Board of Public Works

Gaffney, South Carolina

ELECTRIC
WATER ~ SEWER

TECHNICAL SPECIFICATIONS

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SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 36935 CAMERON CLAFFY MILLER

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 31181 CORY D. COX

BPW PROJECT# XXXX

"INSERT DATE"

TECHNICAL SPECIFICATIONS

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Board of Public Works
P.O. Box 64
Gaffney, S.C. 29342

“INSERT DATE”

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SECTION 01000

GENERAL CONDITIONS

1. CONTRACT AND CONTRACT DOCUMENTS. The plans, specifications and addenda, hereinafter enumerated shall form part of this contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents titles, heading, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the contract documents and in no way affect, limit or cast light on the interpretations of the provisions to which they refer.

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2. DEFINITIONS: The following terms as used in this contract are respectively defined as follows:

(a) Contractor. A person, firm or corporation with whom the contract is made by the Owner.

(b) Subcontractor. A person, firm or corporation supplying labor and materials, or only labor, for work at the site of the project for and under separate contract or agreement with the Contractor.

(c) Work on or at the Project. Work to be performed at the location of the project, including the transportation of materials and supplies to or from the location of the project by employees of the Contractor and any Subcontractor.

3. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS:

The Contractor will be furnished additional instructions and detail drawings as necessary to carry out the work included in the Contract. The additional drawings and instructions thus supplied to the Contractor will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as part thereof. The Contractor shall carry on the work in accordance with the additional detail drawings and instructions. The Contractor and the Engineer will prepare jointly:

a) A schedule fixing the dates at which special detail drawings will be required; such drawings, if any, to be furnished by the Engineer in accordance with said schedule; and

b) A schedule fixing the respective dates for the submission of shop drawings,

the beginning of manufacture, testing and installation of materials, supplies, and equipment, and the completion of the various parts of the work; each such schedule to be subject to change from time to time in accordance with the progress of the work.

4. SHOP DRAWINGS AND SAMPLES:

All shop drawings and field modified drawings for material and equipment shall be submitted to the Engineer for approval before final orders for material or equipment are placed. It shall be the Contractor's responsibility to check these drawings for accuracy and conformity with the Specifications before submission to the Engineer. Each drawing not so marked will be returned to the contractor without the Engineer's approval. The Contractor shall make additional changes or corrections, required by the Engineer, and resubmit such drawings for approval. The Engineer's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from plans or specifications, nor shall it relieve him from responsibility for errors of any sort in shop drawings or schedules.

The Contractor shall furnish outline and principal dimension drawings of all manufactured articles furnished under this Contract, reinforcement setting drawings, schedules and catalog cuts and illustrations, as called for in the specifications or required by the Engineer. Where specific materials, finished, etc. are specific, they shall be shown on shop drawings. Materials and items required to be shown on shop drawings shall not be fabricated or delivered to job site until shop drawing covering such materials or items have been approved.

Shop drawings and/or catalog cuts of all fabricated parts and items shall be submitted for the approval of the Engineer. All such data shall be submitted through the Contractor with such promptness as to cause no delay to any of the work. When catalog cuts are submitted, the specific item to be considered shall be identified by the same nomenclature and/or item number used on the drawing or in the specifications. The same identifications shall be used on shop drawings. Submission of catalog pages containing no such indications will be returned to the Contractor without action. Original submission shall be quadruplicate. The Engineer shall check, with reasonable promptness, such drawings schedules, and data only for conformance with the design concept of the project and compliance with the information given by the Contract Documents. The Contractor shall make any corrections required by the Engineer and shall submit the corrected copies for final approval. Upon approval, three copies of each approved submission shall be retained by the Engineer. The Contractor shall furnish such additional copies as may be required for the use of other contractors.

Submissions at variance with the requirements of the specifications or contract drawing shall be accompanied with a letter setting forth such variations and the

credit to be allowed where such variations are less expensive than contract requirements. If, in the opinion of the Engineer, such variations are of a minor nature, and comply with the intent of the Contract Documents, approval will be given in writing. When variations are such as involve a credit to the Owner, approval will be given only upon receipt of a reasonable and proper credit. In the absence of such approvals, the Contractor shall comply with all specification and drawing requirements.

The Contractor agrees that said work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the contractor and the Owner, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the location of the site, the average climatic range. It is further agreed that in the event construction is not completed, or equipment supplied by the Contractor is not delivered, within the time amounts per day for each day thereafter, Sundays and holidays included, that the contract completion date remains as stated in the Agreement.

5. MATERIALS, SERVICES AND FACILITIES shall be furnished by the Contractor.

   (a) It is understood that except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, gas, lights, power, transportation, superintendence, taxes, insurance, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete and deliver the work within the specified time.

   (b) Any work necessary to be performed after regular working hours, on Sundays, or legal holidays, shall be performed without additional expense to the Owner.

6. CONTRACTOR'S TITLE TO MATERIALS:

   No materials or supplies for the work shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the work, free from all liens, claims or encumbrances.

7. INSPECTION AND TESTING OF MATERIALS:

   Unless otherwise specifically provided for in the specification the inspection and testing of material and finished articles to be incorporated in the work at the site

shall be made by bureaus, laboratories, or agencies approved by the Owner. The cost of such inspection and testing shall be paid by the Contractor.

a) Certification by Contractor. Where the detailed specifications call for certified copies of mill or shop tests to establish conformance of certain materials with the specifications, it shall be the responsibility of the Contractor to assure delivery of such certifications to the Owner. No materials or finished articles shall be incorporated in the work until such materials and finished articles have passed the required tests. The Contractor shall promptly segregate and remove rejected material and finished articles from the site of work.

b) Guaranty. The testing and approval of materials by the laboratory, or laboratories, shall not relieve the contractor of a guarantee of workmanship and materials as called for in paragraph entitled "General Warranty for One Year After Completion of Contract" herein. The Contractor may, at his option and at his own expense, cause such other tests to be conducted as he may deem necessary to assure suitability, strength and durability of any material or finished article.

c) Electrical equipment circuits and devices shall be tested as directed by the Engineer for continuity, insulation quality and function prior to permanent energization.

8. "OR EQUAL" CLAUSE:

The phrase "or equal" shall be construed to mean that material or equipment will be acceptable only when, in the judgment of the Engineer, they are composed of parts of equal quality, or equal workmanship and finish, designed and constructed to perform or accomplish the desired result as efficiently as the indicated brand, pattern, grade, class, make or model. Written approval will be obtained from the Engineer prior to installation.

9. PATENTS:

The Contractor shall hold and save the Owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the contract, including its use by the Owner, unless otherwise specifically stipulated in the Contract Documents. If the Contractor uses any design, device or material covered by letter patent, or copyright, he shall provide for such use by suitable agreement with the Owner of such patented or copyrighted design, device or material. It is mutually agreed and understood that, without exception, the contract prices shall

include all royalties or costs arising from the use of such design, device or material, in any way involved in the work. The contractor and/or his sureties shall indemnify and have harmless the Owner of the project from any and all claims for infringements by reason of the use of such patented or copyrighted design, device or materials or any trademark of copyright in connection with work agreed to be performed under this contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work or after completion of the work.

10. SURVEYS, LAWS AND REGULATIONS: The Contractor shall comply with the following:

a) Construction staking shall be in accordance with the requirements of the Section 01050 - Field Engineering.

b) Laws and Regulations. The Contractor shall keep himself fully informed of all laws, ordinances and regulations of State, City and County in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all orders and decrees of bodies of tribunals having any jurisdiction or authority over same. If any discrepancy or inconsistency should be discovered in this contract, or in the drawings or specifications herein referred to, in relation to any such law, ordinance, regulation, order or decree, he shall forthwith report the same in writing to the Owner. He shall at all times himself observe and comply with all such existing and future laws, ordinances and regulations, (to the extent that such requirements do not conflict with Federal Laws or regulations) and shall protect and indemnify the Owner and its agents against any claims or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by himself or by his employees.

11. CONTRACTOR'S OBLIGATIONS:

The Contractor shall, in good workmanlike manner, do and perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by this contract, within the time herein specified, in accordance with provisions of this contract and said specifications, and in accordance with the plans and drawings covered by this contract and any and all supplemental plans and drawings and in accordance with the directions of the Engineer as given from time to time during the progress of the work. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required. The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements and limitations of the contract and

specifications, and shall do, carry on and complete the entire work to the satisfaction of the Engineer and the Owner.

12. WEATHER CONDITIONS.

In the event of temporary suspension of work or during inclement weather, or whenever the Engineer shall direct, the Contractor will, and will cause his subcontractors to protect carefully his and their work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors to so protect its work, such materials shall be removed and replaced at the expense of the Contractor.

13. PROTECTION OF WORK AND PROPERTY, EMERGENCY:

The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this contract. He shall at all times safely guard and protect his own work and that of adjacent property from damage. The Contractor shall replace or make good any such damage, loss or injury unless such be caused directly by errors contained in the contract or by the Owner or by his duly authorized representatives. In case of emergency which threatens loss or injury of property and/or safety of life, the Contractor will be allowed to act, without previous instructions from the Engineer, in a diligent manner. He shall notify the Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted to the Engineer for approval. Where the Contractor has not taken action but has notified the Engineer of an emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the Engineer. The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in the paragraph entitled "Changes in Work" of these specifications.

14. INTERPRETATIONS.

If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of these proposed contract documents, he may submit to the Engineer a written request for an interpretation thereof. The person submitting the request will be responsible for its prompt and actual delivery. Any interpretation of such documents will be made only by addendum duly issued, and a copy of such addendum will be mailed or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanation or interpretation of such documents which anyone presumes to make on behalf of the Owner before expiration of the ultimate time set for the receipt of bids.

15. REPORTS, RECORDS AND DATA:

The Contractor, suppliers, vendors, sub-contractors, and other applicable parties shall submit to the Owner, Engineer, or other agencies having jurisdiction over the work, such schedules of quantities and costs, progress schedules, payrolls, reports, estimates, records, shop drawings, equipment details, and other data as may be required, or requested, concerning work performed or to be performed under this contract.

Submission of the following items is specifically required; however other submissions are required as may be stipulated elsewhere.

1) Bid Breakdown: The successful Bidder shall furnish to the Engineer a complete cost breakdown of his bid, within 10 days after submission of bids. The breakdown shall include all items for each unit of construction and shall show labor cost, material cost, equipment cost, equipment installation cost, other cost, and the total cost for each unit of work. Bidders will consult with the Engineer prior to submitting the breakdown to insure a complete understanding of the requirements.

2) Construction Schedule: Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Engineer and Owner an estimated construction progress schedule in satisfactory form, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due to Contractor in accordance with the progress schedule.

3) The Construction Schedules of all Contractors and Subcontractors shall be coordinated and consolidated by the Prime as approved by the Engineer.

4) Names of the project superintendent and others responsible for the work shall be included.

16. SUPERINTENDENCE BY CONTRACTOR:

The Contractor shall employ only competent and skilled personnel on the work. The Contractor shall have a competent Superintendent or Foreman present all times when the work is in progress, who shall have full authority to act for the Contractor. It is understood that such representatives shall be acceptable to the

Engineer and shall be one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll. The Contractor shall, upon demand from the Engineer, immediately remove any superintendent, foreman or workman whom the Engineer may consider incompetent or undesirable.

17. CHANGES IN WORK:

No changes in the work covered by the approved contract documents shall be made without having prior written approval of the Owner. Charges or credits for the work covered by the approved change shall be determined by one or more, or a combination of, the following methods:

a) Unit bid prices previously approved.

b) An agreed lump sum.

c) The actual cost of:

1. Labor, including foreman.

2. Materials entering permanently into the work.

3. The ownership or rental cost of construction plant and equipment during the time of use on the extra work.

4. Power and consumable supplies for the operation of power equipment.

5. Insurance.

6. Social Security and old age and unemployment contributions.

To the cost under Item c) there shall be added a fixed fee to be agreed upon but not to exceed 15 percent of the estimated cost of the work. The fee shall be compensation to cover the cost of supervision, overhead, bond, profit and any other general expenses.

18. EXTRAS:

Without invalidating the contract, the Owner may order extra work or make changes by altering, adding to or deducting from the work, the contract sum being adjusted accordingly, and the consent of the surety being first obtained where necessary or desirable. All the work of the kind bid upon shall be paid for at the

price stipulated in the proposal, and no claims for any extra work or materials shall be allowed unless the work is ordered in writing by the Owner, or the Engineer acting officially for the Owner, and the price is stated in such order. Extra work shall be performed only upon the execution of authorized change orders as set forth in the preceding paragraph.

19. TIME FOR COMPLETION AND LIQUIDATED DAMAGES:

It is hereby understood and mutually agreed by and between the Contractor and the Owner that the date of beginning and the time for completion as specified in the contract of the work to be done hereunder are essential conditions of this contract; and it is further mutually understood and agreed that the work embraced in this contract shall be commenced on a date to be specified in the Notice to Proceed.

a) Regular Prosecution of Work. The Contractor agrees that said work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for completion of the work described herein is a reasonable time for completion of same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

b) Liquidated Damages. If the Contractor shall neglect, fail, or refuse to complete the work within the time herein specified, or any proper extensions thereof granted by the Owner, then the Contractor does hereby agree, as a part of consideration for the awarding of this contract, to pay to the Owner the amount specified in the contract as a penalty for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the contract for completing the work. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticality and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodic estimates.

c) Extension of Time for Completion. It is further agreed that time is of the essence of each and every portion of this contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this contract. Provided that the Contractor shall not be charged with liquidated damages or any excess cost

when the delay in completion of the work is due:

1. To any preference, priority or allocation order duly issued by the Government.

2. To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner; fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, and;

3. To any delays of subcontractors or suppliers occasioned by any of the causes specified in subsections 1 and 2 of this article.

Provided further, that the Contractor shall, within seven (7) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the contract, notify the Owner in writing of the causes of delay, who shall ascertain the facts and extent of delay and notify the Contractor within a reasonable time of its decision in the matter, and grant such extension of time as the Owner shall deem suitable and just.

20. CORRECTION OF WORK:

All work, all materials, whether incorporated in the work or not, all processes of manufacture, and all methods of construction shall be at all times and places subject to the inspection of the Engineer, who shall be the final judge of the quality and suitability of the work, materials, processes of manufacture, and methods of construction of the purposes for which they are used. Should they fail to meet his approval, they shall be forthwith reconstructed, made good, replaced and/or corrected, as the case may be, by the Contractor at his own expense. Rejected material shall immediately be removed from the site. If, in the opinion of the Engineer, it is undesirable to replace any defective or damaged materials or to reconstruct or correct any portion of the work injured or not performed in accordance with the contract documents, the compensation to be paid to the Contractor hereunder shall be reduced by such amount as, in the judgment of the Engineer, shall be equitable.

21. SUBSURFACE CONDITIONS FOUND DIFFERENT:

Should the Contractor encounter subsurface and/or latent conditions at the site materially differing from those shown on the plans or indicated in the specifications, he shall immediately give notice to the Engineer of such conditions before they are disturbed. The Engineer will thereupon promptly investigate the

conditions, and if he finds that they materially differ from those shown on the plans or indicated in the specifications, he will at once make such changes in the plans and/or specifications as he may find necessary; any increase or decrease of cost resulting from such changes to be adjusted in the manner provided in Paragraph 17 of these specifications.

a) Where no specific subsurface conditions are indicated or specified, no increase in cost will be considered in regards to subsurface conditions encountered.

22. CLAIMS FOR EXTRA COSTS:

No claim for extra work or cost shall be allowed unless the same was done in pursuance of a written order of the Engineer, as aforesaid, and the claim presented with the first estimate after the change or extra work is done. When work is performed under the terms of subparagraph 17(c) of these specifications, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost and when requested by the Owner, give the Owner access to accounts relating thereto.

23. RIGHT OF OWNER TO TERMINATE CONTRACT:

In the event that any of the provisions of this contract are violated by the Contractor or by any of his Subcontractors, the Owner may serve written notice upon the Contractor and the surety of its intention to terminate the contract, such notices to contain the reasons for such intention to terminate the contract, and unless within 10 days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement or correction be made, the contract shall, upon the expiration of said 10 days, cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the surety and the Contractor, and the surety shall have the right to take over and perform the contract; provided, however, that if the surety does not commence performance thereof within 10 days from the date of mailing to such surety of notice of termination, the Owner may take over the work and prosecute same to completion by contract or by force account for the account and at the expense of the Contractor, and the Contractor and his surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner may take possession of and utilize in completing the work such materials, appliances and plant as may be on the site of the work and necessary therefore. The Contractor shall not remove any such equipment, material, and supplies without the consent of the Owner. If the Contractor should die, be declared an incompetent, be declared bankrupt or insolvent, make an assignment for the benefit of creditors during the term of his contract, the Owner may terminate the contract in the manner and under the procedure set forth above with the

exception that no notices to the Contractor shall be required, but in lieu thereof the Owner must make a reasonable effort to notify the estate of the Contractor, his guardian, assignee, or legal representative of the intention to terminate and fact of termination, if there is any such guardian, assignee, or legal representative at the time the Owner desires to terminate.

24. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES:

Immediately after execution and delivery of the contract and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in form satisfactory to the Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the contract documents and the anticipated amount of each monthly payment that will become due the Contractor in accordance with the progress schedule.

A. Contractor's Estimate. The Contractor shall also furnish:

1. A detailed estimate, giving a complete breakdown of the contract price; and

2. Periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only for determining the basis of partial payments and will not be considered as fixing a basis for addition to or deductions from the contract price.

B. Equipment Delivery Schedule. The Contractor shall also prepare a schedule of anticipated shipping dates for materials and equipment. It is intended that equipment and materials be so scheduled as to arrive at the job site just prior to time for installation to prevent excessive materials on hand for inventory and the necessity for extensive storage facilities at the job site.

25. PAYMENTS TO CONTRACTOR shall be made according to the following:

A. Upon submittal of an approvable payment estimate to the Owner prior to the last day of the month, the Owner shall make a progress payment to the Contractor on the basis of a duly certified approved estimate of the work performed during the preceding calendar month under this contract on the 10^{th} of the following month, but to insure the proper performance of this contract, the Owner will retain a portion of each estimate until final completion and acceptance of all work covered by this contract in accordance with the following:

1. Retention of up to 10% of payment claimed until construction is complete, or as follows:

2. When the project is substantially complete (operational or beneficial occupancy), the retained amount may solely, at the Owner's option, be further reduced below 5% to only that amount necessary to assure completion.

3. The Owner will accept a cash bond or irrevocable letter of credit if offered in lieu of cash retainage under (2), and will accept a cash bond or irrevocable letter of credit if offered in lieu of cash retainage under (3).

B. In preparing estimates, the material delivered on the site and preparatory work done may be taken into consideration so long as the contractor is fully covered with builder's risk insurance.

C. All material and work covered by partial payments shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of materials and work upon which payments have been made or the restoration of any damaged work, or as a waiver of the right of the Owner to require the fulfillment of all the terms of the contract.

D. Owner's Right to Withhold Certain Amounts and Make Application Thereof. The Contractor agrees that he will indemnify and save the Owner harmless from all claims growing out of the lawful demands of subcontractors, laborers, workmen, mechanics, material men, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged, or waived. If the Contractor fails to do so, then the Owner may, after having served written notice on the Contractor, either pay unpaid bills, of which the Owner has written notice, direct, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished at all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed in accordance with the terms of this contract, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Owner to either the Contractor or his surety. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the

Owner shall be considered as a payment made under the contract by the Owner to the Contractor, and the Owner shall not be liable to the Contractor for any such payment made in good faith.

26. ACCEPTANCE OF WORK AND FINAL PAYMENT.

Before final acceptance of the work and payment to the Contractor of the percentage retained by the Owner, the following requirements shall be complied with:

A. Final Inspection. Upon notice from the Contractor that his work is completed, the Engineer will make a final inspection of the work and shall notify the Contractor of all instances where his work fails to comply with the contract drawings and specifications, as well as any defects he may discover. The Contractor shall immediately make such alterations as are necessary to make the work comply with the contract drawings and specifications, and to the satisfaction of the Engineer.

B. Operating Test. After the alterations for compliance with the contract drawings and specifications have been made, and before acceptance of the whole of any part of the work, it shall be subjected to test to determine that it is in accordance with the contract drawings and specifications. The Contractor shall maintain all work in first-class conditions for a thirty (30) day operating period after the work has been completed as a whole, the final inspection has been made, and the Engineer has notified the Contractor in writing that the work has been finished to his satisfaction. The retained percentage as provided herein will not become due or payable to the Contractor until after the thirty (30) day operating period has expired.

C. Letter of Acceptance. Upon completion of sewer line installation, Contractor shall obtain a letter from the SCDOT stating that work completed within the street right-of-way was performed to its satisfaction.

D. Cleaning Up. Before the work is considered as complete, all rubbish and unused material due to or connected with the construction must be removed and the premises left in a condition satisfactory to the Owner. Streets, curbs, crosswalks, pavements, sidewalks, fences and other public and private property disturbed or damaged should be restored to their former condition. Final acceptance will be withheld until such work is finished.

E. Liens. Final acceptance of the work will not be granted and the retained percentage will not be due or payable until the Contractor has furnished the Owner proper and satisfactory evidence under oath that all claims for labor

and material employed or used in the construction of the work under this contract have been settled, and that no legal claims can be filed against the Owner for such labor or material.

E. Final Estimate. Upon completion of all cleaning up, alterations and repairs required by the final inspection or operating test, the satisfactory completion of the operating test, and upon submitting proper and satisfactory evidence to the Owner that all claims have been settled, the Engineer shall then prepare his final estimate. After review and approval of the final estimate by the Engineer and the Owner, the payment shall then become due.

27. ACCEPTANCE OF FINAL PAYMENT AS RELEASE:

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor for all things done or furnished in connection with this work and for every act and neglect of the Owner and others relating to or arising out of this work. No payment, final or otherwise, shall operate to release the Contractor or his sureties from any obligations under this contract or the performance and payment bond.

28. PAYMENTS BY CONTRACTOR:

The Contractor shall pay:

A. For all transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered;

B. For all materials, tools, and other expendable equipment to the extent of ninety (90) percent of the cost thereof not later than the 20th day of the calendar month following that in which such materials, tools, and equipment are delivered at the site of the project, and the balance of the cost thereof not later than the 30th day following completion of that part of the work in or on which such materials, tools, and equipment are incorporated or used; and

C. To each of the subcontractors not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his subcontractors to the extent of each subcontractor's interest therein.

29. INSURANCE:

The Contractor shall procure and maintain during the life of this contract, whether

such operation be by himself or by a subcontractor or anyone directly or indirectly employed by either of them, such insurance as required by statute and/or ordinance to adequately protect the Owner from any claims or damages, including bodily injury or death, which may arise from them during operations under this contract.

A. Limits of Liability. Insurance shall be obtained for not less than the limits of liability as specified in Section 01001 entitled Supplemental General Conditions.

B. Certificates of Insurance. The Contractor shall furnish the Owner, if requested, certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of the policies. Such certificates shall contain substantially the following statement: "The insurance covered by this certificate will not be cancelled or materially altered except after 10 days written notice has been received by the Owner".

30. CONTRACT SECURITY:

The Contractor shall furnish a 100 percent performance bond and a 100 percent payment bond as security for the faithful performance of this contract, as security for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract. The performance bond and payment bond shall be in separate instruments. Before the final acceptance, each bond must be approved by the Owner.

31. ASSIGNMENTS:

The Contractor shall not assign the whole or any part of this contract or any moneys due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any monies due or to become due under this contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this contract.

32. MUTUAL RESPONSIBILITY OF CONTRACTORS:

If, through acts of neglect on the part of the Contractor, any other Contractor or any Subcontractor shall suffer loss or damage on the work, the Contractor agrees to settle with such other Contractor or Subcontractor by agreement or arbitration. If such other Contractor or Subcontractor shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify

the Contractor, who shall indemnify and save harmless the Owner against any such claim.

33. SEPARATE CONTRACTS:

The contractor shall coordinate his operations with those of other Contractors. Cooperation will be required in the arrangement for the storage of materials and in the detailed execution of the work. The Contractor, including his Subcontractor, shall keep informed of the progress and the detail work of other Contractors and shall notify the Engineer immediately of lack of progress or defective workmanship on the part of the other Contractors. Failure of a Contractor to keep informed of the work progressing on the site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by him of the status of the work as being satisfactory for proper coordination with his own work.

34. SUBCONTRACTING shall comply with the following:

A. The Contractor may utilize the services of specialty contractors on those parts of the work which under normal contracting practices are performed by specialty subcontractors. The maximum amount of the subcontract work shall not exceed 30% of the total contract price without prior approval of the Owner.

B. The Contractor shall not award any work to any subcontractor without prior written approval of the Owner, which approval will not be given until the Contractor submits to the Owner a written statement concerning the proposed award to the subcontractor, which statement shall contain such information as the Owner may require.

C. The Contractor shall be as fully responsible to the Owner for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons employed by him.

D. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the Contractor by the terms of the General Conditions and other contract documents insofar as applicable to the work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provisions of the contract documents.

E. Nothing contained in this contract shall create any contractual relation between any subcontractor and the Owner.

35. ENGINEER'S AUTHORITY:

The Engineer shall determine the amount, quality, acceptability and fitness of the several kinds of work and materials which are to be paid for under this contract and shall decide all questions which may arise in relation to said work and the construction thereof. The Engineer's estimates and decisions shall be final and conclusive, except as herein otherwise expressly provided, in case any question shall arise between the parties hereto relative to said contract or specifications, the determination or decision of the Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this contract affected in any manner or to any extent by such question.

A. Interpretation of Drawings and Specifications. The Engineer shall decide the meaning and intent of any portion of the specifications and of any plans or drawings where the same may be found obscure or be in dispute. Any differences or conflicts in regard to their work which may arise between the Contractor under this contract and other Contractors performing work for the Owner shall be adjusted and determined by the Engineer.

36. STATED ALLOWANCES: Not Applicable.

37. USE OF PREMISES REMOVAL OF DEBRIS:

The Contractor expressly undertakes at his own expense:

A. To take every precaution against injuries to persons or damage to property.

B. To store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not unduly interfere with the progress of his work or the work of any other contractors.

C. To place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work.

D. To clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that all times the site of the work shall present a neat, orderly and workmanlike appearance.

E. Before final payment, to remove all surplus material, false work, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in a neat, orderly condition.

F. To effect all cutting, fitting or patching of his work required to make the same conform to the plans and specifications, and, except with the consent of the Engineer, not to cut or otherwise alter the work of any other contractor.

38. QUANTITIES OF ESTIMATE:

The estimated quantities of work to be done and materials to be furnished under this contract, shown in any of the documents, including the proposal, are given for use in comparing bids, and the right is especially reserved except as herein otherwise specifically limited, to increase or diminish them as may be deemed reasonably necessary or desirable by the Owner to complete the work contemplated by this contract, and such increase or diminution shall in no way vitiate this contract, nor shall any such increase or diminution give cause for claims or liability for damages.

39. RIGHTS-OF-WAY AND SUSPENSION OF WORK:

The Owner shall furnish all land and rights-of-way necessary for the carrying out of his contract and the completion of the work herein contemplated, and will use due diligence in acquiring said land and rights-of-way as speedily as possible. But it is possible that all lands and rights-of-way may not be obtained as herein contemplated before construction begins, in which event the Contractor shall begin his work upon such land and rights-of-way as the Owner may have previously acquired, and no claim for damages whatsoever will be allowed by reason of the delay in obtaining the remaining lands and rights-of-way.

Should the Owner be prevented or enjoined from proceeding with the work, or from authorizing its prosecution, either before or after the commencement, by reason of any litigation or by reason of its ability to procure any lands or rights-of-way for said work, the Contractor shall not be entitled to make or assert claim for damage by reason of said delay or to withdraw from the contract except by consent of the Owner; but time for completion of the work will be extended to such time as the Owner determines will compensate for the time lost by such delay, such determination to be set forth in writing.

40. GENERAL WARRANTY FOR ONE YEAR AFTER COMPLETION OF CONTRACT:

For a period of at least one year after the completion of the contract, the Contractor warrants the fitness and soundness of all work done and materials and equipment put in place under the contract, and neither the final certificate of payment nor any provision in the Contract Documents nor partial or entire occupancy of the premises by the Owner shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of

liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting there from, which shall appear within a period of one year from the date of final acceptance of the work, unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.

41. NOTICE AND SERVICE THEREOF:

Any notice to any Contractor from the Owner relative to any part of this contract shall be in writing and considered delivered and the service thereof completed, when said notice is posted by registered mail to said Contractor or his authorized representative on the work, or is deposited in the regular United States Mail in a sealed, postage prepaid envelope and the receipt thereof is acknowledged by the Contractor.

A. Owner's Notice. All papers required to be delivered to the Owner shall be delivered as indicated in Section 01001 entitled Supplemental General Conditions.

42. REQUIRED PROVISIONS DEEMED INSERTED:

Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein, and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted or is not correctly inserted, then upon the application of either party the contract shall forthwith be physically amended to make such insertion or correction.

43. PROTECTION OF LIVES AND HEALTH:

In order to protect the lives and health of his employees under the contract, the Contractor shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the contract. The Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods, and for any damage which may result from their failure or their improper construction, maintenance or operation.

44. WAGES AND OVERTIME COMPENSATION:

The Contractor and each of his Subcontractors shall comply with all applicable

state and local laws or ordinances with respect to the hours worked by laborers and mechanics engaged in work on the project and with respect to compensation for overtime.

45. PROHIBITED INTERESTS:

No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction, or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or any part hereof. No officer, employee, architect, attorney, engineer, or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project shall become directly or indirectly interested personally in this contract or in any part hereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

46. CONFLICTING CONDITIONS:

Any provision in any of the Contract Documents which may be in conflict or inconsistent with any of the paragraphs in these General Conditions shall be void to the extent of such conflict or inconsistency.

47. PUBLIC CONVENIENCE AND PROTECTION:

The convenience and protection of the public must be provided for at all times during progress of the work. The Contractor shall be solely responsible to protect others and work from harm, conduct the work in such a manner as to insure the least practicable obstruction to the public and residents near and adjacent to the area of work. Roads and streets shall be kept open at all times or suitable detours provided. When it becomes necessary to close streets, suitable signs and barricades shall be placed adjacent to the work in proper locations and the Owner, Engineer, law enforcement agencies, fire departments, and all parties operating emergency vehicles shall be notified before the street is closed and again as it is reopened. All closed streets shall be opened at the end of each working day. Access to fire hydrants and other fire fighting equipment shall be maintained at all times.

When necessary, the Contractor shall provide watchmen and lights to burn between twilight and sunrise and shall place and maintain barriers to protect the work and others from harm or damage. The Contractor shall take all necessary steps to protect life, limb, and property. The Owner reserves the right to remedy

any neglect on the part of the Contractor in connection with any unsafe practice or protection of work after 24 hours notice in writing and, in cases of emergency the Owner shall have the right to remedy any neglect without previous notice. All costs incurred by the Owner in remedying neglect on the part of the Contractor shall be deducted from money due the Contractor.

48. OSHA STANDARDS AND REGULATIONS

The Contractor is advised that the Contractor shall comply with all applicable OSHA Standards and Regulations and that the Contractor is responsible for the implementation of all OSHA Standards and Regulations for the work to be performed. The Contractor is further advised that the contractor shall meet with the Owner's Safety Director prior to commencing work in order to complete all necessary documentation with respect to any specific OSHA Standard and Regulation that will apply to the Owner's property and/or personnel.

SECTION 01001

SUPPLEMENTAL GENERAL CONDITIONS

1. ENUMERATION OF PLANS, SPECIFICATIONS AND ADDENDA

   A. The plans, specifications and addenda which form a part of this contract as set forth in Paragraph 1 of the General Conditions, Contract and Contract Documents are enumerated in the Table of Contents.

2. CONTRACTOR'S AND SUB-CONTRACTOR'S INSURANCE

   A. As required under Paragraph 29 of the General Conditions, the Contractor shall not commence work under this contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the Owner, nor shall the Contractor allow any sub-Contractor to commence work on his subcontract until all similar insurance required of the sub-Contractor has been so obtained and approved.

      1. Special Hazards: The Contractor's and his Subcontractor's Public Liability and Property Damage Insurance shall provide adequate protection against use of explosives, collapse, and underground hazards.

      2. Compensation Insurance: The Contractor shall procure and shall maintain during the life of this contract Workmen's Compensation Insurance. In case any such work is sublet, the Contractor shall require the Subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees to be engaged in such work unless such employees are covered by the protection afforded by the Contractor's Workmen's Compensation Insurance. In case any class of employees engaged in hazardous work on the project under this contact is not protected under the Workmen's Compensation Statute, the Contractor shall provide and shall cause such subcontractor to provide a Workmen's Compensation policy for the protection of such of his employees not otherwise protected.

      3. Comprehensive General Liability Insurance: The Contractor shall take out and maintain during the life of the contract such comprehensive general liability insurance as shall protect him and any subcontractor performing work covered by this contract from claims for damage for personal injury, including accidental death, as

well as from claims for property damage, which may arise from operations under this contract whether such operations are by himself or by any subcontractor or by anyone directly or indirectly employed by either of them. The amount of such insurance shall be as follows:

a. Bodily injury and Personal Injury in an amount not less than $500,000 per occurrence, and subject to a limit of not less than $1,000,000 during a period of twelve months.

b. Property Damage Insurance in an amount not less than $500,000 for any one damage claim, and in an aggregate amount up to $1,000,000 during a twelve month period.

4. Comprehensive Automobile Liability Insurance

a. For bodily injury, including accidental death to any one person, in an amount not less than $200,000 and with a limit of not less than $500,000 on account of one accident.

b. For property damage in an amount not less than $150,000 on account of one accident.

5. Broad Form Blanket Contractual Liability Insurance

a. For bodily injury in an amount not less than $500,000 per occurrence and not less than $1,000,000 during a period of twelve months.

b. For property damage in an amount not less than $150,000 per occurrence and not less than $300,000 during a period of twelve months.

c. The Contractor shall indemnify the Owner and the Engineer as follows:

1. The Contractor will indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of

tangible property, or taking of property, including the loss of use resulting therefrom; and is caused in whole or part by any negligent or willful act or omission of the Contractor and sub-Contractor, anyone directly or indirectly employed by any of them or anyone of whose acts any of them may be liable.

2. In any and all claims against the Owner or the Engineer, or any of their agents or employees, by any employee of the Contractor, any sub-Contractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any sub-Contractor under workmen's compensation acts, disability benefit acts or other employee benefits acts.

3. The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications.

6. Owner's Protective Liability Insurance: Issued in the name of the Owner for liability and property damage under 3(a) and 3(b) above, in the same amounts as stipulated for the Contractor.

7. "All Risks" Builders Risk Insurance: For the full contract value of the insurable portions of the Work.

8. Flood Insurance: The Contractor is required to carry flood insurance for projects located in designated flood hazard areas in which Federal Flood Insurance is available.

9. Proof of Coverage of Insurance: The Contractor shall furnish the Owner with a certificate showing satisfactory proof of carriage of the insurance required prior to commencing work on his contract.

10. Scope of Insurance: The insurance required under subparagraphs 1, 2, 3, 4, 5, and 7 hereof shall provide adequate protection for the Contractor and his Subcontractors, respectively, as well as the Owner, against damage claims which may arise from operations

under this Contract, whether such operations be by the insured or by anyone directly or indirectly employed by him.

3. ABBREVIATIONS AND DEFINITIONS

A. Abbreviations used in these Specifications refer to the following:

OWNER: (BPW) Gaffney Board of Public Works

ENGINEER: Cam Miller – employed by the Board of Public Works

B. Definitions: Wherever in the specifications or upon the drawings the words "directed", "required", "permitted", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation or prescription of the Owner is intended; and similarly, the words "approved", "acceptable", "satisfactory", or words of like import shall mean approved by, or acceptable to, or satisfactory to the Owner, unless otherwise expressly stated.

4. PHOTOGRAPHS OF PROJECT – Not applicable.

5. SCHEDULE OF OCCUPATIONAL CLASSIFICATIONS AND MINIMUM HOURLY WAGE RATE – Not applicable.

6. NOTICE AND SERVICE THEREOF

A. All papers required to be delivered to the Owner shall, unless otherwise specified in writing to the Contractor, be delivered to the Owner's representative as indicated below, and any notice to or demand upon the Owner shall be sufficiently given if delivered to the office of said representative, or if deposited in the United States Mail, in a sealed postage prepaid envelope, or delivered with charges prepaid to any telegraph company for transmission, in each case addressed to the Owner's representative as indicated below, or to such other representative of the Owner, or to such other address as the Owner may subsequently specify in writing to the Contractor for such purposes. The Owner's representative is as follows:

Cam Miller, P.E.
Board of Public Works
210 East Frederick Street
Gaffney, South Carolina 29340

7. CORRELATION OF PLANS AND SPECIFICATIONS

A. The contract, plans and specifications are to be interpreted as mutually explanatory or supplementary, and therefore any features shown in one and not in the other shall have the same force and effect as if shown by both, and shall be fully executed. Prior to execution of the work, the Contractor shall check all drawings and specifications, and shall immediately report to the Engineer all errors, discrepancies, conflicts and omissions discovered therein. All such errors, discrepancies, conflicts and omissions will be adjusted by the Engineer, and adjustment by the Contractor without prior approval shall be at his own risk. The settlement of any complications arising from such adjustments shall be made by the Contractor at his own expense and to the satisfaction of the Owner.

8. OWNERSHIP OF DRAWINGS

A. All drawings, specifications and memoranda relating to the work are the property of the Owner and are to be carefully used and returned to the Owner upon completion or cessation of the work from any cause.

B. Contract Documents to be Furnished: One (1) hardcopy and One (1) electronic copy of specifications and plans will be furnished to the Contractor without charge. Additional sets can be secured from the Engineer upon request at cost of reproduction. The Contractor shall have available on the project site at all times one (1) copy of each of said plans and specifications.

9. ORDER OF WORK

A. The prosecution, order or sequence of the work shall be as approved by the Engineer, which approval, however, shall in no way affect the responsibility of the Contractor.

10. PHYSICAL DATA

A. The drawings, which accompany and form a part of the contract, have been prepared on the basis of surveys and inspections of the site, and are intended to present an essentially accurate indication of the physical conditions at the site. However, this shall not relieve the Contractor of the necessity for familiarizing himself with physical conditions at the site, and any discrepancies found in the drawings shall not be grounds for claims by the Contractor against the Owner, or for non-performance of work specifically provided for under the contract.

11. ORGANIZATION, PLANT AND PROGRESS

A. The following is supplemental to Paragraph 16 of the General Conditions:

1. The Contractor shall give his personal superintendence to the work, or shall have a competent superintendent with authority to act for him, to the satisfaction of the Engineer, on the job at all times during the progress of the work.

2. The Contractor shall employ an ample force of properly experienced workers and provide construction plant properly adapted to the work and of sufficient capacity and efficiency to accomplish the work in a safe and workmanlike manner at a rate of progress satisfactory to the Owner. All plants shall be maintained in good working order and provision shall be made for immediate emergency repairs. No reduction in the capacity of the plant employed on the work shall be made except by written permission of the Owner. The measure of the capacity of the plant shall be its actual performance on the work to which these specifications apply. Award of this contract shall not be construed as a guaranty by the Owner that plant listed by the Contractor for use on this contract is adequate for the performance of the work.

3. Should the Contractor fail to maintain a rate of progress which, in the opinion of the Owner, will complete work within the time limit specified, the Owner may require that additional persons working, if necessary, during additional periods or shifts, or additional plant, or both, be placed on the work; or a reorganization of plant layout be effected in order that the progress of the work be brought up to schedule and so maintained. Should the Contractor refuse or neglect so to increase the number of persons, working period, or plant, or to reorganize the plant layout in the manner satisfactory to the Owner, the latter may proceed under the provisions of the Contract to rectify the conditions.

12. SUPERVISION AND INSPECTION

A. The Owner shall require inspection by the Engineer to insure that construction conforms with the approved plans and specifications.

1. The work shall be conducted under the general direction of the Engineer and will be inspected periodically by inspectors appointed by him. The inspectors will keep a record of work done and see that the location and limit marks are kept in proper order, but the

presence of the inspectors shall not relieve the Contractor or his responsible agent of responsibility for the proper execution of the work.

B. The Contractor will be required to furnish at his expense such labor, organization and materials which form a part of the ordinary and usual equipment and crew of the Contractor as may be reasonably necessary in inspecting and supervising the work. Should the Contractor refuse, neglect or delay compliance with this requirement, the specified facilities may be furnished and maintained by the Owner and the cost thereof will be deducted from any amounts due, or to become due, the Contractor.

1. Except as specified in this paragraph, or otherwise provided for in these specifications, all expenses of supervision and inspection will be borne by the Contractor.

C. It is understood that any instruction or decision given by the Engineer is to be considered the instruction or decision of the Owner, in all cases where, under the terms of this contract, decision rests with the Engineer.

D. The work shall be entirely under the control of the Engineer and Owner, and he or his authorized representative shall have access to same at all times. The Engineer may require the Contractor to dismiss such employees as he deems to be incompetent or careless.

13. STANDARD TESTS, QUALITY AND GUARANTEES

A. Standard tests, quality and guarantees shall comply with the following:

1. All materials, supplies and parts and assemblies thereof, entering into the work to be performed under these specifications, shall be tested as specified herein or otherwise required, in conformity with the contract and according to the best modern approved methods for the particular type and class of work.

2. Unless waived in writing by the Engineer, all tests and trials shall be made in the presence of duly authorized representative of the Engineer. When the presence of the inspector is so waived, sworn statements in duplicate of the tests made and results thereof shall be furnished to the Engineer by the Contractor as soon as possible after completion of tests.

3. Unless otherwise authorized, directed or specified, where standard published specifications of recognized authorities and organizations

are mentioned, the latest revision of such specification current at the time when the work is executed shall govern.

4. All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Owner. The Owner will pay for all laboratory inspection services direct and not as a part of the contract.

5. Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

6. In accordance with the Contract, all materials, parts and equipment furnished and incorporated in the work shall be high grade, free from defects and imperfections, of recent manufacture and unused. Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

14. STANDARD PRODUCTS

A. All materials, supplied and articles furnished shall, wherever specified and otherwise wherever practicable, be the standard products of recognized, reputable manufacturers. The standard products of manufacturers other than those specified will be accepted when it is proven to the satisfaction of the Engineer, in accordance with the Contract, that they are equal in strength, durability, usefulness and convenience for the purpose intended. Any changes required in the details and dimensions indicated on the drawings, or the substitution of standard products other than those provided for, shall be properly made as approved by the Engineer and at the expense of the Contractor.

15. WORK ON HIGHWAY RIGHT-OF-WAY:

The Contractor shall not begin work on any right-of-way of the State, County, or City, Highway Department until all required permits have been secured and the Highway Department notified by the contractor that work is beginning. The Contractor shall conform to all requirements of the respective highway department and shall be responsible for contacting all Highway Departments to determine all requirements for the work to be done.

The Contractor shall provide a full-time flagman at all times that work is in progress for the purpose of warning and directing traffic. Proper warning signs shall be

placed at each end of the area while work is in progress and shall remain in place until completion of the work. The signs shall be maintained by the Contractor at all times and shall be placed at such distance from the work area so that sufficient warning is given to oncoming traffic. All signs shall be properly lighted at night and shall conform to the latest S.C. manual on traffic control devices for streets and highways.

All open cuts in highway rights-of-way shall be immediately backfilled and all work to repair pavement completed immediately. All pavement cuts are to be saw cut in a straight line. All ragged and broken edges of pavement are to be recut so as to provide a smooth and straight trench line prior to repaving. All damage to adjacent pavement caused by construction operations is to be repaired at the direction of and to the satisfaction of the respective highway departments have jurisdiction over the highway's rights-of-ways. This repair work shall be done by the Contractor at no additional cost to the Owner.

Excavation material shall not be placed on the pavement side of the trench excavation along highways. All loose dirt and debris shall be removed from the pavement at the end of each working day. All open ditches are to be filled at the end of each working day and properly barricaded to prevent damage to persons and vehicular traffic. Equipment shall not be placed on the shoulders or edges of the roads and highways during shutdown. All shoulders of roads and highways shall be left in good and acceptable condition and all disturbed topsoil and grass shall be replaced.

SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:

1. Provide all staking required to construct the facilities from references shown on the drawings.

2. Establish proper line and levels for installation of utilities.

B. Work by Others:

1. Benchmark elevations will be provided only as noted on the drawings.

1.2 QUALITY ASSURANCE

A. Provide a competent survey party and surveying instruments for staking the work.

B. Exercise proper precautions to verify the figures shown on the Drawings prior to laying out any part of the work.

1. The Contractor will be held responsible for any errors therein that otherwise might have been avoided.

2. Promptly inform the Engineer of any error or discrepancies discovered in the Drawings or Specifications in order that proper corrections may be made.

1.3 PROCEDURES

A. Locate and protect control points before starting work on the site.

B. Preserve permanent reference points during progress of the Work.

C. Do not change or relocate reference points or items of the Work without specific approval from the Engineer.

D. Promptly advise the Engineer when a reference point is lost or destroyed, or requires relocation because of other changes in the Work.

E. Replace all property pins or markers if disturbed during construction. Replacement shall be by a registered land surveyor licensed in the State of South Carolina.

SECTION 01060

REGULATORY REQUIREMENTS

A. The following requirements of Regulatory Agencies having an interest in this project are hereby made a part of this Contract.

B. The Construction of the project, including the letting of the contracts in connection therewith, shall conform to the applicable requirements of State, territorial and local laws and ordinances to the extent that such requirements do not conflict with Federal laws and this subchapter.

C. South Carolina Sales Tax: All applicable South Carolina Sales Tax shall be to the account of the Contractor.

D. Use of Chemicals: All chemicals used during the project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of EPA and USDA. Use of all such chemicals and disposal o residues shall be in strict conformance with instructions.

E. Safety and Health Regulations: The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54).

F. Hazardous gas safety:

1. In accordance with 29 CFR 1910.119 (h) (2) (I) (Process Safety Management Standard), Contractor to provide the following information when working on or around the gas chlorination process:
    a. Copy of Contractor Safety Program; and the following for the year to date and the previous year.
    b. Total OSHA Recordable Case Rate.
    c. Total OSHA Lost Workday Case Rate.
    d. Total Lost Workday Cases Away from Work.
    e. Fatalities.
    f. Worker's Compensation Insurance Experience Modification Rate.
    g. OSHA Inspections.
    h. OSHA Citations.

2. Assure that each employee is trained in the work practices necessary to safely perform his or her job.

3. Assure that each employee is instructed in the known potential fire, explosion or toxic release hazards related to his or her job and the process, and the applicable provisions of the emergency action plan.

4. Document that each employee has received and understood the training required by 29 CFR 1910119 and prepare a record containing the employee identity, training date and means used to verify that the employee understood the training.

5. Assure that each employee follows the safety rules and procedures of the facility including the safe practices per 29 CFR 1910.119 (f) (4).

6. Advise the Owner of any unique hazards presented by the work, or if any hazards are found.

G. The Contractor shall comply with Part V of the South Carolina Manual on Uniform Traffic Control Devices for Streets and Highways.

H. The Contractor shall comply with Part V – Department of Transportation 49 CFR, Part 199 as published in the Federal Register on November 21, 1989 and any amendment thereto, as applicable.

I. Inspection of Agencies: The representatives of the South Carolina Department of Health and Environmental Control, SC Rural Infrastructure Authority, the US Army Corp of Engineers and the South Carolina Department of Transportation shall have access to the work wherever it is, in preparation or in progress, and the Contractor shall provide proper facilities for such access and inspection.

J. Withholding for non-residents shall comply with the following:

1. Attention of non-resident Contractors is invited to Code Sections 12-8-540 and 12-8-550 as amended effective July 1, 1994, Section 49, Appropriations Bill, Part II.

2. If a non-resident Contractor is the successful bidder on this project, he shall be required to provide the Owner with an Affidavit (For I-312, Nonresident Taxpayer Registration Affidavit Income Tax Withholding) affirming registration with the South Carolina Department of Revenue of the South Carolina Secretary of State's Office. (See Attached Form.)

3. Forms to register for all taxes administered by the South Carolina Department of Revenue may be obtained by calling the License and Registration Section at (803) 737-4872 or writing to South Carolina

Department of Revenue, Registration Unit, Columbia, South Carolina 29214-0140.

4. In the absence of an Affidavit being provided, withholding in the amount of two (2) percent of the contract price will be made by the Owner.

SECTION 01061

PERMITS AND RIGHTS-OF-WAY

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: This section establishes requirements pertaining to the measurement and payment for licenses, building permits, rights-of-way, etc. necessary for the construction of the project.

B. Work not included: The Owner will obtain and provide to the Contractor, as required, copies of:

1. SCDOT: Encroachment Permit.
2. SCDHEC: Permit to Construct (Sewer)
3. SCDHEC: Notification of Land Disturbance (Less Than 1-Acre).
4. Cherokee County: Land Disturbance Permit.
5. Easements obtained to cross private property.

1.2 SUBMITTALS

A. Submit to the Engineer satisfactory evidence that all necessary licenses, etc. have been secured prior to commencing the work.

PART 2 – PRODUCTS

No products are required for this work.

PART 3 – EXECUTION

3.1 BUSINESS LICENSE

A. Determine license necessary to perform the work at project location.

B. Obtain all necessary licenses at no additional cost to the Owner.

3.2 BUILDING PERMITS (Not Applicable)

3.3 RIGHTS-OF-WAY, UTILITY LINES

A. Owner will provide necessary rights-of-way or easements for construction of utility lines, whether on privately or publicly owned property.

B. The Owner will provide no right-of-way over other property.

SECTION 01210

PRECONSTRUCTION CONFERENCE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: To help clarify construction contract administration procedures, the Engineer will conduct a Preconstruction Conference prior to start of the Work. Provide attendance by the designated personnel.

1.2 QUALITY ASSURANCE

A. For those persons designated by the Contractor, his subcontractors, and suppliers to attend the Preconstruction Conference, provide required authority to commit the entities they represent to solutions agreed upon in the Conference.

1.3 SUBMITTALS

A. To the maximum extent practicable, advise the Engineer at least 24 hours in advance of the Conference as to items to be added to the agenda.

B. The Engineer will compile minutes of the Conference, and will furnish one (1) copy each of the minutes to the parties represented at the pre-construction conference. The Contractor may make and distribute such other copies as he wishes.

1.4 PRECONSTRUCTION CONFERENCE

A. The Conference will be scheduled to be held prior to issuance of the Notice to Proceed and prior to actual start of the work.

B. Attendance:

1. Provide attendance by authorized representatives of the Contractor and major subcontractors.

2. The Engineer will advise other interested parties, including the Owner.

C. Minimum agenda: Data will be distributed and discussed on:

1. Organizational arrangement of Contractor’s forces and personnel and

those of subcontractors, materials suppliers, and the Engineer;

2. Channels and procedures for communication;

3. Construction schedule, including sequence of critical work.

4. Contract Documents, including distribution of required copies of Drawings and revisions;

5. Processing of Shop Drawings and other data submitted to the engineer for review;

6. Processing of field decisions and Change Orders;

7. Rules and regulations governing performance of the Work; and

8. Procedures for security, quality control, housekeeping, and related matters.

SECTION 01310

CONSTRUCTION SCHEDULES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: To assure adequate planning and execution of the Work so that the Work is completed within the number of calendar days allowed in the Contract, and to assist the Engineer in appraising the reasonableness of the proposed schedule and in evaluating progress of the Work, prepare and maintain the schedules and reports described in this Section.

B. Definitions:

1. “Day”, as used throughout the Contract unless otherwise stated means calendar day.

1.2 QUALITY ASSURANCE

A. Employ a scheduler who is thoroughly trained and experienced in compiling construction schedule data, and in preparing and issuing periodic reports as required below.

B. Perform data preparation, analysis, charting, and updating in accordance with standards approved by the Engineer.

C. Reliance upon the approved schedule:

1. The construction schedule as approved by the Engineer will be an integral part of the Contract and will establish interim completion dates for the various activities under the Contract.

2. Should any activity not be completed within 10 days after the stated scheduled date, the Owner shall have the right to require the Contractor to expedite completion of the activity by whatever means the Owner deems appropriate and necessary, without additional compensation to the Contractor.

3. Should any activity be 30 days or more behind schedule, the Owner shall have the right to perform the activity or have the activity performed by whatever method the Owner deems appropriate.

4. Costs incurred by the Owner and by the Engineer in connection with expediting construction activity under this Article shall be reimbursed by the Contractor.

5. It is expressly understood and agreed that failure by the Owner to exercise the option either to order the Contractor to expedite an activity or to expedite the activity by other means shall not be considered to set a precedent for any other activities.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Preliminary Analysis: Prior to the preconstruction conference, submit a preliminary construction schedule prepared in accordance with Part 3 of this Section.

C. Construction Schedule: Within 10 calendar days after the Contractor has received the Owner's Notice to Proceed, submit five (5) copies of a construction schedule prepared in accordance with Part 3 of this Section.

D. Periodic reports: With the payment request each month, submit a construction schedule updated as described in Part 3 of this section.

PART 2 – PRODUCTS

2.1 CONSTRUCTION ANALYSIS

A. Graphically show by bar chart or other means approved by the Engineer and Owner the order and interdependence of all activities necessary to complete the work, and the sequence in which each activity is to be accomplished, as planned by the Contractor and his project field superintendent in coordination with all subcontractors whose work is shown on the diagram.

PART 3 – EXECUTION

3.1 PRELIMINARY ANALYSIS

A. Contents:

1. Show all activities of the Contractor under this Work for the period

between receipt of Notice to Proceed and submittal of construction schedule required under Paragraph 1.3C above.

2. Show the Contractor's general approach to remainder of the Work;

B. Submit in accordance with Paragraph 1.3B above.

3.2 CONSTRUCTION SCHEDULE

A. Prior to the preconstruction conference complete the construction analysis in preliminary form, and submit it to the Engineer, review contents of the proposed construction schedule, and make all revisions agreed upon.

B. Submit both the preliminary schedule and final schedule in accordance with Paragraph 1.3C above.

3.3 PERIODIC REPORTS

A. As required under Paragraph 1.3D above, update the approved construction schedule.

1. Indicate "actual" progress in percent completion for each activity;

2. Provide written narrative summary of revisions causing delay in the program, and an explanation of corrective actions taken or proposed.

3.4 REVISIONS

A. Make only those revisions to approved construction schedule as are approved in advance by the Engineer and Owner.

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Make submittals required by the Contract Documents and revise and resubmit as necessary to establish compliance with the specified requirements.

1. Provide submittals on all materials.

B. Work not included:

1. Unrequired submittals will not be reviewed by the Engineer.

2. The Contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the work, but such data shall remain between the Contractor and his subcontractors and will not be reviewed by the Engineer.

1.2 QUALITY ASSURANCE

A. Coordination of submittals:

1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.

2. Verify that each item and submittal for it conform in all respects with the specified requirements.

3. By affixing the Contractor's signature to each submittal certify that this coordination has been performed.

B. The following products do not require further approval except for interface within the Work:

1. Products specified by reference to standard specifications such as ASTM, AWWA, and similar standards.

2. Products specified by manufacturer's name and catalog model number.

C. “Or equal”:

1. Where the phrase “or equal” occurs in the Contract Documents, do not assume that the materials, equipment or methods will be considered as equal unless the item has been specifically so approved for this work by the Engineer.

2. The decision of the Engineer shall be final.

1.3 SUBMITTALS

A. Make submittals of shop drawings, samples, substitution requests and other items in accordance with the provisions of this Section.

PART 2 – PRODUCTS

2.1 SHOP DRAWINGS

A. Scale and measurements: Make shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.

B. Large Prints (11’ x 17” or larger):

1. Blueprints will be acceptable.

2. Review comments of the Engineer will be shown on the blueprints when it is returned to the Contractor. The Contractor shall make necessary changes and resubmit such copies to the Engineer.

C. Manufacturer’s Literature:

1. Where contents of submitted literature from manufacturers include data not pertinent to the submittal, clearly show which portions of the contents are being submitted for review.

2. Submit the number of copies which are required to be returned, plus three (3) copies which will be retained by the Engineer.

D. Do not begin fabrication of equipment or purchase of materials prior to Engineer’s approval of shop drawings.

2.2 COVER LETTER

A. Provide a cover letter with each submittal stipulating where the item submitted does not comply with the full extent of the specifications.

B. Provide an explanation of why the item(s) submitted are considered to be equal to the item(s) specified.

C. Failure to submit a cover letter will result in rejection of the submittal.

2.3 SAMPLES

A. Provide sample or samples identical to the precise article proposed to be provided. Identify as described under “Identification of submittals” below.

B. Number of samples required:
   1. Unless otherwise specified, submit samples in the quantity which is required to be returned, plus one which will be retained by the Engineer.

   2. By prearrangement in specific cases, a single sample may be submitted for review and, when approved, be installed in the work at a location agreed upon by the Engineer.

2.4 COLORS AND PATTERNS

A. Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Engineer for selection.

PART 3 – EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. Consecutively number all submittals.

   1. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.

   2. On resubmittals, cite the original submittal number for reference.

B. Accompany each submittal with a letter of transmittal showing all information

required for identification and checking.

C. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.

D. Maintain an accurate submittal log for the duration of the work, showing current status of all submittals at all times. Make the submittal log available to the Engineer for his review upon request.

3.2 GROUPING OF SUBMITTALS

A. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.

1. Partial submittals may be rejected as not complying with the provisions of the Contract.

2. The Contractor may be held liable for delays so occasioned.

3.3 TIMING OF SUBMITTALS

A. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.

B. In scheduling, allow at least ten (10) working days for review by the Engineer following his receipt of the submittal.

3.4 RESUBMITTAL SCHEDULE

A. For submittals marked “Approved as Noted” by the Engineer, resubmittal shall be within fifteen (15) days of the review date shown on the Engineer’s show drawing review stamp.

B. For submittals marked “Revise and Resubmit”, “Submit Specified Item”, or “Rejected”, resubmittal shall be within seven (7) days of the review date shown on the Engineer’s shop drawing review stamp.

3.5 RESUBMITTAL SCHEDULE

A. Review by the Engineer does not relieve the Contractor from responsibility for errors which may exist in the submitted data.

B. Revisions:

1. Make revisions required by the Engineer.

2. If the Contractor considers any required revision to be a change, he shall so notify the Engineer as provided for in the General Conditions.

3. Make only those revisions directed or approved by the Engineer.

4. Submittals which have been reviewed and returned to the Contractor marked “Revise and Resubmit”, “Submit Specified Item” or ‘Rejected” and which are resubmitted and not in an approvable state, will not be reviewed a third time unless payment for the third and any subsequent review is by the Contractor. The engineering cost for review shall be equal to the Engineer’s charges for the Owner under the terms of the Engineering Agreement with the Owner.

3.6 REQUIRED SUBMITTALS

At a minimum, the Contractor shall submit items as listed in Paragraph 04, Section 01000 of this document.

SECTION 01640

PRODUCT HANDLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Protect products scheduled for use in the work by means including, but not necessarily limited to, those described in this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Additional procedures also may be prescribed in other Sections of these specifications.

1.2 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.3 RECOMMENDATIONS

A. Except as otherwise approved by the Engineer, determine and comply with manufacturer's recommendations on product handling, storage and protection.

1.4 PACKAGING

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.

1. Maintain packaged materials with seals unbroken and labels intact until time of use.

2. Promptly remove damaged material and unsuitable items from the job site and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

B. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality and other pertinent information.

1.5 PROTECTION OF MATERIAL AND WORK

A. General:

1. Carefully and properly protect all materials of every description, both before and after being used in the Work in accordance with manufacturer's recommendations.

2. Provide any enclosing or special protection from weather deemed necessary by the Engineer at no additional cost to the Owner.

B. Partial payments under the Contract will not relieve the Contractor from responsibility.

1. When materials and work at the site that have been partially paid for are not adequately protected by the Contractor, such materials will be protected by the Owner at the expense of the Contractor and no further partial payment thereon will be made.

C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

1.6 STORAGE

A. Store all items of equipment, component parts, etc., in accordance with the manufacturers' recommendations or as may otherwise be necessary to prevent damage or deterioration of any sort.

B. Electrical and control equipment:

1. Store in a dry area protected from dust and humidity.

2. Equipment can be protected by a weatherproof cover if shipped to the site no more than two (2) weeks prior to installation and energization.

1.7 REPAIRS AND REPLACEMENTS

A. In the event of damage, promptly make replacements and repairs to the approval of the Engineer and at no additional cost to the Owner.

B. Additional time required to secure replacements and to make repairs will not be considered by the Engineer to justify an extension in the contract time of completion.

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included:

1. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents.

2. Upon completion of the Work, deliver the recorded changes to the Engineer prior to submittal of the final payment request.

1.2 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Engineer.

B. Accuracy of records:

1. Accuracy of records shall be such that future search for items shown on the Project Record Documents may rely reasonably on the information provided under this Section of the Work.

1.3 SUBMITTALS

A. The Engineer's approval of the current status of Project Record Documents may be a prerequisite to the Engineer's approval of requests for progress payment and request for final payment under the Contract.

B. Prior to submitting request for final payment, submit the final Project Record Documents to the Engineer and secure his approval.

1.4 PRODUCT HANDLING

A. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer to the Engineer.

B. In the event of loss of recorded data, use means necessary to again secure

the data to the Engineer's approval. Such means shall include, if necessary in the opinion of the Engineer, removal and replacement of concealing materials.

2. In such case, provide replacements to the standards originally required by the Contract Documents.

PART 2 - PRODUCTS

2.1 JOB SET DOCUMENTS

A. Promptly following receipt of the Owner's Notice to Proceed, secure from the Engineer, at no charge to the Contractor:

1. One complete set of all Documents comprising the Contract.

PART 3 - EXECUTION

3.1 MAINTENANCE OF JOB SET

A. Immediately upon receipt of the job set described in Paragraph 2.1-A above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".

B. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the “Job Set” must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the “Job Set”.

2. Do not use the “Job Set” for any purpose except entry of new data and for review by the Engineer.

3. Maintain the “Job Set” at the site of Work as that site is designated by the Engineer.

C. Making entries on “Job Set” Drawings:

1. Use erasable colored pencil, preferably red (not ink or indelible

pencil) to delineate changes.

2. Show by station number location of all fittings, manholes, valves, wye locations, etc.

3. Reference all fittings and valves to two above ground items reasonably safe from being relocated and indicate such references on the drawings. At 100’ intervals, show location of newly installed water line from edge of existing roadway pavement. Depth of newly installed water line shall also be recorded. Show any changes made in the drawings and specifications.

D. Submittal:

1. Submit "marked-up" set of drawings to the Engineer at the time of substantial completion notification.

2. Make any necessary additions as required by the Engineer.

SECTION 02110

CLEARING AND GRUBBING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Remove trees, underbrush, undesirable growth, stumps, roots, etc., from the area to the limits shown on the Drawings, as specified herein, and as needed to meet the requirements of the construction shown in the Contract Documents.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. Section 02250 – Erosion and Sediment Control.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.

C. Comply with requirements of governmental agencies having jurisdiction.

PART 2 – PRODUCTS – Not used.

PART 3 – EXECUTION

3.1 AREA INCLUDED

A. All roadway right of ways affected by the project and any other areas as indicated on the Drawings.

3.2 PROCEDURES

A. Clearing and grubbing: The entire area within the limit lines described above shall be cleared and grubbed. Remove all incidental vegetation, trees, brush, stumps, etc., from the area. All debris from this operation shall be disposed of off the Owner's property or right-of-way. There will be no burning of debris allowed.

B. Selective clearing shall be done in areas where directed by the Owner or Engineer. Selective clearing shall consist of removing vegetation, brush, stumps, etc. from the area. Selected trees shall be left standing and care shall be taken not to damage trees to be left. All debris from this operation shall be disposed of off the Owner's property right-of-way. Grubbing will not be required in areas designated for selective clearing.

C. Removal of trees and shrubs: All trees to be removed shall be felled in such a manner as to avoid injury to remaining trees and to other features not proposed for removal. Trees shall be cut up and the trunks, limbs, and other debris shall be removed from the site. Undesirable shrubs and small trees shall be selectively removed as directed.

D. Stumps and roots: All stumps and roots larger than 2" in diameter shall be completely removed by grubbing except in areas of building site, parking areas and drives; they may be cut off not less than 18" below any subgrade. The area of operation then shall be cleared of resulting debris and matted roots, weeds and other extraneous matter and such shall be hauled away from the site. Generally, all material that cannot be compacted to 95% of maximum density in all classes shall be removed and replaced with select backfill.

E. Protection of trees: It may become desirable to save certain trees in areas where cut or fill is eighteen inches or less and in parking areas. Consequently, the Contractor shall obtain approval from Engineer prior to removal of significant trees from such areas. The Contractor shall protect existing trees to remain during construction by constructing barricades around such trees as directed.

   Note: Protect all trees and shrubs immediately adjacent to temporary construction easement.

F. Erosion control: Install and maintain erosion control facilities in accordance with the Drawings and Specifications.

SECTION 02220

TRENCHING, BACKFILLING FOR UTILTIES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division I of these Specifications.

2. Section 02730 – Sanitary Sewer Pipe and Appurtenances

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

1.3 JOB CONDITIONS

A. Existing Utilities:

1. There now exists in the construction areas, waterworks, storm drainage, sanitary sewers, street paving, gas mains and other utilities.

2. Approximate location of certain underground lines and structures are shown on the plans for information only, other underground lines or structures are not shown.

3. Locate these and other possible unknown utility lines using electronic pipe finder, or other approved means.

4. Locate, excavate and expose all existing underground lines in advance of trenching operations.

5. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these utilities in the execution of his work under this Section.

6. The Contractor shall familiarize himself with the existing conditions and be prepared to adequately care for and safeguard himself and the Owner from damage.

B. Notification of intent to excavate:

1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars ($1,000) for each violation of the Act.

2. Notification of intent to excavate may be given by calling this toll free number: 1-888-721-7877.

C. Protecting trees, shrubbery and lawns:

1. Trees and shrubbery in developed areas and along the trench line shall not be disturbed unless absolutely necessary, and subject to the approval of the Engineer.

    a. Any such trees and shrubbery necessary to be removed shall be heeled in and replanted.

2. Where trenches cross private property through established lawns, sod shall be cut removed, stacked and maintained in suitable condition until replacement is approved by the Engineer.

    a. Topsoil underlying lawn areas shall be removed and kept separate from general excavated materials.

D. Clearing:

1. Perform all clearing necessary for installation of the complete work.

2. Clearing shall consist of removing all trees, stumps, roots, brush and debris in the rights-of-way obtained for the work.

3. All timber of merchantable size shall remain the property of the Owner and shall be trimmed and cut in such lengths as directed and stacked along the edge of the right-of-way.

4. All other material, including trimmings from above, shall be completely disposed of in a satisfactory manner.

E. Removing and resetting fences:

1. Where existing fences must be removed to permit construction of utilities:

a. Remove such fences and, as the work progresses, reset the fences in their original location and condition.

b. Provide temporary fencing or other safeguards as required to prevent stock and cattle from wandering to other lands.

F. Restoration of disturbed areas:

1. Restore all areas disturbed by, during or as a result of construction activities to their existing or better condition.

a. For existing areas with sod type grasses, replace with new sod. Existing sod may be reused where properly removed and stored.

2. Do not interpret this as requiring replacement of trees and undergrowth in undeveloped sections of the rights-of-way.

G. Minimizing silting and bank erosion during construction:

1. During construction, protective measures shall be taken and maintained to minimize silting and bank erosion of creeks and rivers adjacent to the work being performed during construction.

H. Blasting:

1. Store all explosives in a secure manner, complying with all laws, ordinances, and regulations.

2. Contractor shall be responsible for damage caused by blasting operations.

PART 2 – PRODUCTS

2.1 EXCAVATED MATERIALS

A. Perform all excavation of every description and of whatever substances encountered to depths indicated or specified.

B. Pile material suitable for backfilling in an orderly manner at safe distance from banks or trenches to avoid overloading and to prevent slides or cave-ins.

C. Remove and deposit unsuitable or excess materials as directed by the Engineer.

2.2 BACKFILL MATERIALS

A. Provide from materials excavated for installation of utility.

1. Select soil material free from organic matter and deleterious substances, containing no rocks or lumps over 2” in greatest dimension for backfill up to 12” above top of utility being covered.

2. Do not permit rocks larger than 2” in greatest dimension in top 6” of backfill.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

B. Should the quantity of suitable on-site material be insufficient to complete the work, provide suitable borrow material as approved by the Engineer at no additional expense to the Owner.

C. Provide select materials from on-site if acceptable material as approved by the Engineer is available on-site. Otherwise, provide approved select material from an off-site source.

PART 3 – EXECUTION

3.1 PROCEDURES

A. Existing utilities:

1. Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.

2. If active utility lines are encountered and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.

3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.

4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.

5. Do not proceed with permanent relocation of utilities until written instructions are received from the engineer.

B. Locations within streets or highways:

1. Comply with South Carolina Department of Transportation's (SCDOT) "Encroachment Permit" issued for the Work, and the South Carolina Department of Transportation's (SCDOT) "A Policy for Accommodating Utilities on Highway Rights-of-Way".

2. Take all precautions and comply with all requirements as may be necessary to protect the improvements, including barricades for protection of traffic.

3. Keep a minimum of one lane open to traffic at all times where utility crosses street or highway.

C. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.

D. Dewatering:

1. Remove all surface and subsurface waters from excavations and maintain the excavation in a dry condition during construction operations.

2. Maintain the ground water level a minimum of 3-feet below the trench bottom during excavation, installation and backfilling.

    a. Material disturbed below the invert elevation due to improper dewatering shall be removed and replaced with crushed stone or lean concrete at no expense to the Owner.

    b. Use sumps, pumps, drains, trenching, wells, vacuum or well point system as necessary to maintain the ground water level a minimum of 3-feet below the trench bottom and maintain a dry excavation.

    c. Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls or bedding material will occur.

    d. Provide monitoring wells sufficient in size, location, number and depth to monitor the ground water level in the construction area during excavation and backfill operations.

    e. Maintain dewatering operations until backfilling and compaction operations are complete.

3. Dispose of water pumped from excavations in storm drains having capacity, canals, trenches or other approved locations.

    a. Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.

    b. Prevent flooding of streets, roadways, or private property.

    c. Provide engines driving dewatering pumps with residential type mufflers.

E. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

F. Maintain access to adjacent areas at all times.

3.2 TRENCH EXCAVATION (Classified)

A. Remove all materials of whatever substance encountered, additional payment to be made for rock excavation as hereinafter defined and specified.

1. Rock excavation to consist of the removal and disposal of the following materials:

    a. Boulders ½ cubic yard or more in volume.

    b. Solid rock.

    c. Materials that cannot be removed without systematic drilling and blasting, such as rock material in ledges or aggregate conglomerate deposits that are so firmly cemented as to possess the characteristics of solid rock.

    d. Concrete and masonry structures exceeding ½ cubic yard in volume except sidewalks and paving.

2. Rock excavation does not include:

    a. Boulders, concrete masonry structures less than ½ cubic yard in volume.

b. Hard and compact materials such as cemented gravel and relatively soft or disintegrated rock that can be removed without continuous and systematic drilling and blasting.

c. Material removed by intermittent drilling and blasting performed to increase production.

3. Do not remove material claimed as rock until the Engineer has classified and cross-sectioned same.

B. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.

C. Open cut:

1. Excavate for utilities by open cut.

2. If conditions at the site prevent such open cut, and if approved by the Engineer, tunneling may be used.

3. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conductor can be installed safely and backfill can be compacted properly into such tunnel.

4. Remove boulders and other interfering objects, and backfill voids left by such removals, at no additional cost to the Owner.

5. Remove wet or otherwise unstable soil incapable of properly supporting the utility, as determined by the Engineer, to depth required and backfill to proper grade with stone bedding material, at no additional cost to the Owner.

6. Excavating for appurtenances:

a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12” clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.

b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Engineer, and at no additional cost to the Owner.

D. Trench to the minimum width necessary for protection of the Work and for the safety of personnel.

E. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel.

1. Remove in units when level of backfilling has reached the elevation necessary to protect the utility work and adjacent property.

2. Sheeting at the bottom of trenches over 10’ deep for sewers 15” and larger in size, shall remain in place and be cut off no less than 2” above the top of the pipe, at no additional cost to the Owner.

F. Depressions:

1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.

2. Except where rock is encountered, do not excavate below the depth indicated or specified.

3. Where rock is encountered, excavate rock to a minimum overdepth of 4” below the trench depth indicated or specified, and to provide 6” clearance in any horizontal direction from all parts of the utility and appurtenances.

G. Special requirements relating to excavation for specific types of utilities shall comply with the following:

1. Sanitary or storm sewer lines:

a. Comply with requirement of Section 02730.

b. Do not excavate trench more than 200’ ahead of pipe laying, unless permitted by Engineer.

c. Maintain trench sides vertical to point not less than 2’ above top of pipe.

d. Upper portion of trench may be sloped to any with which will not cause damage to adjoining structures, utilities, pavements or private property.

H. Comply with pertinent OSHA regulations in regards to the excavation of utilities.

3.3 BACKFILLING

A. General:

1. Backfill trenches and excavations immediately after the pipes are laid, unless other protection is directed or indicated.

2. Select and deposit backfill materials with special reference to the future safety of the pipes.

3. Reopen trenches which have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the Engineer.

4. Surplus material shall be deposed of as directed by the Engineer.

5. Original surface shall be restored to the approval of the Engineer.

6. Maintain proper dewatering during backfill and compaction operations.

B. Lower portion of trench:

1. Deposit approved backfill and bedding material in layers of 6” maximum thickness, and compact with suitable tampers to the density of the adjacent soil until there is a cover of not less than 24” over sewers and 12” over other utility lines.

2. Take special care in backfilling and bedding operations not to damage pipe and pipe coatings.

C. Remainder of trench:

1. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6” or ½ the layered thickness, whichever is smaller, in any dimension.

2. Deposit backfill material in layers not exceeding the thickness specified, and compact each layer to the minimum density directed by the soil engineer.

D. Adjacent to buildings: Mechanically compact backfill in 6” layers within ten (10’) feet of buildings.

E. Under roads, streets and other paved areas:

1. Mechanically tamp in 6” layers using heavy duty pneumatic tampers or equal.

2. Tamp each layer to a density equivalent of not less than 100% of an ASTM D 698 Proctor Curve.

3. Provide additional compaction by leaving the backfilled trench open to traffic while maintaining the surface with crushed stone.

4. Refill any settlement with crushed stone and continue such maintenance until replacement of pavement is authorized by the Engineer.

F. Undeveloped areas:

1. Backfill in wooded, swampy or undeveloped areas shall be accomplished to maintain not less than 90% of an ASTM D 698 Proctor Curve.

3.4 EXCAVATION BY JACKING-BORING

A. Install casings where indicated by jacking and boring.

B. Comply with Section 02601.

SECTION 02230

ROCK EXCAVATION

PART 1: GENERAL

1.1 SCOPE OF WORK

A. The work covered by this section consists of the blasting and excavation of rock material in cut areas. Rock excavation shall be classified material which cannot be removed with normal construction equipment such as hydraulic excavators, bulldozers with “rippers” and requires the construction practice of blasting.

1.2 DEFINITIONS

A. Rock is defined as being sandstone, limestone, flint, graphite, quartzite, slate, hard shale, or similar material that cannot be excavated without systematic drilling and blasting.

B. Should rock be encountered in two or more ledges, each ledge being not less than 3” thick and with interlying strata of earth, clay or gravel not more than 12” thick in each stratum, the entire volume between the top of the top ledge and the bottom of the bottom ledge will be classified as rock.

PART 2: EXCUTION

2.1 CONSTRUCTION REQUIREMENTS

A. Hydraulic Hammer: Removal of rock by hydraulic means is the Owner’s preferred method of rock excavation.

B. Blasting: The use of explosives shall conform to be strict accordance with all Federal, State, County and local regulations and only after the approval of the Engineer. The Contractor shall be responsible for all damage caused by blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of excavation of trench.

C. When rock is encountered, all lines and grades will be held in accordance with the plans or adjusted only after approval of the engineer.

D. When rock is encountered within the limits of construction, the Contractor shall notify the Engineer prior to any removal. Upon the Engineer’s authorization, the Contractor shall remove the rock. The Contractor shall not be paid for rock removed without prior approval from the Engineer.

E. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

SECTION 02240

BLASTING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide blasting, blasting monitoring, pre-construction surveys, and post-construction surveys as needed to remove rock during excavation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.

2. Section 02220 – Trenching and Backfilling for Utilities

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. The Contractor or Subcontractor performing the blasting work shall be properly licensed by the State to purchase, store, and use the explosives in the work.

B. Contractor is to perform a pre-construction survey of existing structures near the construction area that could be affected by the process of excavation rock by blasting. This survey should include noting and photographing any existing cracks or other irregularities. If requested, this information is to be made available to the Owner in written report form.

C. The Contractor or Subcontractor shall monitor and record on seismograms peak particle velocity when blasting near structures as required by current State regulations. Monitoring personnel are subject to approval of the Engineer.

D. No sooner than 10 days but before 30 days after completing the blasting, the contractor shall perform a post-construction survey, similar to the pre-construction survey noting any changes in the pre-construction survey or damages that may have occurred.

E. Definitions:

1. Rock excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavation machinery. To be considered as rock excavation, the material shall be continuous; individual boulders or rocks in soil will not be considered rock excavation.

PART 2 – PRODUCTS

2.1 The blasting charge shall be sufficient to fracture and break the rock so that it can be excavated but is shall be such that it does not damage nearby structures. This may require delayed charges, layered blasting, or other methods.

2.2 All blasting work shall be in accordance with current State laws, regulations and procedures.

PART 3 – EXECUTION

3.1 ROCK EXCAVATION

A. Notify the Engineer upon encountering rock or similar material which cannot be removed or excavated by conventional earth moving or ripping equipment.

B. Do not use explosives without written permission from the Engineer.

C. When explosives are permitted, use only experienced powdermen or persons who are licensed or otherwise authorized to use explosives. Store, handle and use explosives in strict accordance with all regulatory bodies and the “Manual of Accident Prevention in Construction” of the Associated General Contractors of America, Inc.

D. The Contractor shall be solely responsible for any damage resulting from the use of explosives.

E. The Contractor is responsible for securing all permits required in performing this work.

3.2 MEASUREMENT AND PAYMENT

A. No separate measurement or direct payment will be made for the work under this section and all costs for same shall be included in the price bid for the item to which it pertains.

SECTION 02250

EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide protection of the environment during the construction of this project to reduce soil erosion and siltation to the lowest reasonably achievable level.

1.2 GENERAL

A. Exercise every reasonable precaution, throughout the life of the project, to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces, or other property. Erosion control practices to be used for this project are shown on the drawings and are to conform to South Carolina Department of Health and Environmental Control Regulations.

PART 2 – PRODUCTS

2.1 CRUSHED STONE

A. Provide clean, washed, crushed stone for each project Erosion and Sediment Control BMP. Coarse aggregate sizes are in accordance with AASHTO M43 Sizes of Aggregate for Road and Bridge Construction and SCDOT Standard Specifications for Highway Construction (SSHC):

1. EC-06 Stabilized Construction Entrance: 1-inch to 3-inch D50 stone (No. 1 coarse aggregate).

2.2 GRASSING

A. Comply with Section 02930 – Grassing and SCDHEC BMP Handbook and BMP Field Manual – Temporary Seeding and Permanent Seeding.

2.3 SILT FENCE

A. Provide silt fence for each project Erosion and Sediment Control BMP. The geotextile filter fabric must conform to the SCDOT Standard Specifications

for Highway Construction (SSHC), Section 815.06 and must be listed on the SCDOT Material Approval Sheet No. 34:

1. Silt Fence:

    a. Limit splices in filter fabric using continuous rolls whenever possible.
    b. Whenever splices are necessary a minimum overlap of 6” is required and all splices must occur at a post so that the integrity of the silt fence is not comprised.
    c. Silt fences should be continuous and transverse to the flow. The silt fence should follow the contours of the site as closely as possible. Place the fence such that the water cannot runoff around the end of the fence.

2. Double Silt Fence: Same as EC-03 Silt Fence, two rows with approximately 1’-6” horizontal separation.

3. EC-07 Type A – Filter Fabric Inlet Protection: Same as EC-03 Silt Fence.

B. All silt fences shall be provided with woven wire reinforcement. Woven wire shall conform to the requirements of ASTM A116, Class I zinc coating for wire. Each woven square shall measure 5.33” x 12”. The top and bottom wires shall be 10 gauge. All other wires shall be 12-1/2 gauge.

1. Securely attach woven wire to posts with wire ties.
2. Securely attach filter fabric to top of woven wire and at posts with wire ties.

2.4 EROSION CONTROL BLANKET (ECB)

A. The erosion control blanket must conform to the SCDOT Standard Specifications for Highway Construction (SSHC) 815.04 and must be listed on the SCDOT Material Approval Sheet No. 55:

B. Use erosion control blanket S150, from North American Green or approved equal.

1. Use Biostakes where staples are required or indicated on the drawings for stabilization.

    a. Staple in pattern recommended by blanket manufacturer.

2. Staple locations must be clearly marked on the blanket when stakes are used.

2.5 SEDIMENT TUBE

A. Provide sediment tubes for each project Erosion and Sediment Control BMP. The sediment tube must conform to the SCDOT Standard Specifications for Highway Construction (SSHC) and Supplement Specification Sections reference and must be listed on the SCDOT Material Approval Sheet No. 57:

1. EC-05 Sediment Tube: Sediment tube, SCDOT Supplemental Specification for Sediment Tube Specifications dated November 4, 2004.
2. EC-07 Type A – Sediment Tube Inlet Protection: Sediment tube, SCDOT Supplemental Specification for Sediment Tube Specifications dated November 4, 2004.

2.6 FILTER FABRIC

A. Provide non-woven geotextile fabric for each project Erosion and Sediment Control BMP. The non-woven geotextile fabric must conform to the SCDOT Standard Specifications for Highway Construction (SSHC), Specifications Sections 804.11, Supplement Sections referenced and must be listed on the SCDOT Material Approval Sheet No. 44:

1. EC-06 Stabilized Construction Entrance: Non-woven geotextile fabric, SCDOT SSHC Specification Section 804.11, Class 2, Type C unless otherwise shown or specified and Supplemental Specification for Stabilized Construction Entrance dated July 7, 2005.

PART 3 – EXECUTION

3.1 GENERAL

A. Construct and maintain all erosion control measures until the substantial completion of the project.

3.2 TEMPORARY CONSTRUCTION ENTRANCE/EXIT

A. Construct a gravel area or pad at points where vehicles enter and leave a construction site.

B. Clear the entrance and exit area of all vegetation, roots, and other objectionable material and properly grade and place gravel to the grade and dimensions shown on the plans.

C. Construction drainage channels to carry water to a sediment trap or other suitable outlet.

D. Use geotextile fabrics to improve stability of the foundation in locations subject to seepage or high-water table.

E. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site by periodic top dressing with two inches of stone.

F. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary.

G. Immediately remove objectionable materials spilled, washed, or tracked onto public roadways.

3.3 TEMPORARY GRASSING

A. Provide a temporary cover for erosion control on disturbed areas within 14 days after construction activity is complete unless construction activity is going to resume within 21 days in accordance with Section 02930.

1. Provide soil test for pH. Lime is required if pH is less than 5.
2. Provide fertilizer.

B. This practice applies to cleared areas, diversions, dams, temporary sediment basins, temporary road banks, and topsoil stockpiles where vegetation is needed for less than 1 year.

C. Provide grassing on slope 5% or greater within 14 days of disturbance. Comply with Section 02930.

3.4 SILT FENCE

A. Provide silt fence barrier where shown on the plans and on utility construction parallel to the disturbed trench where perpendicular sheet flow runoff occurs on disturbed areas with slopes greater than 4%.

B. Place at the extreme limits of the area to be disturbed as shown.

C. Construct temporary sediment barriers of filter fabric, buried at the bottom, stretched and supported by posts and install below small disturbed areas as indicated on the drawings to retain sediment by reducing the flow velocity to allow sediment deposition.

D. Space posts 10’-0” on center, maximum or as indicated on the drawings.

E. Remove sediment deposits prior to reaching one-third height of the fence.

F. Monitor site frequently and place additional silt fencing should evidence indicate that erosion is about to occur at locations other than those shown on the plans.

3.5 INLET PROTECTION

A. Construct temporary sediment barriers around storm drain curb inlets using block and gravel as indicated on the drawings.

B. Construct metal frame barriers around grate and frame of drop inlets as indicated on the drawings.

C. Inspect structure after each rainfall and repair as required.

D. Remove sediment when trap reaches one-half capacity.

E. Remove structure when protected areas have been stabilized.

3.6 EROSION CONTROL BLANKET

A. Provide on areas as shown on the plans or on all embankments with slopes equal to or steeper than 2-1/2:1.

B. Provide on all stream banks from top of bank to bottom of bank on all streams, creeks, drainage swales and other storm water channels and where shown on the wetland delineation on the drawings.

3.7 SEDIMENT TUBE

A. Provide sediment tube check dams and temporary berms and other BMPs as indicated on the plans or directed by the Engineer.

3.8 MAINTENANCE

A. Place all erosion control devices or measures prior to any land disturbing activity within the drainage area they are located.

B. Inspect erosion control devices every seven days and clean or otherwise remove silt buildup as necessary.

C. Clean and maintain all erosion and sediment control BMPs as recommended and prior to rainfall events.

D. Dispose of all sediment and other debris in an acceptable manner and above the 100 year flood plain.

3.9 REMOVAL

A. Remove temporary structures after protected areas have been stabilized.

SECTION 02260

RIP-RAP

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Furnishing all labor, materials, and equipment and performing all operations in conjunction with placing protective coatings of broken stone in accordance with these specifications and in conformity with the lines, grades and thicknesses shown on the plans or established by the Engineer.

B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions and Supplementary Conditions of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

PART 2 – PRODUCTS

2.1 STONE FOR HAND PLACED RIP-RAP

A. Provide rip-rap which:

1. Has thickness of 12” minimum.
2. Weighs a minimum of 25 lbs. to a maximum of 150 lbs.
3. Has at least 60% of stone weighing more than 60 lbs.

2.2 GROUTED RIP-RAP

A. Stone to conform to the requirements for hand placed rip-rap.

B. Mortar for grout shall consist of one-part Portland cement and three parts sand.

C. Water content of the grout shall be such that permits gravity flow into the voids with limited spading and brooming.

2.3 FILTER FABRIC

A. Provide Mirafi 600X or approved equal.

PART 3 – EXECUTION

3.1 HAND PLACED RIP-RAP

A. Where thickness is not shown on the plans, it shall be 12”.

B. The slope upon which this rip-rap is to be placed shall conform with the cross section shown on the plans or as directed by the Engineer.

C. Properly compact depressions that may be filled in trimming and shaping the slope.

D. Install filter fabric, lapping sides 12”.

E. Begin placing in a trench at least 2’ below the toe of the slope.

F. Firmly imbed against the slope and the adjoining piece with the sides in contact and with broken joints.

G. Fill the spaces between the larger pieces with spalls of suitable size, thoroughly ram into place.

H. The finished surface shall present an even, tight surface true to line, grade and section.

3.2 GROUTED RIP-RAP

A. The preparation and placement shall be the same as specified above for hand place rip-rap.

B. All voids between stone shall be filled with mortar to a depth of not less than 4” below the surface of the stone.

C. Surface of the stones shall be left reasonably free of grout.

    1. Plastering of the rip-rap will not be allowed.

D. Spaces between the stones shall be reasonably free of sand or other material and shall be wet during the placing of grout.

3.3 MEASUREMENT AND PAYMENT

A. No separate measurement or direct payment will be made for the work under this section and all costs for same shall be included in the price bid for the project.

SECTION 02510

ASPHALTIC CONCRETE PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide asphaltic concrete paving where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limit to, General Conditions and Supplementary Conditions of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Sections 01340.

B. Product Data: Within 60 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Materials list of items proposed to be provided under this Section.

2. Certificates, signed by the materials producer and the asphalt paving Subcontractor, stating that materials meet or exceed the specified requirements.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01640.

PART 2 – PRODUCTS

2.1 GENERAL

A. All materials and products used shall comply with pertinent sections of the South Carolina Department of Transportation's (SCDOT) "Standard Specifications for Highway Construction".

2.2 ASPHALTIC CONCRETE MIXTER (BINDER COURSE)

A. Materials and composition of mixture shall comply with Section 402 of the SCDOT's "Standard Specifications for Type 1 Mix".

B. Provide hot plant mixed asphaltic concrete paving materials.

1. Temperature leaving the plant: 290ºF minimum, 320ºF maximum.

2. Temperature at time of placing: 280ºF minimum.

2.3 EQUIPMENT

A. Comply with requirements of Section 401 of SCDOT's "Standard Specifications".

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of the Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

1. Sweep primed surfaces if needed.

2. Adjust frames and covers if needed.

3.2 WEATHER RESTRICTIONS

A. Do not apply asphalt mixtures to a wet or frozen surface or when air temperature is below 40ºF in the shade and falling, or below 35ºF in the shade and rising.

3.3 SPREADING AND FINISHING

A. On arrival at point of use, dump directly into mechanical spreader.

B. Immediately spread and strike off true to the line, grade and cross section indicated, to such loose depth that when work is completed, the indicated thickness or weight per square yard will be secured.

C. Correct irregularities while the mixture is still hot.

D. At locations not readily accessible to mechanical spreaders, acceptable hand spreading methods may be used.

E. Finished surfaces placed adjacent to curbs, gutters, manholes, etc., shall be approximately ¼" above the edges of these structures.

3.4 COMPACTION

A. Perform initial rolling with 3-wheel steel roller or a steel wheel 2-axle tandem roller.

B. Follow initial rolling with at least four complete coverages by a pneumatic tired roller.

C. Complete rolling with steel wheel 2-axle tandem roller.

D. Rolling shall start longitudinally at the sides and proceed gradually toward the center of the pavement, overlapping on successive trips approximately ½ the width of the roller.

E. Use hand or mechanical tampers in areas not accessible to powered rollers.

F. Surface mixture after compaction shall be smooth and true to the established crown and grade.

G. Finished paving smoothness tolerance:

1. Free from birdbaths.

2. No deviations greater than 1/8" in 6'.

3.5 PROTECTION OF SURFACE

A. Allow no traffic on surface until the mixture has hardened sufficiently to prevent distortion.

3.6 FLOOD TEST

A. Flood the entire asphaltic concrete paved area with water by use of a tank truck or hoses.

B. If a depression is found where water ponds to depth of more than 1/8” in 6’, fill or otherwise correct to provide proper drainage.

C. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

SECTION 02515

REMOVING AND REPLACING PAVEMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Removal and replacement of existing pavements for installation of utility lines, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.

2. Section 02220 – Trenching, Backfilling for Utilities.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the work of the Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

1.4 PRODUCT HANDLING

A. Comply with pertinent provision of Section 01640.

1.5 WARRANTY

A. All removed and replaced pavement work within the South Carolina Department of Transportation (SCDOT) rights-of-way shall be warranted for two years beginning on the date to acceptance by the SCDOT.

B. All removed and replaced pavement work within individual county road rights-of-way shall be warranted for two years beginning on the date of acceptance by the individual county.

PART 2 – PRODUCTS

2.1 CONCRETE

A. Comply with Section 03300, using strength specified herein.

2.2 ASPHALTIC CONCRETE

A. Use Types 1 and 2 complying with South Carolina Department of Transportation Standard Specifications, Section 403.

2.3 AGGREGATE BASE COURSE WITH PRIME

A. Comply with applicable portions of South Carolina Department of Transportation Standard Specifications, Section 306.

PART 3 – EXECUTION

3.1 GENERAL

A. Remove to neat lines and dispose of as directed.

B. Replace with bases and pavements similar to type removed, unless otherwise indicated.

3.2 CUTTING

A. Concrete pavement or base:

1. Cut on straight and true lines, to a minimum depth of 2”, using powered concrete saw.

2. Shear off remaining depth with pneumatic tools.

B. Concrete sidewalks shall be removed back to the nearest joint on each side of the crossing.

C. Asphaltic concrete pavements: Cut to straight and true lines with powered concrete saw.

3.3 REPLACEMENT

A. Concrete pavements:

1. Use 300 psi concrete.

2. Replace to 6’ below existing slab and undercut each edge 6” to form shelf.

3. Finish surface to match existing surface.

B. Concrete sidewalks:

1. Replace with 3000 psi concrete.

2. Depth shall be equal to existing section removed, but not less than 4”.

3. Finish surface to match existing sidewalk.

C. Flexible pavements (Ditch Line) – Secondary and Primary Roads:

1. Compact subgrade thoroughly.

2. Undercut each edge 6” to form a shelf.

3. Place 8” 2500 psi concrete leaving surface rough and depressed 2”.

4. Top with 2” of asphaltic concrete.

D. Flexible Pavements (Ditch Line) – Driveways:

1. Compact subgrade thoroughly.

2. Place 8” deep aggregate base course with prime.

3. Top with 2” of asphaltic concrete.

E. Flexible pavements (Resurfacing):

1. In some instances where utilities are installed within existing pavements, resurfacing of the entire width of the original pavement will be required.

2. Replace pavement in ditch line as specified above.

3. Prime and resurface with 1 ½” of asphaltic concrete.

4. Taper resurfacing to existing pavement evenly for a distance of 50 feet beyond repaired area.

5. Comply with Section 02513.

SECTION 02601

BORE AND ENCASEMENT

PART 1 – GENERAL

1.1 Scope of Work

A. The work under this section consists of furnishing all materials, labor, equipment and services required for the complete installation of sewer line encasement and carrier pipes under highways and railroads by boring and jacking as shown on the drawings and specified herein.

B. All work in connection with construction encasement pipes under highways and railroads shall comply with all current requirements of governing highway and railroad agencies. The Contractor shall be familiar with these requirements.

C. The Contractor shall inspect the locations at the proposed crossings and shall familiarize himself with the conditions under which the work will be performed, and with all necessary details and the suitability of his equipment and methods for the work required.

PART 2 – PRODUCTS

2.1 Materials

A. Steel encasement pipes shall be smooth wall welded steel pipe conforming to ASTM Designation A139, Grade B. Minimum pipe wall thickness shall be as follows:

Pipe-Nominal Diameter Inches	Wall Thickness Inches
14" and Under	0.188
16"	0.25
20"	0.25
24"	0.25
30"	0.312
36"	0.500

B. The minimum inside diameter of the encasement pipe shall be:

1. 2” greater than the largest outside diameter of the carrier pipe, joints and couplings for carrier pipe less than 6” in diameter.

PART 3 – EXECUTION

3.1 Installation

A. Encasements shall be installed by boring and jacking unless field conditions require otherwise. It shall be the Contractor’s responsibility to notify the Engineer immediately if conditions do not permit a jack and bore installation.

B. The encasement pipe shall be of the diameter indicated on the drawings.

C. Installation of encasement pipe shall include all related work and services such as mobilization of equipment, constructing and maintaining working pits, right-of-way maintenance and restoration, traffic maintenance, mining, excavations, dewatering, sheeting, shoring, bracing for embankments, operating pits, and as elsewhere required shall be placed and maintained in order that work may proceed safely and expeditiously.

D. Installation of the casing pipe shall be carried out without disturbance of the embankment, pavement, tracks, or other railroad or highway facilities and without obstructing the passage of traffic at any time.

E. The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained by the Contractor from the Engineer.

F. The alignment and grade shall be carefully maintained and the encasement pipe installed in a straight line.

G. The space outside the encasement and the ground shall be filled with grout, sand or pea gravel, as directed by the Engineer. The Engineer will direct that this space be filled if the space is large enough to cause any earth settling.

H. Before the pipe is installed in the casing, bolt-on metal skids painted with bitumastic paint shall be rigidly fastened to the barrel of the pipe. After completion of the casing, the Contractor shall insert the pipeline in pre-jointed segments. No contact will be permitted between casing and the carrier pipeline.

SECTION 02602

HORIZONTAL DIRECTIONAL DRILLING

PART 1 – SCOPE

A. GENERAL:

It is the intent of this specification to define the acceptable methods and materials for installing sanitary sewer and water mains by the horizontal directional drilling method and the requirements for high density polyethylene (HDPE) pipe installed by directional drilling or in open cut trenches.

B. INSTALLATION PLAN:

1. At least 7 days prior to mobilizing equipment Contractor shall submit his detailed installation plan to the Engineer. The plan shall include a detailed plan and profile of the bores and be plotted at a scale no smaller than 1 inch equals 20 feet horizontal and vertical.

2. The plan shall also include a listing of major equipment and supervisory personnel and a description of the methods to be used.

C. VARIATIONS IN PLAN OR PROFILE:

The Contractor may request changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points. Proposed changes shall be submitted in writing to the Engineer and receive approval of the Engineer prior to construction.

D. ALIGNMENT:

The proposed plan and profile installation locations are based on alignments to accommodate acquired easements, to avoid obstructions, and to properly maintain operation flow velocities.

E. QUALIFICATIONS:

Directional drilling and pipe installation shall be done only by an experienced Contractor specializing in directional drilling and whose key personnel have at least five (5) years of experience in this work. Furthermore, the Contractor shall have installed directionally drilled pipe at least as large as 20 inches in diameter,

have performed crossings at least 2,000 feet in length, and successfully installed at least 100,000 feet in length.

PART 2 – MATERIALS

A. GENERAL:

High density polyethylene pipe (HDPE) piping system components shall be the products of one manufacturer and shall conform to the latest edition of ASTM D1248, ASTM D3350, and ASTM F714.

B. PIPING AND BENDS:

Piping and Bends shall be extruded from a polyethylene compound and shall conform to the following requirements:

1. The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335443C, or better.

2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by pre-compounding in a concentration of not less than 2 percent.

3. The maximum allowable hoop stress shall be 800 psi at 73.4 degrees F.

4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

5. The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness of 11.

6. Joining shall be performed by thermal butt-fusion in accordance with the manufacturer’s recommendations.

7. Sanitary sewer pipe exterior shall be green in color or contain green striping. Sanitary sewer pipe interior shall be light in color for internal video inspection.

C. PROCEDURES

1. GENERAL:

   All polyethylene pip shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expense for the representative shall be paid for by the Contractor.

2. TRANSPORTATION:

   Care shall be taken during transportation of the pipe to ensure that it is not cut, kinked, or otherwise damaged.

3. STORAGE:

   Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature condition. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

4. HANDLING PIPE:

   The handling of the joined pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at butt-fused joints. Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined.

   The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section.

Waterproof nightcaps of approved design may be used but they will prevent the entrance of any type of natural precipitation into the pipe and will be fastened to the pipe in such a manner that the wind cannot blow them loose.

The practice of stuffing cloth or paper in the open ends of the pipe will be considered unacceptable.

Where possible, the pipe shall be raised and supported at a suitable distance back from the open end such that the open end will be below the level of the pipe at the point of support.

PART 3 – EXECUTION

A. GENERAL:

1. The Contractor shall install the pipelines by means of horizontal directional drilling. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.

2. Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these Specifications.

3. The Contractor shall prepare and submit a plan to the Engineer for approval for insertion of the HDPE pipe into the opened bore hole. This plan shall include pullback procedure, ballasting, use of rollers, side booms and side rollers, costing protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.

4. The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.

B. DRILLING OPERATIONS:

1. The Contractor shall prepare a plan to be submitted for Engineer approval which describes the noise reduction program, solids control plant, pilot hole drilling procedure, the reaming operation, and the pullback procedure. All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling. All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other

required support systems used during this operation shall be provided by the Contractor.

2. Drill pipe shall be API steel drill pipe, Range 2, Premium Class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work. Only drill pipe inspected under API's Recommended Practice Specification API RP 7G within 30 days prior to start and certified as double white band or better shall be used.

3. A smoothly drilled pilot hole shall follow the design centerline of the pipe profile and alignment described on the construction drawings.

4. The position of the drill string shall be monitored by the Contractor with the downhole survey instruments. Contractor shall compute the position in the X, Y and Z axis relative to ground surface from downhole survey data a minimum of once per length of each drilling pipe (approximately 31foot interval). Deviations from the acceptable tolerances described in the Specifications shall be documented and immediately brought to the attention of the Engineer for discussion and/or approval. The profile and alignment defined on the construction drawings for the bores define the minimum depth and radius of curvature. At no point in the drilled profile shall the radius of curvature of the bore be less than 1,600 feet. The Contractor shall maintain and provide to the Engineer, upon request the data generated by the downhole survey tools in a form suitable for independent calculation of the pilot hole profile.

5. Between the water's edge and the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 10 feet wide and 40 feet long centered on the planned exit point.

6. During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

C. ENVIRONMENTAL PROVISIONS:

1. The Horizontal Directional Drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent creek or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling

operation shall be lined by Contractor with heavy duty plastic sheeting with sealed joints to prevent the migration of drilling fluids and/or ground water.

2. The Contractor shall visit the site and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to prevent drilling fluid from adversely affecting the surrounding area.The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

3. Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cuttings and excess drilling fluids shall be dewatered and dried by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of locally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of unplanned leaks or seeps.

4. Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.

5. Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50% of weight.

6. Due to a limited storage space at the worksites, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.

D. JOINING PIPE SECTIONS:

1. Each length of pipe shall be inspected and cleaned as necessary to be free of debris immediately prior to joining.

2. Pipes shall be joined to one another by means of thermal butt-fusion. Polyethylene pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.

3. Mechanical connections of the polyethylene pipe to auxiliary equipment shall be through flanged connections which shall consist of the following:
    a. A polyethylene “sub end” shall be thermally butt-fused to the ends of the pipe.

    b. Provide ASTM A240, Type 304 stainless steel backing flange, 125-pound, ANSI B16.1 standard, and gaskets as required by the manufacturer.

    c. Stainless Steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer’s standard. Re-torque the nuts after 4 hours.

    d. Butt-Fusion Joining: Butt-fusion of pipes shall be performed in accordance with the manufacturer’s recommendations as to equipment and technique. Butt-fusion joining shall be 100% efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe.

E. TESTING:

1. The pipe shall be hydrostatically tested after joining into continuous lengths prior to installation and again after installation. Pressure and temperature shall be monitored with certified instruments during the test. After the test, the water will be removed with pigs. Erosion prevention procedures will be used during removal and discharge of the water.

2. Hydrostatic testing shall be performed in accordance with Section 2730, Sanitary Sewer Pipe and Appurtenances paragraph 3.2 Quality Control of these specifications. All costs associated with acquiring water for testing shall be included in the established contract unit bid prices.

F. TOLERANCES:

1. Pipe installed by the directional drilled method must be located in plan as shown on the Drawings, and must be no shallower than shown on the Drawings unless otherwise approved. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 30 feet. This “as built” plan and profile shall be updated as the pilot bore is advanced. The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure. The Contractor shall grant the Engineer access to all data and readout pertaining to the position of the bore head and the fluid pressures and flows.

When requested, the Contractor shall provide explanations of this position monitoring and steering equipment. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot bores shall be withheld from the Engineer.

2. Each exit point shall be located as shown with an over-length tolerance of 10 feet for directional drills of 1,000 linear feet or less and 40 feet for directional drills of greater than 1,000 linear feet and an alignment tolerance of 5 feet left/right with due consideration of the position of the other exit points and the required permanent easement. For gravity sanitary sewer installations, sags in the pipeline shall not exceed 25 percent of the nominal pipe diameter. Sags will only be allowed where the entering and exiting grades are adequate to provide velocities through the sag area sufficient for moving solids. No more than one (1) sag area shall occur between two (2) manholes. The alignment of each pilot bore must be approved by the Engineer before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require a new pilot boring to be made.

3. After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no sharp anomalies (e.g. dens, buckles, gouges, and internal obstructions) greater that 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of five feet.

G. REAM AND PULLBACK:

1. Reaming: Reaming operations shall be conducted to enlarge the pilot after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.

2. Pulling Loads: The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not over stressed.

3. Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.

4. The lead end of the pipe shall be closed during the pullback operation.

5. Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent over stressing or buckling during the pullback operation. Such support/rollers shall be spaced at a maximum of 60 feet on center, and the rollers to be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before pulling operations resume.

6. The Contractor shall at all times handle the HDPE pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.

H. HANDLING DRILLING FLUIDS AND CUTTINGS:

1. During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. To the greatest extent practical, these fluids must not be discharged into the waterway. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids are not forced through the sub-bottom into the waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

2. Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the beach or waterway.

3. The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these Specifications.

4. To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

5. The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be reused.

6. As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.

SECTION 02615
REMOVING AND REPLACING PAVEMENTS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Removal and replacement of existing pavements for installation of utility lines, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these specifications.

2. Section 02221 – Trenching, Backfilling for Utilities.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods for proper performance of the work of the Section.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

1.4 PRODUCT HANDLING

A. Comply with pertinent provision of Section 01640.

1.5 WARRANTY

A. All removed and replaced pavement work within the South Carolina Department of Transportation (SCDOT) rights-of-way shall be warranted for two years beginning on the date to acceptance by the SCDOT.

B. All removed and replaced pavement work within individual county road rights-of-way shall be warranted for two years beginning on the date of acceptance by the individual county.

PART 2 – PRODUCTS

2.1 CONCRETE

A. Comply with Section 03300, using strength specified herein.

2.2 ASPHALTIC CONCRETE

A. Use Types 1 and 2 complying with South Carolina Department of Transportation Standard Specifications, Section 403.

2.3 AGGREGATE BASE COURSE WITH PRIME

A. Comply with applicable portions of South Carolina Department of Transportation Standard Specifications, Section 306.

PART 3 – EXECUTION

3.1 GENERAL

A. Remove to neat lines and dispose of as directed.

B. Replace with bases and pavements similar to type removed, unless otherwise indicated.

3.2 CUTTING

A. Concrete pavement or base:

1. Cut on straight and true lines, to a minimum depth of 2”, using powered concrete saw.

2. Shear off remaining depth with pneumatic tools.

B. Concrete sidewalks shall be removed back to the nearest joint on each side of the crossing.

C. Asphaltic concrete pavements: Cut to straight and true lines with powered concrete saw.

3.3 REPLACEMENT

A. Concrete pavements:

1. Use 300 psi concrete.
2. Replace to 6’ below existing slab and undercut each edge 6” to form shelf.

3. Finish surface to match existing surface.

B. Concrete sidewalks:

1. Replace with 3000 psi concrete.

2. Depth shall be equal to existing section removed, but not less than 4”.

3. Finish surface to match existing sidewalk.

C. Flexible pavements (Ditch Line) – Secondary and Primary Roads:

1. Compact subgrade thoroughly.

2. Undercut each edge 6” to form a shelf.

3. Place 8” 2500 psi concrete leaving surface rough and depressed 2”.

4. Top with 2” of asphaltic concrete.

D. Flexible Pavements (Ditch Line) – Driveways:

1. Compact subgrade thoroughly.

2. Place 8” deep aggregate base course with prime.

3. Top with 2” of asphaltic concrete.

E. Flexible pavements (Resurfacing):

1. In some instances where utilities are installed within existing pavements, resurfacing of the entire width of the original pavement will be required.

2. Replace pavement in ditch line as specified above.

3. Prime and resurface with 1 ½” of asphaltic concrete.

4. Taper resurfacing to existing pavement evenly for a distance of 50 feet beyond repaired area.

5. Comply with Section 02513.

SECTION 02650

GENERAL PIPE REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: The work described under this section specifies the general requirements for installation of all piping, valves and fittings to include general and yard piping, water lines and equipment piping, and applies to all work where piping is installed. The Contractor shall furnish all labor, equipment, tools and materials necessary to perform all tasks required to properly install all pipe work as shown on the drawings and specified herein, in coordination with all other work and in coordination with the required protection, relocation or connection to existing utilities. Any incidental work, material, or appurtenances not specifically shown, but necessary for completion of the work shall be furnished by the Contractor as required.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.3 SUBMITTALS

a. Products Data: Shop drawings shall be submitted on all pipe, fittings, valves, sleeves, couplings, supports, and appurtenances required for complete installation of the piping.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Materials: All pipe, fittings, packing, jointing materials, valves and fire hydrants shall conform to Section C of the AWWA Standards.

B. All piping to include valves and fittings shall be of the type and size as shown on the drawings or specified in other sections. Materials are to be new and of standard manufacturer, meeting all requirements of applicable ASTM standards. Materials not specifically covered by and meeting

ASTM, AWWA, and National Sanitation Federation Standards shall not be used. All materials or products which come into contact with drinking water shall be third party certified as meeting the specifications of the American National Institute/National Sanitation Foundation Standard 61, Drinking Water System Components – Health Effects. The certifying party shall be accredited by the American National Standards Institute. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for jointing pipes, setting meters or valves, or other appurtenances which will expose the material to the water. Water mains which have been previously used for conveying potable water may be reused provided they meet applicable criteria from AWWA Section C,ANSI/NSF 61, and ASTM D1785 or D2241. The mains must be thoroughly cleaned and restored practically to their original condition. Asbestos cement pipe shall not be used in potable water systems except in the repair of existing asbestos cement lines. Thermoplastic pipe shall not be used above grade.

PART 3 - EXECUTION

3.1 GENERAL

A. Equipment Piping: All piping and appurtenances necessary for proper installation and operation of equipment shall be installed as required to fit the equipment provided. The Contractor shall be responsible for providing piping and support necessary for proper equipment installation and operation whether or not the required piping and pipe supports are shown on the drawings. All piping is to be properly installed and supported in accordance with equipment manufacturer's recommendations so as not to put strain on equipment connections and to prevent excessive vibration.

3.2 INSTALLATION

A. Installation: All piping shall be installed in a proper and workmanlike manner, properly protected and supported, free from leakage and meeting all requirements for inspection and testing as specified in other sections.

1. Concrete Blocking: Concrete blocking shall be provided for all underground pressurized piping at all fittings, bends, and ends of pipe to prevent movement of pipe and fittings. Concrete shall be Class A (3000 psi). The concrete blocking shall bear on undisturbed earth in the bottom and sides of the trench and shall be equal to or greater than the dimensions shown on the drawings.

2. Concrete Protection: Protection and encasement concrete shall be Class B and provided where shown on the drawings, or as

necessary for protection of existing piping or utilities as directed by the Engineer.

3. Installation: All piping is to be installed to the line, grade, and elevations shown on the plans.

   a. Pressure piping is to be installed in a true line and in a manner so as to prohibit the formation of high and low spots in the piping likely to trap air or gasses.

   b. All fittings, valves, sleeves, couplings, and appurtenances are to be compatible with, and of equal or greater pressure class as the piping being used.

B. TESTING: All piping shall be pressure and leakage tested. All potable water lines shall be disinfected. Procedures for testing are specified in Section 02660 and Section 02730.

C. CLEANUP: All piping shall be thoroughly cleaned of concrete, mortar, mud, dirt, debris, and rust prior to painting or coating. All areas of piping shall be cleaned up after installation to remove debris, and discarded and unused piping. The area of piping is to be graded smooth to drain and left in a condition satisfactory to the Engineer before piping shall be considered to be complete.

END OF SECTION

SECTION 02730

SANITARY SEWER PIPE AND APPURTENANCES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, equipment, materials and incidentals necessary to install and complete the sanitary sewer and/or force main installation in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All sewer pipe and force main excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.2 SUBMITTALS

A. Shop drawings or submittals shall be required for the following:

1. All sizes and types of pipe on the project.

2. Pipe fittings and couplings.

3. All valves, valve boxes, manholes, manhole frames and covers, air relief valves or any other required for completion of the project.

1.3 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall unload pipe and appurtenances so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a larger size and shall not be rolled or dragged over gravel or rock during handling. The Contractor shall store the pipe and appurtenances on sills above the storm drainage level and deliver for laying after the trench is excavated. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or if damaged sufficiently, the Engineer will reject the material as being unfit for installation.

PART 2 – MATERIALS

2.1 PIPE AND ACCESSORIES

A. All pipe shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Engineer at the plant, trench, or other point of delivery, for the purpose of culling and rejecting materials which do not conform to the requirements of these specifications. Such material shall be marked by the Engineer and the Contractor shall remove it from the project site upon notice being received of its rejection.

B. All pipe shall be provided with a continuous 12-gauge blue insulated copper tracer wire in accordance with the following requirements:

1. Approved for direct burial by the manufacturer. THHN wire shall not be used.

2. Locate tracer wire a minimum of 6" above top of water main.

3. Terminate tracer wire at each valve and meter and make provisions to allow for connection of testing apparatus without interfering with the proper operation of valves and meters.

4. Connect to the pipe with duct tape at every bell connection or every 20' to ensure that the wire is directly over the top of the pipe.

5. Place in the trench with all service lines.

6. Splice at each service lateral and tee connection with an approved copper compression lug.

C. Pressure Pipe for Force Mains

1. Ductile Iron Pipe: Ductile iron pipe shall be utilized in stream crossings, highway and railroad crossing, all piping inside (carrier pipe) steel casing, and other locations as indicated on the Construction Drawing. All pipe shall be furnished in lengths of at least 18 feet.

    a. Pipe: Ductile iron pipe shall conform to AWWA C151. Pipe and fittings shall be furnished with a bituminous outside coating. The interior of the pipe and fittings shall be lined with Protecto 401 ceramic epoxy lining system or approved equal.

PIPE SIZE (IN)	PRESSURE CLASS (PSI)
4-12	350
14-62	200

b. Joints: Joints shall be push-on type for pipe and standard mechanical joints for fittings. Joints shall conform to AWWA C111. Restrained joint pipe (RJP) shall be either the bolted joint type, or modified push-on type with joint restraint using ductile iron components. Restrained joint pipe on piers shall have bolted joints and shall have bolted joints and shall be specifically designed for clear spans of at least 36 feet. Restrained joint pipe where required shall be EBAA Iron, American, U.S. Pipe, McWane Ductile or Equal. When installed in a casing the pipe shall be supported at every joint by a stainless steel insulator as manufactured by Cascade or an approved equal. Contractor shall install according to manufacturer's recommendations.

c. Fittings shall be ductile iron and shall be manufactured in accordance with AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi.

d. Acceptance: Acceptance will be on the basis of the Owner's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

2. PVC Pressure Pipe:

a. PVC pipe shall be Iron Pipe Size (IPS) pipe in accordance with ASTM D2241 or C900 in accordance with AWWA C900-16. All pipe shall be green in color and furnished in lengths of a minimum of 14 feet.

b. Joints: Joint shall be gasket style using ASTM F477, elastomeric seals.

c. Fittings shall be ductile iron, HARCO Class 200 pressure pipe fittings, or approved equal. Ductile Iron fittings shall be manufactured in accordance with AWWA C110 or AWWA C153 with a minimum rated Working pressure of 250 psi.

d. Detection Tape: Detectable mylar encased aluminum foil marking tape will be installed over all PVC sewer pipe and sewer laterals. Tape will be "safety orange" in color, at least 1-1/2-inches wide and shall bear the printed identification "Caution

Buried Sewer Line Below" (reverse printed), so as to be readable through the mylar. Surface printing on the tape shall equal to Lineguard Type II Detectable.

3. Force Main Air Relief Valves:

    a. Automatic air relief valves shall be installed at all force main high points to prevent air locking.

    b. Air relief valve shall be provided by ARI or approved equal by the Engineer.

    c. Air relief valve shall be installed in accordance with Owner standard air release valve detail.

D. Gravity Sewer

1. Ductile Iron Pipe: Ductile iron pipe used in gravity sewer shall meet the same specifications as for pressure pipe.

2. Polyvinyl Chloride Gravity Sewer Pipe: PVC gravity sewer pipe shall be supplied in lengths not longer than 13 feet. The installation shall conform to requirements of ASTM D2321. Minimum depth of installation of three (3) feet. Maximum depth of installation is twenty (20) feet.

    a. Pipe: PVC gravity sewer pipe shall be manufactured in accordance with ASTM D3034 for pipe 4 to 15 inches in diameter, and in accordance with ASTM F679 for pipe 16 inches and above in diameter.

    b. Joints: Joints for pipe and fittings shall be of the bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage. The joint system shall be subject to the approval of the Owner and shall be identical for pipe and fittings.

    c. Fittings for pipe eight inches and less in diameter shall be one piece with no solvent-welded joints. Fittings for pipe ten inches and larger may be fabricated using solvent welding. No field fabrication or fittings will be allowed. All such fabrication shall be performed at the factory and the fittings delivered ready for use.

    d. Detection Tape: Detectable mylar enclased aluminum foil marking tape will be installed over all PVC sewer pipe and

sewer laterals. Tape will be “safety orange” in color, at least 1-1/2-inches wide and shall bear the printed identification “Caution Buried Sewer Line Below” (reverse printed), so as to be readable through the mylar. Surface printing on the tape shall equal to Lineguard Type II Detectable.

e. Acceptance: Acceptance will be on the basis of the Owner’s inspection and the manufacturer’s written certification that the pipe was manufactured and tested in accordance with the applicable standards.

f. Adapter Couplings: Adapters shall be elastomeric plastic sleeves designed to connect pipes of dissimilar materials. Adapters shall provide a positive seal against infiltration and exfiltration, be root proof and remain leak proof up to 10 psi. The adapter manufacturer shall provide stainless steel clamps, adapter donuts and other required accessories.

Couplings for DI/PVC transition joints shall be alpha couplings supplied by Romac Industries, Inc.

3. <u>High Density Polyethylene Pipe (HDPE):</u>

a. The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335434C, or better.

b. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent.

c. The maximum allowable hoop stress shall be 800 psi at 73.4 degrees F.

d. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

e. The pipe and bends shall have a minimum standard dimension ratio (SDR) wall thickness of 17.

f. Joining shall be performed by thermal butt-fusion in accordance with the manufacturer’s recommendations.

g. Sanitary sewer pipe exterior shall be green in color or contain green stripping. Sanitary sewer interior shall be light in color for internal video inspection.

4. Manholes:

a. Precast concrete manhole bases, risers and cones shall conform to ASTM C478, latest revision of Precast Reinforced Concrete Manhole Sections. Tapered Section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes and where shown or specified. Cast iron manhole covers and assemblies shall be cast into slab tops for access into manholes.

b. Minimum compressive strength of concrete shall be 4,000 psi and the maximum permissible absorption shall be 6.5%. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches for larger sizes. Precast manhole section shall fit together readily and shall have a butyl rubber sealant (“Ram-Nek” or equal) for joint sealing of sections.

c. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Engineer and his inspector. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C 478.

d. Manhole interior shall be spray applied if requested by the Owner with OBIC Armor 1000 aromatic polyurea coating by CTR Coatings. Alternate coating system shall be approved by the Owner.

e. Manhole top elevations shall be greater than or equal to the fifty (50) year flood elevation, unless watertight covers are provided.

f. Force mains tying into manholes shall enter the manhole a vertical distance of not more than 2 feet above the flow line of the receiving manhole.

g. Frames and Covers:

i. Frames and covers shall be cast iron of superior quality, tough and even texture. Castings shall be gray iron conforming to ASTM A 48, size as indicated, free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, well cleaned and coated with asphalt paint. This paint shall result in a smooth coating, tough and tenacious when cold, not tacky and not brittle. The bearing surface between frame and cover shall be machined to prevent rocking and rattling.

ii. The standard manhole casting shall be U.S. Foundry USF 668 ring and KL cover or an approved equal.

iii. The frame and cover shall be properly set in a bed of mortar and aligned to fit the top section of the manhole. Concrete brick, set in mortar, shall be used to adjust the top of the frame and cover to finished grade; however, no more than four (4) courses of brick will be used for adjustment.

h. Manhole Steps:

i. Steps shall be copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.

ii. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the eccentric cone and so as to land upon a bench.

iii. Steps shall be vertically spaced no greater than sixteen (16) inches on center. Step width shall be a minimum of twelve (12) inches. Steps shall protrude

from the wall of the structure a minimum of five (5) inches and a maximum of seven (7).

iv. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place.

i. Manhole Inverts:

i. Manhole inverts and benches shall be constructed in accordance with the standard details shown on the drawings. Invert shall be a U-shaped channel with a height of 0.8 of the diameter and be a smooth continuation of the pipe. The benches shall be constructed with a slope of 1” per foot to the channel.

ii. The channel and invert shall be constructed with a minimum of 2,000 psi concrete or brick fill with concrete finish minimum 1” thick. Where sewer changes directions at the manhole, channel shall be constructed with a smooth curve with as large a radius as the diameter of the manhole will allow.

j. Manhole Drops: Standard drop manholes will be constructed only at those locations shown on the drawings or as approved by the Engineer. The design of the drop connection shall be in accordance with the standard detail drawing. The cost of the extra pipe, labor, etc. required to construct a drop manhole will be included in the unit price for the drop manhole at the depths listed.

k. Manhole Vents:

i. Where designated on the contract drawings, a 4” diameter vent pipe shall be installed as an integral part of the manhole. The vent pipe is to be tapped in to the upper most section of the manhole, anchored in concrete and extended vertically to the elevation shown on the drawings. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering the pipe.

ii. The pipe material shall be Schedule 40 galvanized steel with two (2) coats of epoxy paint approved by the Engineer.

PART 3: EXECUTION

3.1 INSTALLATION

A. Excavation

1. The work covered by this section consists of the excavation and satisfactory disposal of all materials excavated in the construction of trenches.

2. Trenches will be defined as all excavation for the installation of storm sewers, sanitary sewers, water pipe, manholes, catch basins, hydrants, watergates, sewer service, water taps, drainage structures, drainage ditches and other unclassified excavation as may be deemed necessary by the Engineer.

3. The excavation shall be done to the lines, grades, typical sections and details shown on the plans or established by the Engineer. All work covered by this section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be maintained in a satisfactory condition so that adequate drainage is provided at all times. Any roots which protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by the Engineer.

4. All trenches shall be excavated in accordance with all Federal, State, and Local Health and Safety regulations having jurisdiction at the project site.

5. All excavation shall be by open cut unless otherwise authorized by the Engineer. If the bottom of the excavation is found to consist of rock or any materials that cannot be excavated to give a uniform bearing surface, the material shall be removed to a depth at least 6” below established bottom grade and backfilled to grade with sand thoroughly compacted in place. Any excavations carried below the depths indicated, without specific directions, shall be backfilled in the same manner. The excavation shall be of sufficient width to allow a clearance of not less than 6” between the side of the trench and the outside of the pip, or in case of pipe with a bell, the outside of the bell

of the pipe. This rule will apply at all times, and consequently, proper allowance must be made for additional space required for sheeting the trench where necessary.

6. Sheeting, Bracing Trenches, and Trench Boxes:

    a. If necessary, the Contractor will be required to keep the sides of the excavation vertical by sheeting and/or bracing or the use of a trench box to prevent movement by slides or settling of the sides or the trench, in such manner as to prevent injury or displacement of the pipe or appurtenances or diminish the working space required at the sides of the pipe. Also, the Contractor may be required for the purpose of preventing injury to persons or property or adjacent structures in place or to be constructed, to leave sheeting and bracing in place. Sheeting and bracing shall be provided in accordance with all applicable Federal, State and Local safety and health regulations.
    b. No sheeting or bracing shall extend closer than 2'-0" off the ground surface, or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. It is understood that the Owner will be under no obligation to pay for sheeting or bracing left in place by the Contractor. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom.

7. Excavated materials to be used for backfill will be approved by the Engineer, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance. Materials which are excess to the needs of the project will be disposed of according to the section on "Waste Material Disposal"

8. Pipe Foundations:

    a. The preparation of the pipe bedding shall be in accordance with the typical trench cross-sections as shown on the plans for the type of pipe being installed.

    b. The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the plans. Any

deviation or field adjustment will require the approval of the Engineer. When a representative of the Engineer is present on the site and is so requested by the Contractor, he may check the position of grades and lines but the Contractor shall be responsible for the finished work conforming to exact and proper line and grade.

c. Whenever the nature of the ground will permit, the excavations at the bottom of the trench shall have the shape and dimensions of the outside lower third of the circumference of the pipe, care being taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade.

d. In case the bed shaped in the bottom of the trench is to low, the pipe shall be completely removed from position, and earth of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe.

e. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than 6”. A suitably tamped and shaped foundation of approved material shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.

f. Where the foundation material is found to be of poor supporting value, the Engineer may make minor adjustment in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting to the depth as directed by the Engineer, within limits established on the plans, and backfilling with either an approved material secured from unclassified excavation or borrow excavation at the nearest accessible location along the project, or foundation conditioning material consisting of crushed stone or gravel approved by the Engineer as being suitable for the purpose intended. The selection of the type of backfill material to be used for foundation conditioning will be made by the Engineer.

g. The Contractor shall remove all water which may be encountered or which may accumulate in the trenches by pumping or bailing and no pipes shall be laid until the water has been removed from the trench. Water so removed from the trench must be disposed of in such a manner as not to cause injury to work completed or in progress.

h. Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, the Engineer will require the pipe to be laid on a washed stone foundation per detail. Foundation stone shall be placed by the Contractor and compensation will be allowed the Contractor for the work, based on the unit prices provided in the bid schedule for undercut excavation if greater than 6" below the bottom of the pipe. Class I embedment for DIP shall be used only for wet conditions and only as directed by the Engineer. Compensation shall be based on unit prices. No additional payment for Class I embedment shall be made for PVC sewer pipe.

B. Installing Pipe and Appurtenances:

1. Laying Pipe

a. The layout of gravity sanitary sewer lines and invert elevations at governing points are as shown on the drawings.

b. The Contractor shall do all layout work for lines and grades from that information shown on the drawings or as furnished by the Engineer.

c. When a laser beam instrument is used to set line and grade, the unit must be maintained in good working order, and the calibration checked daily for alignment and percent grade. In the event the required accuracy of alignment and grade is not adhered to, the Engineer will prohibit the use of laser beams.

d. Pipe shall be laid working in the upstream with bell ends laid upgrade, unless directed otherwise by the Engineer. In all cases, pipe is to be installed in strict accordance with the manufacturer's recommendations and the contract material specifications. The Engineer may augment any manufacturer's installation recommendations if, in his opinion, it will best serve the interest of the Owner.

e. Proper tools, implements, and facilities satisfactory to the Engineer shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean, sound and free from defects. It shall be laid on the prepared foundation, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.

f. When cutting short lengths of pipe, a pipe cutter, as approved by the Engineer, will be used and care will be taken to make the cut at right angles to the centerline of the pipe or on the exact skew as shown on the plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder, or coarse file to match the manufactured taper.

g. During times when pipe laying is not in progress, the open ends of pipe shall be closed and no trench water or other material shall be permitted to enter the pipe.

h. Where the pipe is laid on a grade of 20% or greater, the laying shall start at the bottom of the slope and proceed upward with the bell end of the new pipe upgrade. All pipe laid on a grade of 20% or greater shall require thrust blocking or keying as shown on the drawings and standard details.

i. Force mains shall be provided with thrust blocking and/or restraint joints at all changes in alignment greater than or equal to 30 degrees.

j. Where pipe lines of different materials are joined together, a standard sewer repair coupling shall be used. The couplings shall be Eastern Standard Sewer Repair Couplings (Mission Rubber Company), the Fernco Joint Sealer Company or an equal product approved by the Engineer.

k. Separation of Sewer and Water Mains:

a. Interconnections: There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto which may permit the passage of any sewage or polluted water into the potable supply. No potable water pipe shall pass through or come into contact with any part of a sewer manhole.

b. Horizontal and Vertical Separation from Potable Water Mains: Sewers shall be laid at least 10 feet horizontally from any existing or proposed potable water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a potable water main, provided that the potable water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the potable water main is at least 18 inches above the top of the sewer.

c. Crossings: Sewers crossing potable water mains shall be laid to provide a minimum vertical separation of 18 inches between the outside of the potable water main and the outside of the sewer. This shall be the case where the potable water main is either above or below the sewer. Whenever possible, the potable water main shall be located above the sewer main. Where a new sewer line crosses a new potable water main, a full length of pipe shall be used for both the sewer line and potable water main and the crossing shall be arranged so that the joints of each line shall be as far as possible from the point of crossing and each other. Where a potable water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the potable water main while maintaining line and grade.

d. Force Main: There shall be at least a 10-foot horizontal separation between sanitary sewer force mains and potable water mains. There shall be an 18-inch vertical separation at crossing as required in subsection 67.300.A.14.b and subsection 67.300.A.14.c.

e. Special Condition: When it is impossible to obtain the distances specified in subsection 67.300.A.14.b, subsection 67.300.A.14.c, and subsection 67.300.A.14.d the Department may allow an alternative design. Any alternative design shall: maximize the distances between the sewer line and the potable water main and the joints of each; use pipe materials which meet the requirements

as specified in Regulation 61-58.4(D)(1) for the sewer line; and allow enough distance to make repairs to one of the lines without damaging the other.

f. Sewer Manholes: No potable water pipe shall pass through or come into contact with any part of a sewer manhole.

2. Manholes:

a. Sanitary sewer manholes shall be installed at each break in line or grade in each sanitary sewer line as shown on the contract drawings.

b. The manhole foundation shall be prepared so as to provide a firm, level area on which to place the precast concrete manhole base section. When poor foundation soil is encountered or excess groundwater exists, the foundation shall be excavated 12” below the final subgrade elevation backfilled with washed stone to provide a proper foundation.

c. The manhole sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the heavy concrete pieces. The manhole shall be set plumb and adjusted to the final finished surface grade with brick and mortar.

d. Pipe openings shall be exactly aligned to that of the pipe entering and leaving the manhole. The gravity sanitary sewer pipe lines shall be placed in the manhole openings, properly aligned, and set to grade. Sanitary sewer shall be connected to the manholes using lock joint flexible manhole sleeves or equal.

e. For large diameter pipe where a flexible rubber sleeve is not available, the pipe line shall be sealed into the manhole using an expanding type or non-shrink type grout.

f. For manhole steps, refer to the precast manhole section above.

3. Manhole Frames and Covers: The frame and cover shall be properly set in a bed of mortar and aligned to fit the top section of the manhole. Concrete brick, set in mortar, shall be used to adjust the top of the frame and cover to finished grade; however, no more than four (4) courses of brick will be used for adjustment.

4. Manhole Inverts:

a. Manhole inverts and benches shall be constructed in accordance with the standard details shown on the drawings. Inverts shall be a U-shaped channel with a height of 0.8 of the diameter and be a smooth continuation of the pipe. The benches shall be constructed with a slope of 1” per foot to the channel.

b. The channel and invert shall be constructed with a minimum of 2,000 psi concrete or brick filled with concrete finish minimum 1”thick. Where sewer changes directions at the manhole, channel shall be constructed with a smooth curve with as large a radius as the diameter of the manhole will allow.

5. Manhole Drops: Drop manholes are required where the invert differential is 24 inches or more. Standard drop manholes will be constructed only at those locations shown on the drawings or as approved by the Engineer. The design of the drop connection shall be in accordance with the standard detail drawing. The cost of the extra pipe, labor, etc. required to construct a drop manhole will be included in the unit price for the drop manhole at the depths listed.

6. Manhole Vents:

   a. Where designated on the contract drawings, a 4” diameter vent pipe shall be installed as an integral part of the manhole. The vent pipe is to be tapped in to the upper most section of the manhole, anchored in concrete and extended vertically to the elevation shown on the drawings. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.

   b. The pipe material shall be Schedule 40 Galvanized Steel with two coats of epoxy paint approved by the Engineer.

7. Exposed Pipe:

   a. Exposed pipe to be installed inside tanks, wetwells, vaults and buildings shall be installed as shown on the Drawings and field painted as described below. All exposed ductile iron pipe shall utilize flanged joints unless otherwise noted.

   b. All exposed cast or ductile iron pipe, fittings and valves shall be field painted with two (2) coats of epoxy paint as recommended

by the paint manufacturer. Color of paint shall be as selected by the Owner.

C. Backfilling and Compaction:

1. Backfill trenches immediately after approval of the pipeline construction.

2. Pipes:

a. PVC pipe shall be installed using Class I embedment for 6” below the pipe and to the spring line per the standard detail. Class I embedment shall be defined as #67 washed stone or approved equal per NCDOT Standard Specifications. No additional payment shall be made for Class I embedment for PVC pipe.

b. For DIP pipe with backfill material other than Class I embedment, use backfill carefully placed in uniform layers not exceeding 6” in thickness to a depth of 2’-0” over the top of the pipe. Place material and fill the area under the pipe haunches. Place each layer, moisten; then uniformly compact by use of hand, pneumatic, or mechanical tampers exercising care to prevent lateral displacement. Areas of backfill 2’-0” over top of pipe to top of trench, shall be backfilled with a material containing no rocks larger than 6” in the greatest dimension and shall be free of material with an exceptionally high void content. The initial backfill shall meet the same requirements except no rocks over 4” in diameter will be allowed.

c. Moisten backfill above 2’-0” over the top of the pipe and place in 8” layers. Compact each layer with hand, pneumatic or mechanical compactor. Puddling or flooding of trench for consolidation of backfill or use of wheel rolling by construction equipment will not be permitted.

d. Foundation stone as required for wet or unstable conditions per the details, shall be defined as #57 or #67 stone per SCDOT Standard Specifications or approved equal. Foundation stone shall be used only as directed by the Engineer and payment shall be per the contract unit prices for under cut.

3. If material excavated from the trench is unsuitable to be used as backfill, “select backfill” shall be transported to the site by the Contractor from outside the project limits to be used as backfill material. Material excavated in conjunction with the construction of the project is not considered “select backfill” for payment purposes.

4. Roadways and Road Crossings: Use backfill placed in uniform layers not exceeding 6” in thickness for full trench depth and width, thoroughly compacted with mechanical tampers under optimum moisture conditions to 95% compaction (100% for the top 2’-0” of subgrade beneath pavements). Replace removed paving and base course with new material of equal or better quality and of the same texture and color as the adjacent roadway.

5. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to 95% of the Standard Proctor Test (100% for the top 2’-0” or subgrade beneath pavements) for the various types of backfill material. Methods of backfilling shall be in strict accordance with the pipe manufacturer’s recommendations. All backfill material shall have been approved by the Engineer. Select backfill material shall be used when requested by the Engineer.

6. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.

7. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the plans. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material at no cost to the Owner. Pipe which becomes mis-aligned, shows excessive settlement, or has been otherwise damaged by the Contractor’s operations, shall be removed and replaced by the Contractor at no cost to the Owner.

8. The Contractor shall maintain all pipes installed in a condition that they will function continuously from the time the pipe is installed until the project is accepted.

9. Cleanup

    a. Grade all areas disturbed to a finish obtained from a blade grade with no abrupt changes in grade or irregularities that will hold water. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.

b. Cleanup and seeding is part of the pipeline installation. No more than 3,000 linear feet of sewer lien may be laid prior to completion of cleanup of the first section of pipeline laid. To facilitate this the Owner reserves the right to withhold up to 30% of the unit price bid for sewer line if in the opinion of the Owner and Engineer completed sections have not been properly cleaned.

3.2 QUALITY CONTROL

A. Testing

1. Line Cleaning

a. Prior to inspection of any section(s) of gravity sanitary sewer pipe or force main the Contractor shall completely clean the lines of all debris, silt, etc. The pipe line shall be ready for use by the Owner and shall be proved to be in first class condition and constructed properly in accordance with the drawings and specifications.

b. The Contractor shall maintain the project, insofar as his construction work is concerned, in first class condition for such time as is necessary to satisfy the Engineer that all installations are correct and acceptable.

2. Inspection and Testing (Sewer Forcemain):

a. General:

i. Pressure and leakage testing must be conducted in accordance with AWWA Standards C600.

ii. Clean and flush line of air, dirt and foreign material.

iii. Do not perform hydrostatic tests until at least five days after installation of concrete thrust blocking.

iv. Test pump, pipe connection, pressure gauges, measuring devices and all other necessary appurtenances to conduct tests are to be provided by the contractor.

v. Install brass corporation cocks at all high points that do not have permanent air vents. Corporation cocks are to be left in place and all costs for providing such cocks are to be borne by the Contractor.

vi. Conduct tests on each line or valved section of line.

vii. Test pressures to be 150 psi, or 1.5 times the maximum working pressure, whichever is greater, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.

viii. Do not test pipe at pressures exceeding manufacturer's recommendations.

ix. The Contractor must provide documentation of the pressure and leakage tests. Documentation must include length of lines, diameter of pipe(s), amount of water required to fill line after test was performed, and amount of allowable leakage.

x. The witness to the hydrostatic testing is to be someone other than the Contractor or the utility installing the lines.

b. Pressure tests:

i. After the pipe is laid, the joints completed, and the trench backfilled, subject the newly laid piping and valved sections of the piping to the test pressure specified in Part A above.

ii. Open and close each valve within the section being tested several times during the test period.

iii. Replace and remake joints showing leakage.

iv. Remove cracked pipe, defective pipe, and cracked or defective joints, fittings and valves. Replace with sound material and repeat the test until results are satisfactory.

v. Make repair and replacement without additional cost to the Owner.

c. Leakage test:

i. Conduct leakage test after the pressure test has been completed satisfactorily.

ii. Duration of each leakage test: At least two hours.

iii. During the test, subject water lines to the test pressure specified in Part A above.

iv. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

1) No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula(s):

Ductile Iron piping:

$L = S \times D \times \sqrt{P} / 133{,}200$; where
L = allowable leakage in gallons per hour;
S = length of pipe tested in feet;
D = nominal diameter of pipe in inches; and
P = average test pressure psi gauge.

PVC piping:

$L = N \times D \times \sqrt{P} / 7{,}400$; where
L = allowable leakage in gallons per hour;
N = number of joints in pipeline being tested;
D = nominal diameter of pipe in inches; and
P = average test pressure psi gauge.

2) When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallons per hour per inch of nominal valve size will be allowed.

3) Should any test of pipe disclose leakage greater than that specified above, locate and repair the defective joint or joints until the leakage is within the specified allowance, and at no additional cost to the Owner.

4) Repair all visible leaks regardless of test results.

3. Inspection and Testing (Gravity Sewer):

a. Alignment and grade between manholes shall be tested by the Engineer by flashing a light between manholes. A full circle of light shall be seen when reviewed from the adjoining end of the line. All

defects disclosed as a result of this test shall be corrected by the Contractor at his expense.

b. PVC pipe shall pass a go-no go Mandrel sized to 95% of the pipe diameter with the pipe in place and properly backfilled. All pipe which will not pass the Mandrel shall be relaid or replaced by the Contractor at no additional cost. The allowable deflection (less than 5%) shall be calculated using the pipe stiffness formula in ASTM D 2321. The Mandrel test shall not take place until the final backfill has been in place for 30 days (minimum).

c. When the sewers are completed they shall be inspected by the Engineer for conformance with the provisions of the plans and specifications, particularly line and grade, and tested to determine the amount of ground water infiltration into the sewer. All visible and audible leaks will be stopped and the remaining infiltration will be measured using a V-notch weir and/or other devices, which shall be furnished by the Contractor. The Contractor shall also furnish all required assistance for measuring the exfiltration and/or infiltration.

d. If exfiltration and/or infiltration into the whole system or any segment thereof exceeds 100 gallons per inch of pipe diameter per mile per day, necessary corrective measures shall be taken by the Contractor to limit the exfiltration and/or infiltration to the maximum specified above. The Engineer shall decide the number and length of segments of sewer line on which the testing shall be performed.

e. All gravity sanitary sewer lines shall be subjected to a low pressure air test to determine the presence of damaged pipe or faulty installation. The Contractor will furnish all facilities and personnel for conducting the test(s).

f. Air testing may be utilized in lieu of an infiltration/exfiltration test as approved by the Engineer. The acceptance air test shall be made after backfilling has been completed and compacted and in the presence of the Engineer. The test shall be performed as described in ASTM F-1417 for non-pressure plastic pipes.

b. Compressor capacity shall be sufficient to pressurize the sewer main to 4 PSIG within a time equal to or less than the required test time. The following equation may be used to insure compliance with this requirement:

$$C = \frac{0.17 \times D^2 \times L}{} + Q$$

T

Where: C = Required Compressor Capacity (cfm)
T = Required Test Time (min)
D = Pipe Internal Diameter (feet)
L = Length of Test Section (feet)
Q = Allowable Air Loss Rate (cfm)

The following allowable air loss rates will be used for all pipe tests:

PIPE SIZE	Q (cfm)	PIPE SIZE	Q (cfm)
4”	2.0	15”	4.0
6”	2.0	18”	5.0
8”	2.0	21”	5.5
10”	2.5	24”	6.0
12”	3.0		

c. The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 PSIG. When a stable condition has been reached, the pressure shall be bled back to 3.5 PSIG. At 3.5 PSIG, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of the groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of five (5) readings will be required for each test.

d. If the time for the air pressure to decrease from 3.5 PSIG to 2.5 PSIG is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air tests.

Minimum Test Time for Pipe

	Pipe Size								
Length Tested	**4”**	**6”**	**8”**	**10”**	**12”**	**15”**	**18”**	**21”**	**24”**
25	0:04	0:10	0:17	0:22	0:26	0:31	0:36	0:44	0:53
50	0:09	0:20	0:35	0:44	0:53	1:02	1:12	1:29	1:47
75	0:13	0:30	0:53	1:06	1:20	1:34	1:48	2:14	2:40
100	0:17	0:40	1:11	1:29	1:47	2:05	2:24	2:58	3:33
125	0:22	0:50	1:29	1:51	2:13	2:36	3:00	3:43	4:27

150	0:26	1:00	1:47	2:13	2:40	3:07	3:36	4:27	5:20
175	0:31	1:10	2:04	2:35	3:07	3:39	4:12	5:12	6:14
200	0:35	1:20	2:22	2:58	3:33	4:10	4:48	5:57	7:07
225	0:40	1:30	2:40	3:20	4:00	4:41	5:24	6:41	8:00
250	0:44	1:40	2:58	3:42	4:27	5:13	6:00	7:26	8:54
275	0:49	1:50	3:16	4:05	4:53	5:44	6:36	8:10	9:47
300	0:53	2:00	3:33	4:27	5:20	6:15	7:12	8:55	10:41
325	0:58	2:10	3:51	4:49	5:47	6:47	7:48	9:40	11:34
350	1:02	2:20	4:09	5:11	6:14	7:18	8:25	10:24	12:28
375	1:06	2:30	4:27	5:34	6:40	7:49	9:01	11:09	13:21
400	1:11	2:40	4:45	5:56	7:07	8:21	9:37	11:54	14:14
425	1:15	2:50	5:02	6:18	7:34	8:52	10:13	12:38	15:08
450	1:20	3:00	5:20	6:40	8:00	9:23	10:49	13:23	16:01
475	1:24	3:10	5:38	7:03	8:27	9:54	11:25	14:07	16:55
500	1:29	3:20	5:56	7:25	8:54	10:26	12:01	14:52	17:48
525	1:33	3:30	6:14	7:47	9:21	10:57	12:37	15:37	18:42
550	1:38	3:40	6:31	8:09	9:47	11:28	13:13	16:21	19:35
575	1:42	3:50	6:49	8:32	10:14	12:00	13:49	17:06	20:28
600	1:47	4:00	7:07	8:54	10:41	12:31	14:25	17:51	21:22

e. For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

$$L_e = \frac{d^2 \times l}{D^2}$$

Where: L_e=Effective Pipe Length (added to Total Test Length)
d=Diamater of Service Lateral Pipe
l=Length of Sewer Lateral
D=Diameter of Sewer Main Pipe being tested

g. Failure of any section of the pipeline to meet the requirements of this test shall cause the Contractor to determine, at his own expense, the source(s) of leakage, and repair or replace all defective materials or workmanship. The repaired section(s) of line shall be re-tested to insure conformance with the requirements of these contract specifications.

4. Inspection and Testing (Manholes): Manholes shall be constructed to provide a true circular inside diameter with properly corbelled tops, satisfactory inverts and properly placed steps and castings. Any visible

leaks in the manholes shall be completely stopped to the satisfaction of the Engineer. Manholes shall be vacuum tested in accordance with ASTM C1244-05 and approved by the Engineer prior to backfill.

B. Final Acceptance:

1. The Engineer will notify the Contractor, in writing, as to the satisfactory completion of the work in any or all sections or gravity sanitary sewer pipe, force main and manholes, included in the project.

2. Upon such notification, the Contractor shall immediately remove all construction equipment, excess materials, tools, debris, etc. from the site(s) and leave the same in a neat, orderly condition acceptable to the Engineer.

3. Final landscaping requirements and restoration of surfaces shall then be completed by the Contractor in accordance with their respective specifications and as shown on the drawings.

SECTION 02750

WASTEWATER LIFT STATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work under this section includes, but is not limited to, furnishing and installing a duplex submersible lift station as indicated on the project drawings, herein specified, as necessary for proper and complete performance.

1.02 REFERENCES

A. Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.

1. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA)

    a. ANSI B16.1 Cast iron pipe flanges and flanged fittings.

    b. ANSI/AWWA C115/A21.51Cast/ductile iron pipe with threaded flanges.

    c. ANSI 253.1 Safety Color Code for Marking Physical Hazards.

    d. ANSI B40.1 Gages, Pressure and Vacuum.

    e. AWWA C508 Single Swing Check Valves.

2. American Society for Testing and Materials (ASTM)

    a. ASTM A48 Gray Iron Castings.

    b. ASTM A126 Valves, Flanges, and Pipe Fittings.

    c. ASTM A307 Carbon Steel Bolts and Studs.

    d. ASTM A36 Structural Steel.

3. Institute of Electrical and Electronics Engineers (IEEE)

   a. ANSI/IEEE Std 100 Standard Dictionary of Electrical Terms.

   b. ANSI/IEEE Std 112 Test Procedure for Polyphase Induction Motors.

   c. IEEE Std 242 Protection of Industrial and Control Power Systems.

4. National Electric Code (NEC) / National Electrical Manufacturers Assoc. (NEMA)

   a. NEC National Electric Code.

   b. NEC 701 National Electric Code article 701.

   c. NEMA Std MG1 Motors and Generators.

5. Miscellaneous References

   a. Ten-State Standards Recommended Standards for Sewage Works.

   b. Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.

   c. NMTBA and JIC Std. National Machine Tool Builders Association and Joint Industrial Council Standards

   d. ISO 9001 International Organization for Standardization.

1.03 SUBMITTALS

A. Product Data

1. Prior to fabrication, pump station manufacturer shall submit three (3) copies and an electronic copy of submittal data for review and approval.

2. Submittal shall include shop drawings, electrical ladder logic drawings, and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and shaft drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), and hydraulic brake horsepower

(BHP). Electrical components used in the motor branch and liquid level control shall be fully described.

B. Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for equipment base plate. The electrical ladder logic drawings shall illustrate motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

C. Operations Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

a. Functional description of each major component, complete with operating instructions.

b. Instructions for operating pumps and pump controls in all modes of operation.

c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.

d. Support data for commercially available components not produced by the station manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.

e. Electrical schematic diagram of the pump station circuits shall be in accordance with NFPA70. Schematics shall illustrate, to the extent of authorized repair, pump motor

branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

f. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.04 QUALITY ASSURANCE

A. The pump manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

B. Components including the pumps, motors, and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual performance anticipated for the complete pumps.

C. The manufacturer’s technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in manufacturer’s packaging and store per manufacturer’s instructions.

1.06 PROJECT/SITE CONDITIONS

A. These pumps will be installed in a circular concrete wet well as shown on the drawings.

1.07 MANUFACTURER'S WARRANTY

A. The pump manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. Pumps and other equipment, apparatus, and parts furnished by the pump manufacturer shall be warranted for five years from the date of start-up, with a minimum of 18 months of 100% coverage from manufacturer defects and workmanship. The warranty shall be in printed form and apply to all similar units.

B. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer.

PART 2 - PRODUCT

2.01 SYSTEM DESCRIPTION

A. Contractor shall furnish and install a submersible duplex pump station at the Upstate Corporate Park, including a pre-cast concrete wetwell and valve vault per the construction drawings. The wastewater lift station shall include all necessary ductile iron piping, fitting, valves, and appurtenances. The installed lift station includes two (2) submersible wastewater pumps, float control system, pump control panel including soft starters, electrical power feed, and necessary conduit, wiring, etc. Pumps and control panel shall be Owner procured and supplied by pump manufacturer.

B. Wet Well

1. The wet well shall be precast reinforced concrete sections conforming to ASTM C-478 or cast-in-place Portland cement conforming to ASTM C150, type II 4,000 psi and absorption shall not exceed 6%. The footing shall be concrete placed on a dry, compacted subgrade. The footing shall be designed to prevent flotation of the empty wet-well structure. The wetwell shall be constructed to the dimensions shown on the drawings. The access hatch in the top slab of the wet well shall have a minimum 60" x 48" (inch) clear opening, with a live load capacity of 300

pounds per square foot as detailed on the construction drawings. The frame shall be complete with hinged and hasp-equipped cover, upper guide holders, chain holders and stainless steel cable holder. Frame shall be securely mounted directly above the pumps. The door shall be torsion bar loaded for ease of lifting and shall have safety locking handle in open position. Fastening hardware used inside the wet well shall be stainless steel.

2. The concrete mix design shall include a XyPex or approved equal admixture for waterproofing the wetwell from exterior groundwater present. All wet-well sections shall be jointed with “Ram-Nek” joint sealer, or approved equivalent, with primer. The primer shall be applied to all contact surfaces of the concrete wall joint as recommended by the manufacturer.

3. The Contractor shall furnish and install guide rails for each pump, to permit the raising and lowering of the pump. Guide bars shall be 316 stainless steel and of adequate length and strength to extend from the lower guide holders on the pump discharge connection to the upper guide holder mounted on the access frame. Guide rails shall be installed plumb with stainless steel intermediate supports as required by the Engineer.

4. All conduit entering the lift station should be sealed air tight at the wet well and at the control panel. Once above grade, these conduits shall also have an air gap immediately below the control panel. Conduit shall be sealed air tight on either side of the air gap.

5. All piping and fittings within a wet well from the pump base to the valve pit shall have an epoxy prime exterior.

6. All exposited metal piping and fittings shall receive TNEMEC, or approved equal, protective coatings with a minimum of 4.0 to 6.0 mils of Series 1028 coating system. The finish coat shall be resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

C. Valve Vault

1. Valve Pit shall be precast reinforced concrete sections conforming this to ASTM C-478 or cast-in-place Portland cement conforming to ASTM C150, type II 4,000 psi and absorption shall not exceed 6%. The footing shall be concrete placed on a dry, compacted sub grade. The footing shall be designed to prevent

flotation of the empty wet-well structure. The valve vault shall be constructed to the dimensions shown on the drawings. The access hatch in the top slab of the valve vault shall have a minimum 36" x 48" (inch) clear opening, with a live load capacity of 300 pounds per square foot as detailed on the construction drawings. The hatch shall include 1/4" (inch) tread plate, flush type lock with inside spoon handle. The frame shall be complete with hinged and hasp-equipped cover, upper guide holders, chain holders and stainless steel cable holder. Frame shall be securely mounted directly above the valves. The door shall be torsion bar loaded for ease of lifting and shall have safety locking handle in open position. Fastening hardware used inside the valve pit shall be stainless steel.

2. The concrete mix design shall include a XyPex or approved equal admixture for waterproofing the wetwell from exterior groundwater present. All wet-well sections shall be jointed with “Ram-Nek” joint sealer, or approved equivalent, with primer. The primer shall be applied to all contact surfaces of the concrete wall joint as recommended by the manufacturer.

3. All piping and fittings within a wet well from the pump base to the valve pit shall have an epoxy prime exterior.

4. All exposited metal piping and fittings shall receive TNEMEC, or approved equal, protective coatings with a minimum of 4.0 to 6.0 mils of Series 1028 coating system. The finish coat shall be resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

5. Drains from the valve pits shall discharge back to the wet well and include drain line flapping valve.

6. The valve vault shall house a service tap with pressure gauge reading between 0 and 100 psi on each discharge piping to confirm pump operating point.

7. The valve vault shall house a quick connect hose fitting for emergency bypass pumping.

D. Plug Valves

All plug valves shall be of the non-lubricated, eccentric type conforming to AWWA C517 with resilient faced plugs, and Class 125 ANSI flanges. Valves to 20” size shall be round port or have

a port area equivalent to 100% of full pipe area and all valves 24” and larger shall be 100% port area. Valve body and bonnet shall be made from ASTM A536 Grade 65-45-12 ductile iron or ASTM A126 Class B cast iron, internally and externally coated with 6-mil epoxy. Valve seats shall have a welded-in overlay of high nickel content on all surfaces contacting the plug face. Valves shall have permanently lubricated, stainless steel bearings in the upper and lower plug stem journals. All valves shall have bolted bonnets and adjustable compression packing or self-adjusting U-cup packing that can be replaced without removing the bonnet. All exposed nuts, bolts, springs, and washers shall be zinc plated. O-ring seals are not acceptable.

E. Check Valves

1. Check valves shall be of cushioned ball type and shall meet the materials requirements of AWWA specification C507. The valve shall be cast iron body, bronze mounted, single-seated for non-shock working pressure of 175 psi. The valve shall have one (1) moving part, the ball, which moves automatically out of the path of the flow, providing an unobstructed smooth flow through the valve body. Upon discontinuation of flow, the ball automatically rolls back to the closed position, providing a positive seal against back pressure or backflow. The valve shall be so constructed that by simply unbolting and lifting off the cover, the internal working parts may easily be removed and replaced without removing the valve from the line. Check valves shall be suitable for mounting in horizontal lines or vertical lines when water flow is up. Check valves should close without any hammering action.

F. Pressure Gauge

1. Pressure gauge shall be 0 to 100 psi unless otherwise indicated on the drawings. Gauge accuracy shall be within 0.5% of the total scale range. Provide diaphragm isolators on all gauges so that their materials of construction are resistant to wastewater. Pressure shall be transmitted to the gauge by a locked in and sealed fluid such as ethylene glycol or silicone oil. Elastomer shall be Butyl or Neoprene. The pressure gauge shall be equivalent to Series 40 as manufactured by Red Valve Co. The pressure gauge will be installed in the valve pit upstream of the plug valves. The installation shall include a 3/4" (inch) tap with a stainless-steel nipple and ball valve for isolation. The ball valve shall be stainless steel.

2.02 PUMP DESCRIPTION

A. The pumps and accessories shall be Owner procured and supplied by the pump manufacturer.

B. Equipment acceptance shall be contingent upon the pumps ability to run continuously at full speed for periods up to twenty-four hours. A demonstration may be required by the engineer.

C. The pump offered shall be the manufacturer's standard production model.

2.03 DESIGN REQUIREMENTS

A. Install two (2) Flygt submersible non-clog wastewater N-3000 series pump(s). Each pump shall be equipped with submersible electric motor connected for operation on 460 volts, 3-phase, 60 hertz service, with fifty (50) feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA Approval. The pumps shall be supplied with a mating cast iron four (4) inch discharge connection and be capable of delivering at the operating points noted below. Each pump shall be fitted with twenty (20) feet of lifting chain or stainless-steel cable. The working load of the lifting system shall be 50% greater than the pump unit weight.

1. Upstate Corporate Park Lift Station
   a. 15 HP, 460 V / 3 Phase / 60 Hz, 323 GPM at 78 feet TDH

2.04 PUMP DESIGN

A. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

2.05 GUIDE RAIL BASE ASSEMBLY

A. There shall be no need for personnel to enter the wet well to remove or reinstall the pumps. In a wet pit installation, the discharge base & elbow assembly shall be permanently installed in the wet well and connected to the discharge piping. In order to prevent binding or separation of the pump from the guide rail system, the pumps shall connect to the guide

rail base automatically and firmly, guided by two 2-inch guide pipes extending from the base elbow to the top of the station. Systems using guide cable in lieu of rigid guide bars or pipes shall not be considered acceptable. The sliding guide bracket shall be a separate part of the pumping unit, capable of being attached to standard 4 inch ANSI class 125 or metric DN100 pump flanges, so that the pump mounting is non-proprietary, and any pump with a standard discharge flange can be mounted on the base assembly. Base or bracket assemblies with proprietary or non-standard flange dimensions shall not be considered acceptable.

B. Positive sealing of the pump flange/guide rail bracket to the discharge elbow shall be by metal to metal contact. No portion of the pump shall bear directly on the floor of the sump. The guide rail system shall be available in an optional non-sparking version.

2.06 PUMP CONSTRUCTION

A. Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

B. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or optional Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

C. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

2.07 COOLING SYSTEM

A. Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

2.08 IMPELLER

A. The impeller shall be of Hard-Iron™, ASTM A-532 (Alloy lll A), 25% chrome cast iron, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 6% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. A brass sleeve shall act as a friction clutch allowing for safe motor stoppage in the event of a solid object entering the cutting area without damaging the motor shaft. The Impeller shall be held by an impeller bolt.

2.09 PUMP VOLUTE/SUCTION COVER

A. The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B, non- concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable volute cutting ring containing five spiral-shaped, sharp-edged grooves, five shearing pockets and five sets of cutting teeth. The spiral groove shall provide the relief path and sharp edges across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute. The cutting ring shall be cast of Hard-Iron™, ASTM A-532 (Alloy lll A), 25% chrome cast iron.

2.10 MOTOR

A. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 30 evenly spaced starts per hour. The rotor

bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board, shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.

B. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

C. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

D. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

2.11 MECHANICAL SEALS

A. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten- carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten-carbide seal ring.

B. Each seal interface shall be held in contact by its own spring system.

The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

C. The following seal types shall not be considered acceptable or equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

D. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

E. Where a seal cavity is present in the seal chamber, the area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

F. Seal lubricant shall be non-hazardous.

2.12 PUMP SHAFT

A. Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T.

B. If a shaft material of lower quality than stainless steel – ASTM A479 S43100-T is used, a shaft sleeve of stainless steel – ASTM A479 S43100-T is used to protect the shaft material. However, shaft sleeves only protect the shaft around the lower mechanical seal. No protection is provided in the oil housing and above. Therefore, the use of stainless steel sleeves will not be considered equal to stainless steel shafts.

2.13 BEARINGS

A. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep

groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. **Single row lower bearings are not acceptable.** The minimum L_{10} bearing life shall be 50,000 hours at any usable portion of the pump curve.

2.14 CABLE ENTRY SEAL

A. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

2.15 VALVES AND PIPING

A. Each pump shall be provided with a full flow type check valve with flanged ends and fitted with an external lever and spring. Each valve shall be capable of passing a three (3) inch diameter spherical solid. The valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O-ring, and shall be replaceable. The valve body shall be cast iron and incorporate a cleanout port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O-rings which shall be easily replaceable without requiring access to interior of valve body. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure.

B. The discharge header shall include a check valve and plug valve for each pump to permit pumps to be isolated from the common discharge header. Valves shall have ports designed to pass spherical solids equal to the pumps capability.

C. Valves shall provide visual indication of valve closure, and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion

resistant materials. Diaphragms, if used, shall be of fabric reinforced neoprene or similar inert material. A cleanout port, three (3) inches in diameter, shall be provided for ease of inspection, cleanout, and service. Valves shall be field adjustable for varying discharge heads.

D. Each pump shall be equipped with a glycerin-filled compound gauge to monitor suction pressures, and a glycerin-filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of four (4) inches in diameter, and shall be graduated in feet water column. Rated accuracy shall be one (1) percent of full scale reading. Pressure gauges shall be graduated 0 to 100 psi minimum. Gauges shall be mounted on tapped on discharge piping with service saddle ball valve and pressure gauge. They shall be housed within the valve vault on a discharge piping from each pump to confirm pump operating point. Gauge installations shall be complete with all hoses and stainless steel fittings, and shall include a shutoff valve installed in each gauge inlet at the point of connection to suction and discharge pipes.

E. Piping

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.
2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.
3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.
4. Bolt holes shall be in angular alignment within 1/2^{o} between flanges. Flanges shall be faced with a gasket finish.

F. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

2.16 FINISH

A. Pumps, piping, and exposed steel framework shall be cleaned prior to painting. Exposed surfaces to be coated with one coat gray wide range non-lift primer and one coat white acrylic alkyd wide range enamel. Paint shall be low VOC, alkyd based, high solids, semi-gloss white enamel for optimum illumination enhancement, incorporating rust inhibitive additives. The finish coat shall be 1.0 to 1.2 MIL dry film thickness (minimum), resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final

installation.

2.17 ELECTRICAL CONTROL COMPONENTS

A. The pump control panel shall be Owner procured and supplied by the pump manufacturer. The pump control panel will be tested as an integral unit by the pump manufacturer. The control panel shall also be tested with the pump system as a complete working system at the pump station manufacturer's facility.

B. Panel Enclosure

1. Electrical control equipment shall be mounted within a NEMA 4X stainless steel control enclosure with a single three-point stainless steel padlockable latch. Door shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on a removable steel back panel secured to enclosure with collar studs.

2. All control devices and instruments shall be secured to the sub-plate with machine screws and lock washers. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount and component. All control devices shall be clearly labeled to indicate function.

3. Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures. All installation requiring penetration of the control panel shall be made in such a manner and with approved devices that will maintain the panels' NEMA 4X rating. All conduits entering the control panels or other enclosures from the wet well shall be sealed with gas-tight fittings (Myers type hubs).

B. Sub-Panel

1. Control sub-panel shall be 12-gauge steel with white enamel finish. Sub-panel shall have flanges on at least two sides. All mounting holes shall be drilled and tapped at the least 8/32" and parts mounted with stainless steel machine screws. Self-tapping screws will not be accepted.

C. Inner Door

1. Provide a removable inner swing door for each door of the enclosure. Inner swing doors must be 5052 grade aluminum having a minimum thickness of 0.125 inches. The door shall be adequately sized to enclose all panel-mounted components while having a vertical swing of a minimum of 90 degrees. Inner doors shall be held closed with a durable ¼-turn latch. The doors shall have a brushed high gloss luster. All inner door mounted components will be labeled with phenolic engraved nameplates.

D. Panel Components

1. Pump Circuit Breakers

   a. Heavy-duty, thermal-magnetic molded case pump motor circuit breakers to be manufactured by Square D Company or approved equal.

   b. Pump breakers shall be accessible through inner door.

2. Control Transformer

   a. A control circuit transformer shall be included to provide 115 VAC power to control components.

   b. Fuses selected according to NEC requirements shall protect transformer primary and secondary. Fuse blocks shall be provided with lights for indication of a blown fuse.

   c. Provide two 20 amp, 120v, 1P breakers to feed lights and remote monitoring system.

3. Surge Protective Device (SPD)

   a. SPD with a minimum surge current rating of 40,000A shall be provided. The SPD shall have LED status indicator lights. It shall be manufactured by Square D Company or approved equal.

4. Three Phase Voltage Monitor
   a. A three phase voltage monitor shall be plug-in pin

type as manufactured by Diversified Corporation or approved equal. It shall monitor:

1) Phase failure
2) Phase reversal
3) Low voltage (Brown outs)

5. Pump Protection

a. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125°C (260°F) the thermal switches shall open, stop the motor and activate an alarm.

A leakage sensor shall be available as an option to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will stop the motor and send an alarm both local and/or remote. Use of voltage sensitive solid state sensors and trip temperature above 125°C (260°F) shall not be allowed.

b. The thermal switches and FLS shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be designed to be mounted in any control panel.

6. The pump controller shall be a MPE SC1000 with a 10 point probe as primary level control and a two float backup system.

7. Control relays shall be plug-in blade type with indicator light. They shall be Square D type 4PDT or approved equal.

8. A time delay relay shall be provided to ensure that both pumps do not restart simultaneously in the event of a power loss. Timer shall be Idec type RTE or approved equal.

9. Power terminals and control terminals shall have minimum 1/4” flat head set screws. Terminals shall be mounted on din rail for easy field access.

E. Indication and Operator Interface (mounted on panel inner doors)

1. Each pump will have a three-position switch to select 'Manual-Off-Automatic' position.

2. Each pump shall have elapsed time meter mounted on the inner door. Meters shall be wired to each starter, six-digit, non-resettable, to indicate total run time in hours and tenths.

3. The following indicating lamps shall be provided:

    a. Pump Running per pump (green)

    b. Pump Overtemp per pump (red)

    c. Pump Overload per pump (red)

    d. Pump Seal Failure per pump (red)

4. Pushbuttons shall be provided for:

    a. Alarm Horn Silence (externally mounted)

    b. Reset Motor Overload per pump

5. All lights and switches shall be SKS type manufactured by Square D Company or approved equal.

6. All door-mounted components shall have engraved nameplates (Two-ply laminated plastic; black letters, white background).

F. Alarm System

1. A flashing alarm light with a minimum 40 watt light bulb shall be installed at the panel and located as to be readily visible from the main road. Alarm light shall be approved for vapor tight top installation and shall have a red lexan globe.

2. A weatherproof alarm horn shall be mounted on the side of the enclosure. Horn shall have a minimum 87 DBA output. The horn silencer shall be mounted on the front of the inner door.

3. Alarm horn and light shall be on at high level.

4. SCADA connections shall be provided for all run and alarm signals.

G. Wiring and Labeling

1. Power wiring shall be properly sized MTW rated 90 degrees C. Control wiring shall be red #16 AWG, MTW, rated 90 degrees C. All panel wiring shall have polyester or vinyl-cloth numerically identified labels on each end to indicate wire number. Labels will be manufactured by Phoenix or approved equal. Wire will be neatly routed in the panel through polyester wire duct except from the backplate to the inner door, which shall be wrapped in a separate bundled harness for control.

2. A laminated “As-Built” wiring schematic shall be posted on the inside of the inner door. A data tag with panel and manufacturer information shall be provided on inside of enclosure door.

3. All panel mounted components including control and power terminal strips will be clearly labeled according to provided wiring diagram.

4. All UL labels shall be posted where required by 508A standards.

H. Rating

1. The control panel shall be UL listed and labeled as an industrial control panel under UL 508 procedures.

2. The pump control panels shall be RSI Series as manufactured by RSI Integrators, Inc. or approved equal.

2.18 LIQUID LEVEL CONTROL

A. The manufacturer of the liquid level control system shall be Xylem (Flygt), and the liquid level control system will be tied to

the pump control panel. The liquid level control system shall be a level-sensing probe (primary control) with four (4) pump control elevations as noted on the drawings and two (2) mechanical float type switches (secondary control) at the Pump Off and Alarm elevations as noted on the drawings.

B. The high-water level alarm system shall be tied to existing communication system for Owner operating staff via cell phone.

C. When flow in the wet well reaches the 'lead probe' level, the lead pump starts. If fluid recedes to the off level, the pump shuts off, if not, fluid will continue to rise until it reaches the 'lag probe' level where the lag pump will begin to operate. Both pumps will operate until the fluid in the wet well returns to the off level where both pumps shut off. At each instance when the off float is activated, the alternator automatically reverses the sequence of pump operation allowing for equal usage of the pumps.

D. If level continues to rise to high level, alarm light will flash and horn will sound until alarm silence is pressed.

E. Control sequence shall be designed so that panel functions automatically again after a power failure and manual reset is not necessary. The control sequence shall also be designed to allow operation of the lead float as off and the lag float as lead in the event of off float failure.

2.19 CELLULAR MONITOR

A. Furnish a cellular monitor capable of transmitting alarms and data over a cellular network. The monitor shall be enclosed within the control panel in a NEMA 1 enclosure. The monitor shall be powered by 120 volts AC and have a built-in battery backup capable of keeping the RTU powered for 40 hours in case of primary AC failure. The monitor shall be capable of monitoring up to six (6) digital inputs.

B. The cellular monitor shall be a Mission M153 MyDro Series RTU and shall monitor the following inputs:

1. Pump 1 Run
2. Pump 2 Run
3. Pump 1 Alarm
4. Pump 2 Alarm
5. High Level Alarm
6. Power failure Alarm (Generated internally)

C. Include omnidirectional antenna with 6’ cable.

D. Include one year of prepaid cellular service.

PART 3 - EXECUTION

3.02 EXAMINATION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Pump system manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer’s representative of any unacceptable conditions noted with shipper.

3.03 PREPARATION

A. Construct pre-cast wet well, valve vault with lid/hatch, etc. as shown on drawings.

3.04 INSTALLATION

A. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.05 FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed form the wet well, contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturer’s Start-up Services

1. Coordinate station start-up with manufacturer’s technical representative. The representative or factory service technician will inspect the completed installation. The services of a qualified service engineer to check the installation, supervise start-up, operation, adjust all controls for optimum equipment operation, and instruct and train owners personnel in the proper and most efficient operation and maintenance of the screening system be provided by the manufacturer for minimum 1 Man-Day or

as required for complete installation and start-up.

3.06 CLEANING

A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

B. Remove dirt, grime, marks, etc., from pumps.

3.07 PROTECTION

A. The pumps should be placed into service immediately. If operation is delayed. Pump and its components shall be stored and maintained per manufacturer's written instructions.

3.08 MEASUREMENT AND PAYMENT

A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

SECTION 02780

CASING PIPES FOR UTILITIES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide and install casing pipes or tunnels under surface structures, where indicated, as specified herein, and as needed for a complete and proper installation.

B. Related work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 15 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

1. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01640.

PART 2 – PRODUCTS

2.1 CASING PIPE FOR DRY BORES

A. Steel complying with ASTM A 139 for Grade B with minimum yield strength of 35,000 psi.

B. Provide ends suitable for field welding.

C. Minimum wall thickness as follows:

Diameter of Casing (Inches)	Minimum Wall Thickness (Inches)
6 thru 14	1/4
16 and 18	5/16
20 and 22	3/8
24 and 26	7/16
28 thru 32	1/2

2.2 PIPELINE CASING SPACERS

A. For piping installed in casing provide pipeline casing spacers.

B. Provide a minimum of 1 spacer per ten linear feet of pipe for ductile iron pipe and a minimum of 1 spacer per six linear feet for PVC pipe.

C. Provide spacer with shell of 14 gauge T-304 stainless steel.

D. Provide shell liner of .090” thick PVC, 85-90 durometer.

E. Provide 5/16” stainless steel connecting bolts and lock nuts, minimum three (3) per flange.

F. Runners from 2” wide ultra high molecular weight polymer with a high resistance to abrasion and a coefficient of friction of 0.11 -0.13 in accordance with ASTM D 1894.

G. Support runners on 14 gauge reinforced T-304 stainless steel risers welded to shell.

H. All metal surfaces to be fully passivated.

I. The diameter as measured over the runners shall exceed the pipeline bell or coupling outside diameter.

J. Provide pipeline casing spacers as manufactured by Cascade Manufacturing, Pipeline Seal and Insulator, Inc. or approved equal.

PART 3 – EXECUTION

3.1 ENTRY PITS

A. Locate to avoid interference with traffic, adjacent structures, etc., to such extent possible.

B. Excavate to required depth, providing sheeting and shoring necessary for protection of the Work and for safety of personnel.

C. Maintain in dry condition by use of pumps, drains or other approved method.

D. Provide concrete barricades around each entry pit to secure pit and provide safety from adjacent travel lanes. Provide barricades on side adjacent to the existing roadway and perpendicular to the lanes of travel.

3.2 INSTALLATION

A. Install casings by dry-boring through the casing while simultaneously jacking the casing.

B. Any proposed alternate method shall be approved in writing by the Engineer.

C. Weld joints to provide a watertight joint.

D. Casings for gravity sanitary sewer, storm drainage, or water lines to be installed to grade, shall not vary more than 3/32” per foot of length from the indicated grade.

1. Remove and replace any improperly installed or otherwise defective casing at no additional cost to the Owner.

3.3 INSTALLING PIPE IN CASING

A. GENERAL:

1. Inspect carefully, insuring that all foreign material is removed from the casing and the casing meets alignment criteria for the type of carrier pipe being used.

2. For pressure systems, the casing deflection shall not exceed the maximum deflection recommended by the carrier pipe.

3. Install casing spacers on the carrier pipe per the manufacturer's instructions.

4. For sanitary and storm sewer provide spacer sizing and length necessary to obtain the pipe slope and elevations as shown on the plans.

5. Provide centered or restrained configuration.

6. Install the carrier pipe in the casing ensuring each joint is pushed "home" before the joint is installed into the casing.

3.4 CASING ENDS

A. Seal each end with brick and mortar to prevent entrance of foreign material.

END OF SECTION

SECTION 02930

GRASSING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide grassing of the areas specified herein, or as indicated, for a complete and proper installation.

1. Sanitary sewer easements, including highway and street shoulders: All areas disturbed by the construction operation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Part 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Seed: Conform to all State laws and to all requirements and regulations of the South Carolina Department of Agriculture.

1. Deliver to site each variety of seed individually packaged and tagged to show name, net weight, original and lot number.

C. Fertilizer: Conform to State fertilizer law.

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 01340.

B. Product data: Within 60 calendar days after the Contractor has received the Owner’s Notice to Proceed, submit:

1. Complete materials list of items proposed to be provided under this Section.

1.4 PRODUCT HANDLING

A. Comply with pertinent provisions of Section 01640.

B. At time of delivery, furnish the Engineer invoices of all materials received in order that application rates may be determined.

C. Immediately remove from the site materials which do not comply with the specified requirements, and promptly replace with materials meeting the specified requirements.

PART 2 – PRODUCTS

2.1 FERTILIZER

A. Provide commercial balanced 16-4-12 or 12-4-8 fertilizer delivered to the site in bags labeled with the manufacturer's guaranteed analysis.

2.2 GRASS SEED

A. Provide grass seed which is:

1. Free from noxious weed seeds, and recleaned;

2. Grade A recent crop seed;

3. Treated wit appropriate fungicide at time of mixing;

4. Delivered to the site in sealed containers with dealer's guaranteed analysis.

2.2 LIME

A. Provide agricultural grade, standard ground limestone conforming to current "Rules, Regulations and Standards of the Fertilizer Board of Control" issued at Clemson University.

B. Bag tags or delivery slip for bulk loads shall indicate brand or trade name, calcium carbonate equivalent, and other pertinent data to identify the lime.

2.4 EMULSIFIED ASPHALT (ANIONIC)

A. Provide Grade EA-P meeting the requirements of South Carolina Highway Department Specifications Subsection 406.5, Edition of 1986.

B. If necessary for satisfactory spraying, material shall be diluted at the manufacturing plant with water.

2.5 WOOD CELULOSE FIBER (Not Applicable)

2.6 STRAW MULCH

A. Provide straw or hay material.

1. Straw to be stalks of wheat, rye, barley or oats.
2. Hay to be timothy, peavine, alfalfa, or coastal bermuda.

B. Material to be reasonably dry and reasonably free from mature seed bearing stalks, roots, or bulblets or Johnson Grass, Nutgrass, Wild Onion and other noxious weeds.

2.7 EXCELSIOR FIBER MUCLH (Not Applicable)

PART 3 – EXECUTION

3.1 GENERAL

A. Seed these areas immediately upon completion of grading or construction and clean-up operations.

1. Slopes greater than four horizontal to one vertical.
2. Utility rights-of-way adjacent to stream banks.

B. Areas ready for planting between August 16 and February 28 shall be planted with a temporary cover of Schedule No. 2. At the acceptable seasons for plant Schedule No. 1, the turf shall be destroyed by reworking the soil, and Schedule No. 1 seeding established as specified herein.

C. Use Rate A pounds per 1000 sq. ft. on slopes over 5’ horizontal to 1’ vertical in height and use Rate B pounds per 1000 sq. ft. on slopes less than 5’ horizontal to 1’ vertical.

3.2 SEEDING SCHEDULE

A. TEMPORARY GRASS

JAN 1 – MAY 1

Rye (Grain)	120 lb/Acre
Annual Lespedeza	50 lb/Acre
Mulch (Straw)	4000 lb/Acre
Agricultural Limestone	2000 lb/Acre
Fertilizer 10-10-10	500 lb/Acre

MAY 1 – AUG 15

German Millet	40 lb/Acre
Mulch (Straw)	4000 lb/Acre
Agricultural Limestone	2000 lb/Acre
Fertilizer 10-10-10	500 lb/Acre

AUG 15 – DEC 30

Rye (Grain)	120 lb/Acre
Mulch (Straw)	4000 lb/Acre
Agricultural Limestone	2000 lb/Acre
Fertilizer 10-10-10	500 lb/Acre

B. PERMANENT GRASS

A. February 1–March 31, August 20 – October 25
Grass shall be provided for all disturbed areas. Fertilizer shall be commercial Type 10-10-10. Lime shall be agricultural grade ground limestone, containing at least 34% magnesium carbonate. Seed shall be Bermuda, minimum 90% purity and 80% germination. Areas to be grassed shall be scarified cultivated to a depth of 3-inches with all clods or clumps broken up and foreign material and debris removed. Fertilizer shall be applied at a minimum rate of 1,000 lb/acre. Lime shall be applied at a minimum rate of 3000 lbs/acre. Fertilizer and lime shall be thoroughly worked into the soil and the surface raked smooth before applying seed. Seed shall be applied evenly at the minimum rate of 130 lb/acre and raked in lightly. Seeded areas shall be dressed smooth, then mulch (straw) applied at 4000 lbs/acre. Areas shall be sprayed with emulsion to bind seed and prevent erosion immediately after seeding.

3.3 GROUND PREPARATION

A. Bring all areas to proper line, grade and cross section indicated on the plans.

B. Repair erosion damage prior to commencing seeding operations.

C. Loosen seed bed to minimum depth of 3 inches.

D. Remove all roots, clods, stones larger than 2 inches in any dimension, and other debris.

E. Conduct soil test to determine pH factor.

1. If pH is not in the range of 6.0 to 6.5, adjust.

3.4 APPLICATION OF FERTILIZER

A. Spread uniformly over areas to be seeded.

1. Use approved mechanical spreaders.

B. Mix with soil to depth of approximately 3 inches.

3.5 SOWING METHODS

A. General:

1. Perform seeding during the periods and at the rates specified in the seeding schedules.

2. Do not conduct seeding work when ground is frozen or excessively wet.

3. Produce satisfactory stand of grass regardless of period of the year the Work is performed.

B. Seeding, slopes less than four horizontal to one vertical:

1. Shall conform to Methods EA, WF or WCF as specified hereinafter.

2. Method EA (Emulsified Asphalt):

a. Sow seed not more than 24 hours after application of fertilizer.

b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills.

c. Cover seed and lightly compact with cultipacker if seed drill does not.

d. Within 24 hours following compaction of seeded areas, uniformly apply 0.2 gallons per square yard of emulsified asphalt over the seeded area.

3. Method WF:

a. Sow seed as specified for Method EA.

b. Within 24 hours following covering of seeds, uniformly apply excelsion fiber at the rate of 100 pounds per 1000 square feet.

c. Material may be applied hydraulically or dry. If applied dry, it shall be thoroughly wetted immediately following placing.

d. Seeded areas to be lightly rolled to form a tight mat of the excelsion fibers.

4. Method WCF:

a. Apply seed, fertilizer and wood fiber mulch using hydraulic equipment.

b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed and water.

c. Minimum capacity of slurry tank: 1000 gallons.

d. Apply fiber mulch at rate of 345 pounds per 1000 square foot.

e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts.

f. Apply slurry in a sweeping motion, in an arched stream, so as to fall like rain, allowing the wood fibers to build upon each other.

g. Use color of wood pulp as guide, spraying the prepared seed bed until a uniform visible coat is obtained.

c. Seeding, slopes greater than four horizontal to one vertical:

1. Sow seed as specified for Method EA, unmulched.

2. Apply straw or hay mulch at the rate of 100 pounds per 1000 square feet uniformly to the seeded area. Mulch may be applied by hand, by mechanical spreaders, or by blowers.

3. Hold mulch in place with a tack coat of emulsified asphalt, applied at the rate of 0.2 gallon per square yard.

3.6 SECOND APPLICATION OF FERTILIZER

A. When plants are established and showing satisfactory growth, apply nitrogen at the rate of 1.0 pound per 1000 square feet.

B. Apply in dry form unless otherwise directed by the Engineer.

C. Do not apply to stands of temporary grasses.

3.6 MAINTENANCE

A. Maintain all seeded areas in satisfactory condition until final acceptance of the work.

B. Areas not showing satisfactory evidence of germination within six weeks of the seeding date shall be immediately reseeded, fertilized and/or muched.

C. Repair any eroded areas.

D. Mow as necessary to maintain healthy growth rate until final acceptance of the work.

3.7 ACCEPTANCE

A. Permanently seeded areas (Schedule “B”) will be accepted when the grass attains a height of two inches.

B. No acceptance will be made of temporary seeded areas (Schedule “A”); Rework and seed with Schedule “B”.