

SECTION 01110
SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Contract Description
- B. Work Required By Contract
- C. Contract Drawings
- D. Contract Technical Specifications
- E. Work Schedule

1.2 CONTRACT DESCRIPTION

- A. Contract Type: Section 00500 Agreement

1.3 WORK REQUIRED

- A. Consists of Contractor furnishing all labor, materials, tools, equipment, and incidentals to complete the Work as depicted on the Construction Drawings entitled **Land Development Plans for PEGASUS PARKWAY LIFT STATION.**
- B. All work shall be performed as shown on the Drawings and as described in the Contract Documents and Technical Specifications.

1.4 CONTRACT DRAWINGS

Contract drawings are numbered C1.0 through E-2 inclusive with each sheet bearing the following general title: **Land Development Plans for PEGASUS PARKWAY LIFT STATION.**

1.5 CONTRACT TECHNICAL SPECIFICATIONS

A.

Section No.	Title
02230	Clearing and Grubbing
02240	Dewatering
02250	Sheeting, Shoring and Bracing
02300	Earthwork
02315	Trench Excavation and Backfill
02370	Erosion, Sedimentation, and Pollution Control
02445	Jack & Bore Crossings
02519	Piping, Testing, and Acceptance
02535	Sanitary Sewer
02640	Manholes and Appurtenances
02920	Grassing

B. Manual of Technical Specifications – Wastewater Pumping Stations for the City of LaGrange within the Corporate City Limits and the City's Water and Sewer Service Area – Approved June 2007.

1.6 WORK SCHEDULE

A. Construct Work in stages to accommodate Owner's requirements during the construction period, coordinate construction schedule and operations with Owner.

PART 2 – PRODUCTS

Not used.

PART 3 – EXECUTION

Not used.

END SECTION

SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SCOPE

- A. This Section describes the methods by which measurement will be made of the quantities for which payment will be made for the Project.
- B. The Bid lists each item of the Project for which payment will be made. No payment will be made for any items other than those listed in the Bid.
- C. Required items of work and incidentals necessary for the satisfactory completion of the work which are not specifically listed in the Bid, and which are not specified in this Section to be measured or to be included in one of the items listed in the Bid, shall be considered as incidental to the work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum or unit prices bid for the various Bid items. The Contractor shall prepare the Bid accordingly.
- D. Work includes furnishing all plant, labor, equipment, tools and materials, which are not furnished by the Owner and performing all operations required to complete the work satisfactorily, in place, as specified and as indicated on the Drawings.

1.2 MEASUREMENT OF WORK

- A. Measurement of an item of work will be by the unit indicated in the Bid Form.
- B. Final payment quantities shall be determined from the record drawings. The record drawing lengths, dimensions, quantities, etc. shall be determined by a survey after the completion of all required work. The precision of final payment quantities shall match the precision shown for that item in the Bid Form.
- C. Payment will include all necessary and incidental related work not specified to be included in any other item of work listed in the Bid Form.
- D. Unless otherwise stated in individual sections of the Specifications or in the bid, no separate payment will be made for any item of work, materials, parts, equipment, supplies or related items required to perform and complete the work. The costs for all such items required shall be included in the price bid for item of which it is a part.
- E. Payment will be made by extending unit prices multiplied by quantities provided and then summing the extended prices to reflect actual work. Such price and payment shall constitute full compensation to the Contractor for

furnishing all plant, labor, equipment, tools and materials not furnished by the Owner and for performing all operations required to provide to the Owner the entire Project, complete in place, as specified and as indicated on the Drawings.

- F. "Products" shall mean materials or equipment permanently incorporated into the work.
- G. "Provide" shall mean furnish and install.
- H. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- I. Work shall be measured by the Engineer or his representative with assistance from the Contractor prior to preparation of a payment request by the Contractor.
- J. Unit quantities that are measured in place shall be measured monthly. The Contractor shall give the Engineer a minimum of two days notice for making all required measurements.
- K. Materials that must be measured as delivered shall be measured at the time of delivery by the Engineer or his representative; the Contractor shall provide sufficient advance notice so that such measurements can be made.
- L. Work completed shall be measured for completion against the schedule of values provided by the Contractor in accordance with the General Conditions. Related work necessary for a complete and operational job, such as relocation of mail boxes removal of trees, relocation of utilities, field engineering, clearing and grubbing, traffic control, etc., not specifically identified as a pay item shall be included in the unit price bid. No additional payments will be made for such activities.

1.3 ESTIMATED QUANTITIES

- A. All estimated quantities for unit price items, stipulated in the BID FORM, or other Contract Documents, are approximate and are to be used as a basis for comparing the bids submitted for the Project. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. The Contractor agrees to make no claim for damages, anticipated profits or otherwise on account of any difference between the amounts of work actually furnished and the estimated amounts included in the BID FORM. The Contractor will not be paid for any work which exceeds the quantity set forth in the BID FORM without a change order issued before the work is performed unless specifically ordered in writing by the Engineer. The Contractor will provide assistance to the Engineer to check quantities and elevations when so requested.

1.4 MEASUREMENT OF QUANTITIES

- A. Measurement by Weight – Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- B. Measurement by Volume – Measured by cubic dimension using mean length, width and height or thickness. Shall be calculated using in-place volumes.
- C. Measurement by Area – Measured by square dimension using mean length and width or radius.
- D. Linear Measurement – Measured by linear dimension, at the item centerline or mean chord.
- E. Stipulated Sum/Price Measurement – Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.

1.5 PROGRESS PAYMENTS

- A. Progress payments shall be based on the quantity of units installed.
- B. All items of Work not specifically listed in the Bid Schedule shall be considered incidental to the construction, and the cost of all such work and material shall be included in the prices bid for various items listed.
- C. All items listed for measurement and payment shall include all machinery, plant, materials and labor, etc., to successfully and satisfactorily complete Work specified.
- D. Payment – The Contractor will receive payment only for the items listed in the Bid Schedule of his contract, and no separate payments will be made for the work under any section of the Contract Documents except as provided for in the Bid Form. Where measurements are required to be made by the Engineer, for the payment of a pay item, the failure of the Contractor to give the adequate notification or failure of the Contractor to give the engineer assistance for the measurement shall result in the forfeiture of payment for the work or item which was not measured.
- E. Work to be paid for as a “Lump Sum” shall be measured for completion against the “Schedule of Values” provided by the Contractor. The “Schedule of Values” shall be submitted at the Preconstruction conference and shall include quantities and prices of items aggregating the total “Lump Sum” and will subdivide the work into component parts in sufficient detail to serve as the basis for progress payments during construction.

PART 2 PRODUCTS

2.1 STORED MATERIALS

- A. Partial payment shall be made for approved materials stored at the project site, provided invoices for said materials are furnished in accordance with payment request submittal and shop drawings for said materials have been approved.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

- A. Measurements: Measurements for clearing and grubbing shall be based on the actual number of acres cleared and grubbed for installation and construction as shown on the plans.
- B. Payment: Payment for clearing and grubbing shall be a part of the lump sum total. Payment shall include all labor, material and equipment necessary to remove trees, stumps, vegetation, topsoil, etc. as required in the plans and specifications.

3.2 EXCAVATION OF UNSUITABLE MATERIALS AND REPLACEMENT

- A. Measurement: Measurement for excavation of unsuitable materials and replacement with suitable onsite material will be based on the measured cubic yardage of area excavated. Measurement will be made by a representative of the geotechnical testing company.
- B. Payment: Payment will include all labor and equipment to excavate the material, haul to the onsite location directed by the Owner, spread and grass, and replace with suitable material as a part of lump sum total.

3.3 TESTING ALLOWANCE

- A. No separate payment shall be made for testing. The items included in the Bid Form have associated testing included as indicated in the Plans and Specifications.

3.4 ROCK REMOVAL

- A. Measurement or payment will be made for trench rock excavation as provided for in Bid Schedule on the basis of unit price per cubic yard removed.

3.5 SANITARY SEWER CONSTRUCTION

- A. Measurement -
 - 1. Gravity Sewer – Measurement of the sanitary sewer pipe will be on the

basis of the length in feet from center of manhole to center of manhole.

2. Manholes – Manholes shall be measured on the basis of vertical feet installed.
3. Service Laterals – Measured of laterals will be on the basis of each installed.
4. Outside Drop – Measurement of outside drop will be measured on the basis of each outside drop connection.
5. Inside Drop – Measurement of outside drop will be measured on the basis of each outside drop connection.

B. Payment -

1. PVC Gravity Sewer – The City of LaGrange will provide all necessary PVC piping. Contractor to provide labor only to include all work required for excavation, shoring, dewatering, bedding, haunching, backfilling, grassing, capping and all other items necessary to properly install the pipe as a part of the lump sum total.
2. DIP Gravity Sewer – Payment for installing DIP Sanitary Sewer will be a part of the lump sum total and shall include all material and work required for excavation sharing, dewatering, bedding haunching, backfilling, grassing, capping, and all other items necessary to property install the pipe.
3. Manholes – The City of LaGrange will provide the manholes, frames and covers, and steps. Contractor to provide labor only to include the cost of excavating, dewatering, constructing the manholes in accordance with the plans, a backfilling and compacting the material around the manhole as a part of the lump sum total.
4. Laterals – Payment will include furnishing the fittings, pipe, plug and marking stake, backfilling, compaction, and all work and materials necessary to complete laterals.
5. Stone Backfill – No separate payment will be paid for stone backfill. Material and installation shall be considered as part of sewer main.
6. Outside Drop – The unit price shall include all labor, pipe, concrete, excavation, fittings, and all necessary items for a complete installation.
7. Inside Drop – The unit price shall include all labor, pipe, concrete, excavation, fittings, and all necessary items for a complete installation.
8. Metal Detector Tape – No separate payment will be made for tape. Cost of furnishing and placing metal detector tape shall be included in

the lump sum total.

9. Trench Wall Supports – No separate payment will be made for bracing and sheeting.

3.6 EROSION CONTROL AND GRASSING

A. Measurement -

1. Type C Silt Fence – Type C Silt Fence shall be measured on the basis of linear feet installed.
2. Temporary Seeding – Temporary Seeding shall be measured on the basis of per acre actually seeded.
3. Permanent Seeding – Permanent seeding shall be measured on the basis of per acre actually seeded.

B. Payment –

1. Type C Silt Fence – Payment for installing Type C Silt Fence shall be a part of the lump sum total, and shall include all equipment, materials, and labor required to properly install the silt fence.
2. Temporary Seeding – Payment for the temporary seeding of all disturbed areas shall be a part of the lump sum total and shall include all required labor, equipment, and materials to properly seed all disturbed areas.
10. Permanent Seeding – Payment for the permanent seeding of all disturbed areas shall be a part of the lump sum total, and shall include all required labor, equipment, and materials to properly seed all disturbed areas.

3.7 Stream Crossings

- A. Measurement – Measurement for the sanitary sewer stream crossings will be based on the actual number of crossings.
- B. Payment – Payment will include all necessary equipment, labor, and materials necessary to accomplish the stream crossings as a part of the lump sum total

3.8 Jack & Bore Crossings

- A. Payment for jack and bore will be as a part of the lump sum total for the various types and places, as shown on the construction plans, or as directed by the Engineer. Excavation, installation, and all other necessary

appurtenances of the jack and bore shall be considered as subsidiary obligations of the contractor for completion of the jack and bore.

END OF SECTION

SECTION 01330

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Pre-Bid Submittal for Equipment and Materials
- B. Submittal Procedures
- C. Construction Progress Schedules
- D. Product Data
- E. Shop Drawings
- F. Samples
- G. Test Reports
- H. Certificates

1.2 RELATED SECTIONS

- A. Section 01335 – Shop Drawings, Product Data, & Samples

1.3 PRE-BID SUBMITTAL FOR EQUIPMENT AND MATERIALS

- A. Equipment model numbers or catalog numbers are listed in the specifications to identify a standard or quality required in this project. Alternate equipment or materials may be utilized by and furnished by the Contractor when such equipment or material has been approved by the Owner. Pre-bid submittals shall be submitted to the Engineer at least three (3) calendar days prior to the bid opening. A list of submittals for substitute equipment will be issued by addendum. Submittals made less than three (3) calendar days prior to the bid opening will not allow adequate time for evaluation, and will not be listed in the addendum.
- B. Listing above of substitute equipment does not constitute approval.
- C. The pre-bid submittals shall list any and all deviations from items specified, and the advantages to be derived if the deviation is approved. If no deviations are noted, it will be assumed that no such deviations exist, and the final submittals will allow no deviations.

1.4 SUBMITTAL PROCEDURES

- A. Deliver submittals to Engineer in acceptable 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 which 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 certifying that review, approval, verification of 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 three (3) days excluding delivery time to and from the Contractor.
- F. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed work.
- G. Provide space for Contractor and Engineer review stamps.
- H. When revised for resubmission, identify all changes made since previous submission.
- I. Distribute copies of reviewed submittals to concerned. Instruct recipients to promptly report any inability to comply with requirements.

1.5 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial schedule in supplicate within three (3) days after established in Notice to Proceed.
- B. After reviewed by the Engineer, revise and resubmit as required.
- C. Submit revised schedules with each Application for Payment, 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 workday 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.

1.6 PRODUCT DATA

- A. Product Data for Review:
 - 1. Submitted to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
 - 2. After review, provide copies and distribute in accordance with Submittal Procedures article above.
- B. Submit the number of copies which the Contractor requires, plus three copies which will be retained by the 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.

1.7 TEST REPORTS

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

1.8 CERTIFICATES

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

- B. Indicate material or product conform 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.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END SECTION

SECTION 01335

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.1 SCOPE

- A. The work under this Section includes submittal to the Engineer of shop drawings, product data and samples required by the various sections of these Specifications.
- B. Submittal Contents: The submittal contents required are specified in each section.
- C. Definitions: Submittals are categorized as follows:
 - 1. Shop Drawings
 - a. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance surveys, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawings is prepared.
 - b. Provide newly prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints hereof, with name or preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings. Show dimensions and note which are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirement. Do not allow shop-drawing copies without appropriate final "Action" markings by the Engineer to be used in connection with the Work.
 - c. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, specification section, schedule or room numbers shown on the Contract Drawings.
 - d. Minimum assembly drawings sheet size shall be 24 X 36-inches
 - e. Minimum detail sheet size shall be 8-1/2 x 11-inches

- f. Minimum Scale:
 - (1) Assembly Drawings Sheet, Scale: 1-inch = 30 feet
 - (2) Detail Sheet, Scale: 1/4-inch = 1 foot
- 2. Product Data
 - a. Product data includes standard printed information on materials, products and systems, not specially prepared for this Project, other than the designation of selections from among available choices printed therein.
 - b. Collect required data into one submittal for each unit of work or system, and mark each copy to show which choices and options are applicable to the Project. Included manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked and special coordination requirements.
- 3. Samples
 - a. Samples include both fabricated and un-fabricated physical examples of materials, products and units of work, both as complete units and as smaller portions of units of work, either for limited visual inspection or, where indicated, for more detailed testing and analysis.
 - b. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by the Engineer. Engineer will note "test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.
- 4. Miscellaneous submittals related directly to the Work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, statements of applicability, quality testing and certifying reports, copies of industry standards, records drawings, field measurement data, operating and maintenance materials, overrun stock, security/protection/safety keys and similar information, devices

and materials applicable to the Work but not processed as shop drawings, product data or samples.

1.2 SPECIFIC CATEGORY REQUIREMENTS

A. General: Except as otherwise indicated in the individual work sections, comply with general requirements specified herein for each indicated category of submittal.

1. Submittals shall contain:

- a. The date of submittal and the dates of any previous submittals.
- b. The Project title
- c. Numerical submittal numbers, starting with 1.0, 2.0, etc. Revisions to be numbered 1.1, 1.2, etc.
- d. The Names of:
 - (1) Contractor
 - (2) Supplier
 - (3) Manufacturer
- e. Identification of the product, with the Specification section number, permanent equipment tag numbers and applicable Drawing No.
- f. Field dimensions, clearly identified as such
- g. Relation to adjacent or critical features of the Work or materials
- h. Applicable standards, such as ASTM or Federal Specification numbers
- i. Notification to the Engineer in writing, at time of submissions, of any deviations on the submittals from requirements of the Contract Documents.
- j. Identification of revisions on re-submittals
- k. An 8 x 3-inch blank space for Contractor and Engineer stamps
- l. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the Work and of Contract Documents.
- m. Submittal sheets or drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.

1.3 ROUTING OF SUBMITTALS

A. Submittals and routine correspondence shall be routed as follows:

1. Supplier to Contractor (through representative if applicable)

2. Contractor to Engineer
3. Engineer to Contractor
4. Contractor to Supplier

1.4 ADDRESS FOR COMMUNICATIONS

Owner: Stantec Consulting Services Inc.
Mr. Willard Neal
2310 Park Lake Drive
Suite 400
Atlanta, Georgia 30345
Ph: 770-492-2666
Email: Willard.neal@stantec.com

PART 2 PRODUCTS

2.1 SHOP DRAWINGS

- A. Unless otherwise specifically directed by the Engineer, make all shop drawings accurately to a scale sufficiently large to show all pertinent features of the item and its method of connection to the Work.

2.2 MANUFACTURER'S LITERATURE

- A. Where content of submitted literature from manufacturers includes data not pertinent to this submittal, clearly indicate which portion of the contents is being submitted for the Engineer's review.
- B. Submit the number of copies which are required to be returned (not to exceed three) plus three copies which will be retained by the Engineer.

PART 3 EXECUTION

3.1 CONTRACTOR'S COORDINATION OF SUBMITTALS

- A. Prior to submittal for the Engineer's review, the Contractor shall use all means necessary to fully coordinate all material, including the following procedures:
 1. Determine and verify all field dimensions and conditions, catalog numbers and similar data.
 2. Coordinate as required with all trades and all public agencies involved.
 3. Submit a written statement of review and compliance with the

requirements of all applicable technical Specifications as well as the requirements of this Section.

4. Clearly indicate in a letter or memorandum on the manufacturer or fabricator's letterhead, all deviations from the Contract Documents.
- B. Each and every copy of the shop drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the contractor for conformance with this requirement.
- C. The Owner may back charge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No Exceptions Taken" mark.
- D. Grouping of Submittals
 1. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items.
 2. 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 the shop drawings for all such interconnecting and/or interdependent items, check them and then make one submittal to the Engineer along with Contractor's comments as to compliance, non-compliance or features requiring special attention.
- E. Schedule of Submittals: Within five (5) days of Contract award and prior to any shop drawing submittal, the Contractor shall submit a schedule showing the estimated date of submittal and the desired approval date for each shop drawing anticipated. A reasonable period shall be scheduled for review and comments. Time lost due to unacceptable submittals shall be the Contractor's responsibility and some time allowance for resubmittal shall be provided. The schedule shall provide for submittal of items which relate to one another to be submitted concurrently.

3.2 TIMING OF SUBMITTALS

- A. Make all submittals far enough in advance of scheduled dates for installation to provide all required time for review, for securing necessary approvals, for possible revision and resubmittal, and for placing orders and securing delivery.
- B. In scheduling, allow sufficient time for the Engineer's review following the receipt of the submittal

3.3 REVIEWED SHOP DRAWINGS

A. Engineer Review

1. Allow a minimum of five (5) days for the Engineer's initial processing of each submittal requiring review and response, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination. Allow a minimum of two weeks for reprocessing each submittal. Advise the Engineer on each submittal as to whether processing time is critical to progress of the Work, and therefore the Work would be expedited if processing time could be foreshortened.
2. Acceptable submittals will be marked "No Exceptions Taken". A minimum of three copies will be retained by the Engineer for Engineer's and the Owner's use and the remaining copies will be returned to the Contractor.
3. Submittals requiring minor corrections before the product is acceptable will be marked "Make Corrections Noted". The Contractor may order, fabricate and ship the items included in the submittals provided the indicated corrections are made. Drawings must be resubmitted for review and marked "No Exceptions Taken" prior to installation or use of products.
4. Submittals marked "Amend and Resubmit" must be revised to reflect required changes and the initial review procedure repeated.
5. The "Rejected - See Remarks" notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.
6. Only two copies of items marked "Amend and Resubmit" and "Rejected - See Remarks" will be reviewed and marked. One copy will be retained by the Engineer and the other copy with all remaining unmarked copies will be returned to the Contractor for resubmittal.

B. No work or products shall be installed without a drawing or submittal bearing the "No Exceptions Taken" notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.

C. Substitutions: In the event the Contractor obtains the Engineer's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using

methods approved by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.

- D. Use of the "No exceptions Taken" notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for error of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is

responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.

3.4 RESUBMISSION REQUIREMENTS

- A. Shop Drawings
1. Revise initial drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.
 2. Indicate on drawings all changes which have been made other than those requested by the Engineer.
- B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

END SECTION

SECTION 01420

CODES AND STANDARDS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Whenever reference is made to conforming to the standards of any technical society, organization, body, code or standard, it shall be construed to mean the latest standard code, specification or tentative specification adopted and published at the time of advertisement for Bids. This shall include the furnishing of materials, testing of materials, fabrication and installation practices. In those cases where the Contractor's quality standards establish more stringent quality requirements, the more stringent requirement shall prevail. Such standards are made a part hereof to the extent which is indicated or intended.
- B. The inclusion of an organization under one category does not preclude those organizations' standards from applying to another category.
- C. In addition, all work shall comply with the applicable requirements of local codes, utilities and other authorities having jurisdiction.
- D. All material and equipment, for which a UL Standard, an AGA or NSF approval or an ASME requirement is established, shall be so approved and labeled or stamped. The label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.
- E. The standards which apply to this Project are not necessarily restricted to those organizations which are listed in Article 1.02.

1.2 STANDARD ORGANIZATIONS

- A. Piping and Valves
 - ACPA American Concrete Pipe Association
 - ANSI American National Standards Institute
 - API American Petroleum Institute
 - ASME American Society of Mechanical Engineers
 - AWWA American Water Works Association
 - CISPI Cast Iron Soil Pipe Institute
 - DIPRA Ductile Iron Pipe Research Association
 - FCI Fluid Controls Institute
 - MSS Manufacturers Standardization Society
 - NCPI National Clay Pipe Institute
 - NSF National Sanitation Foundation
 - PPI Uni-Bell PVC Pipe Association

B. Materials

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials

C. Painting and Surface Preparation

NACE	National Association of Corrosion Engineers
SSPC	Steel Structures Painting Council

D. Electrical and Instrumentation

AEIC	Association of Edison Illuminating Companies
AIEE	American Institute of Electrical Engineers
EIA	Electronic Industries Association
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
TIA	Telecommunications Industries Association
UL	Underwriter's Laboratories
VRCI	Variable Resistive Components Institute

E. Aluminum

AA	Aluminum Association
AAMA	American Architectural Manufacturers Association

F. Steel and Concrete

ACI	American Concrete Institute
AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
CRSI	Concrete Reinforcing Steel Institute
NRMA	National Ready-Mix Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute

G. Welding

ASME	American Society of Mechanical Engineers
AWS	American Welding Society

H. Government and Technical Organizations

AIA	American Institute of Architects
APHA	American Public Health Association
APWA	American Public Works Association
ASA	American Standards Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
CFR	Code of Federal Regulations
CSI	Construction Specifications Institute
EDA	Economic Development Administration
EPA	Environmental Protection Agency
FCC	Federal Communications Commission
FmHA	Farmers Home Administration
FS	Federal Specifications
IAI	International Association of Identification
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
NBFU	National Board of Fire Underwriters
(NFPA)	National Fluid Power Association
NBS	National Bureau of Standards
NISO	National Information Standards Organization
OSHA	Occupational Safety and Health Administration
SI	Salt Institute
SPI	The Society of the Plastics Industry, Inc.
USDC	United States Department of Commerce
WEF	Water Environment Federation

I. General Building Construction

AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AITC	American Institute of Timber Construction
APA	American Plywood Association
BHMA	Builders Hardware Manufacturers Association
BIFMA	Builders and Institutional Furniture Manufacturers Association
DHI	Door and Hardware Institute
FM	Factory Mutual Fire Insurance Company
HPMA	Hardwood Plywood Manufacturers Association
HTI	Hand Tools Institute
IME	Institute of Makers of Explosives
ISANTA	International Staple, Nail and Tool Association
ISDSI	Insulated Steel Door Systems Institute
IWS	Insect Screening Weavers Association
MBMA	Metal Building Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers

NAGDM	National Association of Garage Door Manufacturers
NCCLS	National Committee for Clinical Laboratory Standards
NFPA	National Fire Protection Association
NFSA	National Fertilizer Solutions Association
NKCA	National Kitchen Cabinet Association
NWMA	National Woodwork Manufacturers Association
NWWDA	National Wood Window and Door Association
RMA	Rubber Manufacturers Association
SBC	SBCC Standard Building Code
SDI	Steel Door Institute
SIA	Scaffold Industry Association
SMA	Screen Manufacturers Association
SPRI	Single-Ply Roofing Institute
TCA	Tile Council of America
UBC	Uniform Building Code

J. Roadways

AREA	American Railway Engineering Association
DOT	Department of Transportation
MUTCD	Manual for Uniform Traffic Control Devices
SSRBC	Standard Specifications for Road and Bridge Construction, Georgia Department of Transportation

K. Plumbing

AGA	American Gas Association
NSF	National Sanitation Foundation
PDI	Plumbing Drainage Institute
SPC	SBCC Standard Plumbing Code

L. Refrigeration, Heating, and Air Conditioning

AMCA	Air Movement and Control Association
ARI	American Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
CGA	Compressed Gas Association
CTI	Cooling Tower Institute
HEI	Heat Exchange Institute
IIAR	International Institute of Ammonia Refrigeration
NB	National Board of Boilers and Pressure Vessel Inspectors
PFMA	Power Fan Manufacturers Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SMC	SBCC Standard Mechanical Code
TEMA	Tubular Exchangers Manufacturers Association

M. Equipment

AFBMA	Anti-Friction Bearing Manufacturers Association, Inc.
AGMA	American Gear Manufacturers Association
ALI	Automotive Lift Institute
CEMA	Conveyor Equipment Manufacturers Association
CMAA	Crane Manufacturers Association of America
DEMA	Diesel Engine Manufacturers Association
MMA	Monorail Manufacturers Association
OPEI	Outdoor Power Equipment Institute, Inc.
PTI	Power Tool Institute, Inc.
RIA	Robotic Industries Association
SAMA	Scientific Apparatus Makers Association

1.3 SYMBOLS

Symbols and material legends shall be as scheduled on the Drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END SECTION

SECTION 01440
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 01330 – Submittals: Submission of manufacturers' instructions and certificates.
- B. Section 01450 – Testing Laboratory 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 manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instruction 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 that 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 manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.5 REFERENCES AND STANDARDS

- A. For products or workmanship specified by association, trade, or other consensus standards, comply 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 on date of Owner-Contractor Agreement 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, or responsibilities of the parties in Contract nor those of the 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 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, as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Engineer five (5) days in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' 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 that existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Verify that 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 that 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 SECTION

SECTION 01450

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.1 SCOPE

- A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.
- B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications, i.e., concrete strength and slump testing, soil compaction, etc.
- C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer, e.g., testing of pipe.
- D. Testing shall be the responsibility of the Contractor and shall be performed at the Contractor's expense by a commercial testing laboratory the operates in accordance with subparagraph C above.
- E. Testing laboratory shall operate in accordance to ASTM D 3740 and E 329 and shall be accepted by the Engineer.
- F. The testing laboratory and Project Engineer/Project Representative shall be given a minimum of 48 hours notice prior to taking any of the tests.

1.2 LABORATORY DUTIES

- A. Cooperate with the Owner, Engineer and Contractor
- B. Provide qualified personnel promptly on notice
- C. Perform specified inspections, sampling and testing of materials.
 - 1. Comply with specified standards, ASTM, other recognized authorities, and as specified.
 - 2. Ascertain compliance with requirements of the Contract Documents
- D. Promptly notify the Engineer and Contractor of irregularity or deficiency of work which are observed during performance of service.
- E. Promptly submit three copies (two copies to the Engineer and one copy to the Contractor of report of inspections and tests in addition to those additional copies required by the contractor with the following information included:

1. Date issued
 2. Project title and number
 3. Testing laboratory name and address
 4. Name and signature of inspector
 5. Date of inspection or sampling
 6. Record of temperature and weather
 7. Date of test
 8. Identification of product and Specification section
 9. Location of Project
 10. Type of inspection or test
 11. Results of test
 12. Observations regarding compliance with the Contract Documents
- F. Perform additional services as required.
- G. The laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, or approve or accept any portion of the Work.

1.3 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with laboratory personnel, provide access to Work and/or manufacturer's requirements.
- B. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.
- C. Furnish copies of mill test reports.
- D. Furnish required labor and facilities to:
 1. Provide access to Work to be tested;
 2. Obtain and handle samples at the site;
 3. Facilitate inspections and tests;

- 4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.
- E. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.
- F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at Contractor's expense.
- G. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Engineer.

1.4 QUALITY ASSURANCE

- A. Testing shall be in accordance with all pertinent codes and regulations and with procedures and requirements of the American Society for Testing and Materials (ASTM).

1.5 PRODUCT HANDLING

- A. Promptly process and distribute all required copies of test reports and related instructions to insure all necessary retesting or replacement of materials with the least possible delay in the progress of the Work.

1.6 FURNISHING MATERIALS

- A. The Contractor shall be responsible for furnishing all materials necessary for testing.

1.7 SCHEDULES FOR TESTING

- A. Establishing Schedule
 - 1. The Contractor shall, by advance discussion with the testing laboratory, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.
 - 2. Provide all required time within the construction schedule.
- B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.

- C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the Owner.

1.8 TAKING SPECIMENS

- A. Unless otherwise provided in the Contract Documents, all specimens and samples for tests will be taken by the testing laboratory.

1.9 TRANSPORTING SAMPLES

- A. The Contractor shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END SECTION

SECTION 01510

TEMPORARY FACILITIES

PART 1 GENERAL

1.1 SCOPE

- A. Temporary facilities required for this work include, but are not necessarily limited to:
 - 1. Temporary utilities such as electricity
 - 2. First aid facilities
 - 3. Sanitary facilities
 - 4. Potable water

1.2 GENERAL

- A. First aid facilities, sanitary facilities and potable water shall be available on the Project site on the first day that any activities are conducted on site. The other facilities shall be provided as the schedule of the Project warrants.
- B. Maintenance: Use all means necessary to maintain temporary facilities in proper and safe condition throughout progress of the Work. In the event of loss or damage, immediately make all repairs and replacements necessary, at no additional cost to the Owner.
- C. Removal: Remove all such temporary facilities and controls as rapidly as progress of the Work will permit.

1.3 TEMPORARY UTILITIES

- A. General
 - 1. Provide and pay all costs for all water, electricity and other utilities required for the performance of the Work.
 - 2. Pay all costs for temporary utilities until Project completion.
 - 3. Costs for temporary utilities shall include all power, water and the like necessary for testing equipment as required by the Contract Documents.
- B. Temporary Water: Provide all necessary temporary piping, and upon completion of the Work, remove all such temporary piping. Provide and remove water meters.

C. Temporary Electricity

1. Provide all necessary wiring for the Contractor's use.
2. Furnish, locate and install area distribution boxes such that the individual trades may use, their own construction type extension cords to obtain adequate power, and artificial lighting at all points where required by inspectors and for safety.

1.4 FIRST AID FACILITIES

The Contractor shall provide a suitable first aid station, equipped with all facilities and medical supplies necessary to administer emergency first aid treatment. The Contractor shall have standing arrangements for the removal and hospital treatment of any injured person. All first aid facilities and emergency ambulance service shall be made available by the Contractor to the Owner and the Engineer's personnel.

1.5 SANITARY FACILITIES

Prior to starting the Work, the Contractor shall furnish, for use of Contractor's personnel on the job, all necessary toilet facilities which shall be secluded from public observation. These facilities shall be either chemical toilets or shall be connected to the Owner's sanitary sewer system. All facilities, regardless of type, shall be kept in a clean and sanitary condition and shall comply with the requirements and regulations of the area in which the Work is performed. Adequacy of these facilities will be subject to the Engineer's review and maintenance of same must be satisfactory to the Engineer at all time.

1.6 POTABLE WATER

The Contractor shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, engineers and the Owner who are associated with the Work.

END SECTION

SECTION 01560

DUST CONTROL

PART 1 GENERAL

1.1 SCOPE

- A. Limit blowing dust caused by construction operations by applying water or employing other appropriate means or methods to maintain dust control, subject to the approval of the Owner. As a minimum, this may require the use of a water wagon twice a day to suppress dusty conditions.

1.2 PROTECTION OF ADJACENT PROPERTY

- A. The Bidders shall visit the site and note the buildings, landscaping, roads, parking areas and other facilities near the Work site that may be damaged by their operations. The Contractor shall make adequate provision to fully protect the surrounding area and will be held fully responsible for all damages resulting from Contractor's operations.
- B. Protect all existing facilities (indoors or out) from damage by dust, fumes, spray or spills (indoors or out). Protect motors, bearings, electrical gear, instrumentation and building or other surfaces from dirt, dust, welding fumes, paint spray, spills or droppings causing wear, corrosion, malfunction, failure or defacement by enclosure, sprinkling or other dust palliatives, masking and covering, exhausting or containment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END SECTION

SECTION 01565

JOB SITE SECURITY

PART 1 GENERAL

1.1 BARRICADES, LIGHTS AND SIGNALS

- A. The Contractor shall furnish and erect such barricades, fences, lights and danger signals and shall provide such other precautionary measures for the protection of persons or property and of the Work as necessary. Barricades shall be painted in a color that will be visible at night. From sunset to sunrise, the Contractor shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any work under construction.
- B. The Contractor will be held responsible for all damage to the work due to failure of barricades, signs and lights and whenever evidence is found of such damage, the Contractor shall immediately remove the damaged portion and replace it at Contractor's cost and expense. The Contractor's responsibility for the maintenance of barricades, signs and lights shall not cease until the Project has been accepted by the Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END SECTION

SECTION 01650

TRANSPORTATION AND HANDLING

PART 1 GENERAL

1.1 SCOPE

- A. The Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the Work site. In addition, the Contractor shall provide preparation for shipment, loading, unloading, handling and preparation for installation and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the Work.
- B. All equipment, materials and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the Work.

PART 2 PRODUCTS

2.1 PIPE

- A. Pipe and appurtenances shall be handled, stored, and installed as recommended by the manufacturer. Pipes with paint, tape coatings, linings or the like shall be stored to protect the coating or lining from physical damage or other deterioration. Pipes shipped with interior bracing shall have the bracing removed only when recommended by the pipe manufacturer.

PART 3 EXECUTION

3.1 TRANSPORTATION

- A. All equipment shall be suitably boxed, crated or otherwise protected during transportation.
- B. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.
- C. Small items and appurtenances such as gauges, valves, switches, instruments and probes which could be damaged during shipment shall be removed from the equipment prior to shipment, packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

- D. Identification: Each item of equipment and valve shall have permanently affixed to it a label or tag with its equipment or valve number designated in this contract. Marker shall be of stainless steel. Location of label will be easily visible.

3.2 HANDLING

- A. All equipment, material and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.
- B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Shafts and operating mechanisms shall not be used as lifting points. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.
- C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.
- D. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

END SECTION

SECTION 01660

STORAGE AND PROTECTION

PART 1 GENERAL

1.1 SCOPE

- A. The work under this Section includes, but is not necessarily limited to, the furnishing of all labor, tools and materials necessary to properly store and protect all materials, equipment, products and the like, as necessary for the proper and complete performance of the Work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 STORAGE AND PROTECTION

- A. Storage
 - 1. Maintain ample way for foot traffic at all times, except as otherwise approved by the Engineer.
 - 2. All property damaged by reason of storing of material shall be properly replaced at no additional cost to the Owner.
 - 3. Packaged materials shall be delivered in original unopened containers and so stored until ready for use.
 - 4. All materials shall meet the requirements of these Specifications at the time that they are used in the Work.
 - 5. Store products in accordance with manufacturer's instructions.
- B. Protection
 - 1. Use all means necessary to protect the materials, equipment and products of every section before, during and after installation and to protect the installed work and materials of all other trades.
 - 2. All materials shall be delivered, stored and handled to prevent the inclusion of foreign materials and damage by water, breakage, vandalism or other causes.

3. Substantially constructed weather tight storage sheds, with raised floors, shall be provided and maintained as may be required to adequately protect those materials and products stored on the site which may require protection from damage by the elements.
- C. Replacement: In the event of damage, immediately make all repairs and replacements necessary for the approval of the Engineer and at no additional cost to the Owner.
- D. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel and sheet construction products shall be stored with one end elevated to facilitate drainage.
- E. Unless otherwise permitted in writing by the Engineer, building products and materials such as cement, grout, plaster, gypsum board, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block and structural tile may be stored outdoors under a properly secured waterproof covering.
- F. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

3.2 EXTENDED STORAGE

- A. In the event that certain items of major equipment such as air compressors, pumps, and mechanical aerators have to be stored for an extended period of time, the Contractor shall provide satisfactory long-term storage facilities which are acceptable to the Engineer. The Contractor shall provide all special packaging, protective coverings, protective coatings, power, nitrogen purge, desiccants, lubricants and exercising necessary or recommended by the manufacturer to properly maintain and protect the equipment during the period of extended storage.

END SECTION

SECTION 02230

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SCOPE

- A. This section specifies clearing and grubbing which includes, but is not limited to, removing from the Project site the following: trees, stumps, roots, brush, and other plant life; structures; abandoned utilities; trash; debris; removal of paving, curbs and sidewalks; and all other materials found on or near the surface of the ground in the construction area and understood by generally accepted engineering practice not to be suitable for construction of the type contemplated. Precautionary measures that prevent damage to existing features to remain is part of the Work.
- B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion and sedimentation control procedures.
- C. This section also includes stripping and stockpiling of topsoil as needed.

1.2 QUALITY ASSURANCE

- A. The Contractor shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.
- B. Open burning, if allowed, shall first be permitted by the local authority having jurisdiction. The Contractor shall notify the local fire department and abide by fire department restrictions.
- C. The Contractor shall coordinate all clearing operations with the appropriate utility company(s).
- D. Reference Points: The Contractor will protect and maintain all bench marks, monuments and reference points. Replace if disturbed or destroyed. If found at variance with the drawings, notify the Owner's Representative before proceeding with layout work.

1.3 JOB CONDITIONS

- A. The Contractor shall determine the actual condition of the site as it affects his portion of the work.
- B. The Engineer may limit the clearing and grubbing of the site by showing limits on the drawings and/or on the job site.

1.4 RELATED SECTIONS

- A. Section 02240 - Dewatering
- B. Section 02300 – Earthwork
- C. Section 02370 – Erosion, Sedimentation & Pollution Control

1.5 SEQUENCE OF WORK

- A. Prior to commencing clearing and grubbing operations, the Contractor shall stake out all proposed work. Layout work shall be done under supervision of a Civil Engineer or Registered Land Surveyor, registered in Georgia.
- B. The Contractor shall then mark the clearing perimeter. The Contractor shall notify the Owner's Representative in writing when these limits have been marked. Clearing shall not commence until the Owner's Representative has approved these limits.
- C. All clearing shall be completed before topsoil stripping operation begins. Loose sticks, roots, branches and debris shall not be left on the site.

PART 2 PRODUCTS

2.1 EQUIPMENT

- A. The Contractor shall furnish equipment of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks and loaders.

2.2 MATERIALS

- A. Materials used for protection of trees and vegetation not to be removed during clearing operations shall be at Contractor's option. Materials chosen shall be approved by the Engineer prior to installation and upon installation shall be approved by the Engineer to ensure maximum protection to vegetation.
- B. Materials used for the repair of trees and vegetation damaged outside clearing limits shown on Drawings shall be at Contractor's opinion but must be approved by the Engineer prior to use.
- C. Wound paint shall be a standard bituminous product.
- D. Herbicides shall not be used unless written approval is given by Owner.
- E. Explosives shall not be used unless written approval is given by Owner.

- F. Materials used for the replacement or relocation of existing fences shall be of equal or superior quality to those fence materials existing prior to construction unless specified otherwise on the plans.

2.3 ENGINEERING AND LAYOUT EQUIPMENT

- A. Engineering Equipment: Transit and measuring devices shall be calibrated to layout site and building work.
- B. Other Layout Equipment: Provide stakes and batter boards to execute the work. Use wire to establish reference lines for site, paving and building work.
- C. Furnish equipment of the type normally used in clearing and grubbing operations including but not limited to tractors, trucks, loaders, root rakes and burning equipment.

PART 3 EXECUTION

3.1 PREPARATION

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

3.2 LAYOUT

- A. Protect and maintain bench marks and property corners throughout execution of this work.
- B. Stake building and site improvements relative to reference lines, property lines, easements, and rights-of-way.
- C. Install erosion and sedimentation control structures as shown on the Drawings and any other unmarked places which will allow the Contractor to stay within the guidelines of the Georgia Manual for Sedimentation and Erosion Control (latest edition). In any areas where a variance occurs between the drawings and the Erosion Control Manual, the manual will take precedence.
- D. Protect all utilities and building during all phases of the construction process.

3.3 PROTECTION

- A. Streets, roads, adjacent property, and other works to remain shall be protected throughout the work in accordance with local laws and ordinances.
- B. Contractor shall make every effort to protect existing benchmarks, R/W markers, monuments, iron pins, property corner markers, etc. If any are disturbed or destroyed, Contractor shall provide services of a registered land surveyor to replace the markers, as directed by Owner, at no expense to Owner.

- C. No trees shall be cut outside of areas designated without specific approval of Engineer, and any trees designated shall be protected from damage by Contractor's construction operations. The 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 that the Contractor shall exercise all reasonable precautions to preserve even these trees. The Contractor agrees to pay penalties as established below in the event that he or any of his subcontractors causes the loss or removal of grass designated to be saved under the provisions of the Agreement.

<u>Tree Diameter at a Point 4 Feet Above Existing Grade</u>	<u>Penalty</u>
6" – 7"	\$ 500.00
7" – 8"	\$ 600.00
8" – 11"	\$ 800.00
12" – 20"	\$ 1,000.00
21" and Larger	\$ 2,000.00

- D. Existing trees and other vegetation to remain shall be protected as directed by Owner.
1. Trees shall be protected by fencing, barricades, or wrapping.
 2. Shrubs and bushes shall be protected by fencing, barricades, or wrapping. Wrapping of bushes and shrubs with plastic film will not be permitted.
 3. Shallow-rooted plants shall be protected at ground surface under and in some cases outside the spread of branches by fencing, barricades, or ground cover protection.
- E. In the event that archaeological resources are uncovered, Contractor shall notify Owner prior to proceeding with work.
- F. It shall be the responsibility of the Contractor to inspect the site, determine the amount of work required, and include this work in his proposal.
- G. Contractor is to erect temporary fences as necessary to preserve the privacy of all affected property owners whose existing fences are being removed or relocated. Temporary fences shall be of sufficient strength and quality to prevent escape of animals and livestock and to prevent the intrusion of animals and people.
- H. It is Contractor's responsibility to coordinate the removal and erection of fences with each affected property owner and to maintain any temporary and relocated fences throughout the contract period.

- I. The Contractor shall protect all utilities and buildings that remain.
- J. Clearing operations shall be conducted so as to prevent damage by falling trees to trees left standing, to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others.

3.4 CLEARING

- A. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.
- B. Limits of clearing shall be contained within the limits shown on the construction drawings.
- C. Existing fences that at the direction of Owner can be reused shall be carefully removed and stored at such a distance they shall not be damaged by construction activity.
- D. Fences that cannot be reused shall be removed to such a distance to allow construction activity and shall be replaced with new materials similar to existing fences upon completion of construction.

3.5 GRUBBING

- A. Materials to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and not less than 2 feet in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with crushed rock or other suitable materials and compacted to make the surface conform to the original adjacent surface of the ground.
- B. Surface rocks and boulders shall be grubbed from the soil and removed from the site if not suitable as rip rap.

- C. Grub construction areas with heavy tractors with root rakes. Raking shall proceed along the contours of the site rather than up and slopes to inhibit soil erosion.
- D. Any work pertaining to utility poles shall comply with the requirements of the appropriate utility.
- E. In building and future paving areas remove trees, and shrubs, including their entire root system which occur within building and future paving areas and withing an area 5'-0" adjacent to building.
- F. In unwooded areas, Contractor to separate vegetation and organic matter from the topsoil.
- G. In site cut and fill areas, remove shrubs and shrub root systems and trees, including tree root system entirely.
- H. The Contractor shall be responsible for all damages to existing improvements resulting from the Contractor's operation.

3.6 REMOVAL AND DISPOSAL

- A. The debris resulting from the clearing and grubbing operation shall be hauled to a landfill permitted by the Georgia Environmental Protection Division and secured by the Contractor and shall be disposed of in accordance with the requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or in any street or alley. Do not pile materials in stream channels or along banks subject to flooding. No debris shall be deposited upon any private property except with written consent of the property owner. In no case shall any material or debris be left on the Project, shoved onto abutting private properties or buried on the Project.
- B. Contractor may, at no cost, retain any materials of value from clearing operations for his own use or disposal by sale unless otherwise stated in these Specifications. Such material shall be removed from construction area before date of completion of work under these Specifications. Owner assumes no responsibility for protection or safekeeping of any materials so retained by Contractor.
- C. Timber within the areas cleared shall become the property of the Contractor. The contractor may cut, trim, hew, saw or otherwise dress felled timber within the limits of the Work area, provided all timber and all waste materials are disposed of as specified.
- D. Materials will not be disposed of by burying unless approved by Owner. Buried materials will be covered with not less than 2 feet of earth material.

- E. Burning will be permitted if the required permits have been acquired from the local Fire Department. Burning will be permitted only at times when conditions are considered favorable for burning and at locations approved by proper State or local authorities. Materials to be burned shall be piled neatly and, when in a suitable condition, shall be burned completely. Piling for burning shall be done in such a manner and in such locations as to cause the least fire risk. All burning shall be so thorough that the materials are reduced to ashes. No logs, branches, or charred pieces shall be permitted to remain. Contractor shall at all times take special precautions to prevent fire from spreading to areas beyond the limits of cleared areas and shall have available at all times, suitable equipment and supplies for use in preventing and suppressing fires. Unguarded fires will not be permitted.
- F. Material to be removed from site shall be removed as it accumulates to prevent any unsightly spoil areas.
- G. Material placed in the waste disposal areas shall be placed in lifts. Compaction shall be obtained by routing the haul equipment and spreading equipment over the fill in a uniform manner to obtain uniform compaction effort. Leave waste disposal areas in a neat and slightly condition and slope to provide positive drainage away from all structures except draining channels Place only those materials which are in excess and not suitable for other use in the waste disposal area.

3.6 STRIPPING AND STOCKPILING OF TOPSOIL

- A. Remove topsoil to its entire depth from within graded areas. Minimum depth shall be 6 inches.
- B. Stockpile topsoil in onsite locations where it will not interfere with building or paving construction, site or utility operations or adjacent facilities and functions. Materials stockpiled shall be placed in a manner to afford drainage. Protect against erosion using bales of hay placed continuously around perimeter.
- C. Areas to be stripped shall first be scraped clean of all brush, weeds, grass, roots, wood, glass, rocks, broken concrete, brick and concrete block. Topsoil shall be free from subsoil, debris, and stones larger than 2 inches in diameter.
- D. Topsoil shall be re-spread outward from the buildings at the close of the job. Scope is limited to the supply of material on the site. No topsoil shall be removed from the premises.

END OF SECTION

SECTION 02240

DEWATERING

PART 1 GENERAL

1.1 SCOPE

- A. This Section shall apply to all site excavation.
- B. Construct all permanent work in areas free from water. Design, construct and maintain all dikes, levees, cofferdams and diversion and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose.
- C. The Contractor shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and subsurface, to the lines, grades and conditions existing prior to the damage, at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 PRODUCTS SUPPLIED BY CONTRACTOR

- A. Furnish well points, pumps, tile drains or other approved methods of the type normally used in dewatering operations.

PART 3 EXECUTION

3.1 CARE OF WATER

- A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams and other temporary backfill provided the material meets suitability requirements for these structures.
- B. Furnish, install, maintain and operate necessary pumping and other equipment for dewatering the various parts of the work and for maintaining the foundation and other parts free from water as required for constructing each part of the work.
- C. Install all drainage ditches, sumps and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables and to drain impervious surfaces at final excavation elevation.

- D. Dewater by means which will insure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.
- E. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public or owners of private property.
- F. Do not overload or obstruct existing drainage facilities.
- G. After they have served their purpose, remove all temporary protective work. All diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled and processed under the same Specifications as those governing the compacted fill.
- H. When temporary works will not adversely affect any item of permanent work or the planned usage of the Project, the Contractor may leave such temporary works in place, if approved by Owner's Representative. In such instances, breaching of dikes, levees and cofferdams may be required.

3.2 DEWATERING

- A. By the use of well points, pumps, tile drains or other approved methods, the Contractor shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed.
- B. Excavations shall be continuously dewatered to maintain a ground water level no higher than three to four feet below the lowest point in the excavation. Dewatering shall be accomplished in advance of excavation to ensure that groundwater is already lowered prior to completing the final excavation to finish subgrade.
- C. All destabilized subgrade conditions caused by inadequate or untimely dewatering operations shall be undercut and backfilled with specified backfill material at no additional cost to the Owner.
- D. Where the presence of fine grained subsurface materials and a high groundwater table may cause the upward flow of water into the excavation with a resulting quick or unstable condition, the Contractor shall install and operate a well point system to prevent the upward flow of water during construction. Water pumped or drained from excavations, or any sewers, drains or water courses encountered in the work, shall be disposed of without injury to adjacent property, the work under construction, or to pavements, roads, drives, and water courses. No water shall be discharged to sanitary sewers. Sanitary sewage shall be pumped to sanitary sewers or shall be disposed of by a method approved by the Owner's Representative.

END SECTION

SECTION 02250

SHEETING, SHORING, & BRACING

PART 1 GENERAL

1.1 SCOPE

- A. This section specifies requirements for sheeting, shoring, and bracing of trenches and excavations greater than five (5) feet in depth. Where sheet piling, shoring, sheeting, bracing or other supports are necessary, they shall be furnished, placed, maintained, and except as shown or specified otherwise, removed by the Contractor.

1.2 DESIGN REQUIREMENTS

- A. The design, planning, installation and removal, if required, of all sheeting, shoring, sheet piling, lagging, and bracing shall be accomplished in such a manner as to maintain the required excavation or trench section and to maintain the undisturbed state of the soils below and adjacent to the excavation.
- B. The Contractor shall design sheeting, shoring, and bracing in accordance with the OSHA Safety and Health Standards as well as state and local requirements.
- C. Horizontal strutting below the barrel of a pipe and the use of pipe as support are not acceptable.
- D. When the construction sequence of structures requires the transfer of bracing to the completed portions of any new structure or to any existing structure, the Contractor shall provide the Engineer with a complete design analysis of the expected impact of that bracing on the structure. This action shall in no way absolve the Contractor of responsibility of damage resulting from said bracing.

1.3 REFERENCES

- A. OSHA 2207 Latest Edition – OSHA Safety and Health Standards

1.4 SUBMITTALS

- A. Prior to starting any excavation work requiring sheeting, shoring, and bracing, the Contractor shall submit his plans for trench and excavation support systems to the Engineer for review and comment. No excavations shall be started until the Contractor has obtained written acceptance of the trench support system. Said acceptance will be to assure the Owner of the Contractor's general compliance with the required codes and shall not be construed as a detailed analysis for adequacy of the support system, nor

shall any provisions of the above requirements be construed as relieving the Contractor of his overall responsibility and liability for the work. Submittals shall include the following:

1. Design calculations and method of installation and removal of all sheeting, sheet piling, shoring and bracing. Calculations shall be made by a professional structural or civil engineer in the state of the project.
2. Detailed excavation support drawings.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 GENERAL

- A. Contractor shall be responsible for supporting and maintaining all excavations required even to the extent of sheeting and shoring the sides and ends of excavations with timber or other supports. If the sheeting, braces, shores, and stringers or walling timbers or other supports are not properly placed or are insufficient, the Contractor shall provide additional or stronger supports. The requirement of sheeting or shoring or the addition of supports shall not relieve the Contractor of his responsibility for their sufficiency. All sheeting, shoring and bracing shall have sufficient strength and rigidity to withstand the pressure exerted and to conform to OSHA Safety & Health Standard (29 CFR 1926/1910) OSHA 2207, latest edition.
- B. Excavations adjacent to existing or proposed buildings and structures or in paved streets or alleys shall be sheeted, shored and braced adequately to prevent undermining beneath or subsequent settlement of such structures or pavements. Underpinning of adjacent structures shall be done when necessary to maintain structures in safe condition. The Contractor shall be held liable for any damage resulting to such structures or pavements as a result of his operations.
- C. Trench sheeting shall be left in place until the backfilling has been completed to elevation not less than twelve (12) inches above the top of the pipe. Unless otherwise ordered in writing, sheeting shall then be cut off at the top of the lowest set of bracing and the upper section shall be removed. All voids left by sheeting along trenches shall be carefully refilled and rammed with suitable tools.
- D. In unstable ground, sheeting shall be driven to such depth below bottom of the trench or side of the excavation as required to ensure stability.

- E. The need and adequacy of sheeting, shoring, bracing, or other provisions to protect men and equipment in a trench or other excavation shall be the sole and exclusive responsibility of Contractor.
- F. Underpin adjacent structures, which may be damaged by excavation work, including service utilities and pipe chases.
- G. Notify Engineer of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.
- H. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- I. Grade top perimeter of excavation to prevent surface water run-off into excavation.

END SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 GENERAL

- A. Work under this section shall include all excavation, handling, re-handling, backfilling, compaction of earth material and disposal of any and all deleterious materials encountered during excavation. Other work under this section shall include all dewatering of excavated areas or trenches, backfilling around structures, preparation of subgrades, surfacing and grading and other incidental or appurtenant earthwork operations necessary to complete work in a satisfactory manner. Moreover, the Contractor must assume all responsibility for any added obstacles or conditions, foreseen or unforeseen, and encountered or manifest during the execution of the work.
- B. Contractor shall provide all service, labor, materials, and equipment required for all earthwork and related operations necessary to complete the work as shown on drawings or specified in these specifications, or as determined in the field jointly by Contractor and Engineer.

1.2 RELATED SECTIONS

- A. Section 01450 – Testing Laboratory Services
- B. Section 02230 – Clearing & Grubbing
- C. Section 02240 - Dewatering
- D. Section 02370 – Erosion & Sedimentation Control

1.3 REFERENCES

- A. ASTM D 448-86 (Reapproved 1993) - Sizes of Aggregate for Road and Bridge Construction.
- B. ASTM D 1556-90 - Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- C. ASTM D 1557-91 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
- D. ASTM D 2167-94 - Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- E. ASTM D 2487-93 - Classification of Soils for Engineering Purposes.

- F. ASTM D 2922-91 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- G. ASTM D 3017-88 (Reapproved 1993) - Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- H. ASTM D 3740-94a - Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- I. ASTM E 329-93b - Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.4 SUBMITTALS

- A. Section 01340 - Submittals: Procedures for submittals.
- B. Materials Source: Submit names of materials source.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with Federal, State of Georgia, Local standards.
- B. Safety: The Contractor shall perform all earthwork operations in accordance with applicable OSHA regulations. Safety on the jobsite is the Contractor's responsibility. The contractor shall comply with all local regulations and with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc..

1.6 TESTING

- A. Laboratory tests for moisture density relationship for fill materials shall be in accordance with ASTM D 698, (Standard Proctor).
- B. In place density tests in accordance with ASTM D 1556 or ASTM D 2922.
- C. Testing laboratory shall operate in accordance to ASTM D 3740 and E 329 and shall be accepted by 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 Owner.

1.7 GENERAL

- A. Benchmarks: Establish and maintain two corresponding permanent bench marks on the site for reference. All vertical dimensions shall be checked from these benchmarks.
- B. Finish Grades: Finished grades, as used herein, mean the final grade elevations indicated on the drawings. Should finished grades shown on spot elevations conflict with those shown by the contours, the spot elevations shall govern.
- C. Preliminary Earthwork: Contractor shall remove soft organic type material from the wet areas within the construction areas. This material shall be used after reaching near optimum moisture content as topsoil for final dressing.
- D. Borrow Pits: Submit representative samples of all fill material requiring compaction to the Designated Testing Laboratory. Material and borrow pits shall be approved by the Owner's Representative prior to filling operations. If the quantity available from site grading is not sufficient, purchasing, hauling, and blending of fill shall be done by the Contractor. Staging blending of clayey and sandy soil shall be performed on the site.
- E. Controlled Fill
 - 1. Class I Fill is all structural fill to underside of slabs and to support foundations or footings.
 - 2. Class II Fill is all fill below finish grade immediately behind walls and in trenches and embankments under walks, drives, parking areas, and all areas to be paved. Top two-feet of this fill shall be Class I Fill.
 - 3. Class III Fill is all backfill used for filling trenches not under paved areas, slabs, foundations or footings.
- F. Insufficient Fill Material: If quantity of grading material is insufficient to provide finish grade elevations indicated on drawings, Contractor shall obtain additional fill material of specified quality by excavating on-site as directed by Owner's Representative.
- G. Excess Cut Material: If quantity of acceptable grading material is in excess of quantities necessary to provide finish grade elevations indicated on drawings, any excess material shall be deposited and dressed on site as directed by the Owner's Representative.
- H. Elevations shown on the Drawings as existing are taken from the best known data and are intended to convey reasonably accurate information about existing elevations. The Contractor should satisfy himself as to exact quantities of excavation and fill materials required to complete the work.

- J. Storage: Temporary stockpile locations shall be coordinated with the Owner. Stockpiles shall not block existing surface drainage or access to existing equipment, valves, hydrants, etc. Practice effective erosion control measures around all stockpiles.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Satisfactory earth fill shall be limited to soils classified in accordance with ASTM D 2487 as GM, GC, SW, SP, SM, SC, ML, and CL; and shall have a liquid limit (LL) ≤ 50 , a Plasticity Index (PI) ≤ 25 , and a Dry Unit Weight ≤ 100 pcf.
- B. Unsatisfactory soil materials are classified in accordance with ASTM D 2487 as PT, OH, OL, CH, and MH. The material may be used as site fill material identified on the drawings as "spoil areas" and under topsoil to establish site grades.
- C. Satisfactory earth fill shall be free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, organics, vegetable and other deleterious matter.
- D. Borrow shall consist of sand or sand-clay soils capable of being readily shaped and compacted to the required densities, and shall be free of roots, trash and other deleterious material.
- E. 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 to appropriate moisture contents prior to compaction.
- F. 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.
- G. Contractor shall furnish all borrow material.
- H. Contractor shall be responsible for and bear all expenses in developing borrow sources including securing necessary permits, drying the material, haul roads, clearing, grubbing, and excavating the pits, haul roads, placing, restoration of pits and haul roads to a condition satisfactory to property owners and in compliance with applicable state and local laws and regulations.
- I. Sand Fill: Material shall consist of a clean sand with a fineness modulus of 1.6 to 3.1 and containing not more than 10 percent by weight finer than No. 200 U.S. Standard Sieve.

- J. Previous Fill: Material shall consist of crushed stone or gravel. Size and gradation shall be #7 size as defined by ASTM C33-86, "Standard Specification for Concrete Aggregates" (Normal size 1/2" to #4 Sieves).
- K. Total Percent Sieve (By Weight)

Square Sieve	1-1/2	1	3/4	1/2	3/8	#4	#8
Size #7 (1/2 Inch)	100	100	100	90-100	40-70	0-15	0-5

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.

2.3 TOPSOIL

- A. Dark organic weed free loam which is free of muck.

PART 3 EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify known below grade utilities. Stake and flag locations.
- C. Identify and flag above grade utilities.
- D. Maintain and protect existing utilities remaining which pass through work area.
- E. Notify all utility companies prior to grading and where required to remove utilities.
- F. Upon discovery of unknown utility or concealed conditions, discontinue affected work; notify Owner/Engineer immediately.

3.2 DEWATERING

- A. See Section 02240 – Dewatering

3.3 SHEETING, SHORING AND BRACING

- A. See Section 02250 – Sheeting, Shoring, and Bracing.

3.4 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated or graded and stockpile in designated area. Remove excess topsoil not being reused from site.
- B. Do not excavate wet topsoil.
- C. Stockpile topsoil to height not exceeding 8 feet. (Cover to protect from erosion).

3.5 SITE GRADING

- A. Remove all organic matter, stumps and other deleterious matter. Predensify the areas to be filled or upon which structures are to be placed. A loaded dump truck or other rubber tired equipment should be used for the predensification. Overlapping passes of the vehicle should be made across the site in one direction and then at right angles to the original direction of rolling.
- B. Any yielding, pumping or soft areas should be cut out and replaced with fill compacted as described herein.
- C. Finish grading outside of building, where not shown otherwise, shall be given uniform slopes between points for which finished grades are shown, or between points and existing established grade.
- D. Provide drainage away from building walls, where not shown otherwise on the drawings, at a grade of at least 3-inches in 10-feet. Provide shallow swales where indicated on plans at a minimum width of 6-feet and minimum depth of 3-inches with a minimum flowline grade of not less than 1/8 inch per foot. Provide rounding at top and bottom of banks and at other breaks in grade.

3.6 GENERAL EXCAVATION

- A. Excavation shall include removal of all material from an area necessary for the construction of a structure, dam or dike. Excavations shall provide adequate working space and clearances for the work to be performed therein. Excavation for structures shall conform to the elevations and dimensions shown with a tolerance of plus or minus 0.10 feet.
- B. Contractor shall be responsible for any problems caused to property owners in residential areas due to excessive dust caused by excavation operations. Preparations shall be made by Contractor to control excessive dust in or near any residential area.
- C. Where quicksand, soft clay, spongy, swampy or other materials unsuitable for subgrade or foundation purposes are encountered below excavation limits,

they shall be removed to a level of suitable material as directed by the soils engineer. Areas so excavated shall be backfilled with Class D concrete or with foundation backfill to the original excavation limit unless otherwise directed by the soil engineer.

- D. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of next day until excavations are backfilled. All excavations shall be barricaded in such a manner as to prevent persons from falling or walking into any excavation.
- E. Excavate to elevations and dimensions, plus (excluding buildings) plus space to permit erection of forms and for waterproofing and installation of drains. All bottoms shall be clean cut, true, level, and sound. Any water softened soils in foundation excavations shall be removed prior to steel and concrete placement.

3.7 BORROW EXCAVATION

- A. Wherever the backfill of excavated areas or the placement of embankments or other fills require material not available at the site, suitable material shall be obtained from other sources. This may require the opening of borrow pits at points not immediately accessible to the work. In such cases, Contractor shall make arrangements with the property owner and shall pay all costs incident to the borrowed material including royalties, if any, for the use of the material. Before a borrow pit is opened, the quality and suitability of the material to be obtained shall be approved by the Soils Engineer. Any soil tests required for approval of the borrowed material proposed shall be at the Contractor's expense.

3.8 UNDERCUTTING

- A. During construction, soils classified CH, MH, OH, OL and PT shall be undercut to a depth as shown on the drawings and replaced with compacted structural fill.
- B. Stockpile material by Fill Material classification in on site locations where it will not interfere with construction operations. Materials stockpiled shall be placed in a manner to afford drainage. Protect against erosion.

3.9 EXCAVATION AND STABILIZATION

- A. Where Groundwater Control cannot be accomplished, stabilize bottom of excavation with the installation of 1-foot of crushed aggregate Size #57 (1" to #4) prior to placement of compacted fill.
- B. After stabilization of excavation bottom, initial 1-foot "bridge-lift" of fill may be granular (SP, SW, GP or GW) fill followed by placement of Controlled Fill.

3.10 SUBSURFACE OBSTRUCTIONS

- A. In excavating, backfilling, and laying pipe, care must be taken not to remove, disturb, or injure any existing water, telephone, gas pipes, storm drainage pipe, headwalls or catch basins, or other conduits or structures, without the approval of the Engineer. If necessary, the Contractor at his own expense, shall sling, shore up, and maintain such structures in operation, and shall repair any damage to them. Before final acceptance of the work, he shall return all such structures to as good condition as before the work started.
- B. The Contractor shall give sufficient notice to the interested utility of his intention to remove or disturb any pipe, conduit, etc., and shall abide by their regulations governing such work. In the event that any subsurface structure becomes broken or damaged in the execution of the work, the Contractor shall immediately notify the proper authorities, and shall be responsible for all damage to persons or property caused by such breaks. Failure of the Contractor to promptly notify the affected authorities shall make him liable for any needless loss so far as interference with the normal operation of the utility.
- C. When pipes or conduits providing service to adjoining buildings are broken during progress of the work, the Contractor shall repair them at once.
- D. Delays such as would result in buildings or residences being without services overnight or for a needlessly long period during the day will not be tolerated. Should it become necessary to move the position of a pipe, conduit or structure, it shall be done by the Contractor in strict accordance with the instructions given by the Engineer or the utility involved.
- E. The Owner or the Engineer will not be liable for any claim made by the Contractor based on underground obstructions being different from that indicated in these Contract Documents or plans.

3.11 DISPOSAL OF WASTE AND UNSUITABLE MATERIALS

- A. Materials removed by excavation, which are suitable for the purpose, shall be used to extent possible for backfilling pipe trenches and for making embankment fills, subgrades or for such other purposes as may be shown on Drawings. Materials not used for such purposes shall be considered waste material and shall be disposed of at the Contractor's expense.
- B. Waste materials shall be spread in uniform layers and neatly leveled and shaped. Spoil banks shall be provided with sufficient and adequate openings to permit surface drainage of adjacent lands.
- C. Unsuitable materials, consisting of rock, wood, vegetable matter, debris, soft or spongy clay, peat, and other objectionable material so designated by the soils engineer, shall be removed from the work site and disposed of by

Contractor at his expense.

- D. No waste material shall be dumped on private property unless written permission is furnished by owner of property and unless a dumping permit is issued from local jurisdiction.

3.12 COMPACTION

- A. Control soil compaction and moisture content during construction in accordance with the following requirements.
- B. Fill Placement – Once the subgrade has been approved, the exposed surface and all subsequent fill lifts shall be compacted to at least 95% of the maximum dry density in accordance with ASTM D 698, current edition. These soils shall be placed maintaining the moisture content within 3% of the optimum moisture content.

3.13 BACKFILL AND FILLS

- A. Place acceptable soil material in layers to required elevations.
- B. Ground Surface preparation – Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
- C. When existing ground surface has a density less than that specified under “Compaction” for particular area classifications, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- D. Placement and Compaction – Place backfill and materials in layers not more than 6” in loose depth for material compacted by heavy compaction equipment and not more than 4” in loose depth for material compacted by hand operated tampers.
- E. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- F. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying material uniformly around structure to approximately same elevation in each lift.
- G. Shore wall slabs which are to be tied into bottom slabs prior to installation of Backfill and until slabs have been in place sufficient time to achieve strength and provide structural stability against overturning.

- H. Where Backfill is required on both sides of walls it shall be brought up in even lifts so as not to provide an unequal lateral load.
- I. Install Backfill against wall slabs only when construction progress permits.

3.14 INSTALLATION OF CLASS I FILL

- A. Class I Fill shall be Earth Fill material beneath the footprint of the buildings.
- B. Compact within + or - 3 percent of optimum moisture content in 4-inch to 8-inch loose layers to not less than 95 percent of the maximum density (ASTM D698 using standard proctor test).

3.15 INSTALLATION OF CLASS II FILL

- A. Class II Fill shall be Earth Fill materials except that fill immediately behind walls and under walks, drives and parking areas as indicated on drawings.
- B. Compact within + or - 3 percent of optimum moisture content in 4-inch to 8-inch loose layers to not less than 95 percent of the maximum density (ASTM D1557).

3.16 INSTALLATION OF CLASS III FILL

- A. Compact fill in utility trenches not under buildings or paved areas to not less than 93 percent of the maximum density (ASTM D1557).

3.17 TOLERANCES

- A. Unpaved areas within 0.1 feet of elevations shown on the drawings provided such deviation does not create low spots that do not drain.
- B. Paved Areas – Subgrade to within 0.05 feet of the drawing elevations less the compacted thickness of the base and paving.
- C. Building Pads – Subgrade to within 0.05 feet of the drawing elevations less the thickness of the concrete slab.

3.18 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 originally obtainable from either blade grader or scraper operations supplemented with hand raking and finishing, except as otherwise specified.

- C. The finished surface of unpaved areas shall be not more than 0.10' above or below the established grade or approved cross-section.
- D. Slopes and disturbed areas not covered by pavement, gravel, riprap, or other stabilized material shall be graded smooth and receive 4 inches of topsoil. Contractor shall provide topsoil if not available on site.
- E. Ditches and lagoon banks shall be finished graded, dressed and seeded within fourteen (14) calendar days of work to reduce erosion and permit adequate drainage.
- F. Each building pad subgrade shall be adequate to support 2500 psf.

3.19 PROTECTION

- A. Graded areas shall be protected from traffic, erosion, settlement, or any washing away that may occur prior to acceptance.
- B. The Contractor shall be responsible for protection of below grade utilities shown on the drawings or indicated to him 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 Contractor's 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.

3.20 DRAINAGE

- A. The Contractor shall be responsible for providing surface drainage away from all construction areas. This shall include maintenance of any ditches that exist or may be constructed by others in the immediate vicinity of the work. Contractor shall provide proper and effective measures to prevent siltation of wetlands, streams, and ditches both on the Owner's property, and those properties downstream.
- B. Maintain water table not less than 3-feet below subgrades during operations which require heavy wheeled or roller equipment and below excavation level during placement of structural fill or crushed aggregate subgrade stabilization. See Section 02240, Dewatering.
- C. Provide temporary ditches as necessary during construction to control seepage from springs and direct the water away from the fill areas.

- D. Protect all work, including excavations and trenches, from rainwater, surface water and back-up of drains and sewers. Furnish all labor, pumps, shoring, enclosures, and equipment necessary to protect and to keep work free of water.

3.21 PRE-DENSIFICATION AND PROOFROLLING

- A. At completion of clearing, grubbing and stripping of topsoil, stump holes or other depressions shall be cleared of loose material and debris and shall then be backfilled with approved fill. The backfill shall be placed in six-inch thick loose lifts and compacted to 95% of the maximum dry density in accordance with the ASTM D 698, current edition.
- B. After undercutting and prior to filling, the newly exposed subgrade area shall be scarified and predensified by rolling the surface with compaction equipment. This shall be performed in the presence of an Owner's Representative.
- C. Following the clearing and grubbing of trees and underbrush and stripping of topsoil, the fill subgrade shall be evaluated by the geotechnical engineer or his representative prior to fill placement.
- D. Rolling shall consist of a minimum of eight (8) overlapping coverages in each of two perpendicular directions and shall be continued until density tests at a depth of 8-inches below the surface indicate the attainment of 98% of the Maximum Dry Density (ASTM D-698).
- E. Proofrolling shall not be performed on excessively soft areas or areas of high water table. Recommendations for these areas will be made by the geotechnical engineer at the time of construction. These recommendations may include undercutting soft areas, trenching of soils for drainage or the placement of bridge lifts.
- F. Before placing fill material, the surface shall be smooth and free of stumps, sharp objects, and debris.
- G. Subgrades, where footings will bear on expansive soils, shall not be allowed to dry or to become excessively wet prior to the placement of fill and final build out of the structure. The filling shall begin on the same day excavations are made.

3.22 FIELD QUALITY CONTROL

- A. Field density test shall be made by a fully insured testing laboratory selected and paid for by the CONTRACTOR.
- B. Quality Control Testing During Construction – Allow testing service to inspect and approve subgrades and fill layers before further construction work is

performed. An experienced geotechnical engineer shall observe all proofrolling and all fill and placement. Submit one copy of results of all compaction tests and observations of pre-densification to Owner and Engineer.

- C. Perform field density tests in accordance with ASTM D 2937 (drive cylinder method), ASTM D 2167 (rubber balloon method), as applicable, or nuclear method ASTM D 2922.
- D. For Class I and II fills perform at least one field density test for each layer of fill for every 5,000 square feet of area, or one test per 400 linear feet of trench or roadway per two foot compacted lift.
- E. For Class III fill perform one field density test per 400 linear feet of trench at a depth 3 feet below finished grade.
- F. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, provide additional compaction and testing at no additional expense.
- G. Testing will be the responsibility of the Contractor. Contractor shall coordinate with Testing Laboratory for testing.
- H. Areas that fail tests shall be re-worked and retested at the Contractor's expense.
- I. Exact locations of tests shall be as directed by the Owner's Representative. Test results shall be substituted to Owner's Representative. The Contractor shall be responsible for maintaining a copy of all test results on file at the jobsite.
- J. The Contractor shall be responsible for:
 - 1. Notifying the laboratory on conditions requiring testing.
 - 2. Coordinating the laboratory for field testing.
 - 3. Providing representative fill soil samples to the laboratory for testing purposes. Provide 50 pound samples for each fill soil.

END SECTION

SECTION 02315

TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.1 SUMMARY

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the site utilities, including all pipelines, electrical conduits and duct banks shown on the Drawings and as specified.
- B. Site utility excavations shall include the removal of trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the utility and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Site utility backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.

1.2 DEFINITIONS

- A. The trench is divided into five specific areas:
 - 1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
 - 2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the utility.
 - 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
 - 4. Initial Backfill: The area above the haunching material and below a plane 18-inches above the top of the barrel of the pipe or the top of duct bank.
 - 5. Final Backfill: The area above a plane 18-inches above the top of the utility.

1.3 REFERENCES

- A. Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P Excavation, Trenching & Shoring as described in OSHA publication 2226.
- B. ASTM D-698.
- C. ASTM D 4253, Maximum Index Density of Soils Using a Vibratory Table.
- D. ASTM D1556, Density of Soil in Place by the Sand Cone Method.
- E. ASTM D 2837, Density of Soil in Place by the Drive-Cylinder Method.
- F. ASTM D 2922, Density of Soil and Soil Aggregate In Place by Nuclear Methods (Shallow Depth).

1.4 QUALITY ASSURANCE

- A. Density: Tests for compaction and density shall be conducted by an independent testing laboratory selected by and paid by the CONTRACTOR.
- B. The soils testing laboratory is responsible for the following:
 - 1. Field compaction testing shall be based on using the maximum dry density determined by the Standard Proctor Compaction Test in accordance with ASTM D-698.
 - 2. Maximum dry density for non-cohesive materials shall mean the maximum index density as determined by ASTM D 4253.
 - 3. Determination of in-place backfill density shall be done in accordance with ASTM D 1556, ASTM D 2937, or ASTM D 2922.
 - 4. Field density tests for each two feet of lift; one test for each 5,000 square feet of fill.
 - 5. Inspecting and testing stripped site, subgrades and proposed fill materials.
- C. Contractor is responsible for:
 - 1. Notifying laboratory of conditions requiring testing.
 - 2. Coordinating with laboratory for field testing.

- 3. Providing representative fill soil samples to the laboratory for test purposes. Provide 50 pound samples of each fill soil.
- D. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed in accordance with Section 02300 of these Specifications.
- E. Field density test for each two feet of lift, one test for each 2,000 feet of pipe installed or more frequently if ordered by the Engineer.

PART 2 PRODUCTS

2.1 TRENCH FOUNDATION MATERIALS

- A. Crushed stone shall be utilized as foundation materials. Should existing native materials not be acceptable to support the entire length of the pipe section. Unless otherwise detailed foundation materials shall have earth material trench foundations.
- B. Crushed stone shall conform to Georgia DOT Standard Specifications for Construction, 800.01, size No's. 78 and 57.

2.2 BEDDING AND HAUNCHING MATERIALS

- A. Unless detailed or specified otherwise, bedding and haunching materials shall be sandy native materials or crushed stone as detailed and specified above.
- B. (Only for pressurized mains) Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this Section at no additional cost to the Owner.

2.3 INITIAL BACKFILL

- A. Initial backfill material shall be acceptable earth materials as detailed and specified herein.
- B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Materials shall be clean and free

of rock for at least one foot above the top of the pipe, organics, cinders, stumps, limbs, or frozen earth or mud, man-made wastes and other unsuitable materials. No stone larger than 3/4" inches in its greatest dimension shall be used for backfill. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry and it is capable of meeting the specified compaction requirements. When necessary, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not acceptable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.4 FINAL BACKFILL

- A. Final backfill material shall be general excavated earth materials, shall not contain rock larger than 4-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes. If materials excavated from the trench are not acceptable for use as final backfill material, provide select material conforming to the requirements of this Section.

2.5 SELECT BACKFILL

- A. Select backfill shall be materials which meet the requirements as specified for bedding, haunching, initial backfill or final backfill materials, including compaction requirements.

2.6 CONCRETE

- A. Concrete for bedding, haunching, initial backfill or encasement shall be minimum 3000 psi concrete.

PART 3 EXECUTION

3.1 PREPARATION

- A. Topsoil and grass shall be removed in accordance with the requirements of Section 02300.

3.2 TRENCH EXCAVATION

- A. Description: The trench shall be dug to the alignment and grade required and not to exceed 200 feet in advance of the pipe laying. The trench shall be braced if necessary and drained in order that workmen therein may work safely and efficiently. It is essential that the discharge from any pumps be led to natural drainage channels or to drains.
- B. Width: Minimum width of trench shall be six (6) inches from the outside of barrel of pipe on each side of pipe. Maximum width of trench shall be nine (9) inches from the outside of barrel of pipe on each side of pipe. Sides of trench shall be dug and maintained vertical except Contractor shall adhere to

all applicable requirements of OSHA for trench safety.

- C. Correcting Faulty Grade: Any part of the trench excavated below grade shall be corrected with acceptable material thoroughly compacted.
- D. Bell Holes, Required: Bell holes dimensions shall be dug in trenches at each joint to permit the joint to be made.
- E. Braced and Sheeted Trenches: Wherever necessary to prevent caving, excavations shall be sheeted and braced. Where sheeting and bracing are used, the trench width shall be increased accordingly. Trench sheeting shall remain in place until the pipe has been laid, tested for defects, and repaired if necessary, and the earth around it compacted to a depth of two feet over the top of the pipe.
- F. Trench Stabilization: Wherever the material at the bottom of the trench is not acceptable for installation of the pipe, it shall be removed and replaced in accordance with sub-paragraph "G" herein after.
- G. When so directed, undercut the trench and backfill with No. 57 stone meeting the requirements of GA D.O.T. Specification 800.01. Place and compact this material to bring the trench to the required grade.
- H. Pipe Alignment and Grade: The pipe shall be laid in the trench so that the interior surface of pipe shall conform accurately to the grades and alignments fixed and shown on the plans.
- I. Rock Excavation:
 - 1. Definition of Rock: Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 18,300 pounds (Caterpillar Model 215 or equal), and occupying an original volume of at least one-half cubic yard.
 - 2. Excavation: Where rock is encountered in trenches, excavate to the minimum depth which will provide clearance below the pipe barrel of 4 inches plus required bedding depth for pipe and manholes. Remove boulders and stones to provide a minimum of 6 inches clearance between the rock and any part of the pipe or manhole.
 - 3. Blasting: Provide experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all structures from the effects of the blast. Repair any resulting damage.

If the Contractor persistently used excessive blasting charges or blasts in an unsafe or improper manner, the Engineer or his representative may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.

4. Removal of Rock: Do not use excavated rock as backfill material. Dispose of rock which is surplus or not suitable for use as rip rap.
- J. Haunching of Sewer: Haunch pipelines in accordance with detail drawing and the following specifications. Contractor to pay close attention to the haunching procedures for all pipe installations.
- K. Bedding of Sewer: Bed pipelines in accordance with the following specifications.
 1. PVC Sewer: All bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding materials shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No. 78 stone.
 2. Ductile Iron Sewer: All bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding material shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No. 57 stone.
 3. Sewer Laterals: The bedding requirement for the laterals from the main sewer to the structure shall be the same as applicable to the main sewer.
 4. Manholes: All bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding materials shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No 57 stone.
 5. General: Compact stone bedding material by tamping or slicing with a flatblade shovel. Prepare the trench bottom to support the pipe uniformly throughout its length. Provide bell holes to relieve pipe bells of all load. If the trench is excavated to excessive width or depth, provide the next better class of bedding. In rock trenches, bed pipe in at least six inches of bedding material.
- L. Bedding classifications: All gravity sewer installations shall conform to the following bedding classifications in accordance with ASTM C12.
 1. Gravity Sewers and Accessories: Lay PVC pipe with minimum Class "B" bedding, unless shown or specified otherwise.
 - a. Class "A" (Bedding Factor – 2.8): Excavate the bottom of the trench flat a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. Place concrete to the full width of the trench and to a height of one-fourth of the outside diameter of the

pipe above the invert.

- b. Class "B" (Bedding Factor – 1.9): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.
 - c. Class "C" (Bedding Factor – 1.5): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding materials to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.
 - d. Manholes: Excavate to a minimum of 12 inches below the planned elevation of the base of the manhole. Place and compact stone bedding material to the required grade before constructing the manhole.
 - e. Compaction: Bedding under pipe and manholes shall be compacted to a minimum of 90 percent of the maximum dry density as determined by the Standard Proctor Compaction Test, ASTM D 698.
- M. Compaction: Bedding under pipe and manholes shall be compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor Compaction Test, ASTM D-698.
- N. Care of Surface material for Reuse: If local conditions permit their reuse, all surface materials suitable for reuse in restoring the surface shall be kept separate from the general excavation material.
- O. Manner of Piling Excavated Materials: All excavated materials shall be piled so that it will not endanger the work and so that it will avoid obstructing roads and driveways. Drainage channels shall be kept clear or other satisfactory provisions made for drainage.
- P. Trenching by Machine or by Hand: The use of trench digging machinery will be permitted except in places where operation of same will cause damage to existing structures above or below the ground; in which case, hand methods shall be employed.

3.3 INITIAL BACKFILL

- A. As soon as practicable after the completion of laying and jointing of the pipe,

the trench shall be backfilled, and at no time shall the completed backfilled trench be more than 200 feet behind the pipe laying. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.

- B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18-inches above the pipe or duct bank. Layer depths shall be a maximum of 6-inches for pipe 18-inches in diameter and smaller and a maximum of 12-inches for pipe larger than 18-inches in diameter.
- C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
- E. Initial backfill shall be compacted to a minimum 98 percent of the maximum dry density, unless shown or specified otherwise.
- F. For electrical duct banks, place the first 12-inches of initial backfill materials as specified in this Section. Place in 6-inch layers. Compact with hand tools or tamping equipment.
- G. If materials excavated from the trench are not acceptable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- H. For PVC gravity sewer, crushed stone shall be used for initial backfill up to 6-inches above the pipe barrel.

3.4 CONCRETE ENCASEMENT FOR PIPELINES

- A. Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.5 FINAL BACKFILL

- A. After initial backfill materials has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
 - 1. In 6-inch layers, if using light power tamping equipment, such as a 'jumping jack.'
 - 2. In 12-inch layers, if using heavy tamping equipment, such as hammer

with tamping feet.

3. In 24-inch layers, if using a hydra-hammer.
- B. Final backfill shall be compacted to a minimum 98 percent of the maximum dry density, unless specified otherwise.
- C. Backfill shall provide a finished grade at the elevations shown on the Drawings.
- D. The top 6-inches shall be topsoil obtained as specified in Section 02300 of these Specifications.
- E. If materials excavated from the trench are not acceptable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
- F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- G. Remove and dispose of excess or unacceptable materials in accordance with the requirements of Section 02250 of these Specifications.

3.6 ADDITIONAL MATERIAL

- A. Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. Utilize excess material excavated from the trench, if the material is acceptable. If excess excavated materials are not acceptable, or if the quantity available is not sufficient, provide additional acceptable fill material at the Contractor's expense.

3.7 BACKFILL UNDER ROADS

- A. Compact backfill underlying within ten (10) feet of pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 98 percent of the Standard Proctor maximum dry density.

3.8 DETECTION TAPE

- A. Where required, detection tape shall be buried 4 to 10-inches beneath the ground surface directly over the top of the utility. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20-inches from the finished grade surface.

END SECTION

SECTION 02370

EROSION , SEDIMENTATION, AND POLLUTION CONTROL

PART 1 GENERAL

1.1 SCOPE

- A. Erosion, Sedimentation and Pollution control shall be employed during the construction period and shall include all measures required to prevent soil erosion from the site until permanent measures are installed. Work shall be accomplished through, but not limited to, the use of berms, dikes, sediment barriers, sediment traps, sediment basins, silt fences, temporary grasses, check dams, mulching, construction exits and slope drains.
- B. The Erosion, Sedimentation, and Pollution Control Plan (ES&PC Plan) control measures described herein shall be continued until such time as permanent planting and restoration of natural areas is effectively in control of erosion from project site.
- C. Failure to properly install and maintain the Erosion, Sedimentation, and Pollution Control Plan throughout the construction period may be cause to halt construction by governing authorities until such measures are correctly installed and operational. Activity covered in this section are regulated by the Manual for Erosion and Sediment Control in Georgia (latest revision) and Georgia's National Pollutant Discharge Elimination System Permit (NPDES), General Permit No. GAR100001, GAR100002, or GAR100003, which ever is applicable.

1.2 RELATED SECTIONS

- A. Section 02230 - Clearing and Grubbing
- B. Section 02300 - Earthwork
- C. Section 02315 – Trench Excavation & Backfill
- D. Section 02920 - Grassing

1.3 REGULATORY REQUIREMENTS

- A. Obtain required permits and licenses in accordance with requirements of Federal Clean Water Act (CWA) and Water Quality Act (WQA). Land disturbance activity shall not commence until a Land Disturbance Application (LDA) Permit has been issued and a National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI) has been filed.

- B. **Where work on this project will disturb 1 or more acres, do not start work without obtaining a “National Pollution Discharge Elimination System (NPDES) permit governing discharge of storm water from project site for duration of Contract.**
- C. The Notice of Intent (NOI), shall be submitted fourteen (14) days before land disturbing activities may take place.
- D. Contractor shall be responsible for cost of fines, construction delays and remedial actions resulting from failure to comply with the provisions of the NPDES permit.

THE ABOVE SUMMARY EXPLAINS THE SEPARATION OF WORK BUT DOES NOT ACT AS THE EXPLANATION OF THE LAW. REFER TO GENERAL PERMIT NO. GAR100001, GAR100002, AND GAR100003 BY THE DEPARTMENT OF NATURAL RESOURCES, ENVIRONMENTAL PROTECTION DIVISION (GADNR-EPD) FOR COMPLETE PERMIT AND RESPONSIBILITIES.

PART 2 PRODUCTS

2.1 FILTER FABRIC

- A. Filter fabric for silt fences shall be pervious synthetic polymer filaments forming a stable network so that fibers retain their relative positions. Filter fabric shall be of the type recommended by its manufacturer for the intended application. The filter fabric shall meet the following requirements:
 - 1. Minimum Grab Strength 150 lbs (by ASTM D 1682)
 - 2. Elongation 25%
 - 3. Retention Efficiency 75%
- B. Silt fence shall be constructed in accordance with details shown on Drawings or may be a prefabricated proprietary type subject to approval by Engineer.

2.2 HAY BALE BARRIERS

- A. Hay bales shall be well compacted straw, standard size, wire bound. Hay bales may be used as an alternate to silt fence as approved by Engineer.

2.3 GRASS

- A. Grass seed for temporary erosion control shall be applied at the rates and dates indicated in the following table.

Species	Rate Per 1,000 Sq. Ft.	Rate Per Acre	PLANTING DATES		
			Mountains Limestone Valley	Piedmont	Coastal
Rye	4.00 pounds	3 Bushels	7/15 – 12/1	8/15 – 1/1	9/1 – 3/1
Ryegrass	1.00 pound	40 Pounds	8/1 – 5/1	8/1 – 4/15	8/15 – 4/1
Weeping Lovegrass	0.10 pounds	4 Pounds	3/15 – 6/15	3/15 – 6/15	2/15 – 6/15
Sudangrass	1.40 pound	60 Pounds	4/1 – 9/1	4/1 – 9/1	3/1 – 8/1
Browntop Millet	1.00 pound	40 Pounds	4/1 – 7/1	4/1 – 7/15	4/1 – 7/15
Wheat	4.00 pounds	3 Bushels	9/1 – 1/1	9/1 – 1/1	9/15 – 2/1

- B. For additional information regarding temporary grassing and mulching, see Chapter 6, Section II of the “Manual for Erosion and Sediment Control in Georgia”.

2.4 FERTILIZER

- A. Commercial grass fertilizer with a 10N-10P-10K proportion.
- B. Agricultural lime to be applied at a rate of one (1) ton per acre.

2.5 MULCH

- A. Dry straw or hay of good quality, free of weed seed – spread at a rate of 3 tons per acre.
- B. Wood waste, chips, sawdust or bark spread 2 to 3 inches deep (about 6 to 9 tons per acre).
- C. Erosion control matting or netting, such as excelsior, jute, textile and plastic matting, and netting applied in accordance with manufacturer’s recommendations.

2.6 CHEMICALS FOR DUST CONTROL

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

PART 3 EXECUTION

3.1 GENERAL

- A. All disturbed soil areas except those to support paving shall be graded and protected from erosion with vegetative materials. Sedimentation discharge from the construction site into natural drainage ways and storm drainage

systems shall be prevented by means of vegetative measures and temporary structural practices. These vegetative measures and structural practices are known as Best Management Practices (BMP's). Rainfall, pollution control measures and construction exit condition shall be monitored and reported on each day when construction activities take place. Erosion and sedimentation control measures shall be monitored and reported every seven (7) days and within 24 hours of a qualifying rainfall event of 0.5-inches or more. Sampling of construction site discharging water shall be sampled within 45 minutes of a qualifying rainfall event and analyzed immediately or no later than 48 hours after collection. The above reports shall be submitted to the GaDNR-EPD by the fifteenth (15th) day of the month following the reporting period.

- B. Erosion control shall be directed toward and have the purpose of controlling soil erosion at its potential source. Downstream sediment entrapment measures shall be employed, but only as a backup to primary control at the source.
- C. A continuing program of installation and maintenance of sediment control measures shall be employed during the construction period.
- D. Erosion Control Schedule
 - 1. Prior to the pre-construction conference, Contractor shall submit to the Engineer his proposed erosion control plan for the project in accordance with requirements of this section. The schedule shall be based on an analysis of the project conditions and shall be in written form. This schedule shall specifically indicate the sequence of clearing and grubbing, earthwork operations, including trenching and backfilling, construction of permanent erosion control features and the proposed uses of temporary erosion control features. Schedule shall also include proposed methods to prevent pollution of streams, lakes and rivers and other water resources.
 - 2. Contractor shall outline his proposed methods of controlling erosion and preventing pollution on public and construction access roads, staging areas and waste disposal areas.
 - 3. No work shall be started until the aforementioned plans and schedules have been accepted by Engineer. Contractor will be responsible for accomplishment of work in accordance with accepted plans and schedules. Engineer may approve changes made necessary by unforeseen circumstances that are beyond the control of Contractor.
- E. Engineer has the authority to limit the surface area of erodible earth materials exposed by clearing and grubbing, the surface area of erodible earth exposed by excavation and backfill operations and to direct Contractor to provide immediate permanent or temporary erosion and pollution control measures to prevent contamination of adjacent streams or other water courses.

- F. Clearing and grubbing operations shall be so scheduled and performed that grading operations and permanent erosion control features can immediately follow thereafter, if the project conditions permit, otherwise temporary erosion control measures will be required between successive construction stages.
- G. Engineer will require Contractor to limit the area of excavation, trenching and pipe laying operations in progress commensurate with Contractor's capability and progress in keeping finish grading, mulching, seeding and other permanent and/or temporary measures current with accepted schedule.
- H. The Owner is considered a "Primary Permittee" and shall submit a Notice of Intent (NOI) in accordance with General Permit Number GAR100001, GAR100002, or GAR100003 at least fourteen (14) days prior to the commencement of construction activities. The Contractor shall retain a copy of the Erosion, Sedimentation and Pollution Control Plan (ES&PC Plan) and the Comprehensive Monitoring Program (CMP's) required by the above permit at the construction site or be readily available at a designated alternate location from the date of project initiation to the date of final stabilization. Copies of all Notice of Intent, Notice of Termination, plans, monitoring reports and all other records required by the above permit shall be retained by the Owner for a period of at least three (3) years from the date the site is finally stabilized.

3.2 ON-SITE OBSERVATION

- A. The Engineer is required by General Permit Number GAR100001, GAR100002, or GAR100003 to check the installation of the Erosion, Sedimentation and Pollution Control measures within one (1) week after the initial construction activities commence. The Contractor shall notify the Engineer within 24 hours of the control measures installation for the above site visit. The Engineer, within the above parameters, shall check subsequent installation of control measures.

3.3 TEMPORARY GRASSING AND MULCHING

- A. Where staged construction or other conditions not controlled by Contractor prohibit the completion of work in a continuous manner; Engineer may order Contractor to apply temporary seeding or temporary mulch to an erodible area.
- B. Temporary grass shall consist of sowing a quick growing species of grass suitable to the area and season. Seeding rates shall be in accordance with Paragraph 2.3. Ground preparation will be limited to blading the area to the amount deemed practical by the Engineer for a seedbed and the elimination of water pockets. Fertilizer shall be applied at a rate of 14 pounds per 1,000 square feet.
- C. Areas to be mulched need not be to finished grade. The mulched areas may be placed on slopes as steep as 2:1 using a tractor to imbed the mulch into

the slope.

- D. Spread wood waste uniformly on slopes that are 3:1 and flatter. No anchoring is needed.
- E. Commercial matting and netting. Follow manufacturer's specifications included with the material.

3.4 PERMANENT GRASSING

- A. See Section 02920 – Grassing.

3.5 INLET SEDIMENT TRAP

- A. Shall be installed at or around all storm drain inlets receiving runoff from disturbed areas. Sediment traps must be self draining unless they are otherwise protected in an approved manner that will not present a safety hazard. The drainage area entering the inlet sediment trap shall be no greater than one acre. Sediment traps may be constructed on natural ground surface, on an excavated surface or on machine compacted fill provided they have a non-erodible outlet.
- B. Type C silt fence supported by steel posts may be used where the inlet drains a relatively flat area (slope no greater than 5%) and shall not apply to inlets receiving concentrated flows, such as in street or highway medians. The stakes shall be spaced evenly around the perimeter of the inlet a maximum of 3' apart and securely driven into the ground, approximately 18" deep. The fabric shall be entrenched 12" and backfilled with crushed stone or compacted soil. Fabric and wire shall be securely fastened to the posts and fabric ends must be overlapped a minimum of 18" or wrapped together around a post to provide a continuous fabric barrier around the inlet. The trap shall be inspected daily and after each rain. Repairs are to be made as needed. Sediment shall be removed once it has accumulated to one-half the height of the trap. **Sediment shall not be washed into the inlet. It shall be removed** from the sediment trap and disposed of and stabilized so it will not enter the inlet again. When the contributing drainage area has been permanently stabilized, all materials and any sediment shall be removed and either salvaged or disposed of properly. The disturbed area shall be brought to proper grade, smoothed and compacted. Appropriately stabilize all disturbed areas around the inlet.
- C. A baffle box shall be used for inlets receiving runoff with a higher volume or velocity. The box shall be constructed of 2" x 4" boards spaced a maximum of 1' apart or of plywood with weep holes 2" in diameter. The weep holes shall be placed approximately 6" on center vertically and horizontally. The entire box shall be wrapped in Type C filter fabric that is entrenched 12" and backfilled. Gravel shall be placed around the box to a depth of 2" to 4". The trap shall be inspected daily and after each rain. Repairs are to be made as needed. Sediment shall be removed once it has accumulated to one-half the

height of the trap. Sediment shall not be washed into **the inlet**. It shall be removed from the sediment trap and disposed of and stabilized so it will not enter the inlet again. When the contributing drainage area has been permanently stabilized, all materials and any sediment shall be removed and either salvaged or disposed of properly. The disturbed area shall be brought to proper grade, smoothed and compacted. Appropriately stabilize all disturbed areas around the inlet.

- D. Sod Inlet Protection shall be used only at the time of permanent seeding, to protect the inlet from sediment and mulch material until permanent vegetation has become established. The sod shall be place to form a turf mat covering the soil for a distance of 4' from each side of the inlet structure. Sod strips shall be staggered so adjacent strip ends are not aligned. Re-sod areas where an adequate stand of sod is not obtained. New sod should be mowed sparingly. Grass height should not be less than 2" to 3".
- E. Curb Inlet Protection shall be used on curb inlets receiving runoff from disturbed areas once pavement has been installed. Place 8" concrete blocks wrapped in filter fabric in front of the curb inlet opening. A gap of approximately 4" shall be left between the inlet filter and the inlet to allow for overflow and prevention of hazardous ponding in the roadway. This method of inlet protection shall be removed if a safety hazard is created. Sediment shall be removed from curb inlet protection immediately.

3.6 SEDIMENT BARRIER

- A. Hay or straw bales may be used in areas of low sheet flow rates. They shall not be use if the project duration is expected to exceed three (3) months. Bales shall be placed in a single row, lengthwise, and embedded in the soil to a depth of 4". Bales must be securely anchored in place by stakes or bars driven through the bales or by other acceptable means to prevent displacement. Bales shall be placed so the binding wire or twine around the bale will not touch the soil. Sediment shall be removed once it has accumulated to one-half the original height of the barrier. Barriers shall remain in place until disturbed areas have been permanently stabilized. All sediment accumulated at the barrier shall be removed and properly disposed of before the barrier is removed. The slope lengths contributing runoff to a bale barrier cannot exceed those listed below:

<u>Maximum Slope Length</u>	
<u>Land Slope</u> (Percent)	<u>Above Bale</u> (Feet)
<2	75
2 to 5	50
5 to 10	35
10 to 20	20
>20	10

- B. Silt fence may be used in areas of higher sheet flow rates. The drainage area shall not exceed **14** acre for every 100' of silt fence. Silt fence shall not be **installed across streams, ditches**, waterways or **other** concentrated flow areas. Silt fence shall be installed according to this specification, as shown on the construction drawings or as directed by the Engineer. See details on the construction drawings for installation requirements.
1. Type A: A 36" wide filter fabric silt fence shall be used on construction sites where the life of the project is greater than or equal to six (6) months.
 2. Type B: A 22" wide filter fabric silt fence shall be limited to use on minor projects, such as residential home sites or small commercial developments where permanent stabilization will be achieved in less than six (6) months.
 3. Type C: A 36" wide filter fabric silt fence with wire reinforcement shall be used where runoff flows or velocities are particularly high or where slopes exceed a vertical height of 10'. Along stream buffers and other sensitive areas, two (2) rows of Type C silt fence or one (1) row of Type C silt fence backed by hay bales shall be used.
- C. Where all runoff is to be stored behind the silt fence (where no storm water disposal system is present), the slope lengths contributing runoff to a silt fence barrier cannot exceed those listed below:

Maximum <u>Land Slope</u> (Percent)	Slope	Length <u>Above Fence</u> (Feet)
<2		100
2 to 5		75
5 to 10		50
10 to 20		25
>20*		15

*In areas where the slope is greater than 20%, a flat area length of 10, between the toe of the slope and the fence shall be provided.

- D. Sediment shall be removed once it has accumulated to one-half the original height of the barrier. Filter fabric shall be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced (approximately six months). Barriers shall remain in place until disturbed areas have been permanently stabilized. All sediment accumulated at the barrier shall be remove and properly disposed of before the barrier is removed.

- E. Temporary silt fences shall be located at all points where surface water can leave the construction area.
- F. Silt fences shall be constructed to remove sediments from flowing water through filtration and sedimentation. Silt fences shall be constructed in accordance with the details shown on drawings.
- G. Silt fences shall be removed and the area restored when permanent erosion control is effective.

3.7 GRADING OPERATIONS

- A. Grading operations shall be scheduled so that ground surface will be disturbed for the shortest possible time before permanent construction is installed. Large areas shall be maintained as flat as possible to minimize soil transport through surface flow.
- B. Wherever steeper slopes or abrupt changes in grade are required, a diversion or berm shall be constructed at the top of slope to cause surface water to flow along the diversion to a control point to be transported down slope in a slope drain. In no case shall surface water be allowed to flow uncontrolled down slopes.

3.8 CONSTRUCTION IN STREAM BEDS

- A. Unless otherwise approved in writing by Engineer, construction operations in rivers, streams and impoundments shall be restricted to those areas that must be entered for the construction of temporary or permanent structures. As soon as conditions permit, rivers, streams and impoundments shall be promptly cleared of all false-work, sheeting or piling which are to be removed, debris and other obstructions. Frequent fording of live streams with construction equipment will not be permitted; therefore, temporary bridges or other structures shall be used whenever an appreciable number of stream crossings are necessary. Unless otherwise approved in writing by Engineer, mechanized equipment shall not be operated in live streams except as may be required to construct channel changes and temporary or permanent structures, and to remove temporary structures.

3.9 RUN-OFF EROSION AND SEDIMENTATION CONTROLS

- A. During construction, route run-off through sedimentation barriers and check dams as practical.
- B. Contractor shall maintain sedimentation devices in functional condition. Sedimentation barriers and check dams shall be cleaned out when these devices are at least 60 percent of their capacity. Defective materials in barriers and check dams shall be replaced.
- C. Contractor shall establish sedimentation barriers at the toe of slopes under construction. These barriers may be relocated and reused after permanent

slope stabilization becomes established. As they are relocated, any defective materials shall be replaced. In addition, all debris and silt at previous location will be removed.

- D. A 6-inch minimum thickness of crushed stone construction exit pad shall be located at all access points to site from public streets in accordance with details shown on drawings. All construction vehicles leaving construction site shall have mud cleaned from their tires at these points to protect public streets from the transportation of sediment from site.

3.10 CHEMICAL MEASURES

- A. Dust Control: Dust raised from vehicular traffic will be controlled by wetting down the access road with water or by the use of a deliquescent chemical, such as calcium chloride, if the relative humidity is over 30%. Chemicals shall be applied in accordance with the manufacturer's recommendations. There shall be no separate payment to the Contractor for dust control measures. Any costs connected thereto shall be a subsidiary responsibility of the Contractor.
- B. Soil Binding:
 - 1. This temporary practice is intended for direct soil surface application to sites where the timely establishment of vegetation may not be feasible or where vegetative cover is absent or inadequate. This temporary practice is not intended for application to surface waters of the state. It is intended for application within construction storm water ditches and storm drains which, feed into previously constructed sediment ponds or basins.
 - 2. Anionic Polyacrylamide (PAM) is available in emulsions, powders, gel bars and logs. It is required that other Best Management Practices be used in combination with anionic PAM. The use of seed and mulch for additional erosion protection beyond the life of anionic PAM is recommended. Use 50' setbacks when applying anionic PAM near natural water bodies. Never add water to PAM, add PAM slowly to water. If water is added to PAM, globs can form which can clog dispensers. This signifies incomplete dissolving of PAM and therefore increases the risk of under application. Application rates shall conform to manufacturer's guidelines.
 - 3. The maximum application rate of PAM, in pure form, shall not exceed 200pounds/acre/year. Contractors using anionic PAM shall obtain and follow all Material Safety Data Sheet requirements and manufacturer's recommendations. Gel bars and logs of anionic PAM mixtures may be used in ditch systems. This application shall meet the same testing requirements as anionic PAM emulsions and powders. Maintenance will consist of reapplying anionic PAM to disturbed areas, including

high traffic areas, which interfere in the performance of this practice.

3.11 CLEANUP AND REMOVAL

- A. At the time, that permanent erosion control is effective, temporary devices and their accumulated sediments shall be removed.
- B. Silts and deposits removed from control barriers shall be placed in eroded areas and shall be replanted.

3.12 CHECK DAMS

- A. Stone: Shall be constructed of graded size 2-10 inch stone underlayed with a geotextile fabric. Mechanical or hand placement shall be required to insure complete coverage of entire width of ditch or swale and center of dam is lower than edges. Sediment shall be removed when it reaches a depth of one-half the original dam height or before.
- C. Haybale: Shall be staked and embedded a minimum of 4" and may be used as temporary check dams in concentrated flow areas while vegetation is becoming established. They should not be used where the drainage area exceeds one acre. Sediment shall be removed when it reaches a depth of one-half the original dam height or before.

3.13 CONSTRUCTION EXITS

- A. A stone stabilized pad shall be located at any point where traffic will be leaving the construction site to a public right-of-way, street, alley, sidewalk, parking area or any other area where there is a transition from bare soil to a paved area. The pad shall be constructed of 1.5" to 3.5" stone, having a minimum thickness of 6" and not less than 20' wide and 50, long. The pad shall be underlayed with a geotextile fabric. The pad shall be maintained in a condition, which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with 1.5" to 3.5" stone. All materials spilled, dropped, washed or tracked from vehicles or site onto roadways or into storm drains must be removed immediately.

3.14 FILTER RING

- A. Shall surround all sides of the structure receiving runoff from disturbed areas. It shall be placed a minimum of 4' from the structure. It may also be used below storm drains discharging into detention ponds, creating a centralized area for sediment accumulation. When utilized below a storm drain outlet, it shall be placed such that it does not create a condition causing water to back-up into the storm drain and inhibit the function of the storm drain system. The larger stone can be faced with smaller filter stone on the upstream side for added sediment filtering capabilities. Mechanical or hand placement of stone

shall be required to uniformly surround the structure.

- B. Filter ring must be kept clear of trash and debris. This requires continuous monitoring and maintenance, which includes sediment removal when one-half full. Filter rings are temporary and should be removed when the site has been stabilized.

3.15 STORM DRAIN OUTLET PROTECTION

- A. Outlet protection aprons shall be constructed at all storm drain outlets, road culverts, paved channel outlets discharging into natural or constructed channels. Apron will extend from end of the conduit, channel or structure to the point of entry into an existing stream or publicly maintained drainage system. Apron length, width and stone size shall conform to details on the construction drawings. Apron shall be constructed with no slope along its length. Invert elevation of the downstream end of apron shall be equal to the elevation of the receiving channel invert. There shall be no overfall at the end of apron. Apron shall be located so there are no bends in the horizontal alignment.
- B. Subgrade for geotextile fabric and rip-rap shall follow required lines and grades shown on the construction drawings. Compact any subgrade fill required to the density of surrounding undisturbed material. Low areas in subgrade on undisturbed soil may also be filled by increasing rip-rap thickness. Geotextile fabric shall be protected from punching or tearing during installation. Repair any damage by removing rip-rap and placing another piece of fabric over the damaged area. All connecting joints shall overlap a minimum of 1'. If damage is extensive, replace entire geotextile fabric. Rip-rap shall be placed by equipment or hand. Minimum thickness of rip-rap shall be 1.5 times the maximum stone diameter. Immediately after construction, stabilize all disturbed areas around apron with vegetation.
- C. Check outlet apron after heavy rains to see if any erosion around or below the rip-rap has taken or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

3.16 MONITORING AND REPORTING

- A. Each day, when any type of construction activity takes place on the construction site, Contractor's qualified personnel shall monitor and record rainfall, inspect all areas where petroleum products are stored, used or handled for spills and leaks from vehicles and equipment and check all locations where vehicles enter or exit the site for evidence of off site sediment tracking. These inspections shall be conducted until a Notice of Termination (NOT) is submitted. For linear construction where a phased activity is conducted, this paragraph applies to the active phase(s) of work.
- B. Once every seven (7) calendar days and within 24 hours of the end of a storm 0.5 inches or greater, Contractor's qualified personnel shall inspect

disturbed areas of the construction site that have not undergone final stabilization, areas used for storage of materials that are exposed to precipitation that have not undergone final stabilization and structural control measures (BMPs). Erosion and sediment control measures identified in the Erosion, Sedimentation and Pollution Control Plan shall be observed to ensure they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving water(s). These inspections must be conducted until a Notice of Termination is submitted. For linear construction where a phase activity is conducted, this paragraph applies to the active phase(s) of work.

- C. Contractor's qualified personnel shall inspect at least once per month during the term of the General Permit, areas of the construction site having undergone final stabilization. These areas should be inspected for evidence of, or the potential for, pollutants entering the drainage system and receiving water(s). Erosion and sediment control measure shall be observed to ensure they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measure are effective in preventing significant impacts to receiving water(s). For linear construction, monthly inspections in accordance with this paragraph shall be made for those phases on which final stabilization has been completed.
- D. Contractor shall prepare a report summarizing the scope of inspections, name(s) of qualified personnel making the inspections, date(s) of inspections, major observations relating to the implementation of the Erosion, Sedimentation and Pollution Control Plan and any actions taken. This report shall be retained on the construction site or be readily available at a designated alternate location until the entire site or portion of a construction project that was phased, has undergone final stabilization and a Notice of Termination (NOT) is submitted to EPD. Such reports shall identify any incidents of non-compliance. Where the report does not identify any incidents of non-compliance, the re report shall contain a certification that the facility is in compliance with the Erosion, Sedimentation and Pollution Control Plan and the General Permit. The report shall be signed in accordance with the General Permit.

3.17 SAMPLING AND ANALYSIS

- A. Contractor must manually or automatically sample in accordance with the Comprehensive Monitoring Plan (CMP) at least once for each rainfall event described below. For a qualifying event, samples must be taken within forty-five (45) minutes of:
 - 1. The accumulation of the minimum amount of rainfall, if the storm water discharge to a monitored receiving water or from a monitored outfall has begun at or prior to the accumulation, or

2. The beginning of any storm water discharge to a monitored receiving water or from a monitored outfall, if the discharge begins after the accumulation of the minimum amount of rainfall.
 3. However, where manual and automatic sampling are impossible (as defined in the permit), or are beyond the Contractor's control, the Contractor shall take samples as soon as possible, but in no case more than twelve (12) hours after the beginning of the storm water discharge.
- B. Sampling shall occur for the following events:
1. For each area of the site that discharges to a receiving stream, the first rain event that reaches or exceeds 0.5 inch and allows for monitoring during normal business hours* (Monday thru Friday, 8:00 AM to 5:00 PM and Saturday 8:00 AM to 5:00 PM when construction activity is being conducted by the Contractor) that occurs after all clearing and grubbing operations have been completed in the drainage area of the location selected as the sampling location;
 2. In addition to (1.) above, for each area of the site that discharges to a receiving stream, the first rain event that reaches or exceeds 0.5 inch and allows for monitoring during normal business hours* that occurs either 90 days after the first sampling event or after all mass grading operations have been completed in the drainage area of the location selected as the sampling location, whichever comes first;
 3. At the time of sampling performed pursuant to (1.) and (2.) above, if BMP's are found to be properly designed, installed and maintained, no further action is required. If BMP's in any area of the site that discharges to a receiving stream are not properly designed, installed and maintained, corrective action shall be defined and implemented within 2 business days, and turbidity samples all be taken from discharges from that area of the site for each subsequent rain event that reaches or exceeds 0.5 inch during normal business hours* until the selected turbidity standard is attained, or until post-storm event inspections determine that BMP's are properly designed, installed and maintained; and
- D. Sampling shall be collected by "grab samples" and the analysis of these samples must be conducted in accordance with methodology and test procedures established by 40 CFR Part 136 (unless other test procedures have been approved); the guidance document titled "NPDES Storm Water Sampling Guidance Document, EPA 833-B-92-001" and guidance documents that may be prepared by the EPD.
1. Sample containers should be labeled prior to collecting the samples.
 2. Samples should be will mixed before transferring to a secondary

container.

3. Large mouth, well cleaned and rinsed glass or plastic jars should be used for collecting samples. The jars should be cleaned thoroughly to avoid contamination.
4. Manual, automatic or rising stage sampling may be utilized. Samples required by this permit should be analyzed immediately, but in no case later than 48 hours after collection. However, samples from automatic samplers must be collected no later than the next business day after their accumulation, unless flow through automated analysis is utilized. Dilution of samples is not required. Samples may be analyzed directly with properly calibrated turbidimeter. Samples are not require to be cooled.
5. Sampling an analysis of the receiving waters or outfalls beyond the minimum frequency stated in this permit must be reported to EPD as specified in the General Permit.

E. For construction activities the contractor must sample all receiving waters or all outfalls or a combination of receiving waters and outfalls. Samples taken for the purpose of compliance with this permit shall be representative of the monitored activity and representative of the water quality of the receiving waters and/or the storm water outfalls using the following minimum guidelines.

1. The upstream sample for each receiving water(s) must be taken immediately upstream of the confluence of the first storm water discharge from the permitted activity (i.e., the discharge farthest upstream at the site) but downstream of any other storm water discharges not associated with the permitted activity. Where appropriate, several upstream samples from across the receiving water(s) may need to be taken and the average turbidity of these samples used for an upstream turbidity value.
2. The downstream sample for each receiving water(s) must be taken downstream of the confluence of the last storm water discharge from the permitted activity but upstream of any other storm water discharge not associated with the permitted activity. Where appropriate, several downstream samples from across the receiving water(s) may need to be taken and the average turbidity of these samples used for a downstream turbidity value.
3. Ideally the samples shall be taken from the horizontal and vertical center of the receiving water(s) or the storm water outfall channel(s).
4. Care shall be taken to avoid stirring the bottom sediments in the receiving water(s) or in the outfall storm water channel(s).

5. Sampling container shall be held so the opening faces upstream.
 6. Samples shall be kept from floating debris.
-
- F. Contractor shall provide and implement all safety equipment and procedures necessary for sampling during hazardous weather conditions and in the event of biological, chemical or physical hazards
 - G. Contractor shall submit a summary of the monitoring results to the EPD at the address shown in the General Permit by the fifteenth day of the month following the reporting period. For a monitoring period during which no qualifying rainfall events occur, a monitoring report must be submitted stating such. Monitoring periods are calendar months beginning with the first month after the effective date of the General Permit. Monitoring reports shall be signed in accordance with the General Permit and submitted to EPD until such time as a NOT is submitted.
 - H. Contractor must retain copies of all monitoring results and monitoring information reported. In addition to other record keeping requirements, the monitoring information shall include:
 1. Date, exact place and time of sampling or measurements.
 2. Name(s) of the individual(s) who performed the sampling and measurements.
 3. Date(s) analyses were performed.
 4. Time(s) analyses were initiated.
 5. Name(s) of the individual(s) who performed the analyses.
 6. References and written procedures, when available, for the analytical techniques or methods used. A quality control/quality assurance program must be included in the written procedures.
 7. The results of such analyses, including the bench sheets, instrument readouts, computer disks or tapes, used to determine these results.

END OF SECTION

SECTION 02445

JACK AND BORE CROSSINGS

PART 1 - GENERAL

1.1 SCOPE

- A. The work covered by this Section includes furnishing all labor, materials, and equipment required to bore and jack casings and to properly complete pipeline construction as described herein and/or shown on the construction drawings.

1.2 RELATED SECTIONS

- A. Section 02535 – Sanitary Sewer Collection Systems

1.3 REGULATORY REQUIREMENTS

- A. General: Supply all materials and perform all work in accordance with applicable American Society of Testing Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards. Latest revision of all standards are applicable. If requested by the County, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least 2 years.

1.4 SUBMITTALS

- A. Submit shop drawings, product data, and experience.
- B. Material Submittals: The Contractor shall provide shop drawings and other pertinent specifications and product data as follows:
 - 1. Shop drawings for casing pipe showing sizes and connection details.
 - 2. Casing Spacers.
- C. Experience Submittals: Boring and jacking casing is deemed to be specialty contractor work. If the Contractor elects to perform the work, the Contractor shall provide evidence as required by the General Conditions. A minimum of five continuous years of experience in steel casing construction is required of the casing installer. Evidence of this experience must be provided with the shop drawings for review by the Owner and their Engineers.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Material shall be unloaded in a manner that will avoid 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.

PART 2 – PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

- A. The casing pipe shall be new and unused steel pipe, conforming to ASTM A-139, Grade B, electric fusion welded steel pipe, having a minimum yield strength of 35,000 psi. The exterior and interior of the steel casing pipe shall be coated with a coal tar varnish.
- B. The thickness of casing shown in paragraph B below are minimum thicknesses. Actual thicknesses shall be determined by the casing installer, based on evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired at no additional cost to the Owner.
- C. The diameters of casing shown in Paragraph D below and shown on the drawings are minimum. Larger casings, with the Owner and/or Engineer's approval, may be provided at no additional cost to the Owner, for whatever reasons the Contractor may decide, whether casing size availability, line and grade tolerances, soil conditions, etc.
- D. Casing Sizes:

UNDER RAILROADS		
PVC (Water or Force		
<u>Main) Pipe Dia. In.</u>	<u>Casing Pipe In.</u>	<u>Wall Thickness In.</u>
4	10"	0.250
6	12"	0.250
8	16"	0.250
10	18"	0.281
12	20"	0.281
16	24"	0.312
18	30"	0.406
24	36"	0.469

UNDER HIGHWAYS

PVC (Water or Force

<u>Main) Pipe Dia. In.</u>	<u>Casing Pipe In.</u>	<u>Wall Thickness In.</u>
4	8"	0.250
6	12"	0.250
8	16"	0.250
10	16"	0.250
12	18"	0.250
16	24"	0.250
18	30"	0.250
24	36"	0.250

- E. Casing Spacers: Casing spacers shall meet one of the following requirements:
1. Casing spacers shall be flanges, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing. Casing spacers shall be Cascade waterworks Manufacturing Company or Advanced Products & Systems, Inc., or equivalent product approved by the Engineer.
 2. Casing spacers shall be a two-section, flanged bolted on style constructed of heat fused PVC coated steel, minimum 14 gauge band and 10 gauge risers, with 2-inch wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware shall be Pipeline Seal and Insulator, Inc., or equivalent as approved by the Engineer.
- F. Carrier Pipe: Carrier pipe shall meet requirements as specified in these Specifications.

2.2 EQUIPMENT

- A. A cutting head shall be attached to a continuous auger mounted inside the casing pipe.

PART 3 – EXECUTION

3.1 GENERAL

- A. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor. Any subsurface investigation by the bidder or Contractor must be approved by the appropriate authority having jurisdiction over the site.
- B. Casing construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from casing operations and shall repair and restore damaged property to its original or better condition at no cost to the Owner.
- B. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing.
- C. Casing Design: Design of the bore pit and required bearing to resist jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor, at no additional cost to the Owner. Due to restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal 20-foot length may be necessary.
- D. Highway Crossing:
 - 1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
 - 2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.
 - 3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
 - 4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.

5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.
6. The Contractor shall be responsible for providing the Owner and/or Engineer sufficient information to obtain a blasting permit in a timely manner.

F. Railroad Crossing:

1. The Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.
2. Additional insurance is required for each railroad crossing. The Contractor shall furnish the Railroad with such additional insurance as may be needed, cost of the same shall be borne by the Contractor.
3. All work on the Railroad right-of-way, including necessary support of tracks, safety of operations and other standard and incidental operation procedures may be under the supervision of the appropriate authorized representative of the Railroad affected and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.
4. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall coordinate such work and shall reimburse the Railroad, in cash, for such services, in accordance with accounting procedures agreed on by the Contractor and affected Railroad before construction is started.
5. No blasting shall be permitted within the Railroad right-of-way.

3.2 GROUNDWATER CONTROL

- A. The Contractor shall control the groundwater throughout the construction of the casing.
- B. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Owner immediately and take such action as necessary to maintain safe conditions and prevent damage.
- C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24-hour basis keeping excavations

free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap and comply with requirements specified in Section 02300 of these Specifications.

3.3 SAFETY

- A. Provide all necessary bracing, bulkheads, and shields to ensure complete safety to all traffic persons and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. If in the opinion of the Engineer the installation is being conducted in an unsafe manner, the Contractor will be required to stop work and bulkhead the heading until suitable agreements are reached between the Contractor and the Engineer.
- B. Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.
- C. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI AIO.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons".

3.4 BORING AND JACKING

- A. Shaft:
 - 1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.
 - 2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to site and soil conditions. Keep preparations dry during all operations. Perform pumping operations as necessary.
 - 3. The bottom of the shaft shall be firm and unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if directed by the Engineer due to soil conditions.

B. Jacking Rails and Frame

1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
 2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand 0 jacking forces and loads.
 3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.
- C. Boring and jacking of casing pipes shall be accomplished by the dry auger boring method without jetting, sluicing or wetboring.
- D. Auger the hole and jack the casing through the soil simultaneously.
- E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe to be installed.
- F. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing piping penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such as to require the use of a shield.
- G. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation. For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum intervals of 60 feet.
- H. Any casing pipe damaged in jacking operations shall be repaired, if approved by the Owner and/or Engineer, or removed and replaced at Contractor's own expense.
- I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire joint circumference, in accordance with AWS recommended procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.

- J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.
- K. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.
- L. Care should be taken to ensure that casing pipe installed by boring and jacking method will be at the proper alignment and grade.
- M. The Contractor shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.
- N. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing should be left in place, cut off, or removed, as designated by the Owner and/or Engineer.
- O. Trench excavation, all classes and type of excavation, the removal of rock, muck, debris, the excavation of all working pits and backfill requirements of Section 02260 – Trench Excavation and Support are included under this Section.
- P. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.
- Q. Grout backfill shall be used for unused holes or abandoned pipes.

3.5 FREE BORING

- A. Where the Drawings indicate a pipeline is to be installed by boring without casing, the Contractor shall construct the crossing by the free bore method. The free bore method shall be accomplished by the dry auger boring method without jetting, sluicing, wet boring, or by “punching”.
- B. The diameter of the free bore shall not exceed the pipe bell outside diameter or the pipe barrel outside diameter plus 1-inch, whichever is greater.
- C. Free boring, where indicated on the Drawings, is to be performed at the Contractor’s option. The Contractor may choose to construct the crossing by the conventional bore and jack casing methodology.
- D. The Contractor shall be responsible for any settlement of the roadway caused by the free bore construction activities.

- E. If the Contractor elects to free bore, and an acceptable installation does not result for any reason, the Contractor shall install a casing pipe by the bore and jack method.

3.6 VENTILATION AND AIR QUALITY

- A. Provide, operate and maintain for the duration of casing project a ventilation system to meet safety and OSHA requirements.

3.7 ROCK EXCAVATION

- A. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the Owner and/or Engineer, cannot be removed through the casing, the Owner and/or Engineer may authorize the Contractor to complete the crossing by a method established in a change order.
- B. At the Contractors option, the Contractor may continue to install the casing and remove the rock through the casing at no additional cost to the Owner and/or Engineer.

3.8 INSTALLATION OF PIPE

- A. After construction of the casing is complete, and has been accepted by the Owner, install the pipeline in accordance with the Drawings and Specifications.
- B. Check the alignment and grade of the casing and prepare a plan to set the pipe at proper alignment, grade and elevation, without any sags or high spots.
- C. The carrier pipe shall be held in the casing pipe by one of the following methods:
 - 1. The carrier pipe shall be held in the casing pipe by the use of hardwood blocks spaced radially around the pipe and secured together so that they remain firmly in place. The spacing of such blocks longitudinally in the casing pipe shall not be greater than 10 feet.
 - 2. The pipe shall be supported within the casing by use of casing spacers sized to limit radial movement to a maximum of 1 inch. Provide a minimum of one casing spacer per nominal length of pipe. Casing spacers shall be attached to the pipe at maximum 18 to 20 foot intervals.
- D. Close the ends of the casing with 4-inch brick walls or seal ends with one piece synthetic rubber especially formulated for sealing casing/carrier pipe.

3.9 SHEETING REMOVAL

- A. Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring, and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties, and also to avoid cave-ins or sliding in the banks.

END OF SECTION

SECTION 02519

PIPING, TESTING AND ACCEPTANCE

PART 1 GENERAL

1.1 SUMMARY

- A. The testing requirements covered under this Section shall apply to all piping systems covered under Section 02535 of these specifications.
- B. Manholes shall also be subject to testing specified herein. Refer to Section 02640.
- C. All testing shall be in accordance with the appropriate City of LaGrange Department Standards.

1.2 SUBMITTALS

- A. Submittals shall conform to the requirements of these Specifications and shall include a description of the testing procedures to be employed and the report form to be furnished.

PART 2 PRODUCTS

2.1 TEST MEDIUMS

- A. Provide the necessary water required for testing the Work. The Contractor shall furnish all other test mediums. The Contractor shall furnish all equipment, piping and labor to transport water from its source to the test locations for use in testing.

2.2 TEST EQUIPMENT

- A. The Contractor shall furnish all labor and equipment, including pumps with regulated bypass meters and gauges, for conducting of the piping tests.

PART 3 EXECUTION

3.1 GENERAL

- A. The Contractor shall be responsible for all associated testing costs.
- B. The entire length of all pressurized piping and gravity lines shall be field tested for tightness by a test as described in this Section.
- C. The timing and sequence of testing shall be scheduled by the Contractor. The Contractor shall provide the Owner's Representative with a minimum of 24 hours notice prior to the start of any test. All tests must be observed by the appropriate City of LaGrange Department.

- D. The Contractor shall repair any leaks discovered during the initial filling of the piping and during the testing sequence. All known and visible leaks shall be repaired, whether or not the leakage rate is within allowable limits.
- E. Piping shall include gravity and pressure sewer and sludge lines; potable and non-potable water lines, whether cast iron, ductile iron, steel, copper or PVC. Storm drains shall be exempted from testing required by this Section.
- F. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the lines by means of rods, swabs, or other instruments. Flush out lines and manholes before final inspection.

3.2. GRAVITY PIPING

- A. Pipe lines shall be straight and show a uniform grade between manholes. Correct any discrepancies discovered during inspection.
- B. Pipe joints for pipelines 30-inches in diameter and larger shall be air tested individually. The joint tester assembly shall be placed over the joint and shall pressurize the joint area to 4 psi. The pressure shall not drop more than 2 psi in 10 seconds. The joint tester assembly shall be supplied by Cherne Industries, Inc.
- C. Infiltration Tests: Use only when groundwater is two feet above the top of the pipe.
 - 1. Install weirs in manholes to determine the leakage of ground water into the sewer. Measure leakage only when all visible leaks have been repaired and the ground water is two feet above the top of the pipe. If leakage in any section of the pipeline exceeds 100 gpd/inch/diameter/mile, locate and repair leaks. After repairs are completed, re-test for leakage.
 - 2. Furnish, install and remove the weirs, plugs and bulkheads required to perform the leakage tests. Where continuous monitoring of flow level is required, the Contractor shall provide and operate monitoring equipment.
- D. Exfiltration Tests: Hydrostatically test piping when groundwater is not two feet above the top of the pipe.
 - 1. The segment will be plugged and filled with water to introduce head not to exceed 15 feet (6.5 psig) in any portion of the segment. Test period shall be 24 hours. If exfiltration exceeds 100 gpd/inch diameter/mile, the Contractor must locate and repair the leaks. The Contractor will be responsible for furnishing, installing and removing the weirs, bulkheads, and plugs used during testing.

2. An approved air pressure test may be used as an alternate to the above. The portion of the line segment being air tested shall be termed "acceptable" if the allocated line pressure decreases less than one psi in the time for the given diameter as follows:
 - 1) 4", 0.3 minutes per 100 ft.
 - 2) 6", 0.7 minutes per 100 ft.
 - 3) 8", 1.2 minutes per 100 ft.
 - 4) 10", 1.5 minutes per 100 ft.
 - 5) 12", 1.8 minutes per 100 ft.
 - 6) 15", 2.1 minutes per 100 ft.
 - 7) 18", 2.4 minutes per 100 ft.
 - 8) 21", 3.0 minutes per 100 ft.
 - 9) 24", 3.6 minutes per 100 ft.
 3. Air testing procedures shall follow guidelines outlined in ASTM specification C828, C924 and/or Uni-Bell B6. The sealed pipe shall be pressurized to 5 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs.
- E. Contractor shall conduct all testing including equipment and labor in the presence of the appropriate City of LaGrange Department.
- F. Test all gravity sewers for excessive deflection by passing a "mandrell" through the line with a diameter equal to 95% of the pipes inside diameter. Excavate and reinstall any section of pipe not passing this test. Retest until results are acceptable. Contractor shall clean the gravity line with a "pig" prior to testing. Flush out lines and manholes before testing and inspection. This test shall be performed within the first thirty days of installation and during final inspection, at the end of this contract.

3.3 PRESSURE AND LEAKAGE TESTS (PRESSURIZED PIPE):

- A. Pressure During Test: Immediately after the pipe has been laid and backfilled, but prior to the placement of pavement, each valved section of newly laid pipe shall be subjected to a leakage and pressure test. For any section being tested the pressure applied shall be such that at the highest point in the section, the pressure shall be 150 pounds per square inch.

- B. Duration of Test: The duration of each pressure test shall be two (2) hours.
- C. Cleaning: For pipelines less than 24-inches in diameter, flush pipeline section thoroughly at flow velocities greater than 2.5 feet per second, adequate to remove debris from pipe and valve seats. For pipelines 24-inches in diameter and larger, the main shall be carefully swept clean and mopped. Partially operate valves and hydrants to clean out seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.
- D. Procedures:
 - 1. Each valved section of pipe shall be slowly filled with water and the specified test pressure, measured at the point of highest elevation shall be supplied by means of a pump connected to the pipe in a acceptable manner. The pump, pipe connection, and all apparatus, gauges, and meters shall be furnished by the contractor. The contractor shall furnish all labor and assistance in conducting the tests. All testing shall be performed prior to tying into the existing water supply. Contractor shall provide temporary blocking, bulkheads flanges and plugs to assure all new pipes, valves and appurtenances will be pressure tested.
 - 2. Differential pressure at valves and hydrants shall equal the maximum possible, but shall not exceed the manufacturer's pressure rating. Where necessary, provide temporary back pressure to meet the differential pressure restrictions.
 - 3. Valves and hydrants shall not be operated in either the opening or closing direction at differential pressures above their rated pressure.
- A. Expelling Air Before Tests: Before applying the specified test pressure, all air shall be expelled from the pipe.
- B. Examination Under Pressure: At intervals during the test, the route of the pipe line shall be inspected to locate any leaks or breaks. Any cracked or defective joints, cracked or defective pipe, fittings or valves discovered in consequence of this pressure test shall be removed and replaced with sound material in the manner provided and the test shall be repeated until satisfactory results are obtained. All visible leaks shall be repaired regardless of leakage test results.
- C. Permissible Leakage: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, of any valved section thereof, to maintain the specified leakage test pressure after the pipe has been filled with water and the air in the pipeline has been expelled. No installation will be accepted if leakage is greater than that determined by the formula:

1. $L = (SD(P^{0.5}))/7,400$ Where:
 2. L is the allowable leakage, in gallons per hour, per 1000 feet; S is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.
 3. The allowable leakage shall not be greater than 11.65 gallons/day/mile of pipe/nominal diameter (inches) at 150 psi pressure. The leakage testing procedure shall conform to AWWA C-600 or latest addition.
- H. Completion: After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.

3.4 MANHOLES

- A. Prior to testing manholes for water tightness, all liftholes shall be plugged with a non-shrink grout, all joints between precast sections shall be properly sealed and all pipe openings shall be temporarily plugged and properly braced. Each manhole shall pass one of the following tests:
1. Exfiltration Tests: The manhole, after preparation as noted above, shall be filled with water. The maximum allowable leakage shall be 0.1 gallon per hour per foot of diameter per foot of depth. Tests shall last a minimum of eight hours. The manholes may be backfilled prior to testing.
 2. Vacuum Tests: The manhole, after preparation as noted above, shall be vacuum tested prior to backfilling. The test head shall be placed at the inside of the top of the cone section and the compression head inflated to 40 psi to effect a seal between the vacuum base and the manhole structure. Connect the vacuum pump to the outlet port with the valve open. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9-inches. The manhole shall pass if the time is greater than 60 seconds for 48-inch diameter manholes. If the manhole fails the initial test, necessary repairs shall be made with non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained. Vacuum testing equipment shall be as required by the appropriate City of LaGrange Department.

3.5 REPAIRS

- A. If the leakage exceeds the specified allowable limits, the point or points of leakage shall be sought out and remedied by the Contractor.

3.6 FLUSHING AND CLEANING

- A. The systems shall not be used, except for chemical cleaning, until cleaning has been accomplished.

3.7 FINAL ACCEPTANCE

- A. No pipeline installation shall be accepted until all known and visible leaks have been repaired, whether or not the leakage is within the maximum allowable limits.
- B. The Contractor will certify that all required tests have been successfully completed before the Work is accepted.

END SECTION

SECTION 02535
SANITARY SEWERS

PART 1 GENERAL

1.1 SCOPE

- A. This Section describes products to be incorporated into sewers and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.
- C. All work shall be done in accordance with the City of LaGrange Public Works Standards.

1.2 RELATED SECTIONS

- A. Section 02230 – Clearing and Grubbing
- B Section 02250 – Sheeting, Shoring, and Bracing
- C. Section 02300 – Earthwork
- D. Section 02315 – Trench Excavation and Support
- E. Section 02920 - Grassing

1.3 REFERENCES

- A. ASTM Specifications
 - 1. ASTM D 3740-94a – Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 2. ASTM E 329-93b – Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 - 3. ASTM D 3034-94 – Type PSM PVC Sewer Pipe and Fittings.
 - 4. ASTM D 2321-89 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Installations.

5. ASTM A 746-95 – Ductile Iron Gravity Sewer Pipe.
6. ASTM D 3212-92 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
7. ASTM F 477-95 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
8. ASTM D 3139-95 – PVC Pressure-Rated Pipe (SDR-Series).
9. ASTM D 3139-95 – Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seams.
10. ASTM A 139-93a – Electric-Fusion (Arc) Welded Steel Pipe (NPS 4 and over).
11. ASTM C 478-94 – Precast Reinforced Concrete Manhole Sections.
12. ASTM C 443-94 – Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
13. ASTM C 39-94 - Compressive Strength of Cylindrical Concrete Specimens.
14. ASTM C 890-91 – Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.
15. ASTM C 891-90 – Installation of Underground Precast Concrete Utility Structures.
16. ASTM C 913-89 – Precast Concrete Water and Wastewater Structures.
17. ASTM A 615/A 615 M-95b – Deformed and Plain Billet – Steel Bars for Concrete Reinforcement.
18. ASTM D 2922-91 – Test Methods for Density of Soil and Soil Aggregate In Place By Nuclear Methods (Shallow Depths).
19. ASTM D 1557-91 – Laboratory Compaction Characteristics of Soil Using Modified Effort.
20. ASTM D 1556-90 – Density and Unit Weight of Soil in Place by the Sand Cone Method.
21. ASTM D 714-87 (Reapproved 1994) – Evaluation Degree of Blistering Paints.

22. ASTM D 2794-93 – Resistance of organic Coatings to the Effects of Rapid Deformation (Impact).
23. ASTM E 96-95 – Water Vapor Transmission of Materials.
24. ASTM A 377-95 – Index and Specifications for Ductile Iron Pressure Pipe and Fittings.
25. ASTM C890-73 (Latest Revision) – Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete for Water and Wastewater Structures.
26. ASTM C891-78 (Latest Revision) – Standard Practice for Installation of Underground Precast Concrete Utility Structures.
27. ASTM C913-79 (Latest Revision) – Precast Concrete Water and Wastewater Structures.

B. ANSI/AWWA Specifications

1. ANSI/AWWA C 150/A-21.50-96 – Thickness Design of Ductile Iron Pipe.
2. ANSI/AWWA C 151/A-21.51-91 – Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
3. ANSI/AWWA C-500-93 – Metal-Seated Gate Valves for Water Supply Service.
4. ANSI/AWWA C-509-94 – Resilient-Seated Gate Valves for Water Supply Service.
5. ANSI/AWWA C 111/A 21.11-95 – Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
6. ANSI/AWWA C 600-93 – Installation of Ductile Iron Water Mains and their appurtenances.

C. ACI Specifications

1. ACI 318-89 – Building code Requirements for Reinforced Concrete.

D. AASHTO Guidelines

1. AASHTO T 191-91 – Density of Soil in-Place by the Sand-Cone Method.

1.4 QUALIFICATIONS

- A. If requested by the Owner, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.5 SUBMITTALS

- A. Submittals Required: The Contractor shall furnish to the Engineer and Owner for review in accordance with the procedure outlined below, drawings and descriptive literature for all manufactured or fabricated products. Additional information such as special drawings, schedules, calculations and curves, shall be provided as specifically requested by the Engineer and/or Owner.
- B. Contractor's Review: The Contractor shall review and check drawings and submittals. He shall indicate his review by initials and date. The Contractor shall furnish the Engineer with a minimum of five copies of all submittals. A transmittal form shall accompany each submittal or group of submittals.
- C. Engineer's Review:
 - 1. All submittals will be reviewed, stamped, and dated by the Engineer before they are returned to the Contractor.
 - 2. One copy of reviewed submittals will be returned to the Contractor and the remaining copies retained by the Engineer.
 - 3. Submittals requiring minor corrections will be so noted. Drawings must be resubmitted for review prior to installation or use of products.
- D. Drawings for Construction: Drawings or other submittals not bearing the Engineer's review notation shall not be issued to subcontractors or utilized for construction purposes. The Contractor shall maintain at the job site a complete set of construction drawings bearing the Engineer's review.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.
- C. Lined pipe shall be handled and transported to prevent damage to linings.

- D. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.
- E. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times.
- F. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipes in adjacent tiers.
- G. Store joint gaskets in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- H. Conditions for Delivery and Handling of Pump Station: The manufacturer shall coordinate with the contractor so that the station is delivered to the job site on the day of, or the day before the installation. Lifting pins shall be provided by the manufacturer to insure proper handling of the station structures. After delivery to the job site, the contractor shall store the control panel off the ground in a dry location until such time as it is mounted and supplied with electrical service. The contractor shall also insure that all pump power and control cables, as well as float cables are protected from submergence until they are properly installed.

1.7 QUALITY ASSURANCE

- A. Product manufacturers shall provide the Owner with written certification that all products furnished comply with all applicable provisions of these Specifications.
- B. If ordered by the Owner, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.
- C. The Contractor shall furnish the Engineer and the Owner a description of all material before ordering. The Engineer will review the Contractor's submittals and provide in writing an acceptance or rejection of material.
- D. Where ductile iron pipe is indicated on the plans, or required by the Engineer, it shall be used.
- E. Material and equipment shall be the standard product of a manufacture who has manufactured them for a minimum of 2 years and who provides published data on the quality and performance of the product.

- F. Qualifications of Pump Manufacturer: The manufacturer shall demonstrate the ability to fabricate the various pump station structure components, as specified, utilizing adequate numbers of skilled workmen, tools, and facilities. To insure proper quality control and supervision, all factory cast concrete units shall be poured and vibrated, using steel forms, in the same PCI (Prestressed Concrete Institute) certified manufacturing facility used for the complete assembly of all pump station components and their equipment.
- G. A subcontractor for any part of the work must have experience on similar work and if required, furnish the Engineer with a list of projects and the Owners or Engineers who are familiar with his competence.
- H. Devices, equipment, structures, and systems not designed by the Engineer that the Contractor wishes to furnish shall be designed by either a registered professional engineer or by someone the Engineer accepts as qualified. If required, the Engineer or Owner shall furnish complete design calculations and assumptions before acceptance.
- I. Soil testing shall be done 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.
- J. Infiltration, line and grade of sewer, pump performance, and hydrostatic tests on force mains shall be made by the Contractor with equipment qualified by the Engineer and in the presence of the Engineer. The Engineer or his representatives reserves the right to accept or reject testing equipment.

1.8 WARRANTY

- A. The Contractor shall guarantee the quality of the materials, equipment, and workmanship for 12 months after acceptance of the completed Project. Defects discovered during that period shall be repaired by the Contractor at no cost to the Owner. The Performance Bond shall reflect this guarantee.
- B. The manufacturer shall guarantee the complete pump station to be free from defects in material and workmanship for a period of five years from the date of start-up and acceptance.

1.9 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 are unknown facilities not shown on plans will not relieve the Contractor of his responsibility under this requirement. "Existing Utilities Facilities" means any utility that exist on the project in its original, relocated, or newly installed position. The Contractor will be held responsible for the cost of repairs to damaged underground facilities, even when such facilities are not shown on the

plans. The Contractor shall contact all utility companies prior to beginning work and request an accurate field location of their respective utility lines.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All pipe shall be subject to inspection at the pipe plant, trench or other point of delivery for the purpose of culling and rejecting pipe, independent of laboratory tests, which does not conform to the requirements of these specifications. The manufacturer of the pipe shall submit evidence of having consistently produced both pipe and joints of satisfactory quality and performance results in service over a period of at least five (5) years.
- B. Stone: All bedding, haunching, and trench stabilization stone shall be crushed granite.

2.2 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

- A. Acceptability of PVC pipe for gravity sewers is indicated in the following table:

Standard Min Thick Type PVC¹	Wall	Acceptable Manufacturers	≤ 6	8to15	18	21	24
ASTM D 3034 SDR 26 12454B	SW	Open	Yes	Yes	No	No	No
ASTM F 679 T-1 12454C	SW	Open	No	No	Yes	Yes	Yes
ASTM F 794 Series 46 12454C	OP	Ultra-Rib	No	No	No	No	Yes
ASTM F 794 Series 46 12454C	CP	Vylon	Yes	No	No	No	Yes

¹ As specified in ASTM D 1784

SW Solid Wall
OP Open Profile
CP Closed Profile

Open shall mean any manufacturer whose products meet the specified standard is acceptable.

- B. All pipe shall have a minimum pipe stiffness of 46 psi at five percent deflection as determined by ASTM D 2412.

- C. PVC gravity sewer pipe shall be supplied in lengths not longer than 13 feet.
- D. Each length of pipe shall be marked with the manufacturer's name, trade name, nominal size, class, hydrostatic test pressure, manufacturer's standard symbol to signify it was tested, and date of manufacture. Each rubber ring shall be marked with the manufacturer's identification, the size, the year of manufacture, and the classes of pipe with which it can be used.
- E. Fittings 15 inches in diameter and less shall be manufactured in accordance with ASTM D 3034. PVC compound shall be 12454B or 12454C as specified in ASTM D 1784.
 - 1. For sizes 8-inches and less in diameter, fittings shall be molded in one-piece with no solvent welded joints. Minimum socket depths shall be as specified in ASTM D 3034, Table 2.
 - 2. For sizes 10-inches and larger in diameter, fittings shall be fabricated from pipe conforming to ASTM D 3034 using solvent welding. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings shall be delivered ready for use.
- F. Joints: Joints for pipe and fittings shall be of the integral bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage, when tested in accordance with ASTM D 3212. Gaskets shall meet the requirements of ASTM F 477. The joint system shall be subject to the approval of the Owner and shall be identical for pipe and fittings.
- G. Manhole Connections
 - 1. Solid Wall and Closed Profile Wall Pipe: The sewer shall be connected to manholes utilizing a standard pipe section.
 - 2. Open Profile Wall Pipe: The sewer shall be connected to manholes with an adapter piece. The adapter piece shall have an open profile pipe bell and a solid wall pipe spigot for penetrating the manhole wall.
- H. Acceptance: Acceptance will be on the basis of the Owner's inspection and the manufacturer's written certification that the pipe and fittings were manufactured and tested in accordance with the applicable standards.

2.3 DUCTILE IRON PIPE (DIP)

- A. Ductile iron pipe shall be utilized where shown on the Drawings. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet, with a bituminous outside coating.

- B. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
16 - 24	250

- C. Flexible Joint (Ball Joint) Pipe: Flexible, restrained joint pipe shall be minimum Thickness Class 56. Appropriate transition pieces shall be utilized on each end of run of flexible joint pipe.

D. Fittings and Accessories

1. Fittings shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53 with a minimum rated working pressure of 250 psi, and shall be furnished with a bituminous outside coating.
2. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer.
3. Solid Sleeves: Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the Drawings. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the Owner. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).

E. Joints for Ductile Iron Pipe and Fittings

1. Joints for ductile iron pipe and fittings shall be mechanical joint, flanged joint, ball joint, restrained joint, or push-on joint as shown on the Drawings or specified herein.
2. Unless otherwise shown on the Drawings, specified or directed, all ductile iron pipe laid underground shall be joined using push-on type joints.

3. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.
4. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
5. Mechanical Joints:
 - a. Joints shall conform to AWWA C111/ANSI A21.11.
 - b. Bolts and nuts shall be Tee Head Bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimensions shown in AWWA C111/ANSI A21.11.
 - c. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of plain rubber.
 - d. Mechanical joint glands shall be ductile iron.
6. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints.
7. Flanged Joints:
 - a. Flanged joints shall conform to AWWA C115/ANSI A21.15. Flanges shall be ductile iron and shall be furnished by the pipe manufacturer.
 - b. Gaskets shall be made of 1/8-inch thick, cloth reinforced rubber. Gaskets may be ring type or full face type.
 - c. Flanged ductile iron pipe shall have flanges cast solidly or threaded to the pipe barrel. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with threaded type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Owner.

- d. Flange filler shall conform to AWWA C110/ANSI A21.10. Joint bolt length shall be increased by the thickness of the flange filler.
 - e. Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.
 - f. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.
 - g. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
 - h. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.
8. Restrained Joints:
- a. Restrained joints shall be ACIPCO "FLEX-RING" or "FAST-GRIP", or U.S. "TR-FLEX" or "FIELD LOK".
 - b. Bolts and nuts shall be in accordance with the manufacturer's recommendations.
 - c. Gaskets shall be in accordance with the manufacturer's recommendations.
- F. Interior Lining: Ductile iron pipe and fittings shall be lined with polyethylene, polyurethane or epoxy, as specified below:
- 1. Linings shall cover all exposed surfaces of pipe and fittings subject to contact with sewer liquid or gas. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push-on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends.
 - 2. Lining Materials:
 - a. Polyethylene lining material for pipe barrel shall conform to ASTM D 1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during aboveground

storage. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. Lining material for exterior of spigot and interior of socket shall be equal to Roskote Mastic B-151 or Madewell 1104 Coal Tar Epoxy. Polyethylene lining system shall be ACIPCO Polybond or U.S. Pipe Polylined.

- b. Polyurethane lining material shall consist of a two-part polyurethane coating system conforming to ASTM D 16, Type V, consisting of a polyisocyanate resin and a polyol resin. Polyurethane for pipe barrel and fittings shall be Corropipe II Wasteliner as manufactured by Madison Chemical Industries, Inc. Polyurethane lining material for exterior of spigot and interior of socket shall be equal to Corropipe 'S' as manufactured by Madison Chemical Industries, Inc. Polyurethane lining system shall be equal to U.S. Pipe Polythane.
- c. Epoxy: The lining material shall be Protecto 401 Ceramic Epoxy, a two component, modified epoxy formulated for corrosion control with the following minimum requirements:
 - (1) A permeability rating of 0.0 perms when measured by ASTM E 96, Procedure A. Duration of test shall be six weeks.
 - (2) A direct impact resistance of 125 inch-pounds with no cracking when measured by ASTM D 2794.
 - (3) The ability to build at least 50 mils dry in one coat.
 - (4) The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.
 - (5) The material shall contain at least 20 percent by volume of ceramic quartz pigment.
 - (6) A test and service history demonstrating the ability of the material to withstand the service expected.
 - (7) Possess a minimum solids volume content of 88 percent, \pm one percent.
 - (8) Possess a maximum drying time to allow recoating as follows: 50 degrees F - 72 hours; 75 degrees F - 18 hours; 90 degrees F - 8 hours. If recoating cannot be accomplished within seven days, a light brush blast shall be performed to improve intercoat adhesion.

- 3. All surfaces to be lined with polyethylene shall be blast cleaned equal to

the requirements of SSPC-SP6. All surfaces to be lined with polyurethane shall be blast cleaned equal to the requirements of SSPC-SP10. All surfaces to be lined with epoxy shall be blasted and cleaned to remove all loose laitance, scale, or other loose material. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate.

4. Application:

- a. Lining of pipe barrel and fittings shall be 40 mils nominal thickness; minimum lining thickness shall be 30 mils. Lining thickness for exterior of spigot and interior of socket shall be 8 to 10 mils.
- b. The lining shall be applied using a centrifugal lance applicator by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film.

5. All pipe and fitting linings shall be tested for pinholes in accordance with ASTM G 62, Method B and shall be holiday free.

6. All pipe linings shall be checked for thickness using a magnetic film thickness gauge.

7. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date.

G. Polyethylene Encasement: Where shown on the Drawings, ductile iron pipe shall be encased with polyethylene film. Polyethylene film shall have a minimum thickness of 8 mils.

2.4 MISCELLANEOUS ACCESSORIES

A. Flexible Adaptor Couplings

1. Couplings for pipe sizes 15-inches in diameter and less shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi. The adaptor manufacturer shall provide all stainless steel clamps and required accessories.
2. Couplings shall be products of Fernco and shall be installed in

accordance with the manufacturer's recommendations.

B. Flexible Adaptor Donuts

1. Adaptor donuts shall be elastomeric polyvinyl chloride (PVC), compressible seals designed for sealing joints between sewer pipes of different sizes and/or dissimilar materials. Adaptors shall provide a positive seal against infiltration and exfiltration and remain leakproof and rootproof up to 4.3 psi.
2. Donuts shall be products of Fernco and shall be installed in accordance with the manufacturer's recommendations.

- C. Detection Tape:** Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.

PART 3 EXECUTION

3.1 GENERAL

- A.** The contractor shall excavate the trenches and manholes to the required dimensions; excavate the bell holes; construct and maintain all bridges required for traffic control; sheet, brace and support the adjoining ground or structures where necessary; handle all drainage or ground water; guard the site; unload, haul, distribute, lay the pipe, fittings and accessories; rearrange other conduits, ducts or pipes where necessary; replace all damaged water services, drains, sewers, or other structures; backfill trenches; restore the roadway surfaces; remove surplus excavated materials; clean the site of the work of any trees and stumps and maintain the street or other surfaces over the trenches.
- B.** Manholes shall be constructed at the locations shown on the plans. Manholes shall be the type and to the depth shown on the plans. Details of manhole are shown on the plans and construction shall be in accordance with these details.
- C.** Where inlet leads and main or lateral pipe sewers enter a manhole, such pipes shall be cut off flush with the inside of the manhole, and any irregularities shall be touched up with mortar.
- D.** The inverts of the sewer lines entering manholes at or near the flow line

elevation of the manhole shall be shaped and routed across the floor of the manhole using concrete and mortar to obtain the proper contour.

- E. Where the sewers enter the manhole, a neoprene boot shall be used to positively seal against infiltration or exfiltration.
- F. Where sewers enter an existing manhole, the seal will be fully grouted with non-shrink grout to positively seal against infiltration or exfiltration.
- G. Do not connect any sewage flow to new work until authorized by the City of LaGrange. Contact the City of LaGrange a minimum of 72 hours prior to connection.

3.2 SERVICE FITTINGS

- A. Location of Service Fittings: All wyes and other fittings shall be placed at the points indicated on the plans or by the Owner's Representative. They shall not be covered until the representative has measured their exact location in relation to the nearest manhole, and recorded it clearly on a record plan for the Owner's permanent records.
- B. Wye branches shall be laid to correspond with the sewers and house service lines entering them. When service lines are not laid, or whenever wyes are installed and short runs of service lines are constructed to a point for future extension, they shall be closed with caps from the same pipe material and sealed with like joint material as used for jointing bell and sockets of regular sewer pipe.
- C. Each wye branch shall be provided with a 45 degree bend connected to the branch.
- D. Service lines, unless otherwise shown on the Drawings or requested by the Owner's Representative are to be installed to suit field conditions at a minimum grade of 1.0 percent and with a minimum pipe cover of 30 inches.
- E. Provide cleanouts in service lines at not more than 50 foot intervals and where pipe horizontal deflection equals or exceeds 45 degrees. Unless noted otherwise, furnish cleanouts consisting of wye and 45 degree fittings, vertical pipe, and threaded brass or plastic removal plug. Arrange cleanout to permit cleaning in the direction of flow.

3.3 INSPECTION

- A. Of Materials at Delivery Point: During the process of unloading all pipe and accessories shall be inspected by the contractor for loss or damage in transit.
- B. Field Inspection: All pipe and accessories shall be laid and jointed in the manner herein specified in the presence of the owners authorized inspector.

- C. Disposition of Defective Material: All material found during the process of the work to have cracks, flaws or other defects will be rejected and the contractor shall promptly remove such material from the job site.
- D. Contractor's Responsibility for Materials: The contractor shall be responsible for all material furnished to him and he shall replace at his own expense all such materials that has become damaged in handling after delivery. The contractor shall be responsible for the safe storage of materials furnished by or to him, and accepted by him intended for the work until it has been incorporated in the completed project.
- E. Handling Pipe and Accessories: Pipe, fittings and other accessories shall be unloaded at the point of delivery, hauled to and distributed at the site of the project by the contractor; they shall at all times be handled with care to avoid damage. Under no circumstances shall they be dropped. Pipe and fittings shall be properly distributed in such a manner as to be convenient for laying and so as to be of as little inconvenience to the public as practicable.

3.4 ALIGNMENT AND GRADE

- A. General: All pipe shall be laid and maintained in the required lines and grades, with wyes or fittings at the required locations, and with joints centered and spigots home. The contractor shall, at his own expense, furnish and place in position all necessary stakes and batter boards for locating the work. The Contractor must also furnish, at his own expense, good spun twilled lines or wire for use in giving lines and grades and the necessary plummets and grade poles. The laser beam method of establishing pipe grade is preferred.
- B. Protecting Underground and Surface Structures: Temporary support, adequate protection and maintenance of all underground and surface utility structures, water services, gas services, poles, guy wires, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense.

3.5 PROTECTION OF WATER SUPPLIES

- A. Water Supply Interconnections: There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable supply.
- B. Relation to Water Works Structures: While no general statement can be made to cover all conditions, it is generally recognized that sewers shall meet the requirements of the approving agency with respect to minimum distances from public water supply wells or other water supply sources and structures.

C. Relation to Water Mains:

1. Horizontal Separation: Whenever possible, sewers should be laid at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if:
 - a. It is laid in a separate trench.
 - b. It is laid in the same trench with the water mains located at one side on a bench of undisturbed earth.
 - c. In either case the elevation of the crown of the sewer is at least 18 inches below the invert of the water main.
 2. Vertical Separation: Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirement, the water main shall be relocated to provide this separation or reconstructed with slip-on or mechanical-joint cast-iron pipe, asbestos-cement pressure pipe or prestressed concrete cylinder pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.
- D. Deviations Occasioned by Other Utility Structures: Wherever existing utility structures or branch connections leading to main sewers or storm sewers, or other conduits, ducts, pipes or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated or reconstructed by the Contractor through cooperation with the owner of the utility structures, or obstruction. Where necessary to move service poles, guy wires, pipe lines or other obstructions, the Contractor shall notify and cooperate with the utility owner. In those instances where their location or reconstruction is impracticable, a deviation from line and grade will be ordered, and the change shall be made in the manner directed.
- E. Sub-Surface Explorations: Whenever necessary to determine the location of existing pipes, valves, or other underground structures, the Contractor, after examination of available records, shall make the explorations and excavations for such purpose, at his own expense.
- F. Pipe Alignment and Grade: The pipes and specials shall be laid in the trench so that after the sewer is completed, the interior surface thereof shall conform accurately to the grades and alignments fixed and shown on the plans. On completion, no pipe sewer will be accepted unless a clear lamp may be seen from manhole to manhole.

3.6 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

- A. It is the responsibility of the Contractor to locate all existing utilities along the path of his construction. The drawings shall indicate underground utilities or obstructions that are known to exist. Where these or unforeseen underground utilities are encountered, the location and alignment of the water main may be changed, upon written approval of the Owner's Representative and the Owner, to avoid interference.
- B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.
 - 1. Provide the required notice to the utility owners and allow them to locate their facilities according to Georgia Law. Field utility locations are valid for only 10 days after original notice. The Contractor shall ensure, at the time of any excavation, that a valid utility location exists at the point of excavation.
 - 2. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
 - 3. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.
 - 4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Owner's Representative an updated copy of the log bi-weekly, or more frequently if required.
- C. Conflict with Existing Utilities
 - 1. Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed piping does not permit safe installation of the piping by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the piping to avoid horizontal conflicts if the new alignment remains within the available right-of way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the Owner's Representative. Where such relocation of the piping is denied by the Owner's Representative, the Contractor shall arrange to have the utility, main, or service relocated.
 - 2. Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed piping does not

permit the crossing without immediate or potential future damage to the utility, main, service, or the piping. The Contractor may change the proposed grade of the piping to avoid regulatory agencies requirements after written request to and subsequent approval by the Owner's Representative. Where such relocation of the piping is denied by the Owner's Representative, the Contractor shall arrange to have the utility, main, or service relocated.

- D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

3.7 TRENCHING

- A. Additional directives for Utility Trenching are covered in Section 02324 of these Specifications
- B. Description: The trench shall be dug to the alignment and grade required. The trench shall be braced if necessary and drained in order that workmen therein may work safely and efficiently. It is essential that the discharge from any pumps be led to natural drainage channels or to drains.
- C. Width: Minimum width of trench shall be six (6) inches outside of barrel of pipe on each side of pipe. Maximum width of trench shall be nine (9) inches outside of barrel of pipe on each side of pipe. Sides of trench shall be dug and maintained substantially vertical.
- D. Correcting Faulty Grade: Any part of the trench excavated below grade shall be corrected with approved material thoroughly compacted.
- E. Trench Stabilization: Wherever the material at the bottom of the trench is unsuitable for the proper installation of the pipe, the Owner's Representative will direct the removal and replacement of the unsuitable material. When so directed, undercut the trench and backfill with bedding material (#57 stone). Place and compact this material to bring the trench to the required grade.
- F. Haunching of Sewer: Haunch pipelines in accordance with the detail drawings in the plans and the following specifications. Haunching will be required for all gravity sewers.
- G. Haunching Materials - PVC and Ductile Iron Sewer: All haunching materials shall be crushed granite stone.

3.8 BEDDING OF SEWER

- A. Types of Piping Sewer
 - 1. Ductile Iron Sewer: All bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding material

shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No. 57 Stone.

2. PVC: All bedding materials shall be or crushed stone bedding material meeting the requirements of Georgia Department of Transportation Specification 800.01 for No. 78 stone.
 3. Sewer Laterals: The bedding requirement for the laterals from the main sewer to the designation shall be the same as applicable to the main sewer, (same type material) and as explained above.
 4. Manholes: All bedding materials shall be crushed stone unless shown or specified otherwise. Crushed stone bedding material shall meet the requirements of Georgia Department of Transportation Specification 800.01 for No. 57 Stone.
- B. Compact stone bedding material by tamping or slicing with a flatblade shovel. Prepare the trench bottom to support the pipe uniformly throughout its length. Provide bell holes to relieve pipe bells of all load. If the trench is excavated to excessive width or depth, provide the next better class of bedding. In rock trenches, be pipe in at least six inches of suitable earth material.
- C. Bedding Classifications: Refer to Section 02324 – Trench Excavation and Backfill

3.9 CONSTRUCTION

- A. PVC and Ductile Iron Pipe: Excavate the bottom of the trench flat at a minimum depth shown on the Drawings below the bottom of the pipe barrel. If required, place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under the pipe and to the height above the pipe as shown on the detailed plans.
- B. Manholes: Excavate to a minimum of 12 inches below the planned elevation of the base of the manhole. Place and compact bedding material to the required grade before constructing the manhole.
- C. Compaction: Bedding under pipe and manholes shall be compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor Compaction Test, ASTM D698.
- D. Care of Surface Material for Reuse: If local conditions permit their reuse, all surface materials suitable for reuse in restoring the surface shall be kept separate from the general excavation material.

- E. Manner of Piling Excavated Materials: All excavated material shall be piled so that it will not endanger the work and so that it will avoid obstructing roads and driveways. Drainage channels shall be kept clear or other satisfactory provisions made for drainage.
- F. Trenching by Machine or by Hand: The use of trench digging machinery will be permitted except in places where operation of same will cause damage to existing structures above or below the ground; in which case, hand methods shall be employed.

3.10 PIPE HANDLING

- A. Manner of Handling Pipe: Proper implements, tools and facilities shall be provided and used by the Contractor for convenient prosecution of the work. All pipe shall be carefully lowered into the trench piece by piece by means of suitable tools or equipment in such manner as to prevent damage to pipe. Under no circumstances shall pipe be dropped or dumped into the trench.
- B. Inspection: Before lowering and while suspended, the pipe shall be inspected for defects. Any defective, damaged or unsound pipe shall be rejected.
- C. Pipe Kept Clean: All foreign matter or dirt shall be removed from the pipe, and it shall be kept clean by approved means during and after laying.
- D. Laying of Pipe: The laying of pipe in finished trenches shall be constructed at the lowest point, so that spigot ends point in the direction of flow. All pipes shall be laid with ends abutting true to line and grade. They shall be fitted and matched so that when laid in the work they will form a sewer with a smooth and uniform invert. All possible care shall be taken when shoving the pipes together so that the joints will not be unnecessarily large. Sockets and spigots shall be carefully cleaned and lubricated according to manufacturer's recommendations before pipes are jointed.
- E. Unsuitable Conditions for Laying Pipe: No pipe shall be laid in water, or when the trench conditions or weather is unsuitable for such work, except in an emergency. Owner's Representative must be informed of such emergency.
- F. Encasement and Blocking of Sewer Pipes: Where specifically indicated on the plans the Contractor shall encase or block sewer pipes in conformity with details and type of concrete specified. Sewer lines to be encased shall be encased in 3000 psi concrete, a minimum of six (6) inches on all sides of the pipe.

3.11 BACKFILLING TRENCHES AND AROUND MANHOLES

- A. Time of Backfilling: As soon as practicable after the completion of laying and jointing of the pipe, the trench shall be backfilled, and at no time shall the completed backfilled trench be more than 200 feet behind the pipe laying.

B. Backfill Procedure:

1. The backfill material shall be moistened if necessary, tamped in thin (about 6" layers) and thoroughly compacted under and on each side of the pipe, with mechanical tamps to provide solid backing against external surface of the pipe. Walking or working on the completed pipe line, except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a height of at least 12" over the top of the pipe.
 2. The backfill in all the trenches shall be compacted to 98% of the maximum dry density under and within 10 feet of pavement or dirt roadways, and 95% elsewhere, determined by the Standard Proctor Compaction Test. The testing agency shall run as a minimum one (1) Proctor for each type of soil encountered.
 3. During the backfilling, loose lifts shall not exceed eight (8) inches in thickness. Field density determination (compaction tests) should be made at a minimum of one (1) test per 1000 linear feet one foot above the pipe. Additional tests may be required for special conditions such as backfill around manholes in streets and other critical areas. The range of moisture content should be maintained within plus or minus three (3) percent of the optimum moisture content.
- C. Rock and Rock Fragment Exclusion: No rock or rock fragments shall be used in the backfill for at least 18" above the top of the pipe, and no stone larger than eight inches in its greatest dimension shall be used in the backfill.
- D. Deficiency of Backfill: Any deficiency in the quantity of material for backfilling the trenches, or for filling depressions caused by settlement, shall be supplied by the Contractor.

3.12 RESTORATION OF SURFACES

- A. The Contractor shall replace all curbing, sidewalks, pavements, gutters, shrubbery, fences, sod and other surfaces disturbed to a condition equal to that before the work began, furnishing all labor and materials incidental thereto.

3.13 UNSUITABLE SOIL CONDITIONS

- A. Where the subgrade is too soft or mucky for the proper installation of the sewer pipe, areas where the subgrade is not capable of in-situ compaction, the Contractor shall undercut the trench and backfill with fill type S1 or A1 and compact to density equal to or greater than requirements for backfill material. The stone shall be brought to grade and thoroughly compacted to conform to the outside of the pipe barrel.

3.14 DEWATERING TRENCHES

- A. Where high groundwater is encountered, dewatering shall be done by well pointing. If soil conditions are not suitable for well points, trench drains or crushed stone or gravel shall be constructed to carry the water to sumps and the water removed by pumps or bailing. No extra payment will be made for dewatering trenches.

3.15 CLEANING UP

- A. Any surplus pipe line materials, tools, rubbish, temporary structures, or Contractor's trash shall be removed by the Contractor and the construction site shall be left clean.

3.16 INSPECTION AND TESTING:

- A. The Owner's Representative and Owner reserves the right to inspect construction methods to insure compliance with these specifications. Sewer lines and related facilities will be inspected by the Owner's Representative or Owner's representative before acceptance or tie-in to the Owner's system is permitted. All lines must be clean and all obstructions removed prior to requesting inspection.
- B. The Contractor will test the system for leakage as set forth in Section 02519 - Piping, Testing and Acceptance. The Owner's Representative or Owner's representative will inspect for construction or material defects, and will randomly check PVC sewer for excessive deflection.

3.17 SAFETY AND PROPERTY INSPECTION

- A. Barricades, Guards and Safety Provision: To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns and guards shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the trenched areas. Rules and regulations of the local authorities respecting safety provisions shall be observed.
- B. Traffic and Utility Controls: Excavations for pipe laying operations shall be conducted in a manner to cause the least interruption to traffic. Where traffic must cross open trenches the Contractor shall provide suitable bridges. Hydrants under pressure, valve pit covers, valves boxes, curb stop boxes, fire or police call boxes or other utility controls shall be left unobstructed and accessible during the construction period.
- C. Flow of Drains and Sewers Maintained: Provisions shall be made for the flow of storm and sanitary sewers, drains and water courses encountered during construction, and the structures which may have been disturbed shall be satisfactorily restored upon completion of the work.

D. Protection and Restoration of Work Area:

1. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.
2. Man-Made Improvements: Protect, or remove and replace with the Owner's approval, all fences, piers, docks, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, and other improvements that may be encountered in the work.
3. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Owner. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman
4. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.
5. Grassing: See Section 02921 for detailed information.
6. Erosion Control: Plan excavation work to prevent erosion and the washing of soil into adjacent streams. Limit the amount of open excavation at any one time. Place spoil in the proper place and keep natural water routes open. See Erosion and Sedimentation Control Section.
7. Disposal of Rubbish: Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, county, state and federal.

END SECTION

SECTION 02640

MANHOLES AND APPURTENANCES

PART 1 GENERAL

1.1 DESIGN REQUIREMENTS

- A. Manholes shall be constructed of specified materials to the sizes, shapes and dimensions and at the locations shown on the Drawings. The height of depth of the manhole will vary with the location. Unless shown otherwise on the Drawings, the top of the manhole will vary with the location. Unless shown on the Drawings, the top of manhole frame will be at the finished grade of the pavement or ground surface and inverts will be at the elevations shown on the Drawings.

1.2 SUBMITTALS

- A. Complete product data on all precast manhole bottoms, riser sections, transition slabs and tops shall be submitted in accordance with these Specifications.
- B. Complete product data on frames, covers and steps shall be submitted to the Owner's Representative for approval.
- C. Complete product data on all piping appurtenances shall be submitted to the Owner's Representative for approval.

1.3 QUALITY ASSURANCE

- A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory. Certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable.

PART 2 PRODUCTS

2.1 MANHOLES

- A. Concrete and Reinforcement
 - 1. Concrete used in construction shall be concrete with a minimum compressive strength of 3000 psi unless noted or specified otherwise.
 - 2. Steel reinforcement shall be deformed bars conforming to ASTM A 615. Reinforcement shall be manufactured from new billet steel of American Manufacture Grade 60.

3. Brick used in manhole construction shall be either solid or cored, medium hard or better, Grade MS brick conforming to the requirements of ASTM C 32 for sewer and manhole brick.
 4. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150, C175 and C33. Sand shall meet the requirements of ASTM C 144.
- B. Round Precast Concrete Manholes: Provide manholes and other precast concrete products in accordance with the following:
1. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.
 2. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the installation of the rubber boots.
 1. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.
 4. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant.
 5. Manholes shall be coated/sealed to prevent interior corrosion and waterproofed as required to meet the minimum testing requirements.

2.2. MANHOLE FRAMES AND COVERS

- A. Cast iron frames and covers shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of bituminous paint before rusting begins.
- B. Manhole frames and covers shall be as indicated on the Detail Drawings:
- C. All frames and covers shall have machined horizontal bearing surfaces.
- D. All manholes shall have standard frames and covers except where specifically shown otherwise on the Drawings.

2.3. JOINT SEALANT:

- A. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealant shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No.2 or concrete Sealant CS202.

2.4. RUBBER BOOTS

- A. Provide preformed rubber boots and fasteners as manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

PART 3 EXECUTION

3.1 GENERAL

- A. Excavation for backfilling for all manholes covered under this Section shall conform to the requirements of Section 02324 of these Specifications.
- B. Top Elevations: Build manholes castings shall be flush with the finished grade unless otherwise shown on the Drawings.
- C. Drop Connections: Manholes requiring drop connections are shown on the Drawings. Construct drop connections of the same materials as the upstream sewer and in accordance with the details shown on the Drawings.
- D. Inlet and Outlet Pipe
 - 1. Inlet and outlet pipes shall be supported outside the manhole in accordance with the requirements of Section 02324 of these Specifications.
 - 2. Where required, inlet and outlet pipes shall be cut-off flush with the interior surface of the manhole walls.
 - 3. Inverts: All inverts shall be 3000 psi concrete and shall conform to the shape indicated on the Drawings. The invert shall be formed to the required size and grade by gradual and even changes in sections. Changes in directions of flow through the inlet shall be made to a true curve with as large a radius as the size of the inlet will permit.
- E. Invert Elevations: The invert elevations shown on the Drawings shall be for the invert elevation of the incoming and outgoing pipe. Prior to setting the laser or other vertical alignment control system for the sewer upstream of the manhole, the Contractor shall verify the elevation of the sewer installed at the manhole.

- F. Manholes shall be constructed with plumb walls.
- G. The cast iron frame for the manhole cover shall be set at the required elevation and anchored to the masonry. Where manholes are constructed in paved areas, the top surface of the frame and cover shall be tilted to conform to the exact slope, crown and grade of the existing adjacent pavement.
- H. Masonry work shall be allowed to set for a period of not less than 24 hours. Outside forms, if any, then shall be removed and the manhole backfilled and compacted. All loose or waste material shall be removed from the interior of the manhole. The manhole cover then shall be placed and the surface in the vicinity of the work cleaned off and left in a neat and orderly condition.

3.2 CONSTRUCTION OF CAST-IN-PLACE CONCRETE STRUCTURES

- A. Cast-in-place structures shall be constructed in place as shown and detailed on the Drawings.
- B. Should circumstances make a vertical joint necessary, a formed groove or reinforcing dowels shall be required in the top of the first placement for shear protection. Immediately before the second vertical placement is made, the surface of the cold joint shall be thoroughly cleaned and wetted with a layer of mortar being deposited on the surface.

3.3 PRECAST MANHOLE CONSTRUCTION

- A. Construct manholes as shown on the Drawings and in accordance with the requirements of ASTM C 891.
- B. Precast Concrete: Handle sections to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.
- C. Where bricks are used to adjust the frame and cover to grade, bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.
- D. Pipe Connections: Seal the void between the pipe and the manhole with brick and mortar on both the inside and outside.
 - 1. Pipe 36-inch Diameter and Less: Connect pipe to manhole utilizing rubber boots.
 - 2. Pipe 42-inch Diameter and Larger: Construct manhole collars as shown on the Drawings after the pipe has been sealed into the manhole.
- E. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.

- F. Seal all manhole joints and lift holes, both inside and out, with grout. Between precast sections, this is in addition to joint sealant.

3.4 INSPECTION AND TESTING

- A. All manholes shall be tested in accordance with the requirements of Section 02519 of these Specifications.

END SECTION

SECTION 02920

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 SECTIONS

- A. **Section 02370 – Erosion, Sedimentation, & Pollution Control**

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.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer. Damaged bags are not acceptable.
- 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 the 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 the permanent grass during the favorable season between the dates specified above unless otherwise accepted, the Contractor will be required to plant a temporary cover to protect the 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

2.1 SEED

- A. 33% Centipede grass, 67% Carpet grass.
- B. All seed shall conform to all Georgia State Laws and to all requirements and regulations of the State of Georgia Department of Agriculture.

- C. The several varieties of seed 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 of Georgia Department of Agriculture.
- D. The Engineer reserves the right to test, reject, or accept all seed before seeding.
- E. The seed shall be delivered to the site in the original sacks as received from the producer and each sack shall be tagged in accordance with the agricultural seed laws of the United States and the State of Georgia. Each sack shall be tagged showing the dealers guarantee as to the year grown, percentage of purity, percentage of germination and the date of the test by which the percentages of purity and germination were determined. All seed sown shall have a date of test within six months of the date of sowing.
- F. Any seed delivered prior to use, shall be stored so that it will be protected from damage by heat, moisture, rodents, or other cause.

2.2 FERTILIZER

- A. Shall be a slow release, complete fertilizer as stated by the soil analysis results. The nitrogen content of which shall be derived from either organic or inorganic sources and meet the minimum requirements of plant food by weight. Should the soil analysis and report indicate a need for a different fertilizer mixture, the recommended mixture shall be furnished and applied at the Contractor's expense. All State and Federal laws relating to fertilizer shall be complied with.

2.3 SEEDING SCHEDULE

A.

SEED	RATE	PLANTING DATES
Centipede	25 lbs/acre	March 1 – September 30
Carpet	30 lbs/acre	March 1 – September 30
Bermuda	10 lbs/acre	March 1 – September 30
Rye	75 lbs/acre	October 1 – February 28

- B. In areas where existing grass is to be matched, contractor shall sow seed at the rate and dates recommended by seed distributor.

2.4 LIME

- A. Agricultural grade, ground limestone: Shall be ground dolomitic limestone containing not less than 85 percent of total carbonates and shall be ground to a fineness such that more than 50 percent will pass through a 100-mesh sieve and 90 percent will pass through a 20-mesh sieve. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve. Slag may be used as a substitute for limestone and must pass the sieve tests cited above.

2.5 AMMONIUM NITRATE

- A. Shall be a commercial product in dry powder form of recent manufacture and shall be delivered in the original, unopened containers each bearing the manufacturer's guaranteed statement of analysis. It shall contain not less than 33.5% Nitrogen.

2.6 WATER

- A. The Contractor shall be responsible for providing water to the newly planted grass. The Contractor shall be responsible for providing temporary above-ground irrigation equipment for watering purposes.

2.7 SOD

- A. Sod shall be densely rooted, good quality centipede grass, free from noxious weeds. The sod shall be obtained from areas where the soil is reasonably fertile. The sod shall be raked free of all debris and the grass mowed to two inches before cutting. The sod shall contain practically all of the dense root system and not be less than one (1) inch thick. Sod shall be cut in uniform strips not less than twelve (12) inches in width and not less than twenty-four (24) inches

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 the fibers shall be 4 to 6 inches. The cut shall be made in such a manner as to provide maximum strength of fiber, but at a slight angle to the natural grain of the wood so as to cause splintering of the fibers when weathering in order to provide adherence to each other and to the 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. The mulch fibers shall intertwine physically to form a strong moisture holding mat on the ground surface and allow rainfall to percolate into the underlying soil. The mulch shall be heat processed so as 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. The 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. The areas to be seeded shall be made smooth and uniform and shall conform to the finished grade indicated on the plans.
- B. Slopes and disturbed areas not covered by pavement, gravel, riprap, or other stabilized material shall be graded smooth and receive 4 inches of topsoil. Contractor shall provide topsoil if not available on site.
- C. Remove foreign materials, plants, roots, stones, and debris from surfaces to be seeded.
- D. Grassing areas, if not loose, shall be loosened to a minimum depth of 3-inch before fertilizer, seed or sod is applied.

3.2 STAND OF GRASS

- A. Before acceptance of the seeding performed for the establishment of permanent vegetation, the Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and the winter weather and be capable of re-establishment in the spring.
- B. Before acceptance of the seeding performed for the establishment of temporary vegetation, the 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 the establishment of permanent vegetation is to commence.

3.3 SEEDING DATES

- A. Seeding shall be performed during the periods and at the rates specified in the seeding schedules. Seeding work may, at the discretion of the Contractor, be performed throughout the year using the schedule prescribed for the given period. Seeding work shall not be conducted when the ground is frozen or excessively wet. The Contractor will be required to produce a satisfactory stand of grass regardless of the period of the year the work is performed.

3.4 APPLYING LIME AND FERTILIZER

- A. Following advance preparation and placing selected material for shoulders and slopes, lime, if called for based on soil tests and fertilizer, shall be spread uniformly over the designated areas and shall be thoroughly mixed with the soil to a depth of approximately 2-inches. Fertilizer shall be applied at the rate of 500 pounds per acre for the initial application unless otherwise directed by the Engineer. Lime shall be applied at the rate determined by the

soil 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 the application of fertilizer and lime and preparation of the seedbed as specified in Section 3.4. Seed shall be uniformly sown at the 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 that are inaccessible to seed drills.
- B. The 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 HYDROSEEDING

- A. Hydroseeding may be used on any area to be grassed. Under this method of seeding, the seed and fertilizer, at the specified rates, with Wood Fiber Mulch shall be distributed over the area to be seeded in the form of a slurry. Seeds of all sizes may be mixed together.
- B. Wood Fiber Mulch is required to be used as a metering agent and seedbed when hydroseeding is used. The application rate for Wood Fiber Mulch shall be approximately 1500 pounds per acre and is required regardless of which mulching method is chosen.
- C. Ground preparations for hydroseeding shall be the same as for conventional seeding.
- D. Equipment for mixing and applying the slurry shall be especially designed for this purpose. It shall be capable of applying a uniform mixture over the entire area to be seeded. The slurry mixture shall be agitated during application to

keep the ingredients thoroughly mixed. All materials shall be discharged within one hour after being combined in the hydroseeder. Hydroseeding shall not be performed when winds prevent an even, thorough application. The equipment manufacturer's directions shall be followed.

- E. The entire hydroseeded area shall be mulched as specified.

3.7 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.

3.8 SEED PROTECTION (EXCELSIOR MULCH)

- A. Seed shall be sown as specified in Section 3.5. Within 24 hours after the 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. The Engineer may require light rolling of the mulch to form a tight mat.

3.9 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 the rate of 1,500 pounds per acre in a mixture of seed and fertilizer. Hydraulic equipment shall be used for the 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 the slurry on the various areas to be seeded. The slurry tank shall have a minimum capacity of 1,000 gallons.
- B. The seed, fertilizer, wood pulp mulch, and water shall all be combined into the slurry tank for distribution of all ingredients in one operation by the hydraulic seeding method specified herein. The materials shall be combined in a manner recommended by the manufacturer. The slurry mixture shall be so regulated that the amounts and rates of application shall result in a uniform application of all materials at rates not less than the amount specified. Using the color of the wood pulp as a guide, the equipment operator shall spray the prepared seedbed with a uniform visible coat. The slurry shall be applied in a sweeping motion, in an arched stream so as to fall like rain, allowing the wood fibers to build upon each other until an even coat is achieved.

3.10 SODDING

- A. Sod shall be placed between March 1st and December 1st.
- B. Sod shall be placed within 48 hours of cutting.
- C. 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 the strips shall be at right angles to the flow of surface water. All joints shall be tightly butted and end joints shall be staggered at least 12 inches. The 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. The sod shall be watered, mowed, weeded, repaired or otherwise maintained, to insure the establishment of a uniform healthy stand of grass until acceptance.

3.11 MAINTENANCE

- A. Maintain seeded 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.

3.12 ACCEPTANCE

- A. Before acceptance of the seeding performed for the establishment of permanent vegetation, the Contractor will be required to produce a satisfactory stand of perennial grass whose root system shall be developed sufficiently to survive dry periods and the winter weather and be capable of reestablishment in the spring.

END SECTION