 10 feet or be less than 5 feet in length. Straight edging along the edge of gutter and top of curb shall conform to those requirements for adjacent pavement but with no irregularities to exceed 1/4 inch in 10 feet.
- B. If slip-form or extruded construction is used, contraction joints shall be located at intervals no greater than 10 feet by sawing the hardened concrete at the proper time. Joints shall be sawed between 4 to 8 hours after placing of concrete. Depth of saw-cut shall be one-fourth thickness of the curb and gutter section. The maximum width of cut shall be 1/4 inch. All joints shall be sawed in succession.
- C. Half inch thick premolded expansion joints shall be installed completely through the joints at spaces not to exceed 50 feet and at all structures and walks.
- D. When the curb forms are removed, backfill shall be immediately placed, tamped, and graded behind the new curb to help protect the line and grade. Machine methods of placing and forming may be used provided the finished product is satisfactory to the Engineer.
- E. Contractor shall place a concrete depressed curb at all driveways shown on the drawings or where a driveway is in use.
- F. Cracked curb and gutter will not be accepted.

### **3.13 CONCRETE CURING**

- A. Immediately after placement and finishing, concrete shall be protected from moisture loss for not less than 7 days. For surfaces not in contact with forms, curing compound shall be uniformly applied after water sheen disappears from the concrete. Formed surfaces shall receive an application of curing compound if forms are removed during the 7 day curing period. Curing compound shall not be applied during rainfall.
- B. Curing compound shall be applied under pressure at the rate of 1 gallon per 150 square feet by mechanical sprayers. The spraying equipment shall be of the fully atomizing type. At the time of use, the compound shall be thoroughly mixed with a fugitive dye uniformly dispersed throughout the sprayer. Care shall be taken to

prevent application to joints where concrete bond is required, to reinforcement steel and to joints where joint sealer is to be placed. The compound shall form a uniform continuous coherent film which will not crack or peel and shall be free from pinholes and other imperfections. Concrete surfaces subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by above method and at above coverage at no additional expense to the Owner.

- C. No pedestrian or vehicular traffic shall be allowed over the surface for seven days unless surface is protected by planks, plywood, or sand. Protection shall not be placed until at least 12 hours after application of the curing compound.
- D. Protect concrete by suitable methods to prevent damage by mechanical injury or excessively hot or cold temperatures.

### **3.14 FIELD QUALITY CONTROL**

- A. Field quality control tests specified herein will be conducted by the Owner's Independent Testing Laboratory at no cost to the Contractor in accordance with Section 01410. The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required as a result of failed initial tests shall be at the Contractor's expense.
- B. Field testing, frequency, and methods may vary as determined by and between the Owner and the Owner's Testing Laboratory.
- C. Review the Contractor's proposal materials and mix design for conformance with specifications.
- D. Perform testing in accordance with ACI 301 and testing standards listed herein.
- E. Strength Tests
  - 1. Secure composite samples in accordance with ASTM C 172. Sample at regularly spaced intervals from middle portion of the batch. Sampling time shall not exceed 15 minutes.
  - 2. Mold and cure specimens in accordance with ASTM C31.
    - a. A minimum of four concrete test cylinders shall be taken for every 50 cubic yards or less of each class of concrete placed each day and not less than once for each 5,000 square feet of paved area.
    - b. During the initial 24 hours (plus or minus 8 hours) after molding, the temperature immediately adjacent to the specimens shall be maintained in the range of 60 to 80 degrees F. Control loss of moisture from specimens by shielding from direct rays of the sun and from radiant heating devices.
    - c. Specimens transported prior to 48 hours after molding shall not be demolded, but shall continue initial curing at 60 – 80 degrees F until time for testing.

- d. Specimens transported after 48 hours age shall be demolded in 24 hours (plus or minus 8 hours). Curing shall then be continued but in saturated limewater at 73.4 degrees (plus or minus 3 degrees F) until the time of testing.
  - e. Wet cure cylinders under controlled temperature until testing.
- 3. Test cylinders in accordance with ASTM C 39.
  - a. Date test cylinders and number consecutively. Give each cylinder of each set an identifying letter (i.e. A, B, C, and D). Prepare a sketch of the building plan for each test set identifying location of placed concrete.
  - b. Test on cylinder (A) at 7 days for information. If the compressive strength of the concrete sample is equal to or above the 28 day specified strength, test another cylinder (B) at 7 days. The average of breaks shall constitute compressive strength of concrete sample.
  - c. Test two cylinders (B and C) at 28 days and the average of the breaks shall constitute compressive strength of concrete sample.
  - d. Retain fourth cylinder (D) for further testing if needed, but do not retain cylinder more than 60 days.
- 4. Evaluation and Acceptance
  - a. Strength level of concrete will be considered satisfactory if the average of all sets of three consecutive strength tests equal or exceed specified strength and no individual strength test (average of two cylinders) results are below specified compressive strength test by more than 500 psi.
  - b. Completed concrete work will not be accepted unless requirements of ACI 301, have been met, including dimensional tolerances, appearance, and strength of structure.

### 3.15 PROTECTION

- A. Immediately after placement, protect pavement from premature moisture loss, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit vehicular traffic over pavement or curb for seven days minimum after finishing. Do not permit pedestrian traffic over concrete for three days.

END OF SECTION