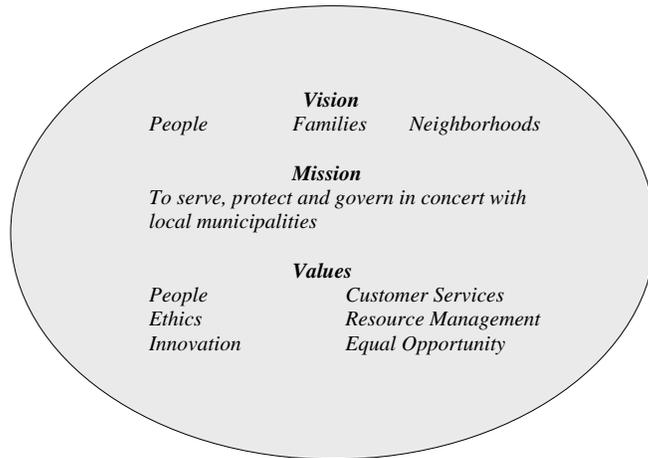




FULTON COUNTY



INVITATION TO BID O8ITB63800K-DB

S-231 MARSH CREEK PUMP STATION

VOLUME 2 of 2

For

DEPARTMENT OF PUBLIC WORKS

BID DUE DATE AND TIME: Monday February 2, 2009 11:00A.M.
BID ISSUANCE DATE: Thursday December 11, 2008
PRE-BID CONFERENCE DATE: Thursday January 8, 2009 9:30 A.M.
PURCHASING CONTACT: Darlene Banks, Assistant Purchasing Agent
E-MAIL: darlene.banks@fultoncountyga.gov

**LOCATION: FULTON COUNTY DEPARTMENT OF PURCHASING &
CONTRACT COMPLIANCE
130 PEACHTREE STREET, S.W., SUITE 1168
ATLANTA, GA 30303**

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**SECTION 02000
SITE WORK****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. These general site work requirements apply to all site work operations. Refer to specification sections for specific product and execution requirements.

1.02 QUALITY ASSURANCE

- A. Comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.
- B. Obtain and pay for all required inspections, permits, and fees. Provide notices required by governmental authorities.

1.03 PROJECT CONDITIONS

- A. Locate and identify existing underground and overhead services and utilities within contract limit work areas. Provide adequate means of protection of utilities and services designated to remain. Repair utilities damaged during site work operations at Contractor's expense.
- B. Arrange for disconnection disconnect and seal or cap all utilities and services designated to be removed before start of site work operations. Perform all work in accordance with the requirements of the applicable utility company or agency involved.
- C. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, notify the Engineer and the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.
- D. Locate, protect, and maintain benchmarks, monuments, control points and project engineering reference points. Reestablish disturbed or destroyed items at Contractor's expense.
- E. Perform site work operations and the removal of debris and waste materials to assure minimum interference with streets, walks, and other adjacent facilities.
- F. Obtain governing authorities' written permission when required to close or obstruct street, walks and adjacent facilities. Provide alternate routes around closed or obstructed traffic ways when required by governing authorities.
- G. Control dust caused by work. Dampen surfaces as required. Comply with pollution control regulations of governing authorities.
- H. Protect existing buildings, paving, and other services or facilities on site and adjacent to the site from damage caused by site work operations. Cost of repair and restoration of damaged items at Contractor's expense.
- I. Protect and maintain street lights, utility poles and services, , curb boxes, valves and other services, except items designated for removal. Provide for temporary relocation when required to maintain facilities and services in operation during construction work. **Note Protect existing conduits supplying power to the existing pump station.**

- J. Preserve from injury or defacement all vegetation and objects designated to remain.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment: As selected by Contractor, except as indicated in contract documents.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Examine the areas and conditions under which site work is performed. Do not proceed with the work until unsatisfactory conditions are corrected.
- B. Consult the records and drawings of adjacent work and of existing services and utilities, which may affect site work operations.

+++ END OF SECTION 02000 +++

SECTION 02050
DEMOLITION

PART 1 - GENERAL

1.01 SCOPE

- A. The work covered under this Section includes furnishing all labor, equipment and material required to remove, handle, crush and dispose of all equipment, materials and piping as shown on the Drawings, directed by the Engineer or required for the completion of the Work, including all necessary excavation and backfilling.
- B. Where structural tile and brick is removed from existing structures, the work shall include all patching and reconditioning to restore the remaining tile or brick to its existing state and to provide a proper joint for joining the existing to new construction.
- C. Where concrete is cut from existing structures under this Section to permit setting or inserting pipes, flumes, equipment or appurtenances, the work shall include all reconcreting, dressing and finishing of openings to the required lines and dimensions or as necessary for the placing and fixing of inserts.
- D. The Contractor shall remove from existing structures and dispose of as specified hereinafter, all valves and piping, mechanical equipment, plumbing, heating, electrical, and ventilating fixtures, pipes, ducts, wires, and equipment, doors and windows, floor grating and cover plates, steel stairs, pipe railing and the like which are not to remain in service in the finished work, whether or not shown on the Drawings and/or specified herein.
- E. The work specified herein and shown on the Drawings is intended to give a general idea of the scope of this work but must not be construed as covering it entirely. The Contractor shall visit the site and judge the amount of work required and the problems anticipated in the performance of the work.
- F. Requirements for removal of pavement and abandonment of site utilities are specified in Section 02200.
- G. Buildings, facilities, and utilities to be demolished are listed below. This is a condensed list intended to provide an overview of the selective demolition requirements of the project. As the list is not all inclusive, it must be complemented by a careful review of the Drawings and thorough site visits and inspections.

Facility	Description
Trickling Filters	Equipment, filter media and Concrete Structure
Primary Settling Tanks	Equipment, filter media and Concrete Structure.
Digester and Head house	Equipment, filter media and Concrete Structure.
Final Settling Tanks	Equipment, filter media and Concrete Structure
Grit Pump Station and Control building	Equipment, filter media and Concrete Structure

- H. Many obstructions are not shown on the Drawings. Bidders are advised to carefully inspect the existing facilities before preparing the Bid Proposal. This Contract shall include removal of

obstructions such as electrical conduits and wire; air, water and waste piping; and similar items which may interfere with or hinder installation of equipment or materials; construction; or demolition required under the scope of the project.

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:
1. The Contractor shall submit to the Engineer, prior to beginning work, a schedule of demolition and detail methods to be used on each facility to be demolished.
 2. The Contractor shall develop and submit a demolition plan, which includes a demolition schedule comparable to a room finish schedule that covers:
 - a. Each building surface affected by demolition.
 - b. Proposed method and materials for demolition and patching.
 - c. Catalog cuts and samples of the materials to be used.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. The Contractor shall provide all materials and equipment in suitable and adequate quantity as required to accomplish the work shown, specified herein, and as required to complete the project.
- B. All concrete, mortar, grout, and backfill used in patching, plugging or repairing shall comply in all respects with the applicable material requirements of these Specifications.

PART 3 - EXECUTION

3.01 GENERAL

- A. Shutdown of Existing Operations and Utilities
1. The existing Marsh Creek Pumping Station is required to remain in service during construction of the new Pumping Station and demolition of the existing facilities.
 2. Total shutdown of the existing facilities to perform any new construction, to make the required structural or piping modifications, and, and/or to make or install the **required** electrical service or system modifications, will not be permitted.
 3. Prior to making any piping or structural connections or modifications to existing facilities, obtain specified timing and schedule approval.
 4. Existing Pump station wet well contains sewage solids and hazardous sewage, contractor shall employ safe means to clean the wastes from the wet well prior to demolition.
 5. Investigate for presence of any hazardous materials or Asbestos, etc, notify the engineer if asbestos is present.
- B. Protection
1. Take care to prevent the spread of dust and flying particles. Sprinkle rubbish and debris with water to keep dust to a minimum.

2. Maintain adequate fire protection, including extinguisher and operative water-hose lines during demolition.

C. Perform work by personnel experienced in this type work and in such a manner as to eliminate hazards to persons and property without interference with new work and with use of adjacent areas, public rights-of-way, utilities and structures.

3.02 CONCRETE DEMOLITION

A. Remove concrete using suitable mechanical equipment. All necessary precautions shall be taken during removal of concrete to prevent debris from falling and damaging adjacent piping, equipment, and facilities.

3.03 MASONRY DEMOLITION

A. Existing masonry to be removed shall be broken by air hammer and chisel or other suitable equipment.

3.04 REMOVAL OF EXISTING EQUIPMENT AND PIPING

A. Equipment specified to be removed shall be removed completely, including all related accessories and concrete bases. Any embedded items such as anchor bolts, steel reinforcement, conduit and piping shall be cut off 1-inch below adjacent finished surfaces.

B. Prior to removing any electrical equipment, all power to the equipment shall be shut off and properly locked out. All power and control wiring for the equipment shall then be disconnected at the starter or circuit breaker, as applicable, and removed from the conduit. Unused conduits shall be plugged.

3.05 PROTECTION OF WORK AND EXISTING FACILITY

A. Perform the work in a manner that will not damage parts of the structure, facility, or system not intended to be removed. If, in the opinion of the Engineer, the method of demolition or cutting may endanger or damage parts of the structure(s) or affect the operation of the facilities, promptly change the method when so notified by the Engineer. Perform all cutting required regardless whether such cutting is specifically indicated. Examine the existing structures, evaluate conditions to be encountered in accomplishing the work, and accommodate such requirements accordingly in the Bid Proposal. No blasting will be permitted.

B. The Contractor shall exercise full care and shall use such methods and equipment during removal as will maintain the usefulness of the various materials and equipment removed.

C. Any damage done to structures or equipment during removal and any patching, plugging of holes or repairs necessitated because of removal of equipment and piping shall be repaired to the satisfaction of the Engineer and the cost thereof shall be included in the Contract Price.

3.06 DISPOSAL

A. Disposal: All rubble and waste material shall be removed from each work area in order to provide a clean area for plant operations. Such removal and cleanup is to be completed upon conclusion of daily work, outage period, or a specific work period. Removal of waste material from the work areas constitutes physical removal of the debris, rubble, or waste from the building proper or work site to a proper storage container or stockpile. If material is stockpiled for later disposal, the stockpile location shall be as approved by the Engineer. Should stockpiling not be approved an appropriate container may be used, or the Contractor may dispose of the material directly. If

stockpiling is approved, disposal of stockpiled materials shall be accomplished at a frequency no less other than weekly. Waste containers shall be located as approved by the Engineer. Waste material is considered to be any item or material that is removed from an existing condition and is not intended for reinstallation or salvage to the County. The Contractor shall be fully responsible for proper disposal of waste materials in accordance with all federal, state and local laws at no additional cost to the County

3.07 DISPOSITION OF SALVAGEABLE MATERIALS

- A. The following material or equipment is to be salvaged and delivered to the County at a location to be designated at the project site. Loading and unloading shall be the responsibility of the Contractor.
 - 1. NONE

+++ END OF SECTION 02050 +++

**SECTION 02110
CLEARING AND GRUBBING****PART 1 - GENERAL****1.01 SCOPE**

- A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for all clearing and grubbing including, but not limited to, the removal from the Site of trees, stumps, roots, brush, structures, abandoned utilities, trash, debris 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 to 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 control procedures.
- C. Related Work Specified Elsewhere:
 - 1. Section 02125 - Temporary and Permanent Erosion and Sediment Control.
 - 2. Section 02050 - Demolition.
 - 3. Section 02200 - Earthwork.

1.02 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.

1.03 JOB CONDITIONS

- A. Location of the Work: The area to be cleared and grubbed shall be the minimum required to perform the Work.

PART 2 - PRODUCTS**2.01 EQUIPMENT**

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

PART 3 - EXECUTION**3.01 EXISTING TREES AND VEGETATION**

- A. Avoid cutting or injuring trees and vegetation outside easement line and outside areas to be cleared as indicated, without Engineer's permission. Contractor shall be responsible for damages outside these lines.
- B. Remove trees within permanent and temporary easement as designated by the Engineer.

3.02 CLEARING AND GRUBBING

- A. Grubbing shall consist of completely removing roots, stumps, trash and other debris from all areas to be graded so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.
- B. All stumps, roots, foundations and planking embedded in the ground shall be removed and disposed of. Stumps and roots larger than 1 inch shall be grubbed and removed to a depth not less than 4 feet below grade. All holes or cavities, which extend below the sub grade elevation of the proposed work, shall be filled with crushed rock or other suitable material, compacted to the same density as the surrounding material.
- C. Surface rocks and boulders shall be grubbed from the soil and removed from the site or used as fill in accordance with Section 02200, Earthwork.
- D. Burying of residual materials and organics will not be allowed.
- E. The Contractor shall exercise special precautions for the protection and preservation of trees, cultivated shrubs, sod, fences, etc. situated within the construction area but not directly within excavation and/or fill limits. The Contractor shall be held liable for any damage Contractor's operations inflicts on such property.
- F. The Contractor shall be responsible for all damages to existing improvements resulting from Contractor's operations.

3.02 DISPOSAL OF REFUSE

- A. The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be disposed of in accordance with all requirements of federal, state, county and municipal regulations. No refuse of any kind shall be deposited in any stream or body of water, or in any street or alley. In no case shall any material be left on the site, shoved onto abutting private properties, or buried on the Project Site.

+++ END OF SECTION 02110 +++

**SECTION 02125
EROSION AND SEDIMENTATION CONTROL****PART 1 - GENERAL****1.01 SCOPE****A. Submittals:**

1. Within fifteen (15) days after the date of the Notice to Proceed, the Contractor shall submit a narrative description, working drawings and schedule for proposed temporary erosion and sedimentation controls to the local authority and Engineer for approval. The description and working drawings shall meet the requirements of the Georgia Erosion and Sedimentation Act of 1975 (as amended) and local soil erosion and sedimentation control ordinances. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.
2. Land disturbance activities shall not commence until the erosion and sedimentation control plans are approved. The Engineer will provide a reproducible drawing of plan sheets to the Contractor for Contractor's use if necessary. The reproducible will not bear the Engineer's seal or logo and is provided only for the Contractor's convenience in obtaining land disturbance permits.
3. Description and working drawings shall indicate controls, which will minimize erosion and prevent the off-site transport of sediment in storm water and drainage from the jobsite areas.
4. Submit a written plan to the Engineer for both temporary and permanent grassing. The plan shall include selection of species, dates and rates of application for seeding, fertilizer and mulching.

B. Basic Principles:

1. Conduct the earthwork and excavation activities in such a manner to fit the topography, soil type and condition.
2. Minimize the disturbed area and the duration of exposure to erosion elements.
3. Stabilize disturbed areas immediately.
4. Safely convey run-off from the site to a stable outlet.
5. Retain sediment on site that was generated on site.
6. Minimize encroachment upon watercourses.

C. Temporary Erosion and Sedimentation Control: In general, temporary erosion and sedimentation control procedures shall be directed toward:

1. Preventing soil erosion at the source.
2. Preventing silt and sediment from entering any waterway if soil erosion cannot be prevented.
3. Preventing silt and sediment from migrating downstream in the event it cannot be prevented from entering the waterway.

- D. Permanent Erosion Control: Permanent erosion control measures shall be implemented to prevent sedimentation of the waterways and to prevent erosion of the Project site.
- E. Related Work Specified Elsewhere:
 - 1. Section 02110 - Clearing and Grubbing
 - 2. Section 02200 - Earthwork
 - 3. Section 02933 - Seeding

1.02 QUALITY ASSURANCE

- A. General: Perform all work under this Section in accordance with all pertinent rules and regulations including, but not necessarily limited to, those stated above and these Specifications.
- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern. All are subject to the Engineer's approval.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Silt fence fabric shall be Mirafi 100X, Amoco 1380, Exxon GTF-100 Series or equal.
- B. Filter fabric under rip-rap shall be Mirafi, Amoco, Exxon or equal.

2.02 MATERIALS

- A. Materials used in temporary and permanent erosion and sedimentation control shall meet the following requirements:
 - 1. Silt fence shall be polymer type netting with a built-in cord running throughout the top edge of the fabric. Stakes shall be pressure treated southern pine and shall be spaced not more than 6 feet on center. Silt fence shall be provided with netting to provide reinforcing when necessary. Silt fence shall have an Equivalent Opening Size (EOS) of 40 to 100. Silt fence fabric shall have a maximum permeability of 40 gallons per minute per square foot.
 - 2. Hay bales shall be clean, seed free cereal hay type.
 - 3. Netting shall be ½-inch, galvanized steel, chicken wire mesh.
 - 4. Filter stone shall be crushed rock conforming to Georgia Department of Transportation Table 800.01H, Size Number 57.
 - 5. Concrete block shall be hollow, non-load-bearing type.
 - 6. Concrete shall be Class B in accordance with Section 03300, Cast-in-Place Concrete.
 - 7. Plywood shall be ¾-inch thick exterior type.

2.03 RIP RAP

- A. Use only one method throughout the job.

- B. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Specific gravity shall be 2.0 or greater. Rip-rap shall have less than 66 percent wear when tested in accordance with MSHT0 T-96. Unless shown or specified otherwise stone rip-rap shall be Type 3 rip-rap.
1. Type 1 Rip Rap: The largest pieces shall have a maximum volume of two cubic feet. At least 35 percent of the mass shall be comprised of pieces, which weigh 125 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve. Rip-rap size shall conform to Georgia Department of Transportation Section 805.01 Stone Dumped Rip Rap, Type 1.
 2. Type 3 Rip Rap: The largest pieces shall have a maximum approximate volume of one cubic foot. At least 35 percent of the mass shall be comprised of pieces, which weigh 15 pounds or more. The remainder shall be well graded down to the finest sizes. Rock fines shall comprise a maximum of 10 percent of the total mass. Rock fines are defined as material passing a No. 4 sieve. Rip-rap size shall conform to Georgia Department of Transportation Section 805.01 Stone Dumped Rip Rap, Type 3.

2.04 FILTER FABRIC

- A. The filter fabric for use under rip-rap shall be a monofilament, polypropylene woven fabric meeting the specifications as established by Task Force 25 for the Federal Highway Administration. The filter fabric shall have an equivalent opening size (EOS) of 70.

PART 3 - EXECUTION

3.01 GENERAL

- A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with the Georgia Erosion and Sedimentation Act of 1975, local enforcing agency guidelines and these Specifications.
- B. Implementation: The work shown on the approved plans and working drawings shall be considered a minimum requirement. What is shown shall not relieve the Contractor of the responsibility to actively take all steps necessary to prevent soil erosion and off site sediment transport.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt and sediment from occurring.
- B. Silt dams, traps, barriers, appurtenances and other temporary measures and devices shall be installed as indicated on the approved plans and working drawings and shall be maintained until permanent improvement or vegetation is established. Deteriorated hay bales and dislodged filter stone shall be replaced with new materials. Sediment traps shall be inspected after each rainfall or weekly and shall be cleaned out when accumulation reaches one-half of the capacity of the structure.
- C. Where permanent grassing is not appropriate, and where the Contractor's temporary erosion and sedimentation control practices are inadequate, the Contractor shall provide temporary vegetative cover with fast growing seedlings. Such temporary vegetative cover shall be provided by the Contractor in compliance with the Manual for Erosion and Sedimentation Control in Georgia,

specifically in the selection of species, planting dates and application rates for seedlings, fertilizer and mulching.

- D. All erosion and sedimentation control devices, including check dams, shall be inspected by the Contractor on a weekly basis and after each rainfall occurrence and repaired by the Contractor as necessary.
- E. Temporary erosion and sedimentation control devices shall be installed and maintained prior to the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

3.03 PERMANENT EROSION CONTROL

- A. Permanent erosion control shall include:
 - 1. Restoring the work site to its original contours, unless shown otherwise on the Drawings.
 - 2. Permanent vegetative cover shall be performed in accordance with 3.04 of this Section.
- B. Permanent erosion control measures shall be implemented as soon as practical after the completion of structure installation or land disturbance for each segment of the Project. In no event, other than inappropriate planting season, shall implementation be postponed when no further activities related to structure installation will impact that portion or segment of the Project. Partial payment requests may be withheld for those portions of the Project not complying with this requirement.

3.04 GRASSING

- A. General:
 - 1. Refer to Section 02933, Seeding for detailed specifications on permanent seeding.
 - 2. When final grade has been established, all bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched in an effort to restore to a protected condition.
 - 3. Specified permanent grassing shall be performed at the first appropriate season following establishment of final grading in each section of the site.
 - 4. All references to grassing, unless noted otherwise, shall relate to establishing permanent vegetative cover as specified herein for seeding, fertilizing, mulching, etc.
 - 5. Permanent grassing shall be of a perennial species.
- B. Grassing activities shall comply with Section 02933, Seeding and the Manual for Erosion and Sediment Control in Georgia, specifically for the selection of species, planting dates and application rates for seeding, fertilizer and mulching. Where permanent vegetative cover (grassing) cannot be immediately established (due to season or other circumstances) the Contractor shall provide temporary vegetative or mulch cover.

3.05 RIP-RAP

- A. Unless shown otherwise on the Drawings, rip-rap shall be placed at all points where banks of streams or drainage ditches are disturbed by excavation, or at all points where their natural

vegetation is removed. Carefully compact backfill and place rip rap to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a stream or drainage ditch as well as crossing a stream or drainage ditch.

- B. When trenching across a creek, place rip-rap a distance of 10 feet upstream and 10 feet downstream from the top of the trench excavation. Place rip rap across creek bottom, across creek banks and extend rip-rap placement five feet beyond the top of each creek bank.
- C. Preparation of Foundations: The ground surface upon which the rip rap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced. Where filling of depressions is required, the new material shall be compacted with hand or mechanical tampers. Unless at creek banks or otherwise shown or specified, rip-rap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the rip-rap is placed, the toe ditch shall be backfilled and the excess dirt spread neatly within the construction easement.
- D. Placement of Filter Fabric: The surface to receive fabric shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The fabric shall be placed with the long dimension running up the slope and shall be placed to provide a minimum number of overlaps. The strips shall be placed to provide a minimum width of one foot of overlap for each joint. The filter fabric shall be anchored in place with securing pins of the type recommended by the fabric manufacturer. Pins shall be placed on or within 3-inches of the centerline of the overlap. The fabric shall be placed so that the upstream strip overlaps the downstream strip. The fabric shall be placed loosely so as to give and therefore avoid stretching and tearing during placement of the stones. The stones shall be dropped no more than three feet during construction. The fabric shall be protected at all times during construction from clogging due to clay, silts, chemicals or other contaminants. Any contaminated fabric or any fabric damaged during its installation or during placement of rip-rap shall be removed and replaced with uncontaminated and undamaged fabric at no expense to the County.
- E. Placement of Rip-Rap: The rip-rap shall be placed on a 6-inch layer of soil, crushed stone or sand overlaying the filter fabric. This 6-inch layer shall be placed to maximize the contact between the soil beneath the filter fabric and the filter fabric. Rip-rap shall be placed with its top elevation conforming to the finished grades or the natural slope of the stream bank and stream bottom.
 - 1. Stone rip-rap shall be dumped into place to form a uniform surface and to the thickness specified on the Drawings. The thickness tolerance for the course shall be -6-inches and +12-inches. If the Drawings do not specify a thickness, the course shall be placed to a thickness of not less than 18-inches.

+ + + END OF SECTION 02125 + + +

**SECTION 02140
DEWATERING****PART 1 - GENERAL****1.01 SCOPE:**

- A. Work described in this Section includes furnishing all labor, equipment, tools and incidentals required for all dewatering. This work includes the installation, operation, and removal of all facilities required to maintain the shafts, inlets, open excavations, and trenches in a dewatered condition to permit unrestricted construction operations.
- B. Construct all permanent Work in areas free from water. Design, construct and maintain all pumping systems, dikes, levees, cofferdams, 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, trenches, 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 sub-surface, to the lines, grades and conditions existing prior to the damage at no additional cost to the Owner.
- D. Related Work Specified elsewhere:
 - 1. Section 02125 – Temporary and Permanent Erosion and Sedimentation Control
 - 2. Section 02200 - Earthwork

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents and as specified hereinafter.
- B. Working Drawings
 - 1. Submit complete working drawings and supporting documents showing the type of water control system proposed for each site where required. Obtain Engineer's approval prior to installation of the system.
 - 2. Working drawings and supporting documents will show:
 - a. Arrangement and location of the system.
 - b. Complete description of equipment and materials to be used.
 - c. Installation and operation and maintenance procedures.
 - d. Design calculations.
 - e. Standby equipment and power supply.
 - f. Location and size of berms, dikes, settling basins, sumps, and discharge items.
 - g. Pollution control facilities.
 - h. Discharge locations.
 - i. Number and location of monitoring wells
 - 3. Working drawings and supporting documents will be revised and resubmitted if the system is modified during installation or during operation.
- C. Copies of all permits required to discharge the water as specified below.

1.03 JOB CONDITIONS

- A. Subsurface Conditions: The results of subsurface investigations or groundwater level readings are shown if available in the geotechnical report.
- B. Permits: Prior to discharging water into a storm sewer or waterway, obtain all necessary permits from the jurisdictional agencies and submit a Notice of Intent to the Georgia Environmental Protection Division by certified return receipt mail at least 48 hours prior to conducting any land disturbance activities.
- C. Responsibilities
 - 1. Select and install a system to control water as herein specified, and to comply with the requirements of the jurisdictional agencies.
 - 2. Take measures to prevent damage to properties, buildings or structures, sewers and other utility installations, pavements, sidewalks, improvements and work.
 - 3. Do not overload or obstruct existing facilities.
 - 4. Modify the system at no additional cost to the Owner if after installation and while in operation it causes or threatens to cause damage to existing buildings, structures, utilities, facilities, or other adjoining property.
 - 5. Monitor the quality of the discharge from the dewatering system to determine if soil particles are being removed by the system and install and maintain settling basins as required to control particle removal .
 - 6. Measure and evaluate if movements are being caused to adjacent buildings, structures, utilities, facilities or other adjoining properties by dewatering operations.
 - 7. Repair damage, disruption, or interference resulting directly or indirectly from dewatering operations at no additional cost to the Owner and to the Engineer's approval.
 - 8. Restore, maintain and monitor on a weekly basis all existing piezometric observation wells located within or on the project site. Additional piezometric observation wells shall be required to monitor the ground water level, to insure proper dewatering prior to excavation below the static water table. The number of wells required will vary to meet the Contractor's responsibilities and will depend on the size and depth of the excavations required for the work to be constructed.
 - 9. Submit plans and details for the protection of downstream contracts where applicable. These plans shall include details of bulkheads, pumping facilities, dikes, and drainage.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION****3.01 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.

- 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. After they have served their purpose, remove all temporary protective work at a satisfactory time and in a satisfactory manner. 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.
- E. When the temporary works will not adversely affect any item of permanent work or the planned usage of the Project, the Contractor may be permitted to leave such temporary works in place. In such instances, breeching of dikes, levees and cofferdams may be required and grout filling of all wells. Otherwise the temporary works and all debris shall be completely removed and the site restored to its original condition.
- F. Intercept and divert surface drainage away from the excavation, by the use of dikes, curb walls, ditches, pipes, sumps, or other means.
- G. Design surface drainage systems so that they do not cause erosion on or off the site or cause unwanted flow of water.

3.02 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 2 feet below the lowest point in the excavation unless otherwise specified.
- C. Piezometric observation wells shall be required, to monitor the ground water level, to insure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures.
- D. No separate payment will be made for dewatering required to accomplish the work., the cost for such shall be considered incidental to the work for which it is required.
- E. Provide and maintain ditches of adequate size to collect surface water and seepage which may enter the excavations and divert the water into a sump so that it can be drained or pumped into drainage channels and settling basins prior to discharge to storm sewers if approved by the Engineer and the jurisdictional agency concerned.
- F. Dewater by means which will insure dry excavations, preserve final lines and grades, and not disturb or displace adjacent soil.
- G. Excavations shall be continuously dewatered to maintain a ground water level no higher than twofeet below the lowest point in the excavation unless otherwise specified. Dewatering shall be accomplished well enough in advance of excavation to ensure that groundwater is already lowered prior to completing the final excavation to finish subgrade.

- H. All destabilized subgrade conditions caused by inadequate or untimely dewatering operations shall be undercut and backfilled with suitable backfill material at no additional cost to the County.
- I. Should a storm sewer become blocked or have its capacity restricted due to the dewatering operations, make arrangements with the jurisdictional agency for the cleaning of the sewer and appurtenances at no additional expense to the County.

+++ END OF SECTION 02140 +++

**SECTION 02200
EARTHWORK****PART 1 - GENERAL****1.01 SCOPE**

- A. The work under this Section includes earthwork and related operations, including, but not limited to; excavating all classes of material encountered; trenching; handling; storage; transportation; and disposal of all excavated and unsuitable material; construction of fills and embankments; backfilling around structures; backfilling all pits; compacting; all sheeting; shoring and bracing; preparation of subgrades; surfacing and grading; and any other similar, incidental, or appurtenant earthwork operation which may be necessary to properly complete the Work.
- B. The work under this Section applies to the development and use of the construction sites and not to excavations for shafts, tunnels and pipelines.
- C. The Contractor shall provide all services, labor, materials, and equipment required for all earthwork and related operations necessary or convenient to the Contractor for furnishing complete Work as shown on the Drawings or specified in these Contract Documents.
- D. Related Work specified elsewhere:
 - 1. Section 01410 - Testing Laboratory Services
 - 2. Section 02110 - Clearing and Grubbing.
 - 3. Section 02125 - Erosion and Sediment Control.
 - 4. Section 02140 - Dewatering
 - 5. Section 02575 - Asphalt Paving.
 - 6. Section 02933 - Seeding

1.02 GENERAL

- A. The elevations shown on the Drawings as existing are taken from the best available data and are intended to give reasonable information about the existing elevations. The Contractor shall verify conditions to determine the exact quantities of excavation and fill required.
- B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.
- C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the County. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material at no cost to the County.
- D. The Contractor shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can flow uninterrupted in existing open ditches or channels; other surface drains; or temporary drains.
- E. No classification of excavated materials will be made. Excavation work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the Work, regardless of the type, character, composition or condition thereof. All excavating shall be unclassified.

- F. The soil testing will be performed by an independent testing laboratory selected by the Engineer. Payment for soil testing shall be made by the Contractor from the "Specialty Contractors" allowance. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests. The cost of all retests made necessary by the failure of materials supplied by the Contractor, his agents or subcontractors, to conform to the requirements of these Contract Documents shall be paid by the Contractor. Contractor shall provide at least 24 hours advance notice of earthwork operations to the Testing Laboratory. Testing Laboratory shall provide periodic reports, at least monthly during the earthwork operations, to the Engineer with copies to the Contractor certifying (and sealed by a Registered Georgia Engineer) that earthwork is in conformance with the plans and specifications. As a minimum at least one density test shall be performed for every 5,000 square feet of fill area and every two feet of fill lift. The Testing laboratory shall witness the placement of all fill, unless otherwise directed by the Engineer.
- G. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the Engineer.
- H. Stockpile Areas: Provided there is space available, stockpiling material may be on site.

1.03 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:
1. Copies of permits obtained by the Contractor for the work.
 2. Test results, certification of compliance, source and samples for all imported materials.
 3. Samples of fill materials to be used. Samples shall be submitted 2 weeks in advance of use and shall consist of 0.5 cubic feet of each type of material.

1.04 QUALITY ASSURANCE

- A. Reference Standards. Comply with all Federal and State laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
1. ASTM C136-84a, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 2. ASTM D1556-82, Test Method for Density of Soils in Place by the Sand Cone Method.
 3. ASTM D1557-78, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in. (457-mm Drop).
 4. ASTM D3107-88, Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Earthwork Materials
1. Controlled Fill:

- a. Proposed fill soils shall be laboratory tested prior to construction use to determine their suitability. All fill material shall be subject to the approval of the Engineer.
 - b. Notification: For approval of imported fill material, notify the Engineer and Testing Laboratory at least three (3) weeks in advance of intention to import material, designate the proposed borrow area, and permit the Testing Laboratory to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material. Test results shall be submitted to the Engineer for approval. All fill shall be free of significant organic matter or debris, have a low to moderate plasticity, ($PI \leq 15$) uniform composition, and be free of rock fragments greater than three inches in dimension. Soils selected for use as fill material shall also have a standard Proctor (ASTM D 698) maximum dry density of at least 90 pounds per cubic foot.
 - c. All on-site fill material shall be soil exclusive of organic matter, frozen lumps or other deleterious substances.
 - d. It shall contain no rocks or earth clumps over 3-inches maximum in dimension.
2. Structural Fill and Structural Backfill:
- a. Select on site materials may be suitable. Testing and recommendation of suitability shall be made by the Testing Laboratory and submitted by the Contractor to the Engineer for approval.
 - b. Imported material shall be sand, uniformly graded crushed rock or other select material recommended by the Testing Laboratory and submitted by the Contractor to the Engineer for approval. Graded aggregate base material as specified in Section 02575, Removing and Replacing Pavement, is acceptable for structural fill and backfill.
 - c. Crushed Rock: Crushed rock used for bedding and drainage stone shall conform to the Georgia Department of Transportation Standard Specifications for construction of Road and Bridges, 800.01 for No. 57 Stone.
3. Coarse Aggregate: Coarse aggregate shall conform to the Georgia Department of Transportation Standard Specifications of Transportation Systems construction of Road and Bridges, 800 for No. 57 Stone, Group II, and shall have the following gradation:

Sieve size	Percent Passing	
1-½ inch	100	-
1 inch	95	100
¾ inch	-	-
½ inch	25	60
inch	-	-
#4	0	10
#8	0	5

4. Top Soil: Dark organic weed free loam.
- B. Sheeting, Bracing and Timbering: The Contractor shall furnish, place and maintain all sheeting, bracing and timbering required to properly support trenches and other excavations in open cut and to prevent all movement of the soil, pavement, structures, or utilities outside of the trench or pit.
1. General:

- a. All cofferdams, sheeting, bracing and timbering shall be designed, sealed and signed by a registered Professional Engineer in the State of Georgia at the Contractor's expense. A copy of the drawings and design computations shall be submitted to the Engineer for the project files.
 - b. Sheeting, bracing and timbering shall be so placed as to allow the Work to be constructed to the lines and grades shown on the Drawings.
 - c. If at any time the method being used by the Contractor for supporting any material or structure in or adjacent to any excavation is not reasonably safe the Engineer may require and the Contractor shall provide additional bracing and support necessary to furnish the added degree of safety. The Contractor shall provide such added bracing and support by such method as Contractor may elect to use, but the taking of such added precautions shall in no way relieve the Contractor of sole and final responsibility for the safety of lives, work and structures.
 - d. All sheeting and shoring in contact with the concrete or masonry shall remain in place. The sheeting or shoring above the structure may remain in place or be cut off. No sheeting shall be left in place within three feet below the ground surface.
 - e. There shall be no payment for sheeting, bracing, and timbering left in place.
2. Timber:
- a. Timber may be substituted for steel sheet piling when approved by the Engineer. Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.
 - b. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the work and adjacent property. Leave sheeting in place when it cannot be safely removed. Cut off sheeting left in place below the finished ground surface by three feet.
3. Steel Sheet Piling:
- a. Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral or vertical movement at all times. In addition to the drawings and computations, the Contractor shall provide closure and sealing details between sheet piling and existing facilities, as well as method of excavation within sheet piling to the Engineer for review before commencing construction operations. Contractor shall be responsible for all damage to existing utilities and structures resulting from installation of sheet piling. Damage to existing utilities and/or structures resulting from installation of sheet piling shall be repaired at the Contractor's expense.
- C. Other Materials: All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the prior approval of the Engineer.
- D. Stockpile area: The stockpile area shown on the drawings, or as directed by the Engineer, shall

be used to stockpile soil material for backfilling around structures and to stockpile needed topsoil.

PART 3 - EXECUTION

3.01 GENERAL

- A. Benching of Slopes: When the embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when the embankment is to be built $\frac{1}{2}$ width at a time, the slopes that are steeper than 4:1 as measured at right angles to the embankment shall be continuously benched over those areas as the work is brought up in layers. Benching shall be of sufficient width to permit the operation of placing and compacting equipment. Each successive cut shall begin at the intersection of the original ground and the vertical side of the previous cut. Material thus cut shall be recompacted along with the new embankment material. Proof roll subgrade prior to placement of fill material.
- B. Topsoil:
1. Remove all topsoil to a depth at which subsoil is encountered, from all areas, which are to be cut to lower grades or filled.
 2. Topsoil to be used for finish grading may be stored on the site. It shall be piled properly, sloped to drain and covered.
- C. Bracing and Sheeting:
1. Furnish, install, and maintain all sheeting, bracing, and shoring as may be required to properly support the sides of all excavations and to prevent all movement of earth, which could in any way injure the work, adjacent property, or workmen.
 2. Properly support all trenches for duct bank installation so as to conform to all pertinent rules and regulations and these Specifications. All trenches deeper than 5 feet shall be shored unless cut to the angle of repose of the excavated soils.
 3. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the work and adjacent property.
 4. Do not leave any sheeting or bracing in the trench or excavation after completion of the work, unless approved or instructed by the Engineer. The cost of leaving sheeting or bracing shall be at the Contractor's expense.
 5. All sheeting and shoring in contact with concrete or masonry shall remain in place. The sheeting and shoring above the structure may remain or be cut off. No sheeting or shoring left in place shall be within three feet below the ground surface.
- D. Obstructions:
1. Remove and dispose of all trees, stumps, roots, boulders, pavement, pipes and the like, as required for the performance of the work.
 2. Exercise care in excavating around catch basins, inlets, manholes, piping, duct banks, underground vaults, etc.
 3. Avoid removing or loosening castings or pushing dirt into structures.
 4. Damaged or displaced casting shall be repaired and replaced, and dirt entering the

structures during the performance of the work shall be removed at no additional cost to the County.

E. Utilities to be Abandoned:

1. When pipes, conduits, sewers or other structures are removed from the trench leaving dead ends in the ground, such ends shall be fully plugged and sealed as indicated on the Drawings.
2. Abandoned structures such as manholes, catch basins or chambers shall be entirely removed unless otherwise specified or indicated on the Drawings.
3. All materials from abandoned utilities which can be readily salvaged shall be removed from the excavation and stored on the site at a location as directed by the Engineer.
4. All salvageable materials will remain the property of the County unless otherwise indicated by the Engineer.

F. Extra Earth Excavation:

1. In case soft material, which, in the opinion of the Engineer is not suitable, is encountered in the bottom of a trench or underneath a structure, the soft material shall be removed and replaced with structural fill or gravel.

G. Cutting Paved Surfaces and Similar Improvements:

1. Remove existing pavement as necessary for installing utilities and appurtenances or as otherwise shown on the Drawings.
2. Before removing any pavement, mark the pavement neatly, paralleling pipe lines and existing street lines. Space the marks to match the width of the trench.
3. Break asphalt pavement along the marks using jack hammers or other suitable tools. Break concrete pavement along the marks by use of jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
4. Do not pull pavement with machines until completely broken and separated from pavement to remain.
5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement. Refer to Section 02575 for replacement of damaged or removed pavement.
 - a. NOTE: No additional payment will be made for removing and replacing damaged adjacent pavement.
6. Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
7. The Contractor may tunnel under curbs that are encountered. Remove and replace any curb disturbed by construction to the nearest undisturbed joint.

H. Dewatering:

1. The proposed dewatering plan shall be submitted by the Contractor to the Engineer for approval at least ten (10) working days prior to the beginning of any excavation.

2. 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.
3. 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.
4. Excavations shall be continuously dewatered to maintain a ground water level no higher than 3 feet below the lowest point in the excavation.
5. Piezometric observation wells shall be required, to monitor the ground water level, to insure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures and shall be included in the plan.
6. The cost for all dewatering and discharge shall be at the Contractor's expense and shall be considered incidental.

3.02 EXCAVATION

A. Method:

1. All excavation shall be by open cut from the surface except as indicated on the Drawings.
2. All excavations for appurtenances and structures shall be made in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting, and supporting the sides of the excavation, for pumping and draining groundwater and wastewater which may be encountered, and for the removal from the trench of all materials excavated.
3. Water shall not be allowed to accumulate in excavations. Contractor shall provide sufficient temporary pumping to assure that surface and ground waters do not saturate foundation soils.
4. Take special care so that soil below the bottom of the structure to be built is left undisturbed.

B. Grades:

1. Excavate to lines and grades indicated on the Drawings.
2. Where excavation grades are not indicated on the Drawings, excavate as required to accommodate installation.

C. Disposal of Excavated Material:

1. Remove and legally dispose of all excavated material not needed to complete filling, backfilling, and grading.
2. Dispose of excess excavated material at locations secured by the Contractor and in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street or alley. No debris shall be deposited on any private property except by written consent of the property owner. In no case shall any material be left on the Project, or be buried in embankments or trenches on the Project. With recommendation of the Testing Laboratory

and approval by the Engineer, demolished, crushed concrete may be acceptable for use in fill areas.

3. Excavated materials shall be placed adjacent to the work to be used for backfilling as required.
4. Excavated materials shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and to not cause any drainage problem. Excavated material shall be placed so as to not damage existing landscape or man-made improvements. Surcharging of any bank is not allowed.

D. Rock Excavation:

1. No separate payment for rock excavation shall be made. All costs for rock excavation shall be included in the Contractor's Lump Sum Bid.
2. Rock excavation shall mean rock requiring blasting and shall be such material which cannot be removed with a crawler tractor equal to a D-8 Caterpillar, equipped with a single-tooth ripper or by an excavator trackhoe equal to a Caterpillar 225 rated with a $\frac{3}{4}$ cubic yard capacity with a bucket curling pullout capacity of 25,000 pounds.
3. Where rock is encountered within excavation for structures, it shall be excavated to the lines and grades indicated on the Drawings or as otherwise directed by the Engineer. The Contractor shall be responsible for obtaining any blasting permits required.
4. If excess excavation is made or the material becomes disturbed so as to require removal below final subgrade elevations or beyond the prescribed limits, the resulting space shall be refilled with Class "C" or Class "B" concrete in accordance with Section 03300 of these Specifications.
5. Blasting: If blasting is permitted blasting operations shall be conducted in accordance with all existing ordinances and regulations. All structures shall be protected from the effects of the blast. The blasting shall be done by licensed experienced workers. Dispose of excavated rock in accordance with applicable federal, state, county and local regulations.
 - a. If, in the sole opinion of the Engineer, the Contractor persistently uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer will direct the Contractor to employ an independent, qualified blasting consultant, approved by the Engineer, to supervise the preparation for each blast and approve the quantity of each charge. The cost of the blasting consultant will be paid for by the Contractor and the Contractor shall not be reimbursed through the Contract allowance. The qualified blasting consultant when required to perform drilling and blasting will be paid for by the Contractor.
 - b. The Contractor will notify the inspector before any charge is set and prior to blasting. Following review by the inspector regarding the proximity (normally within 300 linear feet) of permanent structures to the blasting site, the Engineer may direct the Contractor to employ an independent qualified specialty subcontractor, approved by the Engineer, to monitor the blasting by use of seismograph, identify areas where light charges must be used, conduct pre-event and post-event inspections of all structures, including photographs or videos, and maintain a detailed written log. The cost of this independent qualified specialty subcontractor allowance will be used only to pay for a specialty subcontractor when directed by the Engineer to monitor blast, conduct pre-event and/or post-event inspections and maintain a log of these activities.

- c. Any damage done shall be promptly repaired by the Contractor at the Contractor's own expense.

3.03 EXCAVATING FOR STRUCTURES

A. Excavation:

1. All excavation is unclassified and shall be included in the Lump Sum portion of the Contractor's Base Bid.
2. Excavation shall include all substances to be excavated. Excavation for structures shall be to limits not less than 2 feet outside wall lines, to allow for formwork and inspection.
3. Where rock excavation is carried below grade the Contractor shall backfill to grade using concrete or structural fill.
4. Where unsuitable material is encountered excavate material to a depth acceptable to the Engineer and fill with compacted structural fill as required.

B. Excavation for Foundations: Footings and slabs on grades shall rest on undisturbed earth, rock or compacted materials to insure proper bearing.

1. Unsuitable Foundation Material

- a. Any material in the opinion of the Engineer which is unsuitable for foundation shall be removed and replaced with compacted crushed stone, or with compacted fill material as directed by the Engineer. Crushed stone shall meet the requirements of the Georgia Department of Transportation Specification 800.01 for No. 57 stone.
- b. No determination of unsuitability will be made until all requirements for dewatering are satisfactorily met.

2. Foundation in Rock: Foundations for a structure shall be on similar materials. Should excavation for a foundation be partially in rock, the Contractor shall undercut that portion of the rock 12-inches and bring the excavation to grade with compacted crushed stone.

C. Construction Observations:

1. All excavations should be examined by the Engineer prior to reinforcing steel placement to verify that the design bearing pressure is available. All excavations should be clean, level and free of ponded water, mud and loose, frozen or water-softened soils. If it is necessary for an excavation to remain open overnight, or if rain is imminent, a 3-to 4-inch thick "mud mat" of Class B concrete may be placed in the bottom of the excavation to protect the bearing soils until reinforcing steel and concrete can be placed.

D. Unsuitable Bearing:

1. If unsuitable bearing for foundations is encountered at the elevations indicated on the Drawings, the Engineer shall be notified immediately.

3.04 EXCAVATION BELOW GRADE AND REFILL

- A. If the bottom of any excavation is taken out below the limits shown on the Drawings or specified, it shall be refilled to the bottom grade, at the Contractor's expense, except where rock or unsuitable soil is encountered. The refill shall be 6-inch layers of structural fill or other material satisfactory to the Engineer. The type of material to be used shall be the Engineer's option.

3.05 BACKFILL AND FILL PLACEMENT

- A. Compaction of fill shall be accomplished by placing the fill material in horizontal lifts of eight-inches (8") maximum loose thickness and mechanically compacting each lift to at least the specified dry density.
- B. All fill placement shall be witnessed by an experienced soils technician of the Testing Laboratory and fill density and moisture tests for each lift shall be performed to verify that the specified degree of compaction is being achieved.
- C. Prior to placement of any material in embankments, the area within embankment limits shall be stripped of topsoil and all unsuitable materials removed as described under Excavation. Area to receive fill shall then be scarified to a depth of at least 6-inches.
- D. The fill shall be brought to the proposed elevation by placing and compacting only approved fill materials upon a subgrade approved by the Engineer.
- E. Fill materials shall be placed in continuous approximately horizontal layers extending the full width of the embankment cross-section and the full dimension of the excavation where practicable.
- F. The fill shall be placed at a moisture content that corresponds to a +/- 3% of the optimum moisture content, as determined by the standard Proctor moisture-density relationship test.
- G. Compaction:
 - 1. The fill shall be uniformly compacted to a dry density that corresponds to at least 95% of the standard Proctor maximum dry density (ASTM D 698) of the fill soil.
 - 2. The upper twelve-inches (12") of fill beneath the structures and pavement areas shall be compacted to 98% of the standard Proctor maximum dry density.
 - 3. Scarification and recompacting of the upper fill soils immediately prior to the slab-on-grade and/or pavement construction shall be required.
 - 4. Compaction of embankments shall be by sheepsfoot rollers with staggered uniformly spaced knobs and suitable cleaning devices. The projected area of each knob and the number and spacing of the knobs shall be such that the total weight of the roller and ballast when distributed over the area of one (1) row of knobs shall be 250 psi. Placement and compaction of materials shall extend beyond the final contours sufficiently to insure compaction of the material at the resulting final surface. Final contours shall then be achieved by a tracked bulldozer or grader shaping the face of the embankment.
 - 5. The backfill placement in trenches and behind structures shall be uniformly compacted to a dry density that corresponds to at least 95% of the standard Proctor maximum dry density (ASTM D 698) of the fill soil. In confined areas requiring portable compaction equipment the fill material shall be placed in horizontal lifts of four-inches (4") maximum loose thickness.
 - 6. If tests indicate that density of backfill fill is less than that specified, the area shall be either recompacted or undercut, filled, and compacted until specified density is achieved.
- H. Final Grading: Upon completion of construction operations, the area shall be graded to finish contour elevations and grades shown on the Drawings. Graded areas shall be made to blend with remaining ground surfaces. All surfaces shall be left smooth and free to drain.

I. Moisture:

1. If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.
2. If fill material is too dry, provide and operate approved means to add moisture to the fill layers.

J. Proofrolling:

1. All areas where pavement or structures are to be built on compacted fill and other areas where indicated on the Drawing, shall be proofrolled to detect soft spots prior to the placement of fill material or construction of foundations.
2. Proofrolling shall consist of the moving a 20-30 ton loaded dump truck or pneumatic tire roller over the subgrade after the subgrade is shaped. Proofrolling shall be witnessed by the Engineer.
3. Pneumatic-tired rollers shall have not fewer than four pneumatic tired wheels which shall be of such size and ply that tire pressures can be maintained between 80 and 100 pounds per square inch for 25,000 pound wheel load during rolling operations. Unless otherwise required, rolling shall be done with tires inflated to 90 psi. The roller wheels shall be located abreast in a rigid steel frame. Each wheel shall be loaded with an individual weight box so that each wheel will bear an equal load when traversing uneven ground. The weight boxes shall be suitable for ballast loading such that the load per wheel shall be 25,000 pounds. The spacing of the wheels shall insure that the distance between the nearest edges of adjacent tires shall be not greater than one-half of the tire width of a single tire at the operating pressure for a 25,000 pound wheelload. The roller shall be operated not faster than 5 feet/second.
4. Subgrade shall be proofrolled with 6 passes. Depressions that develop during the proofrolling operation shall be filled with suitable material and those filled areas shall be proofrolled with 6 passes. If, after having been filled and proofrolled, the subgrade still contains depressions, the soil shall be undercut to the full depth of the soft material or 5 feet whichever is less, backfilled, and rolled to achieve a compacted subgrade.
5. After the proofrolled subgrade has been accepted by the Engineer, the surface of the subgrade shall be finish rolled with a smooth steel wheel roller weighing not less than 10 tons. Finished surface of the subgrade shall be within a tolerance of 0.04 feet at every point.
6. Conduits, pipes, culverts and underdrains shall be neither disturbed nor damaged by proofrolling operations. Rollers shall neither pass over, nor approach closer than 5 feet to conduits, pipes, culverts and underdrains unless the tops of those facilities are deeper than 3 feet.

- K. During wet or rainy periods, aeration (drying) shall be required to reduce the fill materials to the required moisture condition. During dry periods, water shall be added to achieve the proper moisture content for compaction. Silty soils, which are wet, shall require aeration prior to compaction even during dry periods.

3.06 BACKFILLING AROUND STRUCTURES

A. General:

1. Remove debris from excavations before backfilling.

2. Do not backfill against foundation walls until so instructed by the Engineer
3. Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.
4. Do not backfill on only one (1) side of vertically spanning walls unless walls are adequately shored or permanent construction is in place to furnish lateral support on both top and bottom of wall.

3.07 GRADING

A. General:

1. Perform all rough and finish grading required to attain the elevations indicated on the Drawings.
2. Perform rough grading to an accuracy of plus or minus 0.10 feet.

B. Grading Around Buildings: Control the grading around buildings so the ground is pitched to prevent water from running into the excavated areas of a building or damaging other site features.

C. Treatment After Completion of Grading:

1. After grading is completed, permit no further excavation, filling or grading, except with the approval of the Engineer.
2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.08 EXCESS WATER CONTROL

A. Unfavorable Weather:

1. Do not place, spread or roll any fill material during unfavorable weather conditions.
2. Do not resume operations until moisture content and fill density are satisfactory to the Engineer.
3. Any inundated area that freezes shall be removed and refilled at the Contractor's expense.

B. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.

C. Pumping, Drainage and Dewatering:

1. Provide, maintain and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the Work.
2. Dewater by means, which will insure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil.
3. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances,

and regulations.

4. Do not overload or obstruct existing drainage facilities.

3.09 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments, which may occur within one (1) year after final acceptance of the Work by the County.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within thirty (30) days after receipt of written notice from the Engineer.

3.10 CLEANING

- A. Upon completion of the work of this Section, remove all rubbish, trash and debris resulting from construction operations. Remove surplus equipment and tools. Leave the site in a neat and orderly condition acceptable to the Engineer, and in conformance with the General Conditions of the Contract Documents.

+++ END OF SECTION 02200 +++

SECTION 02225
TRENCH EXCAVATION AND BACKFILL**PART 1 – GENERAL****1.01 SCOPE**

- 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 pipelines shown on the Drawings and as specified.
- B. Related Work Specified Elsewhere:
1. Section 02200 - Earthwork
- C. Excavation shall include the removal of any trees, stumps, brush, debris, or other obstacles that remain after the clearing and grubbing operations, which may obstruct the work. Excavation shall also include the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- D. 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.
- E. 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 barrel of the pipe.
 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 12-inches above the top of the barrel of the pipe.
 5. Final Backfill: The area above a plane 12-inches above the top of the barrel of the pipe.
- F. The choice of method, means, techniques, and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the: type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area.

1.02 QUALITY ASSURANCE

- A. Density: All references to "maximum dry density" shall mean the maximum dry density defined by ASTM D 698, except that for cohesion less, free draining soils "maximum dry density" shall mean the maximum index density as determined by ASTM D 4253.

Determination of the density of foundation, bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, ASTM D 2922, or ASTM D 2937.

- B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory.

1.03 SAFETY

- 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.

PART 2 – PRODUCTS

2.01 TRENCH FOUNDATION MATERIALS

- A. Crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble, or dolomite) or Group II (quartzite, granite, or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

2.02 BEDDING AND HAUNCHING MATERIALS

- A. Unless specified otherwise, bedding and haunching materials shall be crushed stone as specified below.
- B. Crushed stone utilized for bedding and haunching shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble, or dolomite) or Group II (quartzite, granite, or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

2.03 INITIAL BACKFILL

- A. Initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials.
- B. Earth materials utilized for initial backfill shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, 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, initial backfill materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as initial backfill material, provide select material conforming to the requirements of this Section.

2.04 FINAL BACKFILL

- A. Final backfill material shall be general excavated earth materials, shall not contain rock larger than 2-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and

other unsuitable materials. If materials excavated from the trench are not suitable for use as final backfill material, provide select material conforming to the requirements of this Section.

2.05 SELECT BACKFILL

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

2.06 CONCRETE

- A. Concrete for bedding, haunching, initial backfill, or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.07 FLOWABLE FILL

- A. Flowable fill, where required for trench backfill, shall meet the requirements of Georgia Department of Transportation Standard Specifications, Section 600 for Excavatable or Non-Excavatable type.

2.08 GRANULAR MATERIAL

- A. Granular material, where required for trench backfill, shall be sand, river sand, crushed stone or aggregate, pond screenings, crusher run, recycled concrete, or other angular material. Granular material shall meet gradation requirements for Size No. 57 or finer.
- B. Crushed Rock for in the vicinity of structures: Crushed rock used for pipe bedding and drainage stone shall conform to the Georgia Department of Transportation Standard Specifications for construction of Road and Bridges, 800.01 for No. 57 stone. For Concrete, cast iron, steel and galvanized iron pipe less than 12-inch, use ¾ -inch minus gravel, crushed gravel or crushed rock. For plastic pipe, copper tubing and heating pipes use ¼ -inch to 1 -inch pea gravel.

PART 3 – EXECUTION

3.01 TRENCH EXCAVATION

- A. Topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.
- B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions that provide the proper support and protection of the pipe and other structures and accessories.
- C. Trench Width for Pipelines:
 - 1. The sides of all trenches shall be vertical, as much as possible, to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.

2. Minimum width of trench: The minimum width of pipe trenches, measured at the crown of the pipe, shall not be less than 24-inches greater than the exterior diameter of the pipe exclusive of bells. The minimum base width, measured at the invert of the piping, of such trench, shall be not less than 24-inches greater than the exterior diameter of the pipe, exclusive of special structures or connections, and such minimum width shall be exclusive of all trench supports.
 3. Maximum Width of trench: The maximum allowable width of trench for all pipes measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of bells or collars) plus 24-inches, and such maximum shall be inclusive of all timbers and/or trench boxes, shoring, etc. A trench wider than the outside diameter plus 24-inches may be used without special bedding if the contractor, at his expense will furnish pipe of the required strength to carry the additional trench load. Such modifications shall be submitted to the Engineer and approved in writing. Whenever such maximum allowable width of the trench is exceeded for any reason, except provided for on the drawings or in the specifications or by written instruction of the Engineer, the Engineer shall, at his discretion, require that the contractor, at his own expense for all labor and materials, cradle the pipe in Class "B" concrete or other approved pipe bedding.
 2. Excavate the top portion of the trench to any width, within the construction easement or right-of-way, that will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees, or private property. Where necessary to accomplish this, provide sheeting and shoring.
 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe or manhole. The maximum allowable width of rock excavation for payment shall be based on a trench width equal to the outside diameter of the pipe barrel plus 18-inches, but the total allowable rock excavation width for payment will not be less than 36-inches.
 4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher Class or Type of bedding and haunching as shown on the Drawings for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or the County.
- D. Depth:
1. The trenches shall be excavated to the required depth or elevation that allows for the placement of the pipe and bedding to the dimensions shown on the Drawings.
 2. Where rock is encountered in trenches for pipelines, excavate to the minimum depth, which will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe, manhole, or accessory.
- E. Excavated Materials:

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be carefully separated and lastly placed in its original location.
2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.02 SHEETING, BRACING, AND SHORING

- A. Sheeting, bracing and shoring shall be performed in the following instances:
 1. Where sloping, of the trench walls, does not adequately protect persons within the trench from slides or cave-ins.
 2. In caving ground.
 3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced, and shored.
 4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties, which are required to remain.
 5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.
- B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.
- C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.
- D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth, and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities.
- E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield shall be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.
- F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Engineer

it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.

- G. Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the Engineer.

3.03 TRENCH ROCK EXCAVATION

- A. Definition of Trench Rock: Any material that cannot be excavated with conventional excavating equipment and that is removed by drilling and blasting, and occupies an original volume of at least one cubic yard.
- B. Blasting: Exhaust other practical means of excavating prior to utilizing blasting as a means of excavation. Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
- C. Removal of Rock: Dispose of rock, off site, that is surplus or not suitable for use as Rip Rap or backfill.
- D. The Contractor shall notify the Engineer prior to any blasting. Additionally, the Contractor shall notify the Engineer and local fire department before any charge is set.
- E. Following review by the Engineer, regarding the proximity of permanent buildings and structures to the blasting site, the Engineer may direct the Contractor to employ an independent, qualified specialty sub-contractor, approved by the Engineer, to: monitor the blasting by use of a seismograph; identify the areas where light charges must be used; conduct pre-blast and post-blast inspections of structures, including photographs or videos; and maintain a detailed written log.

3.04 DEWATERING EXCAVATIONS

- A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.
- B. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.
- C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.
- D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.
- E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two feet below the bottom of the trench. Pumping equipment shall be of sufficient quantity

and/or capacity to maintain the water level in the sump two feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.

- F. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.05 TRENCH FOUNDATION AND STABILIZATION

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Engineer shall then order trench stabilization by directing the Contractor to over excavate trench bottom and fill with crushed stone.
- C. Where the replacement of unsuitable material with crushed stone does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two feet below the specified trench bottom. Place filter fabric in the bottom of the trench and support the fabric along the trench walls until the trench stabilization, bedding, haunching and pipe have been placed at the proper grade. The ends of the filter fabric shall be overlapped above the pipe.
- D. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.06 BEDDING AND HAUNCHING

- A. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders, or large dirt clods.
- B. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All bedding shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the bedding material or by removal of the excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint.
- C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.

- D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders, or dirt clods.
- E. Gravity Sewers and Accessories: Lay PVC pipe with minimum Class "B" bedding. Lay all other pipe with Class "C" bedding, unless shown or specified otherwise.
1. Class "A": Excavate the bottom of the trench flat at 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.
 2. Class "B": 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.
 3. Class "C": 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 a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.
 4. Type 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 material to the proper grade before installing pipe. After the pipe has been brought to the proper grade, haunching material shall be carefully placed by hand and compacted to the top of the pipe.
- F. Manholes: Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.
- G. Sewage Force Mains:
1. Ductile Iron Pipe:
 - a. Unless otherwise shown on the drawings or specified, utilize earth materials for bedding and haunching. Pipe bedding shall be as detailed on the drawings.
 - b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 3 Pipe Bedding, except bedding for restrained joint pipe and fittings which shall meet the requirements for Type 4 Pipe Bedding.
- H. Excessive Width and Depth:
1. Gravity Sewers: If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor. Type 5 Bedding may be used in lieu of Class "A" bedding, where Class "A" bedding is necessitated by excessive trench width.

2. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.
- I. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

3.07 INITIAL BACKFILL

- A. 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 12-inches above the pipe barrel. 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 90 percent of the maximum dry density, unless shown or specified otherwise.
- F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section for initial backfill.

3.08 CONCRETE ENCASEMENT FOR PIPELINES

- A. Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 12-inches clearance from the barrel of the pipe. Lay the pipe to line and grade on solid concrete blocks or solid bricks. 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 12-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.09 FINAL BACKFILL

- A. Backfill carefully to restore the ground surface to its original condition.
- B. The top 6-inches shall be topsoil obtained as specified in "Trench Excavation" of this Section.
- C. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of in a manner approved by the Engineer. Surplus soil may be neatly distributed and spread over the site, if approved by the Engineer, except that surplus soil shall not be distributed and spread over the site in areas under Corps of Engineers jurisdiction. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
- D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

- E. After initial backfill material 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
- F. Settlement: If trench settles, re-fill, compact and grade the surface to conform to the adjacent surfaces.
- G. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

3.10 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 suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material.

3.11 BACKFILL WITHIN RIGHT-OF-WAYS

- A. Compact backfill underlying pavement and sidewalks, and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density.

3.12 BACKFILL WITHIN GEORGIA DOT RIGHT-OF-WAY

- A. Backfill within the Georgia DOT right-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards", published by the Georgia Department of Transportation.

3.13 FLOWABLE FILL

- A. Where flowable fill is required, excavate the trench to provide a minimum of 6-inches clearance on either side of the pipe barrel. Lay the pipe to line and grade on solid concrete blocks or bricks. In lieu of bedding, haunching and initial backfill, place flowable fill to the full width and depth of the trench.
- B. Flowable fill shall be protected from freezing for a period of 36 hours after placement. Minimum temperature of flowable fill at point of delivery shall be 50 degrees F.
- C. The Contractor shall provide steel plates over flowable fill in road locations.

3.14 COMPACTED GRANULAR MATERIAL

- A. Where compacted granular material is required as initial and final backfill material, it shall be placed after bedding and haunching material specified elsewhere has been placed. Compacted granular material shall be compacted to a minimum 95 percent of the maximum dry density.

3.15 TESTING AND INSPECTION

- A. The soils testing laboratory is responsible for the following:
 - 1. Compaction tests in accordance with Article 1.02 of this Section.
 - 2. Field density tests for each two feet of lift, one test site between each manhole, every 100 feet within road rights-of-way, or more frequently if ordered by the Engineer. The County shall direct where density tests will be performed along the Project route.
 - 3. Inspecting and testing stripped site, subgrades and proposed fill materials.
- B. The Contractor's duties relative to testing include:
 - 1. Notifying laboratory of conditions requiring testing.
 - 2. Coordinating with laboratory for field testing.
 - 3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.
 - 4. Providing excavation as necessary for laboratory personnel to conduct tests.
- C. Inspection:
 - 1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the Engineer.
 - 2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.

- D. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

+++ END OF SECTION 02225 +++

SECTION 02532
Concrete Curbs and Gutters**PART 1 – GENERAL****1.01 SCOPE**

- A. The extent of concrete curbs and gutters is as shown on the Drawings or as required to replace curbs and gutters damaged or destroyed by the Contractor's work.

1.02 RELATED SECTIONS

- A. The Work of the following Sections specifically apply to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of Work.

1 Division 3 Concrete Work

PART 2 – PRODUCTS**2.01 FORMS**

- A. Either full depth steel or wood forms of a size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are straight and free of distortion and defects.
- B. Use flexible spring steel forms or laminated boards to form radius bends as required.

2.02 CONCRETE

- A. Ready-Mix concrete, 3,000 psi compressive strength, conforming to ASTM C94.

2.03 JOINT FILLER

- A. Preformed joint filler meeting AASHTO M153 or AASHTO M213.

2.04 CONCRETE MIX

- A. Comply with applicable requirements of Section 03300 for concrete mix design, sampling and testing, and quality control, and as herein specified. Design the mix to produce standard-weight concrete consisting of Portland cement, aggregate and water to produce the following properties:

1. Compressive Strength: 3000 psi minimum at 28 days as determined by ASTM C39.
2. Slump: 4 inches maximum per ASTM C143.
3. Air Content: 3% to 6%.

PART 3 – EXECUTION**3.01 SUBGRADE PREPARATION**

- A. Remove loose material from compacted sub grade immediately before placing concrete.

3.02 FORM CONSTRUCTION

- A. Set forms to the required grades and lines rigidly braced and secured.
- B. Check completed formwork for grade and alignment to the following tolerances:
 - 1. Top of Form: Within 1/8 inch of design line and grade.
 - 2. Vertical Face: Not more than 1/4 inch in 10 feet from vertical.
- C. Thoroughly clean forms and coat, with form release agent as required ensuring form separation from concrete without damage, before placing concrete.

3.03 REINFORCEMENT

- A. Locate, place and support reinforcement, if any, as indicated or specified.

3.04 CONCRETE PLACEMENT

- A. General: Comply with the applicable requirements of Section 03300 for mixing and placing concrete and as herein specified.
- B. Do not place concrete until sub grade and forms have been checked for line and grade. Moisten sub grade as required to provide a uniform dampened condition at the time concrete is placed.
- C. Place concrete using methods that prevent segregation and separation of the mix, and with as little re-handling as possible. Consolidate concrete along the face of forms with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Discontinue vibration before segregation or excessive surface grout occurs. Perform any necessary hand spreading and consolidation with hand tools that will not cause segregation and separation.

Deposit and spread concrete in a continuous operation between transverse joints, as far as possible.

Machine methods of placing and forming may be used at Contractor's option, provided that an acceptable finished product, true to line, grade and cross section and conforming to specified finish and jointing requirements, is consistently produced. If machine results are not acceptable, remove and replace with formed concrete as specified.

3.05 JOINTS

- A. General: Construct contraction and expansion joints true to line with face perpendicular to surface of curb and gutter, unless otherwise shown. Construct transverse joints at right angles or radial to the curb centerline, unless otherwise shown.

When curb and gutter is constructed abutting concrete pavement, place transverse joints to align with pavement joints.

- B. Contraction Joints: Provide contraction joints at intervals of 10 feet, except where a lesser interval is required for closure, but no section is to be less than 6 feet in length.

Contraction joints may be formed by metal divider plates or may be sawed. In either case, joint depth is to be 20 to 25 percent the depth of the concrete.

- C. Expansion Joints: Form expansion joints with 1/2 inch thick premoulded joint filler. Locate expansion joints no further than 100 feet apart, unless otherwise shown, where curb and gutter is constructed adjacent to asphalt concrete paving. Match pavement expansion joints where curb and gutter is placed abutting concrete pavement.

Furnish joint fillers in one-piece that extend the full width and depth of the joint. After concrete is finished, trim any protruding joint material flush with concrete surface.

3.06 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth the exposed surface to a uniform finish by screeding and floating.
- B. With the exception of sawed joints, round all joint edges to 1/4 inch radius.
- C. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing as follows:
1. Broom finish, by drawing a fine-hair broom across the concrete, perpendicular to the line of traffic.
 2. Trowel finish, smooth, and free of trowel marks, uniform in texture and appearance.

3.07 CURING

- A. Protect and cure finished concrete curbs and gutters complying with applicable requirements of Section 03010.

3.08 REPAIR AND PROTECTION

- A. Acceptably repair or replace broken or defective curbs and gutters.
- B. After the concrete has set sufficiently, backfill and compact adjacent ground to design line and grade.
- C. Protect completed curbs and gutters from damage until final project acceptance.
- D. Clean concrete curbs and gutters free of stains, discolorations, dirt, trash, leaves, and other foreign material just prior to final inspection.

++ END OF SECTION 02532 ++

SECTION 02575
Removing and Replacing Pavement**PART 1 – GENERAL****1.01 SCOPE**

- A. The work to be performed under this Section shall consist of furnishing all labor, equipment and materials to replace existing pavement as indicated on the plans.
- B. Existing pavement, sidewalks, curbs, and gutters shall be replaced to meet the current standards, as described herein.
- C. Related work specified elsewhere:
 - 1. Section 02200, Earthwork
 - 2. Section 02225, Trench Excavation and Backfill
 - 3. Section 03300, Cast-in-Place Concrete

1.02 SUBMITTALS

- A. If required by the Engineer, provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.

1.03 CONDITIONS

- A. Weather Limitations:
 - 1. Apply bituminous tack coat only when the ambient temperature in the shade has been at least 50 degrees F for 12 hours immediately prior to application.
 - 2. Do not conduct paving operations when surface is wet or contains excess of moisture that would prevent uniform distribution and required penetration.
 - 3. Construct asphaltic courses only when atmospheric temperature in the shade is above 40 degrees F, when the underlying base is dry and when weather is not rainy.
 - 4. Place concrete pavement only under atmospheric conditions as specified in Section 03300.
 - 5. Place base course when air temperature is above 35 degrees F and rising.
- B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

PART 2 – PRODUCTS**2.01 MATERIALS AND CONSTRUCTION**

- A. Graded Aggregate Base: The sub-base shall be a minimum of 6-inches thick and a width equal to the width of the finished paving. Aggregate base shall be Class A, meeting the requirements of the Georgia Department of Transportation Specification for Construction of Transportation Systems, latest edition, Section 815. Compact to at least 95% of maximum density per Standard Proctor (ASTM D-698).

- B. Asphalt Base: The base for asphaltic pavement shall be Recycled Asphaltic Concrete Type 1, Group 1 or Blend 1, 25 mm Superpave, including bituminous material and hydrated lime (330lbs/sy) and conforming to the requirements of the Georgia Department of Transportation Specifications Section 828.
- C. Surface Course: The surface course for asphaltic pavement shall be Recycled Asphaltic Concrete Group 1 or 2, 9.5 mm Superpave, including bituminous material and hydrated lime (165lbs/sy) and conforming to the requirements of the Georgia Department of Transportation Specifications for Section 828.
- D. Prime coat shall be in accordance with Section 412 of the DOT Standard Specifications.
- E. Tack coat shall conform to Section 413 of the DOT Standard Specifications.
- B. Concrete: Provide concrete and reinforcing for concrete pavement or base courses in accordance with the requirements of Section 03300 of these Specifications. Concrete shall be minimum 3,000 psi compressive strength or as otherwise shown on the Drawings.
- C. Special Surfaces: Where pavement, or curbs, or gutters, not indicated to be removed, are disturbed or damaged these facilities shall be restored utilizing similar, if not original, materials, placed to the existing configurations..

PART 3 – EXECUTION

3.01 REMOVING PAVEMENT

- A. General: Remove existing pavement as necessary for other aspects of the construction. Do not damage existing facilities and structures indicated to remain. Any damage shall be repaired at the Contractor's expense.
- B. Saw Cutting: Under no circumstances shall the Contractor be allowed to remove concrete or asphalt without prior saw cutting. Asphalt pavement shall be saw cut along the marks using suitable equipment. The saw cutting shall be deep enough to produce an even, straight cut through the entire depth of pavement to the sub grade.
- C. Breaking: Break asphalt pavement along the marks using pavement shearing equipment, jack hammers or other suitable tools. Break concrete pavement along the marks by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
- D. Machine Pulling: Do not pull pavement with machines until the pavement is completely broken and separated from pavement to remain.
- E. Damage to Adjacent Pavement: Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
- F. Remove and replace any curb and/or gutter, which is disturbed by construction to the nearest undisturbed joint.

- G. Where milling is required, utilize adequate equipment to provide the required depth of milling in a neat and efficient manner.

3.02 REPLACING PAVEMENT

- A. Preparation of Sub grade: Upon completion of backfilling and compaction of the backfill, arrange to have the compaction tested by an independent testing laboratory approved by the Engineer/Owner. After compaction testing has been satisfactorily completed, replace all pavements, and curbing if any, removed.
1. Trench backfill shall be compacted for the full depth of the trench as specified in Section 02225 of these Specifications.
- B. Pavement Replacement:
1. Replace and repave all the areas specified, to the limits shown on the Drawings; and in accordance with the details shown.
 2. Forms for concrete pavement shall be of wood or metal, shall be straight and free from warp, and shall be of sufficient strength, when in place, to hold the concrete true to line and grade without springing or distorting.
 3. Asphaltic pavement construction shall be performed in accordance with Section 400 of the Georgia Department of Transportation Standard Specifications.
 4. Concrete pavement construction shall conform to the requirements of Section 03300 of these Specifications.
 5. Where pavement indicated to remain is damaged with potholes, the Contractor shall remove all existing loose pavement material and fill the hole with black base, as specified, to the level of the existing pavement. Contractor shall bear the cost of repairs.
- C. Finishing:
1. Strike off the surface of concrete pavement with a template and finish the surface with a wood float using heavy pressure, after which, contraction joints shall be made and the surface finished with a wood float or steel trowel.
 2. Finish the face of the curbs at the top and bottom with an approved finishing tool of the radius indicated on the Drawings.
 3. Finish edges with an approved finishing tool having a 1/4-inch radius.
 4. Provide a final broom finish by lightly combing with a stiff broom after troweling is complete.
 5. The finished surface shall not vary more than 1/8-inch in 10 feet from the established grade.

- D. Concrete shall be suitably protected from freezing and excessive heat. It shall be kept covered with burlap or other suitable material and kept wet until cured. Provide necessary barricades to protect the work. All damage caused by people, vehicles, animals, rain, the Contractor's operations and the like shall be repaired by the Contractor, at no additional expense to the Owner.

3.03 MAINTENANCE

- A. The Contractor shall maintain the surfaces of roadways built and pavements replaced until the acceptance of the Project. Maintenance shall include replacement, scraping, reshaping, wetting, and re-rolling as necessary to prevent raveling of the road material, the preservation of reasonably smooth surfaces and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the Engineer. Maintenance shall include sprinkling as may be necessary to abate dust from the gravel surfaces.

3.04 SUPERVISION AND APPROVAL

- A. Obtain the Engineer's/Owner's approval of newly constructed pavement.
- B. Complete pavement restoration as soon as possible after backfilling.
- C. Failure of Pavement: Should any pavement fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.
- D. Prior to acceptance and approval of any pavement, the Engineer may require one or all of the following tests: 1) coring, 2) extraction, 3) compaction, 4) density. The frequency and location of these tests will be left up to the discretion of the Engineer.

3.05 CLEANING

- A. The Contractor shall remove all surplus excavation materials and debris from the surfaces and shall deliver the area in a condition acceptable to the Engineer.

+++ END OF SECTION 02575 +++

**SECTION 02607
MANHOLES, JUNCTION BOXES CATCH BASINS AND INLETS****PART 1 - GENERAL****1.01 SCOPE**

- A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required to install cast-in-place, and precast concrete manholes, junction boxes, catch basins and inlets. The term manholes, as used, herein and shown on the Drawings includes manholes, junction boxes, catch basins and inlets. All work shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.
- B. Related Work Specified Elsewhere:
1. Section 02200, Earthwork.
 2. Section 03200, Concrete Reinforcement and Dowelling.
 3. Section 03300, Cast-In-Place-Concrete.

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:
1. Complete shop drawings and engineering data on frames, covers, steps and precast manhole sections and flotation calculations shall be submitted to the Engineer in accordance with the requirements of the General Conditions of the Contract Documents.

1.03 QUALITY ASSURANCE

- A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the Engineer, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials which fail to conform to these Specifications shall be rejected.
- B. After delivery to the site, any materials which have been damaged in transit or are otherwise unsuitable for use in the Work shall be rejected and removed from the site.

1.04 QUALITY STANDARDS

- A. Manufacturers offering products that comply with these specifications include:
1. Standard manhole frame and cover.
 - a. Vulcan Foundry, VM-26.
 - b. Neenah Foundry, Series R-1700.
 - c. Or equal.
 2. Manhole adjusting rings.
 - a. Neenah Foundry, R1979-H.
 - b. Higgins Foundry,
 - c. Or equal.
 3. Manhole rungs.
 - a. M.A. Industries.
 - b. Or equal.

1.05 WARRANTY

- A. Provide a warranty against defective materials and workmanship in accordance with the requirements of the General Conditions of the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Manholes shall be constructed of specified materials to the sizes, shapes and dimensions and at the locations shown on the Drawings or as otherwise directed by the Engineer. The height or depth of the manhole will vary with the location, but unless shown otherwise on the Drawings, shall be such that the top of the manhole frame will be at the finished grade of the pavement or ground surface and the invert will be at the designated elevations.

2.02 MATERIALS AND CONSTRUCTION

- A. Concrete and Reinforcement:

1. Concrete used in manhole and junction chamber construction shall be Class "A" concrete conforming to the requirements of Section 03300, Cast-In-Place Concrete.
2. Steel reinforcement shall conform to the requirements of Section 03200, Concrete Reinforcement and Dowelling.
3. Brick. The brick shall conform to the requirements of AASHTO M 91.
4. Mortar. The mortar for brick masonry and similar work shall be composed of 1 part of portland cement and 2 parts of mortar sand, by volume. The portland cement shall conform to the requirements of AASHTO M 45. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15 percent of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C 6. The water shall be clean and free of deleterious amounts of acids, alkalies, or organic material. If the water is of questionable quality, it shall be tested in accordance with AASHTO T 26.

- B. Precast Concrete Manholes:

1. Precast concrete manholes shall consist of precast reinforced concrete sections, a conical or flat slab top section, and a base section conforming with the typical manhole details as shown on the Drawings.
2. Precast manhole section shall be manufactured, tested and marked in accordance with the latest provisions of ASTM C 478.
3. The minimum compressive strength of the concrete for all sections shall be 4,000 psi.
4. The maximum allowable absorption of the concrete shall not exceed 8 percent of the dry weight.
5. The circumferential reinforcement in the riser sections, conical top sections and base wall sections shall consist of one (1) line of steel and shall be not less than 0.17 square inches per lineal foot.
6. The ends of each reinforced concrete manhole riser section and the bottom of the manhole top section shall be so formed that when the manhole risers and the top are assembled, they will make a continuous and uniform manhole.

7. Joints of the manhole sections shall be of the tongue and groove type. Sections shall be joined using 0-ring rubber gaskets conforming to the applicable provisions of ASTM C443, latest revision, or filled with an approved preformed plastic gasket meeting the requirements of Federal Specifications 55-5-00210, "Sealing Compound, Preformed Plastic for Pipe Joints", Type 1, Rope Form.
 8. Each section of the precast manhole shall have not more than two (2) holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or mortar after installation.
 9. Polypropylene plastic manhole steps shall be installed in each section of the manhole in accordance with the standard details shown on the drawings.
- C. Brick Structures:
1. Foundations. A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of reinforced concrete mixed, prepared, and placed in accordance with the requirements of Section 03300. The foundation shall be built to the correct elevation and shall be finished to cause the least possible resistance to flowing water.
 2. Laying Brick. All brick shall be clean and thoroughly wet before laying so that they will not absorb any appreciable amount of additional water at the time they are laid. All brick shall be laid in freshly made mortar. Mortar that is not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted. An ample layer of mortar shall be spread on the beds and a shallow furrow shall be made in it which can be readily closed by the laying of the brick. All bed and head joints shall be filled solid with mortar. End joints of stretchers and side or cross joints of headers shall be fully buttered with mortar and a shoved joint made to squeeze out mortar at the top of the joint. Any bricks that may be loosened after the mortar has taken its set shall be removed, cleaned, and relaid with fresh mortar. No broken or chipped brick shall be used in the face, and no spalls or bats shall be used except where necessary to shape around irregular openings or edges; in which case, full bricks shall be placed at ends or corners where possible, and the bats shall be used in the interior of the course. In making closures, no piece of brick shorter than the width of a whole brick shall be used; and wherever practicable, whole brick shall be used and laid as headers.
 3. Joints. All joints shall be slushed with mortar at every course, but slushing alone will not be considered adequate for making an acceptable joint. Exterior faces shall be laid up in advance of backing. Exterior faces shall be back plastered or pargeted with a coat of mortar not less than 1/2-inch thick before the backing is laid up. Prior to pargeting, all joints on the back of face courses shall be cut flush. Unless otherwise noted, joints shall be not less than 1/4-inch nor more than 1/2-inch wide and whatever width is adopted shall be maintained uniform throughout the work.
 4. Pointing. Face joints shall be neatly struck, using the weather joint. All joints shall be finished properly as the laying of the brick progresses. When nails or line pins are used, the holes shall be immediately plugged with mortar and pointed when the nail or pin is removed.
 5. Cleaning. Upon completion of the work, all exterior surfaces shall be thoroughly cleaned by scrubbing and washing down with water and, if necessary to produce satisfactory results, cleaning shall be done with a 5 percent solution of muriatic acid which shall then be rinsed off with liberal quantities of clean fresh water.
 6. Curing and cold weather protection. In hot or dry weather the brick masonry shall be protected and kept moist for at least 48 hours after laying the brick. Brick masonry work or pointing shall not be done when there is frost in the brick or when the air temperature is

below 50 degrees F unless the Contractor has on the project, ready to use, suitable covering and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 60 degrees F for the duration of the curing period.

D. Frames and Covers:

1. Frames and covers shall be cast iron conforming to the minimum requirements of Federal Specifications WWOI-652 or to ASTM A 48 for Class 30 Gray Iron Castings. All castings shall be made accurately to the required dimensions, fully interchangeable, sound, smooth, clean, and free from blisters and/or other defects. Defective castings which have been plugged or otherwise treated shall not be used. All castings shall be thoroughly cleaned and painted or coated with a bituminous paint. Each casting shall have its actual weight in pounds stenciled or painted on it in white paint.
2. Standard manhole frames and covers shall have a minimum of 22-inches clear inside diameter and shall be a minimum of 5-inches high, with guide ring, and shall weigh not less than 446 pounds, total. Manhole covers shall be as detailed on the Drawings.
3. The contact surfaces of all manhole covers and the corresponding supporting rings in the frames shall be machined to provide full perimeter contact.
4. All sanitary and storm sewer manhole covers shall have the word "PROPERTY OF THE FULTON COUNTY" cast on the top in letters 1-inch high.
5. An adjusting ring shall be provided for each manhole in a street.
6. Provide solid manhole and handhole covers and frames for electrical underground systems. Covers shall have letters "HIGH VOLTAGE", "LOW VOLTAGE", "SIGNAL", as applicable, embossed on top.

PART 3 - EXECUTION

3.01 CONSTRUCTION OF CAST-IN-PLACE CONCRETE MANHOLES

- A. Cast-in-place manholes, excluding curved manhole bases, shall be constructed in place with the base, barrel, and conical section all monolithically cast using removable forms of material and design approved by the Engineer.
- B. The vertical forms, vertical and horizontal wall spacers, steps and placing cone must be carefully positioned and firmly clamped in place before any placement is made. The wall spacers must be located 90 degrees from each other. The forms shall be firmly supported with bottom of forms at the proper elevation to permit the base to be deposited through the vertical forms.
- C. No pipe penetration shall be formed within 12-inches of a corner, on a square bases, or within 12-inches of another penetration, in any direction, for circular bases.
- D. The manhole base shall be deposited down through the wall forms onto undisturbed earth or shall be rock bearing. It shall be evenly distributed around the walls and vibrated both inside and outside the forms until there is a minimum slope of 60 degrees from the bottom of the forms to the bearing surface both inside and outside of the manhole. When this is complete and before

additional concrete is added, the concrete must be carefully vibrated on each side of each sewer pipe.

- E. The base shall be concentric with the manhole, except where eccentric alignment with ladder is required, and have a minimum diameter of 4-feet or 16-inches greater than the outside diameter of the manhole whichever is greater, and 10-inch minimum thickness under the lowest pipe. Minimum wall thickness shall be 6-inches.
- F. Additional concrete must be deposited in evenly distributed layers of approximately 18-inches with each layer vibrated to bond it to the preceding layer. The wall spacers must be raised as the placements are made. The concrete in the area from which the spacer is withdrawn shall be carefully vibrated. Excessive vibration shall be avoided.
- G. Adjustment rings shall be provided between the conical section and the manhole frame. The rings shall be cast-in-place using building felt between pours to create a weakened joint or as directed by the Engineer. If adjustment of the lid elevation is called for, concrete adjusting rings shall be used.
- H. All manhole bases, including curved manhole bases and inverts shall be constructed of Class "A" concrete in accordance with details on the Drawings. Inverts shall be smooth and accurately shaped and have the same cross section as the invert of the sewers which they connect. The manhole base and invert shall be carefully formed to the required size and grade by gradual and even changes in sections, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations. Changing directions of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit. The invert and flow channel shall be formed during or immediately after the placing of the concrete and brush-finished as soon as the concrete has sufficiently set.
- I. Form marks and offsets shall not exceed 1-inch on the outside surface of the manhole. Form marks and offsets shall not exceed 1/2-inch inside of the manhole. All offsets on the inside surface of the manhole shall be smoothed and rubbed so there is no projection or irregularity capable of scratching a worker or catching and holding water or other materials. Honeycombed areas shall be completely removed immediately upon removal of the forms and replaced with a Class "A" concrete as directed by the Engineer, or patched with epoxy grout.
- J. Should circumstances make a 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 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.
- K. Concrete setting time and backfilling shall be in accordance with the applicable requirements of Section 03300. 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.

3.02 CONSTRUCTION OF PRECAST CONCRETE MANHOLES

- A. After placing manhole base, inverts shall be constructed using Class "A" concrete and 3 to 5 inches slump range in accordance with details on the Drawings and inverts shall have the same cross section as the invert of the sewers which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. Changes in directions of flow through the sewer shall be made to a true curve with as large a radius as the size of the manhole will permit.

- B. After the base section has been set, and inverts formed, the precast manhole sections shall be placed thereon, care being exercised to form the incoming and outgoing sewer pipes into the wall of the manhole at the required elevations.
- C. The cast iron frame for the manhole cover shall be set at the required elevation and properly anchored to the riser section. 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.
- D. After backfilling has been completed, the excavated area, if located in a street, alley or sidewalk, shall be provided with a temporary surface.

3.03 MANHOLES OVER EXISTING SEWERS

- A. Construct manholes over existing operating sewer lines at locations shown. Perform necessary excavation as specified hereinbefore, break into existing line, and construct manhole.
- B. Maintain flow through existing sewer lines at all times, and protect new concrete and mortar work for a period of 7 days after concrete has been placed. Advise Engineer of plans for diverting sewage flow and obtain Engineer's approval before starting. Engineer's approval will not relieve Contractor of responsibility for maintaining adequate capacity for flow at all times and adequately protecting new and existing work.
- C. Construct the new base under the existing sewer and the precast sections as specified herein.
- D. Break out the existing pipe within the new manhole, cover the edges with mortar, and trowel smooth.

3.04 INSPECTION AND TESTING

- A. After completion, all manholes will be inspected. The Contractor shall make, at Contractor's expense, all necessary changes, modifications, and/or adjustments required to assure satisfactory operation.

+++ END OF SECTION 02607 +++

**SECTION 02711
FENCING AND GATES****PART 1 - GENERAL****1.01 SCOPE**

- A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete installation of chain link fence and gates. All materials shall be installed and adjusted, in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.
- B. Contract drawings show only functional features and some of the required external connections. They do not show all components required for a complete installation nor exact dimensions particular to any manufacturer's products. Contractor shall supply all parts, devices and equipment necessary to meet the requirements of the Contract Documents and shall make all dimensional adjustments particular to the materials being furnished. All costs associated with such changes and adjustments shall be considered as being included in the price bid for the Work shown and specified.
- C. Related Work specified elsewhere:
 - 1. Section 03300 – Cast-in-Place Concrete.

1.02 SUBMITTALS

- A. Manufacturer's data and shop drawings for fence and gates shall be submitted in accordance with the General Conditions of these Contract Documents.

1.03 QUALITY ASSURANCE

- A. Reference Standards: Comply with all Federal and State laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
- B. Department of Transportation Standard Specifications for Construction of Roads and Bridges, Sections 643 and 894.
- C. Experience: Products furnished under this Section shall be of a design and manufacture that has been successfully used in similar applications. The manufacturer shall have furnished product for a minimum of five similar applications. Provide a list of such installations complete with installation description contact names, addresses, telephone numbers. This reference list shall be submitted with the shop drawings.

1.04 QUALITY STANDARDS

- A. The chainlink fence and gates shall be furnished by a single manufacturer who shall assume sole responsibility for providing a complete system designed for long life with a minimum of required maintenance meeting the requirements specified herein and as shown on the Drawings.
- B. Manufacturer shall provide written certification that the material provided under this Specification has been amply designed and is a suitable application for these service conditions.
- C. Manufacturer's offering products that comply with these specifications include:

1. Georgia Pacific Corporation, Building Products Division.
2. Anchor Fence, Inc.
3. Approved equal.

1.05 WARRANTY

Provide a warranty against defective materials and workmanship in accordance with the requirements of the General Conditions of the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Zinc and aluminum coated steel and aluminum alloy fabric, posts, fittings and accessories, shall conform to AASHTO M 181.

2.02 FENCE FABRIC

- A. All Chain Link Fence shall consist of woven wire in the form of reasonably uniform 2-inch square mesh, having parallel sides and horizontal and vertical diagonals of approximately uniform dimensions. The wire size shall be as specified on the Drawings.
- B. PVC coated steel fabric, posts and fittings as specified.

TYPES

1. Zinc-Coated Steel Fabric: The base metal of the fabric shall be a good commercial quality of steel wire coated with prime western spelter or better (AASHTO: M120) applied at the rate of not less than 1.2 oz. of zinc per square foot of uncoated wire surface after weaving.
 2. Aluminum-Coated Steel Fabric: The base metal of the fabric shall be a good commercial quality steel wire, coated with aluminum alloy applied at the rate of not less than 0.40 oz. per square foot of uncoated wire surface.
 3. PVC Coated Steel Fabric.
- C. Workmanship: Chain Link fence fabric shall be produced by methods recognized as good commercial practices. The zinc or aluminum coating shall be applied to the fabric in a continuous process and shall not be applied to the fabric in roll form. Both coated before weaving and coated after weaving fabric shall be given careful visual inspection to determine the quality of the coating. Excessive roughness, blisters, salammoniac spots, bruises, flaking bare spots or other obvious defects, to any considerable extent, shall be cause for rejection.
 1. Tolerances: All dimensions, weights, and test methods shall conform with the applicable portions of AASHTOM 181 or Federal Specification RR-F-191.

2.03 POSTS

- A. Line Posts shall be 1-7/8 inch nominal galvanized steel "H" column minimum weight of 2.70 pounds per linear foot, nominal 2-3/8 inch outside diameter galvanized steel pipe minimum weight 3.65 pounds per linear foot, or "C" section measuring 2.25" x 1.70", minimum weight of 2.73 pounds per linear foot.
- B. End, Corner and Pull Posts:

1. Zinc and aluminum coated posts shall be nominal 2-7/8" outside diameter galvanized steel pipe weighing a minimum of 5.79 pounds per linear foot, 2-1/2" square posts with a minimum weight of 5.70 pounds per linear foot or 3-1/2" x 3-1/2" rolled form sections with integral fabric loops, weighing a minimum of 5.14 pounds per linear foot.

2.04 TOP RAILS AND HORIZONTAL BRACES FOR END, CORNER AND PULL POSTS

- A. Truss Bracing shall be 3/8" round rod with suitable turnbuckle or take-up arrangement. Rods shall be of the approximate metal and coating according to the type of fence installation. All braces shall be furnished with suitable metal connections so that they can be securely fastened to the posts.
- B. Top rail shall be furnished in lengths of not less than 15 feet. Each section shall be provided with a suitable expansion sleeve or coupling not less than 7 inches long. Every fifth coupling as installed shall have a heavy spring to take up expansion and contraction of the top rail.
- C. Zinc and aluminum coated rails and braces shall be nominal 1-5/8" outside diameter steel pipe, minimum weight of 2.27 pounds per linear foot, or 1-5/8" x 1-1/4" roll formed sections weighing a minimum of 1.35 pounds per linear foot.

2.05 POST TOPS AND FITTINGS

1. All posts shall be fitted with tops designed to fit securely over the posts and carry the top rail. The tops and fittings shall be of dimensions shown on the Drawings.

2.06 FABRIC FASTENERS

- A. Wire for fabric fasteners may be zinc coated or aluminum coated of the gauges specified.

2.07 GATES

- A. Frames, posts, hinges and fitting shall be in accordance with dimensions shown in Federal Specification RR-F-191, unless otherwise specified.
 1. Gates: Shall be provided with combination spring latch and plunger rod of approved design for padlocking.
 2. Hinges: Heavy-duty malleable iron or steel, industrial service type, 270 degree swing. Provide at least 3 hinges on each gate leaf at vehicular gate openings.
 3. Hold-Open Device: Equip designated gate openings with galvanized steel or malleable iron stop/hold open devices with catch or plunger rod of standard manufacture and approved design.

2.08 BARBED WIRE

- A. Galvanized steel barb wire shall be composed of two strands of No. 12 1/2 gauge wire with round barbs, four-point pattern, spaced 5+1/2 inch apart conforming to ASTM:A 121, Class 2, or at the Contractor's option may be high tensile strength barbed wire. If the Contractor elects to furnish high tensile strength bared wire, it shall meet the requirements of ASTM:A 121 with the following exceptions:
 1. The coated line wires shall have a nominal diameter of 0.067 inch. The coated barbed wires shall have a nominal diameter of 0.057 inch.

2. The minimum weight of zinc coating shall be 0.75 ounce per square foot for the line wire and 0.70 ounce per square foot for the barbed wire.
3. The line wire shall have a minimum tensile strength of 475 pounds per individual strand.

2.09 GROUND RODS

- A. Ground Rods shall be 5/8 inch in diameter but no less than 9/16 inch and shall be 8 feet in length unless otherwise shown on the Plans. Ground Rods shall be galvanized steel. Galvanizing shall have a minimum coating of 2 oz. per square foot in accordance with the requirements of ASTM:A 153.

PART 3 - EXECUTION:

3.01 GENERAL

- A. Fence shall constructed at location shown on the drawings, remove existing fence and posts where existing fence will be replaced with new fence.
- B. Fence shall generally follow the contour of the ground, with the bottom of fence fabric no less than one inch nor more than six inches from the ground surface. The fence line shall be cleared a maximum of 8 feet wide and minor grading shall be performed where necessary to provide a neat appearance. Where abrupt changes in the ground profile in low areas make it impractical to maintain the specified ground clearance, longer posts may be used and multiple strands of barbed wire stretched thereon with vertical clearances between strands of barbed wire 6 inches or less.
- C. Any of the various types of fencing materials shown in Part 2, may be used, except that posts, fabric, barbed wire, and appurtenances, including gates when required, shall be of the same or matching type for each Project, unless otherwise directed.

3.02 INSTALLATION

- A. Posts shall be located and installed as called for on the Drawings. "C" and 2 3/8" tube type line posts for all types of fences shall be installed using concrete encasement. Posts installed in rock shall be in accordance with Article 643.03.B.3 of the DOT Standard Specifications.
 1. All corner, end and pull posts shall have concrete encasement as shown in the Drawings. Posts damaged by driving shall be replaced by the Contractor at his expense. When posts are set in concrete, the entire hole around the post shall be filled with Class A or B concrete. Concrete may be hand mixed for batches of 1/2 yard or less. The posts shall be firmly braced and held in place until the concrete has set. Distance between end, pull, and corner or angle post assemblies, shall not exceed the following:

For Chain Link Fence, Straight Line	500 ft.
For Chain Link fence, Curved Line	250 ft.
 2. Posts placed on concrete walls, slabs or solid rock shall be set in round holes 12" deep or as indicated on the Drawings. The space around the post shall be filled with a cement filler approved by the Engineer.
 3. Posts shall be repaired after cutting or drilling. Galvanized steel posts shall be repaired in accordance with the manufacturer's recommendations.
- B. Fence Erection: Fence fabric or barbed wire, except when posts are set in concrete footings may be installed when posts are set and braced. When posts are set in concrete footings the

installation of fabric or wire shall be delayed to allow the concrete to cure at least 5 days. When barbed wire fence is required, three strands shall be installed unless otherwise indicated on the Drawings.

- C. Gates: Gate assemblies shall be of the length, height and type designated on the Drawings, and installed so as to provide for 270° swing. Gate frames shall be welded units and shall be properly coated after welding.
- D. Fabric matching the fence fabric shall be stretched taut over the gate frame. Gate assemblies shall be provided with a positive type locking device, padlock and keys.
- E. Electrical Ground: Whenever a power line carrying more than 600 volts passes over the fence, a ground rod shall be installed. The ground rod shall be installed at the nearest point directly below the point of crossing. Where possible the ground rod shall be driven into the ground for a full 8 feet of penetration. In rocky soil, the rod may be driven slanted, so as to provide 18 inches of cover at the tip. If solid rock is encountered, two ground rods may be installed at the nearest post on each side of the power line crossing where soil conditions will permit. A length of No. 6 bare copper seven stranded wire shall be attached between the fence and the ground rod with suitable clamps.

3.03 STORAGE OF MATERIALS

- A. Barbed wire, wire fence fabric, steel posts, hardware, and other materials, shall not be stored in contact with the ground but shall be placed in floored buildings, on platforms, or on wooden timbers or poles. Floors, platforms, or props shall be high enough to prevent the wire and steel posts from having any contact with the ground or surface water. Wire or steel posts which are damaged due to improper storage at any time between fabrication and final erection will be rejected. Except when rusting occurs as a result of ponding water after erection of the fence, all wire or posts which show signs of rusting before final acceptance shall be repaired, as directed, or removed and replaced with new material at the Contractor's expense.

+ + + END OF SECTION 02711 + + +

SECTION 02720
STORM/SANITARY SEWERS, FRENCH DRAINS AND PIPE CULVERTS

PART 1 - GENERAL**1.01 SCOPE**

- A. The work covered in this Section shall include the furnishing and laying of precast concrete pipe or perforated polyvinyl chloride (PVC) French drain pipe with fittings as called for on the Drawings and specified.
- B. Related Work Specified Elsewhere:
 - 1. Section 02200 – Earthwork.

1.02 QUALITY ASSURANCE

- A. Each length of pipe, each fitting and special fitting shall be inspected by an independent commercial testing laboratory acceptable to the Engineer prior to delivery. Each joint of pipe and each special shall be stenciled or otherwise clearly and legibly marked with the laboratory's mark of acceptance.
- B. Each pipe shall be clearly marked as required by the governing ASTM standard specifications to show its class or gauge, date of manufacture, and the name or trademark of the manufacturer.
- C. Any pipe or specials which have been broken, cracked, or otherwise damaged before or after delivery or which have failed to meet the required tests shall be removed from the site and shall not be used therein.

1.03 WARRANTY

- A. The Contractor shall provide a warranty against defective materials and workmanship in accordance with the requirements of the General Conditions of the Contract Documents.

1.04 SUBMITTALS

- A. Piping layout drawings.
- B. Quality control certifications on all products

PART 2 - PRODUCTS**2.01 GENERAL**

- A. Pipe, French drain and special fittings shall be furnished in sizes, types, and classes as shown on the Drawings or specified herein.
- B. All pipe and special fittings shall be of all new materials, which have not been previously used.

2.02 CONCRETE PIPE

- A. All concrete pipes shall be Class III, Wall B Reinforced Concrete Pipe (RCP) and shall meet all quality requirements of ASTM C-76.

- B. Reinforced concrete pipe shall be centrifugally cast or vibrated prebed, horizontally or vertically cast, or made on a Packerhead machine and shall be furnished in lengths not less than 4 feet.
- C. Reinforced concrete pipe shall have circumferential reinforcement as required for the particular class of pipe furnished.
- D. Reinforced concrete pipe shall have bell and spigot joints suitable for the use of a rubber gasket to be provided as a part of this item.

2.03 FRENCH DRAIN - PERFORATED POLYVINYL CHLORIDE (PVC) PIPE

- A. Pipes shall be type SDR 35 and shall meet all quality requirements per ASTM D-3034.
- B. Geotextile filter material shall be of type and quality meeting or exceeding Trevira Spunbound Type II Filter No. 1135 manufactured by Contec Construction Products, Typar Nonwoven geotextile filter No. 3301 manufactured by Reemay, Inc., or equal, and shall meet all test requirements per ASTM D-4491.

2.04 JOINT MATERIALS FOR CONCRETE PIPE

- A. Rubber gaskets for bell and spigot joints shall be O-ring rubber gasket joints conforming to the latest revisions of ASTM Standard Specification C 443 for Joints for Circular Concrete Sewer and Culvert Pipe, Using Flexible Watertight Rubber Gaskets, with manufacturer's environmentally safe lubricant.

PART 3 - EXECUTION

3.01 PIPE LAYING - CONCRETE PIPE

- A. Immediately prior to laying the pipe, all projections or irregularities, which will prevent the joints from closing properly, shall be removed.
- B. Changes in Line and Grade. In the event obstructions not shown on the Drawings are encountered during the progress of the work, which will require alterations to the Drawings, the Engineer shall have the authority to change the Drawings and order the necessary deviation from the line or grade. The Contractor shall not make any deviation from the specified line and grade without approval by the Engineer. Should any deviations in line and grade be permitted by the Engineer in order to reduce the amount of rock excavation or for other similar convenience to the Contractor, any additional costs for thrust blocks, valves, air and vacuum valve assemblies, blow-off assemblies, extra pipe footage, concrete, sewer structures, or other additional costs shall be borne by the Contractor.
 - 1. Contractor shall include in its bid provisions to cover any deviation from the invert grade shown on the plans to facilitate extra depth required to eliminate possible conflicts between culverts and other utilities with the force and sewer mains.
- C. Installing Pipe. Contractor shall after excavating the trench and preparing the proper bedding for the pipe furnish all necessary facilities for properly lowering and placing sections of the pipe in the trench without damage and shall properly install the pipe. The section of pipe shall be fitted together correctly and shall be laid true to line and grade in accordance with stakes established by the Engineer. The full length of the barrel of the pipe shall have a uniform bearing upon 4 inches minimum of bedding material, but if the pipe has a projecting bell, suitable excavation shall be made to receive the bell, which shall not bear on the subgrades. The requirement for closely fitting the bottom of the pipe to the bedding material for the width shown on the Drawings will be strictly enforced.

1. Pipe shall be laid up grade. Any pipe which is not in true alignment, both vertical and horizontal, or shows any undue settlement after laying shall be replaced when so ordered by the Engineer. No pipe shall be laid which is damaged, cracked, checked or spalled or has any other defect deemed by the Engineer to make it unacceptable, and all such sections shall be permanently removed from the Work.
2. At all times when the work of installing pipe is not in progress, all openings into the ends of the pipelines shall be kept tightly closed with suitable plywood or sheet metal bulkheads to prevent the entrance of animals and foreign materials and to prevent water from entering the pipe.
3. Keep the pipe trench free from water at all times and take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source. Any damage is the Contractor's full responsibility. Restore and replace the pipe to its specified condition and grade if it is displaced due to floating.
4. All pipeline adjoining concrete structures (including manholes) shall have flexible joints.

3.02 PIPE LAYING - PERFORATED PVC FRENCH DRAIN

- A. Perforated PVC pipes for french drains shall be laid at the locations and elevations shown on the Drawings. Crushed rock for french drains shall be No. 57 crushed rock and shall be placed around perforated PVC pipe according to the dimensions shown on the Drawings. All crushed rock placed around perforated PVC french drain pipes shall be wrapped in geotextile filter material.

3.03 EXISTING UTILITIES

All existing sewers, water lines, gas lines, underground conduits, telephone lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the work shall be carefully protected by the Contractor from damage at all times. Where it is necessary for the proper accomplishment of the work to repair, remove, and/or replace any such utility, the work shall be done as directed by the Engineer. No separate payment shall be made for removing and replacing and/or repairing damaged existing sewers, water, gas, electric, or telephone lines, or conduits or other utilities, culverts, drains, or similar existing services or structures that are to remain in service. Any item damaged during construction will be the Contractor's responsibility to repair to the Engineer's satisfaction at no additional cost to the County.

3.04 INFILTRATION AND EXFILTRATION TESTING

- a. Normal Infiltration or Exfiltration Standards: A maximum infiltration and/or exfiltration rate of 200 gallons per inch of diameter per day per mile of sewer will be permitted for sanitary sewers. Any visible or detectable leaks shall be repaired under all circumstances.
 - b. Testing for Water Leakage in Sanitary Sewers: Tests shall be made by the Contractor on all portions of the sewers built under this Contract. The Contractor shall perform the tests as specified herein and as directed by the Engineer.
1. Gravity Sanitary Sewer lines shall be tested as follows:
 - a. All sewers above the groundwater table will be tested by the exfiltration method. This test will be made by plugging the lower manhole and filling the pipe section

between the manholes with water and measuring the quantity of water lost by the drop in the water level in the manholes.

- b. All sewers below the groundwater table will be tested by the infiltration method. This test will be made by measuring the quantity of water infiltration into the pipe section at the lower end of the pipe section by means of weir installed in the pipe or other means approved by the Engineer.
 - c. All sewers shall be tested in individual sections or a summarization of sections in lengths approved by the Engineer. If the summarization method is used, each section between the manholes shall meet the infiltration and exfiltration requirements specified herein.
- C. All sewers before they are tested shall be carefully plugged and backfilled to a depth of not less than two (2) feet above the top of the sewer.
- D. Water for both tests shall be furnished by the Contractor and maintained at such levels as directed by the Engineer for a period of at least twenty (20) hours immediately prior to the time of the test and shall be maintained during the test.
- E. The Contractor shall repair all pipe sections with visible leaks and shall replace or repair all defects on all sections of sewers failing to meet the leakage tests.

3.05 CLEANING

After completing each section of the storm sewer or culvert, the Contractor shall remove all debris and construction materials and equipment from the site, grade and smooth over the surface on both sides of the line and leave the entire right-of-way in a clean, neat, and serviceable condition in accordance with the requirements of the General Conditions of the Contract Documents.

3.06 SEEDING

All ground areas that are disturbed during construction of the storm sewer or culvert shall be prepared and seeded in accordance with the requirements of Section 02933 entitled "Seeding" of these Specifications. No separate payment shall be made for seeding or seeding preparation, but shall be included in the unit prices Bid for other items of work done under this Section.

+++ END OF SECTION 02720 +++

**SECTION 02933
SEEDING****PART 1 - GENERAL****1.01 SCOPE**

- A. The work covered by this Section consists of furnishing all labor, equipment and material required to place topsoil, seed, commercial fertilizer, agricultural limestone and mulch material, including seedbed preparation, harrowing, compacting and other placement operations on graded earthen areas as described herein and/or shown on the Drawings. In general, seeding operations shall be conducted on all newly graded earthen areas not covered by structures, pavement or sidewalks; all cleared or grubbed areas which are to remain as finish grade surfaces; and on all existing turf areas which are disturbed by construction operations and which are to remain as finish grade surfaces. Areas disturbed by borrow activities shall also be seeded according to these Specifications.
- B. The Work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion. Temporary seeding shall be performed at the times and locations as directed by the Engineer.
- C. Related Work Specified Elsewhere:
- Section 02110, Clearing and Grubbing
 - Section 02200, Earthwork
 - Section 02125, Erosion and Sediment Control

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following information shall be submitted:
1. Prior to seeding operations, labels or certified laboratory reports from an accredited commercial seed laboratory or a state seed laboratory showing the analysis and germination of the seed to be furnished. Acceptance of the seed test reports shall not relieve the Contractor of any responsibility or liability for furnishing seed meeting the requirements of this Section.
 2. Prior to topsoil operations, the Contractor shall obtain representative samples and furnish soil test certificates including textural, pH, and organic ignition analysis from the State University Agricultural Extension Services or other certified testing laboratory.

PART 2 - PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. Wood-cellulose fiber mulch shall be manufactured by Weyerhaeuser Company or Conway Corporation.

2.02 MATERIALS AND CONSTRUCTION

- A. Topsoil
1. Utilizing designated stockpiles or borrow areas on site, the Contractor shall place a minimum of 6-inches of topsoil over all graded earthen areas and over any other areas to be seeded. Sources of topsoil shall be approved by the Engineer prior to disturbance.

2. Topsoil shall be a friable loam containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2-inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.
3. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam or a combination thereof. The pH shall range from 5.5 to 7.0. Topsoil shall contain not less than 5 percent or more than 20 percent, by weight, or organic matter as determined by loss on ignition of oven-dried samples to 65 Degrees C.
4. Seed shall be hulled common Bermuda (*Cynodon dactylon*) guaranteed by the dealer to be 98% minimum purity and 90% minimum germination and certified free of giant strain Bermuda.

B. Seed

1. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U.S. Department of Agriculture Federal Seed Act.
2. All seed shall be from the last crop available at time of purchase and shall not be moldy, wet or otherwise damaged in transit or storage.
3. Seed shall bear the growers analysis testing to 98 percent for purity and 90 percent for germination. At the discretion of the Engineer, samples of seed may be taken for check against the grower's analysis.
4. Species, rate of seeding, fertilization and other requirements are shown in Table 1 of this Section.

C. Fertilizer and Liming Materials

1. Fertilizer and liming materials shall comply with applicable state, local and federal laws concerned with their production and use.
2. Commercial fertilizer shall be a ready mixed material and shall be equivalent to the grade or grades specified in Table 1. Container bags shall have the name and address of the manufacturer, the brand name, net weight and chemical composition.
3. Agricultural limestone shall be a pulverized limestone having a calcium carbonate content of not less than 85 percent by weight.
4. Fertilizer shall be a complete fertilizer, the content of which shall meet the following minimum requirements: 10% nitrogen, 10% phosphoric acid, 10% potash, available materials. It shall be uniform in composition, dry and free flowing, and shall be delivered to the site in original unopened containers bearing the manufacturer's statement of guarantee.
5. Ammonium Nitrate shall be a standard brand and shall be delivered to the site in original unopened containers. It shall contain not less than 33-1/3% Nitrogen.

D. Mulch Material

1. All mulch materials shall be air dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.
2. Mulch shall be composed of wood cellulose fiber, straw or stalks, as specified herein. Mulch shall be suitable for spreading with standard mulch blowing equipment.
3. Straw mulch shall be partially decomposed stalks of wheat, rye, oats or other approved grain crops.
4. Stalks shall be the partially decomposed, shredded residue of corn, cane, sorghum or other approved standing field crops.

E. Mulch Binder

1. Mulch on slopes exceeding 3 to 1 ratio shall be held in place by the use of an approved mulch binder. The mulch binder shall be non-toxic to plant life and shall be acceptable to the Engineer.
 2. Emulsified asphalt binder shall be Grade SS-1, ASTM D 977. Cutback asphalt binder shall be Grade RC 70 or RC 250.
- F. Inoculants for Legumes: All leguminous seed shall be inoculated prior to seeding with a standard culture of nitrogen-fixing bacteria that is adapted to the particular seed involved.

G. Water: Water shall be clean, clear water free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the Contractor.

H. Sod: Sod shall be living, growing sod of Bermuda hybrids "Tifway 419" or Tifgreen 328". This includes sod which is dormant during the cold or dry season and capable of renewing growth after the dormant period. All sod shall be obtained from approved sources. The presence of weeds or other noxious growth or any other foreign material which may be detrimental to the proposed planting will be cause of rejection. At least 85% of the plants in the sod shall be composed of the designated variety of bermuda grass.

The Engineer shall be notified of sources before it is harvested. Approval of such sources shall not be construed as an acceptance of the material. The sod will be subject to inspection while it is being planted and any material which has been permitted to dry out excessively or exposed to extreme heat, or which is not viable, will be rejected.

In the harvesting of the sod, grass more than 3 inches tall shall be mowed to a height of 3 inches, raked and removed before sod cutting begins. The sod shall be cut into square or rectangular sections which may vary in length, but which shall be of uniform width and thickness, and shall have at least 1/2 inch of soil adhering firmly to the roots. Care shall be exercised at all times to retain the soil on the roots of the sod during the process of cutting, transporting and planting. Sod shall be transplanted within 24 hours from the time it is harvested. All sod stored shall be kept moist, shall be protected from exposure to the air and sun and from freezing, and shall not be stored for more than 10 days. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected.

PART 3 - EXECUTION**3.01 SECURING AND PLACING TOPSOIL**

- A. Topsoil shall be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil shall not be removed to a depth in excess of

the depth approved by the Engineer.

- B. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage and other characteristics as to offer assurance that, when removed the product will be homogeneous in nature and will conform to the requirements of these Specifications.
- C. All areas from which topsoil is to be secured, shall be cleaned of all sticks, boards, stones, lime, cement, ashes, cinders, slag, concrete, bitumen or its residue and any other refuse which will hinder or prevent growth.
- D. In securing topsoil from a designated pit, or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil or if required by the Engineer, the pit shall be abandoned?
- E. Before placing or depositing topsoil upon any areas, all improvement within the area shall be completed, unless otherwise approved by the Engineer.
- F. The areas in which topsoil is to be placed or incorporated shall be prepared before securing topsoil for use.

3.02 SEEDBED PREPARATION

- A. Before liming, fertilizing and seeding, the topsoil surfaces shall be trimmed and worked to true line from unsightly variation, bumps, ridges and depressions and all detrimental material, roots and stones larger than 3-inches in any dimension shall be removed from the soil.
- B. Not earlier than 24 hours before the seed is to be sown, the soil surface to be seeded shall be thoroughly cultivated to a depth of not less than 2-inches with a weighted disc, tiller, pulvimixer or other equipment, until the surface is smooth and in a condition acceptable to the Engineer.
- C. If the prepared surface becomes eroded as a result of rain or for any other reason, or becomes crusted before the seed is sown, the surface shall again be cultivated for seeding.
- D. Ground preparation operations shall be performed only when the ground is in a tillable and workable condition, as determined by the Engineer.

3.03 FERTILIZATION AND LIMING

- A. Following seedbed preparation, fertilizer shall be applied to all areas to be seeded so as to achieve the application rates shown in Table 1.
- B. Fertilizer shall be spread evenly over the seedbed and shall be lightly harrowed, raked, or otherwise incorporated into the soil for a depth of 1/2-inch.
- C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed shall not remain in water containing fertilizer for more than 30 minutes when a hydraulic seeder is used.
- D. Agricultural limestone shall be thoroughly mixed into the soil according to the rates in Table 1. The specified rate of application of limestone may be reduced by the Engineer if pH tests indicate this to be desirable. It is the responsibility of the Contractor to obtain such tests and submit the results to the Engineer for adjustment in rates.

- E. It is the responsibility of the Contractor to make one application of a maintenance fertilizer according to the recommendations listed in Table 1.
- F. On the approved grade, spread 20 lbs. per 1,000 sq. ft. of 10-10-10 fertilizer into top 3", hand rake and smooth. The surface shall be brought to finish grade requirements, allowance being made for settlement. Finish grades shall be smooth and free from hollows or other inequalities.
- G. Three weeks after construction of lawns add ammonium nitrate at the rate of 5 lbs. per 1000 sq. ft. of lawn area, and thoroughly watered in."

3.04 SEEDING

- A. Seed of the specified group shall be sown as soon as preparation of the seedbed has been completed. No seed shall be sown during high winds, nor until the surface is suitable for working and is in a proper condition. Seeding shall be performed during the dates shown in Table 1 unless otherwise approved by the Engineer. Seed mixtures may be sown together provided they are kept in a thoroughly mixed condition during the seeding operation.
- B. Seed shall be uniformly sown by any approved mechanical method suitable for the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder or approved mechanical power drawn seed drills. Hydro-seeding and hydro-mulching may be used on steep embankments, provided full coverage is obtained. Care shall be taken to adjust the seeder for seedings at the proper rate before seeding operations are started and to maintain their adjustment during seeding. Seed in hoppers shall be agitated to prevent segregation of the various seeds in a seeding mixture.
- C. Immediately after sowing, the seeds shall be covered and compacted to a depth of 1/8 to 3/8-inch by a cultipacker or suitable roller.
- D. Leguminous seeds shall be inoculated prior to seeding with an approved and compatible nitrogen-fixing inoculant in accordance with the manufacturer's mixing instructions.
- E. Italian Rye Grass (*Lolium Multiflorum*) shall be evenly seeded with a mechanical spreader at the rate of 5 lbs. per 1000 sq. ft. of area, lightly rake, suitably compact and thoroughly water. Before planting the permanent lawn, the Rye shall be thoroughly scarified in a manner to incorporate it into the top three inches of the ground.
- F. The planting of bermuda grass shall be done only within the season extending from April 15 to August 1."

3.05 MULCHING

- A. All seeded areas shall be uniformly mulched in a continuous blanket immediately after seeding. The mulch shall be applied so as to permit some sunlight to penetrate and the air to circulate and at the same time shade the ground, reduce erosion and conserve soil moisture. Approximately 25 percent of the ground shall be visible through the mulch blanket.
- B. One of the following mulches shall be spread evenly over the seeded areas at the following application rates:

Wood Cellulose Fiber	1,400 pounds/acre
Straw	4,000 pounds/acre

Stalks	4,000 pounds/acre
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4. These rates may be adjusted at the discretion of the Engineer at no additional cost to the Owner, depending on the texture and condition of the mulch material and the characteristics of the seeded area.
- C. The Contractor shall cover structures, poles, fence and appurtenances if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.
- D. Mulch and binder shall be applied by suitable blowing equipment at closely controlled application rates in a manner acceptable to the Engineer.

3.06 WATERING

- A. The Contractor shall be responsible for maintaining the proper moisture content of the soil to insure adequate plant growth until a satisfactory stand is obtained. If necessary, watering shall be performed to maintain adequate water content in the soil.
- B. Watering shall be accomplished by hoses, tank truck or sprinklers in such a way to prevent erosion, excessive runoff and over watered spots. Watering shall be accomplished only during state and county authorized time frame.

3.07 MAINTENANCE

- A. Upon completion of seeding operations, the Contractor shall clear the area of all equipment, debris and excess material and the premises shall be left in a neat and orderly condition.
- B. The Contractor shall maintain all seeded areas without additional payment until final acceptance of the work by the Owner, and any regarding; refertilizing, reliming, reseeding or remulching shall be done at Contractor's own expense. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is accomplished. Damage resulting from erosion, galleys, washouts or other causes shall be repaired by filling with topsoil, compacting and repeating the seeding work at Contractor's expense.
- C. Contractor's guarantee of one (1) year shall also cover a fully rooted stand of grass.

TABLE 1
SEEDING REQUIREMENTS

Area	Sowing Season	Species	Seed	Rates per 1,000 Square Feet		
				Fertilizer	Limestone	Maintenance**
Flat to rolling terrain with slopes less than 3:1	3/1 to 4/15	Rebel II Turf-Type Tall Fescue	6-8 lbs.	30 lbs. 6-12-12	200 lbs.	10 lbs. 10-10-10
	9/1 to 11/15	Rebel II Turf-Type Tall Fescue	6-8 lbs.	30 lbs. 6-12-12	200 lbs.	15 lbs. 10-10-10
Embankments with slopes greater than 3:1	3/1 to 6/1	Crownvetch* Kentucky 31 Fescue Weeping Love grass	1 lb. 2 lbs. 1/4 lb.	30 lbs. 6-12-12	200 lbs.	10 lbs. 0-20-20
	8/1 to 11/1	Crownvetch* Kentucky 31 Fescue Annual Ryegrass	1 lb. 2 lb. 2 lb.	30 lbs. 6-12-12	200 lbs.	10 lbs. 0-20-20

* Requires inoculation

** Maintenance fertilizer shall be applied in early spring following initial establishment of cover

+++ END OF SECTION 02933 +++

**SECTION 03100
CONCRETE FORMWORK****PART 1 - GENERAL****1.01 SCOPE**

- A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide the concrete formwork as shown and specified. The Work also includes:
 - 1. Providing opening in formwork to accommodate the Work under this and other Sections and building into the formwork all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.
 - 2. Providing openings in formwork to accommodate the work under other contracts and assisting other contractors in building into the formwork all items such as sleeves, anchor bolts, inserts and all other items required to be embedded in concrete.
- B. Coordination:
 - 1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the formwork.
 - 2. Notify other contractors in advance of the construction of the formwork to provide the other contractors with sufficient time for the installation of items included in their contracts that must be installed with the formwork.
- C. Related Work specified elsewhere:
 - 1. Division 01000 - General Specifications.
 - 2. Section 02050 - Demolition.
 - 3. Section 03250 - Concrete Joints.
 - 4. Section 03300 - Cast-In-Place Concrete.
 - 5. Section 03600 - Grout.
 - 6. Section 05500 - Miscellaneous Metals
 - 7. Section 15060 - Piping and Appurtenances.

1.02 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit for approval copies of manufacturer's data and installation instructions for proprietary materials, including form coatings, manufactured form systems, ties and accessories.
 - 2. Submit samples ties, cones, anchors and embeds with manufacturer's certification.
 - 3. Submit formwork drawings for approval.
- B. Slip Forms:
 - 1. If slip forms are proposed for the structure, submit details of design and methodology to Engineer for approval.

1.03 QUALITY ASSURANCE

- A. Contractor shall examine the substratum and the conditions under which concrete formwork is to be performed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ACI 301, Specifications for Structural Concrete For Buildings.
 - 2. ACI 305, Hot Weather Concrete.
 - 3. ACI 350, Environmental Engineering Concrete Structures.
 - 4. ACI 347, Recommended Practice for Concrete Formwork.
 - 5. SP 4, Formwork Standards.
- C. Allowable Tolerances:
 - 1. Construct formwork to provide completed concrete surfaces complying with tolerances specified in ACI 347, Chapter 3.3, except as otherwise specified.
 - 2. Maximum acceptable deflection is 1/4" in 10'-0" on all flat surfaces.
 - 3. Dimples or honeycomb in the finished concrete, which penetrate to expose the reinforcing steel will be cause for the rejection of the work and the Contractor will be required to remove and replace at his own expense.
- D. All items for permanent or temporary facilities shall be used in accordance with manufacturers instructions, and a copy of those instructions must be available, at all times, on the jobsite.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. On delivery to jobsite, place materials in area protected from weather.
- B. Store materials above ground on framework or blocking. Cover wood for forms with protective waterproof covering. Provide for adequate air circulation or ventilation.
- C. Handle materials to prevent damage.
- D. Limit form re-use to (3) three pours or less, except where slip forms are used; if surface warping of the plyform occurs, surplus the form or re-skin it before re-use.

PART 2 - PRODUCTS**2.01 FORM MATERIALS**

- A. Forms for Exposed Finish Concrete:
 - 1. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other panel type materials acceptable to Engineer, to provide continuous, straight, smooth as-cast surfaces.

2. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown or specified. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Forms for Unexposed Finish Concrete:
1. Form concrete surfaces that will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side.
- C. Form Ties:
1. Provide factory-fabricated, removable or snapoff metal form ties designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal. Materials used for tying Forms will be subject to approval of the Engineer.
 2. Unless otherwise shown, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1 inch from the outer concrete surface. Unless otherwise shown, provide form ties that will leave a hole no larger than 1-inch diameter in the concrete surface.
 3. Ties for exterior walls and walls subject to hydrostatic pressure shall have waterstops that are integral with the tie, preferably a solid washer at mid-point of the tie.
 4. Provide wood or plastic cones for ties, where concrete is exposed in the finish structure.
- D. Forms Coatings:
1. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds. For concrete surfaces' which will be in contact with potable water, the form coating shall be a mineral oil base coating.

PART 3 - EXECUTION

3.01 DESIGN OF FORMWORK

- A. Design, erect, support, brace and maintain formwork so that it shall safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system or in-place construction that has attained adequate strength for this purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design forms and falsework to include values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
- C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations using wedges or jacks or a combination thereof. Provide trussed supports or temporary timber mats when adequate foundations for shores and struts cannot be secured.
- D. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. For long span members without

intermediate supports, provide camber in formwork as required for anticipated deflections resulting from weight and pressure of fresh concrete and construction loads.

E. Forms for Exposed Concrete:

1. Do not use metal cover plates for patching holes or defects in forms.
2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra beams or girts to maintain true, square intersections.
3. Use extra beams walers and bracing to prevent bowing of forms between beams and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
5. Form molding shapes, recessed and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.
6. Chamfer exposed corners and edges.

F. Corner Treatment:

1. Form exposed corners of beams, walls, foundations, bases and columns to produce smooth, solid, unbroken lines, except as otherwise shown. Except as specified below for re-entrant or internal corners, exposed corners shall be chamfered.
2. Form chamfers with 3/4-inch by 3/4-inch strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
3. Re-entrant or internal corners and unexposed corners may be formed square.

G. Joints:

1. See Specification Section 03250 and Drawings for treatment of joints. Locate as shown and specified.

H. Openings and Built-In Work:

1. Provide openings in concrete formwork shown or required by other Sections or other contracts. Refer to paragraph 1.01 herein for the requirements of coordination.
2. Accurately place and securely support items to be built into forms.

I. Cleaning and Tightening:

1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Re-tighten forms immediately after concrete placement as required to- eliminate mortar leaks.
2. In add on pours; dampen the previous adjacent pours an hour before the next pour. Be careful to avoid puddles in the form.

3.02 FORM COATINGS

- A. Coat form contract surfaces with a non-staining no petroleum formcoating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.03 INSTALLATION OF EMBEDDED ITEMS

- A. General:
 - 1. Set and build into the formwork, anchorage devices and other embedded items, shown specified or required by other Section and other contracts. Refer to paragraph 1.01 herein for the requirements of coordination. Use necessary setting drawings, diagrams, instructions and directions.
 - 2. All embeds should be supported, plumbed and carefully taped or covered to prohibit the infiltration of concrete during the pour.
 - 3. Coat any aluminum or reactive metal inserts, with non-reactive coating to isolate the metal surfaces.
- B. Edge Forms and Screed Strips for Slabs and Sidewalks:
 - 1. Set edge forms or bulkheads and intermediate screed strips for slabs and sidewalks to obtain required elevations and contours in the finished slab surface. Provide and secure units to support screeds.
 - 2. The screeds may not be tack welded to the rebar embeds, or structural steel.

3.04 FIELD QUALITY CONTROL

- A. Before concrete placement, the Engineer shall inspect all formwork. No concrete shall be poured without Engineer approval.
- B. Before concrete placement, Contractor shall check the formwork, including lines, ties, tie cone, and form coatings. He shall make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- C. During concrete placement Contractor shall check formwork and related supports to ensure that forms are not displaced and that completed Work shall be within specified tolerances.
- D. If Contractor finds that forms are unsatisfactory in any way, either before or during placing of concrete, placement of concrete shall be postponed or stopped until the defects have been corrected, and reviewed by the Engineer.

3.05 REMOVAL OF FORMS

- A. Conform to the requirements of ACI 301, Chapter 4 and ACI 347, Chapter 3.6.2.3, except as specified below.
- B. Do not remove supporting forms or shoring until the members have acquired sufficient strength to safely support their weight and the load upon them. Results of suitable control tests may be used as evidence that the concrete has attained sufficient strength or a minimum of 75% of the stated

design strength, or a minimum of 75% of the stated design strength. Refer to Section 03300, Cast-In-Place Concrete for testing procedures.

- C. The time for removal of all forms will be subject to the Engineer's approval, and the presentation of a completed pour card to the Engineer's field representative with truck tickets.

3.06 PERMANENT SHORES

- A. Provide permanent shores as defined in ACI 347, Chapter 3.7.
- B. Reshores will not be permitted, except as reviewed by the Engineer

3.07 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
 - 1. Plywood surfaced forms must have smooth clean faces for re-use, and may not have excessive knots or tie hole plugs. They may not be used more than (3) times without an Engineer's inspection and approval.
 - 2. Metal surfaced forms must have a smooth even surface not plate patches.

+ + + END OF SECTION 03100 + + +

**SECTION 03200
CONCRETE REINFORCEMENT AND DOWELLING****PART 1 - GENERAL****1.01 SCOPE**

- A. Contractor shall furnish all labor, materials, equipment and incidentals required to provide concrete reinforcement and dowelling as shown and specified.
- B. The extent of concrete reinforcement and dowelling is shown on the Drawings.
- C. The Work includes fabrication and placement of reinforcement including bars, ties and supports for concrete and encasements.
- D. Related Work specified elsewhere:
 - 1. Section 03100 - Concrete Formwork.
 - 2. Section 03250 - Concrete Joints.
 - 3. Section 03300 - Cast-In-Place Concrete.
 - 4. Section 03600 Grout.

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:
 - 1. Shop Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Chapters 1 thru 8. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrications and placement of concrete reinforcement unless otherwise noted. Splices shall be kept to a minimum. Show construction joints.
 - 2. Copies of manufacturer's specifications and installation instructions for all materials and reinforcement accessories.
 - 3. 5 copies of steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.03 QUALITY ASSURANCE

- A. Contractor shall examine the substrate and the conditions under which concrete reinforcement is to be placed, and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.
- B. Reference Standards: Comply with all Federal and State laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:
 - 1. Concrete Reinforcing Steel Institute, "Manual of Standard Practice", includes ASTM standards referred to herein.
 - 2. ACI 318, "Building Code Requirements for Reinforced Concrete".

3. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 4. ACI 350, Environmental Engineering concrete structures.
 5. Concrete Reinforcing Steel Institute, Placing Reinforcing Bars.
 6. AWS D.1, Structural Welding Code.
- C. Minimum Concrete Cover for Reinforcement: Comply with ACI 350, except as shown on Drawings.
- D. Splices other than lap splices shall not be used except where permitted in writing by the Engineer.
- E. Reinforcement which arrives on the jobsite which is not tagged as specified in Paragraph 1.04A shall be rejected by the Engineer and removed at the Contractor's expense.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver concrete reinforcement materials to the site bundled, tagged and marked. Use metal tags indicating bar size, length, and other information corresponding to markings shown on placement diagrams.
- B. Store concrete reinforcement material at the site to prevent damage and accumulation of dirt or excessive rust. Store on heavy wood blocking so that no part of it will come in contact with the ground.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing Bars and Dowelling: ASTM A 615, Grade 60, where welding is not required, or ASTM A706, Grade 60, for reinforcing to be welded.
- B. Steel Wire: ASTM A82.
- C. Welded Smooth Wire Fabric: ASTM A185:
1. Furnish in flat sheets, not rolls.
- D. Supports for Reinforcement: Bar supports coming into contact with forms shall be CRSI Class 1 plastic protected or Class 2 stainless steel protected and shall be located in accordance with CRSI MSP-1 and placed in accordance with CRSI PRB. Precast concrete block supports shall be provided for reinforcing in concrete cast against grade.
- E. Mechanical Connections:
1. Metal Sleeve. Steel sleeve with cast filler metal, capable of developing, under tension or compression, 125 percent of specified yield strength of the reinforcing bar. Metal sleeve shall be as manufactured by:
 - a. Erico Products, Inc., Cleveland, OH.
 - b. Or equal.
 2. Mechanical Threaded Connection. Metal coupling sleeve with internal threads which engage

threaded ends of bars to be spliced, and develops under tension or compression, 125 percent of the specified yield strength of the bar. Mechanical threaded connection shall be as manufactured by:

- a. Erico Products, Inc., Cleveland, OH, Lenton Reinforcing Steel Couplers.
- b. Richmond Screw Anchor Co., Inc., Fort Worth, TX, Richmond DB-SAE Dowel Bar Splicers.
- c. Or equal.

- F. High Strength Bars. High strength bars shall be 150 KSI steel conforming to ASTM A-722, threaded full length. Anchor nuts shall be manufacturer's standard designed for use with bars. Mechanical couplers, when required, shall be capable of developing 100% of guaranteed ultimate strength of the bars.

2.02 FABRICATION

- A. General: Fabricate reinforcing bars and dowelling to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice" and ACI minimums. In case of fabricating errors, do not re-bend, retemper, heat, deform or straighten reinforcement.
- B. Unacceptable Materials: Reinforcement with any of the defects listed below will not be permitted in the Work:
1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.
 2. Bends or kinks not shown on approved Shop Drawings.
 3. Bars with reduced cross-section due to excessive rusting or other cause.
 4. Surface contamination that would affect the bond i.e. grease, dirt, paint, rust etc.
 5. Heat deformed or torched bars.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with the applicable recommendations of specified codes and standards, and CRSI "Placing Reinforcing Bars" and ACI requirements for details and methods of reinforcement placement and supports.
- B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Position, support, and secure reinforcement and dowelling against displacement during formwork construction or concrete placement and grouting operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required. No wood blocks allowed for rebar support.
1. Place reinforcement to obtain the minimum concrete coverages as shown and as specified in ACI 350. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 2. Reinforcing steel shall not be secured to forms with wire, nails or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.