TECHNICAL SPECIFICATIONS

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SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

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F. Work Sequence.

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H. Lines and Grades.

I. Connections to Existing Facilities.

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1.2 CONTRACT DESCRIPTION

A. Contract Type: Lump Sum, as set forth in the Bid Form and Agreement

B. Description of Work under this Contract: Construction of the Nashua Maintenance Facility Sewer Improvements will generally include the following:

1. The project consists of the installation of three (3) simplex, grinder pump stations with a common 2-inch force main that will discharge wastewater into an existing manhole of the KCMO First Creek Interceptor Sewer. Each grinder pump station will include a 1 Hp motor and pump with a rated capacity as specified; installed into a 40 gallon wetwell, as specified and recommended by the pump manufacturer. All the necessary appurtenances shall be furnished and installed to provide a complete and functional pressure sewer system. The two existing septic tanks and pump stations will be removed from service in accordance with the Project Documents.

1.3 WORK BY OWNER

A. The Owner will not be performing any work on this project.

1.4 CASH ALLOWANCES NOT USED

1.5 SALVAGE OF MATERIALS AND EQUIPMENT

A. Existing materials and equipment removed and not reused or retained by Owner shall be disposed of by Contractor. Owner will notify Contractor of construction project items which Owner desires to retain.

1.6 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow:
   1. Owner occupancy, operations, and maintenance.
   2. Work by Owner.

B. Construction Operations:
   1. Limited to areas within general limits shown on the Drawings, inside Owners properties and, easements, except where specifically noted on the Drawings.
   2. Contractor may use the areas noted on the Drawings for storage and staging, or designated by the Owner.

C. Time Restrictions: No work shall be done on Sunday, legal holidays, or at night, without the approval of Owner in each case, except such work as may be necessary for the proper care, maintenance and protection of work already done or of equipment and public property covered by the Contract, or to meet demanding time limitations on specific work activities called for under this contract. Approval of Owner shall be sought at least forty-eight (48) hours in advance of such work whenever practicable.
   1. Before Contractor requests work to take place on Sundays, or legal holidays on a repeated basis to expedite the Work or make up for lost progress, Contractor shall first schedule and work five weekdays and Saturdays for at least two weeks prior.

D. Unfavorable Construction Conditions: During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine his operations to Work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

E. Utility Outages and Shutdown: Brief shutdown of utilities, other than described herein, will be acceptable to Owner provided that the duration does not exceed one-half hour, and at least 48 hours prior notice has been given by Contractor.

1.7 WORK SEQUENCE

A. The suggested construction sequence specified herein has been developed to serve as a guide to Contractor for development of a complete and comprehensive construction schedule in accordance with Section 01300 - Submittals. The Contractor shall expand the construction schedule from the suggested sequence of construction presented herein. Contractor shall address in his construction schedule, the sequence of construction to be followed for each of the elements of Work identified herein and any other construction activities required for completion of the Work required by the Contract Documents. Alternatives to the suggested sequence of construction will be considered only if they offer advantages of fewer disruptions to facility operation, fewer or shorter duration shutdowns for facility tie-ins, or reduced risk of permit violations. The suggested sequence of construction shall not relieve Contractor from any Work required by the Contract Documents nor from meeting the Contract Times specified in the Agreement.

B. Suggested Sequence of Construction:
   1. Install the pressure system force main as indicated on the Drawings,
   2. Install the three grinder pump stations, with connections made to the common force main.
   3. Test the new pressure sewer system and place in service to transfer the three sewer services over to the new pressure system.

1.8 CRITICAL ACTIVITIES: Critical Activities: The following portions of the work relate to modifications of the existing facilities which will require careful advance planning and coordination with Owner. Contractor shall notify Owner and Engineer at least three days prior to the commencement of the following activities, and shall discuss the work plan with Owner and Engineer. The following time limitations shall also apply. All days are calendar days.

A. Contractor shall work with Owner to schedule tasks that limit the down time of the following:
   1. Minimize the sewer service down time to the existing buildings and vehicle wash down facility as services are transferred to the pressure sewer system.

B. Contractor shall make every effort to meet the above mentioned time limitations, recognizing that Owner may encounter fines, financial loss, or additional operating costs if these limitations are not met. It is understood that if Contractor does not meet these limitations, Contractor shall reimburse Owner for the resultant costs incurred, or Contractor shall make and pay for alternate arrangements to avoid loss on the part of Owner, excepting delays beyond Contractor's control, as provided under Paragraph 12.03 of the General Conditions. Alternate arrangements shall be acceptable to Engineer. Engineer shall be the judge of what constitutes fair and reasonable losses which shall be reimbursable by Contractor. If Contractor and Engineer cannot agree upon the monetary amount, then liquidated damages will be assessed as for failure to meet Final Acceptance, as set forth in the Agreement.

1.9 OWNER OCCUPANCY

A. The Owner will periodically require access to the facility during the entire period of construction. To the extent possible, Owner's personnel will restrict activities to not interfere with construction.

B. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

1.10 LINES AND GRADES

A. All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

B. Basic horizontal and vertical control points will be established or designated by Engineer. Such control points shall be used as datum for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as part of the Work.

C. Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of the Work. In addition, Contractor shall furnish, without charge, competent persons from his force and other tools which Engineer may require in checking survey, layout, and measurement work performed by Contractor.

D. Contractor shall keep Engineer informed, a reasonable time in advance, of the times and places at which he wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by Engineer may be done with minimum inconvenience to Engineer and minimum delay to Contractor.

1.11 CONNECTIONS TO EXISTING FACILITIES

A. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, telephone, and electric. In each case, Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

B. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Overtime work shall be scheduled with and approved by Owner in advance, as required within.

C. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

1.12 CUTTING AND PATCHING

A. As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

B. Contractor shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:
   1. Removal of improperly timed Work.
   2. Removal of samples of installed materials for testing.
   3. Alteration of existing facilities.
   4. Installation of new Work in existing facilities.

C. Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without Engineer's concurrence.

D. Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvageable shall be removed from the site by Contractor.

E. All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

F. Restoration of pavement and other surface construction shall be performed in accordance with the applicable specification section.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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SECTION 01019

CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule of values.

B. Application for payment.

C. Change procedures.

D. Defect Assessment.

1.2 RELATED SECTIONS

A. Section 01600 - Material and Equipment: Product substitutions and options.

1.3 SCHEDULE OF VALUES

A. Submit a printed schedule on Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 10 days after date of Owner-Contractor Agreement.

C. Schedule of values shall represent a fair, reasonable, and equitable dollar cost allocation for each major work activity on Contractor's construction schedule. Schedule of values shall not be imbalanced. Engineer may declare a work task imbalanced and require Contractor to adjust values if the scheduled value differs significantly from an industry standard value or commonly accepted unit price guide.
   1. The work activities shall be subdivided in sufficient detail to serve as the basis for progress payments during construction.
      a. Items of equipment shall be itemized to divide bare equipment shipped to site, installation, and start-up services.
   2. With the exception of major equipment items, no single work activity or unit in the schedule of values shall be assigned a cost greater than ten thousand dollars ($10,000.00).

D. Revise schedule to list approved Change Orders, and resubmit with each Application for Payment.

E. Schedule of Values may serve as basis for estimating credits to Work for items deleted or reduced, or for pricing of items added to the Contract of a similar nature.

1.4 APPLICATIONS FOR PAYMENT

A. Submit five copies of each application. Contractor shall use EJCDC Form C-620 (2007 Edition). Contractor may use an electronic media driven form if essentially equivalent to the EJCDC form, and provided that the Contractor's Certification clause and Engineer's signature block are used verbatim from the enclosed form.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Payment Period: Monthly.

D. Include an updated construction progress schedule; monthly.

1.5 CHANGE PROCEDURES

A. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by the General Conditions by issuing a Field Order. Contractor shall execute the form and return to Engineer within 2 working days.

B. The Engineer may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within 15 days.

C. The Contractor may propose changes by submitting a request for change to the Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01600 - Material and Equipment.

D. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Engineer.

E. Work Change Directive: Engineer may issue a directive, on EJCDC form C-940, Work Change Directive, signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute the change.

F. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract. Engineer will determine the change allowable in Contract Price and Contract Time as provided in the Contract Documents.

G. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work. Time charges for labor and equipment must be approved and initialed by the Resident Project Representative.

H. Change Order Forms: Form EJCDC C-941, Change Order.

I. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.6 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct an appropriate remedy or adjust payment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal Procedures.

B. Construction Progress Schedules.

C. Proposed Products List.

D. Submittal of Shop Drawings and Data.

E. Resubmittal of Shop Drawings and Data

F. Product Data.

G. Shop Drawings.

H. Certificates.

I. Manufacturer's Instructions.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal with submittal form acceptable to Engineer.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix. For example, the first submittal under Section 15100 would be numbered "15100-01", and a re-submittal of the same item(s) would be numbered "15100-01a".

C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. If Contractor affixes a stamp to the submittal which says "exceptions noted" or a clause to similar effect, Contractor shall specifically list all exceptions.

E. Submittal Checklist: Where specification sections list specific items to be included in the submittal, manufacturer or supplier shall make a copy of the list and include it as a checklist. Each item shall be checked that it is included. If an item is not included, an explanation as to why it was not included must be attached. If items are not included and/or an explanation why that item is not included is not attached, Engineer will return the submittal without review marked as "Revise and Resubmit". If no checklist is present, the submittal will not be reviewed until a manufacturer or supplier generated checklist is received.

F. Schedule submittals to expedite the Project, and deliver to Engineer at business address. Coordinate submission of related items.

G. Submittal Review Period by Engineer: For each submittal for review, allow fifteen (15) days excluding delivery time to and from Contractor, provided submittals are complete.

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

I. Provide space for Contractor and Engineer review stamps.

J. Conform with specific submittal requirements given in the individual sections of the specifications.

K. When revised for re-submission, identify all changes made since previous submission.

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

M. Submittals not requested will not be recognized or processed.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedule in duplicate within fifteen (15) days after date established in Notice to Proceed.

B. Revise and resubmit on a monthly basis with the application for payment.

C. Submit a horizontal bar chart with separate line for each major portion of Work or operation, identifying first work day of each week.

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

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

F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.

1.4 PROPOSED PRODUCTS LIST

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

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

1.5 SUBMITTAL OF SHOP DRAWINGS AND DATA

A. Submittals of shop drawings and data pertaining to equipment, materials, and products to be incorporated into the work shall be submitted to Engineer well before such equipment, materials, and products are incorporated into the Work. Payment will not be made for equipment, materials, and products delivered to the site or incorporated into the Work until submittals pertaining to such are acceptable to Engineer.

B. Engineer's review of shop drawings and data is for the limited purpose of checking for general conformity with the design concept expressed in the Contract Documents. Engineer's review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment,

device or item shown. Engineer's review shall not relieve Contractor of Contractor's responsibility for errors, omissions, or deviations in the drawings and data, nor of the sole responsibility for compliance with the Contract Documents.

C. It shall be Contractor's responsibility to see that submittals which require revisions or re-submission receive such in a timely manner.

1.6 RESUBMITTAL OF SHOP DRAWINGS AND DATA

A. Contractor shall accept full responsibility for the completeness of each re-submittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided in the re-submittal.

B. Requirements specified for initial submittals shall also apply to re-submittals. Re-submittals shall bear an identification number as specified herein.

C. When corrected copies are re-submitted, Contractor shall in writing direct specific attention to all revisions and shall list separately any revisions made other than those called for by Engineer on previous submissions.

D. If more than one re-submission is required because of failure of Contractor or supplier to provide all previously requested corrected data or additional information, Contractor shall reimburse Owner for the charges of Engineer for review of the additional re-submissions. This does not include initial submittal data such as shop tests and field tests which are submitted after initial submittal, or additional information requested by Engineer that is not an item required by the project manual.

E. Re-submittals shall be made within 40 days of the date of the transmittal returning the material to be modified or corrected, unless within 30 days Contractor submits a written request for an extension of the stipulated time period, listing the reasons the re-submittal cannot be completed within that time.

F. Any need for more than one re-submission, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Times unless delay of the Work is directly caused by a change in the Work authorized by a Change Order or by failure of the Engineer to review any submittal within the submittal review period specified herein and to return the submittal to Contractor.

1.7 PRODUCT DATA

A. Product Data for Review:
   1. Submitted to Engineer for review.
   2. After review, provide copies and distribute in accordance with submittal procedures article above and for record documents purposes described in Section 01700 - Contract Closeout.

B. Product Data for Information:
   1. Submitted for Engineer's knowledge as contract administrator or for Owner.

C. Product Data for Project Close-out:
   1. Submitted for Owner's benefit during and after project completion.

D. Submit the number of copies which Contractor requires, plus three (3) copies which will be retained by Engineer.
   1. In lieu of hardcopy submittals, Contractor may submit to Engineer electronically in Adobe PDF format. Submittals will be reviewed and returned to Contractor electronically in Adobe PDF format.

E. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

F. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

G. After review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01700 - Contract Closeout.

1.8 SHOP DRAWINGS

A. Shop Drawings for Review:
   1. Submitted to Engineer for review.
   2. After review, produce copies and distribute in accordance with submittal procedures article above and for record documents purposes described in Section 01700 - Contract Closeout.

B. Shop Drawings for Information:
   1. Submitted for Engineer's knowledge as contract administrator or for Owner.

C. Shop Drawings for Project Close-out:
   1. Submitted for Owner's benefit during and after project completion.

D. Submit the number of opaque reproductions which Contractor requires, plus three (3) copies which will be retained by Engineer.

E. Upon agreement of both Owner and Engineer, Contractor may submit shop drawings electronically in Adobe Acrobat (.pdf) format in lieu of hard copies as specified in Paragraph D above.

1.9 CERTIFICATES

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

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

1.10 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer, as specified in Section 01700 - Contract Closeout.

B. Manufacturer's instructions (Operation and Maintenance Data) shall be submitted in timely manner as set forth in Section 01700 - Contract Closeout.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

D. Submit the number of copies set forth in Section 01700 - Contract Closeout.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality Assurance - Control of Installation.

B. References and Standards.

C. Testing Services.

D. Resident Observation.

E. Offsite Inspection.

F. Examination.

G. Preparation.

1.2 RELATED SECTIONS

A. Section 01010 - Summary of Work.

B. Section 01300 - Submittals: Submission of manufacturers' instructions and certificates.

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

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

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

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

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

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

1.4 REFERENCES AND STANDARDS

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids, except where a specific date is established by code.

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

D. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 TESTING SERVICES

A. All testing shall be performed by an independent materials testing firm selected by Owner and Engineer. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified or applicable standards.

B. Testing Services paid for by Contractor. Unless otherwise specified, Contractor shall pay for all testing services in connection with the following, as incidental to the Work.
   1. Concrete materials and mix designs. Submit in accordance with Section 01300 - Submittals.
   2. All other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work.

C. Testing Services paid for by Owner. Unless otherwise specified, Owner shall pay for all testing services in connection with the following, as incidental to the Work.
   1. Soils testing (materials gradation and moisture density tests, field compaction tests, etc.) in accordance with Section 02320 - Earthwork and Trenching.
   2. Concrete job cylinders, as specified.
   3. Concrete on-site testing. Perform concrete testing as required in Section 03300 - Cast-in-Place Concrete.

D. Testing, including sampling, will be performed by the testing firm's laboratory personnel, in the general manner indicated in the Specifications. Owner or Engineer, if present, shall determine the exact time, location, and number of tests, including samples.

E. Contractor shall arrange for delivery of samples and specimens for tests to the testing firm's laboratory. The testing firm's laboratory shall perform all laboratory tests within a reasonable time consistent with the specified standards and shall furnish a written report of each test.

F. Contractor shall furnish all sample materials and cooperate in the sampling and field testing activities, including sampling. Contractor shall interrupt the Work when necessary to allow testing, including sampling, to be performed. Contractor shall have no claim for an increase in Contract Price or Contract Times due to such interruption. When testing activities, including sampling, are performed in the field by Engineer or the testing firm's laboratory personnel, Contractor shall furnish personnel and facilities to assist in the activities.

G. Written reports of tests shall be submitted to Engineer. Testing lab shall submit the number of copies which Contractor requires, plus three (3) copies which will be retained by the Engineer.

H. Owner may elect to provide additional testing services for the sole benefit of Owner. Testing services provided by Owner are for the sole benefit of Owner; however, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.

1.6 RESIDENT OBSERVATION

A. Engineer will provide the Resident Project Representative or Resident Observer to perform resident observation services of all Work.

B. Cooperate with Resident Observer; furnish safe access and assistance by incidental labor as requested.
   1. Notify Engineer twenty-four (24) hours prior to expected time for construction operations requiring observation services.

C. Resident Observation does not relieve Contractor to perform Work to contract requirements.

1.7 OFFSITE INSPECTION

A. When the Specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services will be performed by Engineer or an independent testing firm or inspection organization acceptable to Owner.

B. Contractor shall give appropriate written notice to Engineer not less than 10 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

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

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

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

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

3.2 PREPARATION

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

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

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

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SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, ventilation, telephone service, water and sanitary facilities.

B. Temporary Controls: Barriers, fencing, protection of the Work, damage to existing property, and water control.

C. Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary buildings.

1.2 RELATED SECTIONS

A. Section 01700 - Contract Closeout: Final cleaning.

1.3 TEMPORARY ELECTRICITY

A. Cost: By Owner; connect to Owner's existing power service. Do not disrupt Owner's use of service. Owner will pay cost of energy used. Exercise measures to conserve energy.

B. Provide temporary electric feeder from electrical service at location indicated on the Drawings. Owner's utility personnel will make service connection.

C. Power Service Characteristics: Power service and requirements may differ by site. See Drawings for electrical service at each location. Coordinate with local electrical utility.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

E. Provide main service disconnect and over-current protection at meter.

F. Permanent convenience receptacles may not be utilized during construction.

G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Temporary lighting, if required by Contractor, shall be provided by Contractor.

1.5 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.6 TELEPHONE SERVICE

A. Provide, maintain, and pay for telephone service to field office at time of project mobilization. Engineer and Resident Project Representative shall be allowed use of Contractor’s telephone facilities, unless separate telephone service is provided by Contractor for this purpose.

1.7 FACSIMILE SERVICE

A. Provide, maintain and pay for facsimile service and a dedicated telephone line to field office at time of project mobilization.

B. A mobile fax machine and cellular phone service, assigned to Contractor's Personnel, will be acceptable in lieu of the above.

1.8 TEMPORARY WATER SERVICE

A. Connect to existing water source for construction operations at time of project mobilization.

B. Owner will pay for cost of water used. Make efforts to conserve water.

1.9 TEMPORARY SANITARY FACILITIES

A. Contractor shall furnish temporary sanitary facilities at each site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

B. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent.

C. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.

1.10 BARRIERS

A. Provide barriers to prevent unauthorized entry to hazardous construction areas to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.11 FENCING

A. All existing fences, affected by the Work, shall be maintained by Contractor until completion of the Work.

B. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the Engineer and alternative temporary fencing has been agreed upon.

C. Prior to final acceptance, Contractor shall restore all fences to their original or to a better condition, as specified in the fencing specifications, and to their original location, unless indicated otherwise on the Drawings.

1.12 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.13 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.14 PROTECTION OF INSTALLED WORK

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

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

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

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

F. Prohibit traffic from landscaped areas.

1.15 DAMAGE TO EXISTING PROPERTY

A. Contractor will be held responsible for any damage to existing structures, Work, materials or equipment, because of his operations, and shall repair or replace any damaged structures, Work, materials or equipment to the satisfaction of, and at no additional cost to Owner.

B. Contractor shall protect all existing structures and property from damage, and shall provide bracing, shoring or other work necessary for such protection.

C. Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or men to or from the Work. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

1.16 PARKING

A. Arrange for temporary parking areas to accommodate construction personnel.

B. When site space is not adequate, provide additional off-site parking.

1.17 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.18 PROJECT IDENTIFICATION

A. Contractor, at his/her option, may erect one project sign on the site for the duration of the Project. Sign shall be no larger than 25 square feet in size and shall meet all applicable local codes. Sign shall give project title, and names of the Contractor, Owner, and Engineer.

B. Erect on site at location acceptable to Owner.

C. No other signs are allowed without Owner permission except those required by law.

1.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Final Application for Payment.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Installation and Operation.

E. Product options.

F. Substitutions.

G. Equipment Function and Controls.

H. Lubricants.

I. Warranties.

J. Extended Warranties.

1.2 RELATED SECTIONS

A. Instructions to Bidders: Product options and substitution procedures.

B. Section 01750 - Starting of Systems

1.3 PRODUCTS

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

B. Provide interchangeable components of the same manufacturer for components being replaced.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle Products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

A. Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.

B. Store and protect Products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive Products in weather tight, climate controlled enclosures, in an environment favorable to Product.

E. Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings, shall be stored in weather tight structures maintained at a temperature above 60°F. Equipment, controls and insulation shall be protected against dust, moisture and water damage.

F. For exterior storage of fabricated Products, place on sloped supports above ground.

G. Provide insured off-site storage and protection when site does not permit on-site storage or protection.

H. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

I. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

J. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement or damage.

K. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.6 INSTALLATION AND OPERATION

A. Equipment shall not be installed or operated, except by or with the guidance of qualified personnel having the knowledge and experience necessary to obtain proper results. When so specified, or when employees of Contractor or his Subcontractors are not qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.

B. Qualified field representatives shall be provided by the equipment manufacturers, as required, to perform all manufacturer's field services called for in the Specifications.

C. Manufacturer's field representatives shall observe, instruct, guide and direct Contractor's erection or installation procedures, or perform an installation check, as required. The field representative shall revisit the site as often as necessary to attain installation satisfactory to Engineer.

D. All equipment installed under this Contract shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.

E. Acceptance of Work, in connection with the installation of equipment furnished by others, will be subject to approval of the field representative. Contractor shall be responsible for planning,

supervising and executing the installation of Work, and the approval or acceptance of Engineer will not relieve Contractor of responsibility for defective Work.

1.7 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers where substitutions are not prohibited: Submit a request for substitution for any manufacturer not named, in accordance with the following article.

C. Products Specified by Naming One or More Manufacturers and Prohibiting Substitutions: No substitutions shall be permitted.

D. Products Designated as Base Bid Equipment in the Bid Form: No substitutions will be permitted for base bid equipment after execution of the Agreement. Proposed substitutes for base bid equipment, may be submitted to Engineer for consideration during the bid advertisement period, subject to the time limitations and requirements set forth in the Instructions to Bidders. In such case, the following article shall not apply to substitutes for base bid equipment items.

1.8 SUBSTITUTIONS

A. The term "Substitutions", as discussed under this subpart, applies to any product which is not named in the specifications and which is proposed by Contractor as an "or-equal" item or a "substitute" item. Substitutions are discussed in Article 6.05 of the General Conditions.

B. No substitutions will be permitted for base-bid equipment. Bidders may propose substitutes for base bid equipment items during the advertisement period, as set forth in the Instructions to Bidders.

C. Engineer will consider requests for Substitutions only within 45 days after date established in Notice to Proceed.

D. Substitutions may be considered at any time after Notice to Proceed when a Product becomes unavailable through no fault of the Contractor.

E. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents. Contractor shall indicate if his request is intended as an "or-equal" item or a "substitute" item.

F. A request constitutes a representation that the Contractor:
1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
2. Will provide the same warranty for the Substitution as for the specified Product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner and Engineer for review or redesign services associated with re-approval by authorities.

G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require revision to the Contract Documents.

H. Substitution Submittal Procedure: As set forth in Article 6.05 of the General Conditions, and as modified below:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Engineer will notify Contractor, in writing, of decision to accept or reject request.

1.9 EQUIPMENT FUNCTION AND CONTROLS

A. The Contract Drawings and Specifications present operational descriptions, sequences of operation, circuit diagrams, and component requirements for automated equipment and control systems. These have been prepared by Engineer to communicate the design intent and aid in bidding the Work. This information is not necessarily detailed enough to serve as installation guides for wiring equipment and controls components. It is the responsibility of Contractor and Contractor's electrical subcontractor to:
   1. Coordinate among themselves and the various suppliers to provide a system which functions as specified.
   2. Review shop drawings and submittals to ensure compatibility and avoid conflicts and duplication.
   3. Employ on the site at least one supervisor who is knowledgeable and experienced in electrical wiring and controls, and who can read and interpret circuit schematics and wiring diagrams, in accordance with the General Conditions. Copies of all pertinent shop drawings and submittals shall be kept on hand by workers.

B. If a supplier takes exception to the Drawings and Specifications, or proposes to modify the equipment and controls to provide what he believes is a more functional and serviceable system, Contractor shall bring such proposed changes to the attention of Engineer as early as possible, but not later than the submittal review process. By affixing his stamp of approval, Contractor certifies that he approves of all changes proposed and required by the submittal, and agrees that such changes will be made at no additional cost to Owner. Contractor may not void this certification and acceptance of additional requirements by affixing a stamp of "exceptions noted", whether or not the exceptions are delineated. If Engineer allows such changes by virtue of submittal review, Contractor shall be responsible for the resultant changes to other systems, including but not limited to additional circuits.

1.10 LUBRICANTS

A. For each pump and individual item of mechanical process equipment, the manufacturer shall furnish to Owner all oils, greases, and other lubricants recommended for proper operation in sufficient quantities to last for two (2) years at manufacturer's suggested schedule of maintenance and lubrication, under normal operating conditions. These quantities shall be in addition to that required by Contractor for start-up and commissioning. All containers shall be clearly labeled with product name and name of associated equipment.

1.11 WARRANTIES

A. For warranties by suppliers or manufacturers of materials and equipment, it shall be understood, unless specifically stated in the individual section, that:
   1. Warranties shall be for a period of one (1) year and shall commence on the date of Final Acceptance.
   2. Warranties shall be in the name of the Owner.
   3. Replacement is full and not prorated.
   4. Manufacturer's or supplier's liability cannot be limited to some arbitrary value selected by the manufacturer or supplier.

5. Owner will cover the cost of equipment delivery to the manufacturer's or supplier's local service center in the Kansas City, MO metro area. Manufacturer or supplier shall cover return shipping.
6. If Owner makes a claim against the warranty for a defect in manufacturing or installation, it shall be the responsibility of the manufacturer or supplier to prove the claim is NOT a cause of a defect in manufacturing or installation. If the manufacturer or supplier cannot prove the claim is not a result of defect in manufacturing or installation, the claim shall be honored.

1.12 EXTENDED WARRANTIES

A. Certain items require extended warranties as set forth in individual sections. It is the intent that this extended warranty be provided by the manufacturer of the equipment or item. Contractor is directly responsible for installation and performance of equipment during the one year correction period. After the one year, Owner will pursue equipment warranty matters directly with the respective manufacturers, unless it becomes evident that the equipment was improperly installed by the Contractor.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Project record documents.

D. Operation and Maintenance Data.

E. Spare Parts and Maintenance Products.

1.2 RELATED SECTIONS

A. Section 01500 - Construction Facilities and Temporary Controls.

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.

B. Submit final Application for Payment identifying total adjusted Contract Price, previous payments, and sum remaining due.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean site, remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 PROJECT RECORD DOCUMENTS

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

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

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

D. Record information concurrent with construction progress.

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

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Details not on original Contract drawings.
   2. Record Drawings shall be maintained and updated throughout the Work, and presented at each progress meeting for review by Engineer.

G. Submit documents to Engineer with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2x11 inch (A4) text pages, in D side ring binders (binding rings mounted on back cover) with durable plastic covers. All binders shall be same size, style, and color. Binders shall be no more than 75 percent full.

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

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Information contained in Operation and Maintenance Instructions shall be specific to the products provided under this Contract. If data sheets, manuals, diagrams and other information applies to several models or types, the applicable model shall be clearly indicated and the information which does not apply shall be crossed out. Furnished options, including materials options, shall be clearly indicated.

E. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on 20 pound white paper, in three parts as specified below. Additional requirements given in individual specification sections shall also apply.
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and equipment Suppliers.
   2. Part 2: Operation and Maintenance Instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment
      c. Parts list for each component, with arrangement diagram.
      d. Spare parts
      e. Operating instructions
      f. Maintenance instructions for equipment and systems
      g. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
      h. Warranties
      i. Copies of equipment start-up reports certified by manufacturer's representative with start-up dates.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data
      b. Air and water balance reports
      c. Originals and Photocopies of warranties and any guarantees.

F. Timing of Submittals:

1. At 90 percent completion, Contractor shall assemble two (2) complete copies of Operations and Maintenance Instructions. This 90 percent draft shall contain operation instructions, maintenance data, and warranties for all equipment and other items requiring such. Contractor shall not submit Operations and Maintenance Instructions as individual sections or in a "piece meal" fashion. Contractor shall submit complete volumes of the manuals as specified herein.
   a. Note: Engineer will not begin review of draft Operations and Maintenance Instructions until shop drawing and data submittals have been submitted and corrected in accordance with Section 01300 - Submittals.
   b. This draft copy will be reviewed and returned, with Engineer comments and directions for arrangement.
   c. Revise manuals per Engineer comments. Revise 90 percent documents also to reflect changes made during start-up and commissioning.
2. Submit four (4) sets of revised final volumes, prior to final inspection. Contractor shall revise Operation and Maintenance Manuals as required and directed by Engineer to reflect changes made prior to final completion. One set will be retained by the Engineer, and three sets will be retained by Owner. Deliver final volumes to Engineer and Owner. Final volumes must be received by Engineer prior to application for final payment.

1.7 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide maintenance, and extra products in quantities specified in individual specification sections.

B. Contractor shall store and be responsible for all spare parts and furnished lubricants until acceptance by Owner at final completion. No materials shall be turned over to Owner before this time. Contractor shall organize spare parts and ensure that parts are neatly packaged and clearly and permanently labeled with description, supplier name, and project manual section number.

C. Contractor shall meet with resident project representative (or Engineer) and Owner representative to hand over spare parts all at once. Engineer will provide a written log which will be initialed by Contractor and Owner. Items missing from the list of parts required by Contract Documents shall be delivered to Owner prior to application for final payment. Items which are damaged shall be replaced by Contractor.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01750

STARTING OF SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Starting Systems.

B. Manufacturer's Field Services

C. Demonstration and Training.

D. Testing, Adjusting and Balancing.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals: Manufacturers field reports.

B. Section 01700 - Contract Closeout: System operation and maintenance data and extra materials.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer seven (7) days prior to start-up of each item.

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

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

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

F. Execute start-up in accordance with manufacturers' instructions, and under supervision of manufacturer's representative, if required.

1.4 MANUFACTURER'S FIELD SERVICES

A. An experienced, competent and authorized representative of the manufacturer of each item of equipment for which start-up services are indicated in the specification sections shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is placed in operation.

B. The manufacturer's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

C. Each manufacturer's representative shall furnish to Engineer, through Contractor, a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated

under full load conditions; and that it operated satisfactorily. Copies of this report shall be included with the O&M manuals.

D. All costs for these services shall be included in the Contract Price.

1.5 DEMONSTRATION AND TRAINING

A. Demonstrate general operation of Products to Owner's personnel at start-up.

B. Demonstrate Project equipment instructed by a qualified manufacturers' representative who is knowledgeable about the specific equipment and systems on this Project. The training session shall occur on a separate visit from start-up services, unless otherwise permitted by Engineer and Owner.

C. Timing of Training: Contractor shall schedule training sessions for all required systems.
   1. Training program may commence individually at start-up of a given system. All sessions need not be complete to meet the contract deadline for final completion, but all must be completed prior to Owner making final payment to Contractor.
   2. Contractor shall submit proposed schedule to Engineer at least two (2) weeks prior to first scheduled session. Engineer will review with Owner and may require Contractor to revise and resubmit to conform to Owner's schedule.

D. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
   1. If final Operation and Maintenance manuals are not yet available when start-up occurs, provide additional copies of draft Operation and Maintenance Instructions for use by Owner's personnel.

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

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

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

1.6 TESTING, ADJUSTING, AND BALANCING

A. Contractor shall employ services of an independent firm to perform testing, adjusting and balancing.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02320

EARTHWORK & TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall perform all excavation, embankment, trenching, backfilling, cushioning, surface dressing, dewatering, shoring, surface restoration and disposal of waste as required for site grading, structures, piping, and appurtenances as shown on the Drawings.

1.2 SECTION INCLUDES

A. Pipe Embedment Material.

B. Crushed Rock.

C. Fill Materials.

D. Impervious Trench Check Material.

E. Classification of Materials

F. Site Clearing.

G. Subgrade Preparation.

H. Earthfills and Embankments.

I. Excavation.

J. Pipe Embedment Schedule.

K. Backfilling.

L. Surface Restoration.

M. Disposal of Materials.

N. Soil Testing.

1.3 RELATED SECTIONS

A. Section 02530 - Piping System Products.

B. Section 02535 - Piping Systems Installation.

C. Section 02922 - Seeding.

D. Section 03300 - Cast In Place Concrete.

1.4 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the section requirements shall govern.

A. American Society for Testing Materials (ASTM):
1. D-698 - Moisture-Density Relations of Soils, Using 5.5 Pound (2.5 kg) Rammer and 12-Inch (304.8 mm) Drop.
2. D-1140 - Test Method for Amount of Material in Soils Finer Than the No. 200 (75μm) Sieve.
3. D-2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
4. D-3017 - Standard Test Methods for Water content of Soil and rock by Nuclear Methods.

1.5 SUBMITTALS: The Contractor shall submit the following items required by this division in accordance with Section 01300 - Submittals.

A. Product data for review: Soil test results as specified herein for soil testing.

1.6 DEFINITIONS

A. Earth excavation: Earth excavation is defined as the removal of all material whose removal is not defined as rock excavation.

B. Pipe embedment: Pipe embedment is defined as soil or stone aggregate material placed under, around, and in some cases over the pipe. The material type and extent of embedment is specified herein and shown on the Drawings.

C. Trench backfill: Trench backfill is defined as soil or stone aggregate material placed in a pipe or utility trench, above the pipe embedment and up to the existing ground surface, finished grade, or the bottom of pavement.

D. Structure backfill: Structure backfill is defined as soil or stone aggregate material placed around or above subsurface structures, such as manholes, vaults, foundations, and wetwells.

1.7 MAINTENANCE OF WORK: The Contractor shall be responsible for the satisfactory compaction and maintenance of all completed excavation, embankment, and backfill. If, prior to the expiration of the General Guaranty period stipulated in the Front End Documents, any grades or subgrades are found to have settled or eroded, they shall be reworked immediately by the Contractor and restored to the specified grades, and the surface restored.

1.8 REGULATORY REQUIREMENTS

A. The Contractor shall conform to Kansas Statute Annotated 66-1801-66-1814 for obtaining information from the various owners of underground facilities prior to performing excavation.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials shall conform to the respective references listed above and other requirements specified herein.

B. Topsoil, and material required for structural backfill and trench backfill in excess of suitable material excavated from trenching and structural excavation shall be furnished by the Contractor at no additional cost to the Owner.

2.2 PIPE EMBEDMENT MATERIAL: Granular Embedment Material: Granular embedment material for installation in pipe trenches and other locations indicated on the Drawings shall be crushed stone conforming to the 2007 MCIB Concrete Standards, Section 2.1.D for coarse aggregate meeting the gradation specified under Column IV, Table 2.1.D-1 for 2-inch aggregate with the modification that the maximum allowable percentage of material finer than No. 200 sieve shall be between 2.0% and 5.0% as determined by ASTM C-117. The gradation is repeated below for information:

Sieve Size	Percent Passing
3/4"	100
1/2"	80 - 100
3/8"	40 - 70
No. 4	0 - 15
No. 8	0 - 5
No. 200	0 - 3

2.3 CRUSHED ROCK: Crushed rock for use beneath concrete slabs and structures, and in other locations shown on the Drawings, shall be freely draining, siliceous gravel or crushed stone aggregate, conforming to 1999 Missouri Standard Specifications for Highway Construction, Section 1007, Type 1007.4.3. The gradation is repeated below for information:

Sieve Size	Percent Passing
1"	100
1/2"	55 - 90
No. 4	8 - 40
No. 10	0 - 15
No. 200	0 - 4

2.4 FILL MATERIALS

A. Random Fill Material: Random fill material for earthfills, embankments and other uses, shall be a soil material which is free from: rocks or stones larger than 6 inches in greatest dimension, brush, stumps, logs, roots, debris, top soil, and organic or harmful materials. The portion of fill material passing the No. 40 sieve shall have a liquid limit not exceeding 40 and a plastic limit not exceeding 25, when tested in accordance with ASTM D-4318. To the extent possible, site excavated material may be used. Random fill material shall be imported if suitable soil material is not available on site.

B. Select Fill Material: Select fill material shall be a sorted, job-excavated or imported soil material as specified for random backfill material, except no rocks, stones, or lumps larger than one inch in largest dimension shall be present. Select fill material, used for filling beneath or against structures, shall not contain weathered shale.

C. Granular Fill Material:

1. Granular fill material shall be a densely graded gravel of the following gradation:

Sieve Size (square opening)	Percent Passing (by weight)
1 inch	100
3/4 inch	85 - 100
3/8 inch	50 - 80
No. 4	35 - 60
No. 40	15 -25
No. 200	5 -15

2. Granular fill material shall be free from clay lumps or organic matter. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5. The fraction passing the No. 200 sieve shall not exceed 3/4 of the fraction passing the No. 40 sieve.

2.5 IMPERVIOUS TRENCH CHECK MATERIAL

A. Material for impervious trench checks shall be naturally occurring clay or a soil and sodium bentonite mixture with the permeability of the material to be no greater than $10x10^{-6}$ cm/sec.

B. Material shall be free of any stones, bricks, concrete, etc., except gravel or crushed rock of 3/4 inch size or less.

PART 3 EXECUTION

3.1 PREPARATION

A. The Contractor shall verify that required lines, levels, contours and datum are as shown in the plans.

B. Grading, excavation and backfilling shall be made to the lines, grades and cross sections indicated in the plans.

C. The Contractor shall maintain the site and conduct earthwork operations to ensure that the property is well drained at all times. The Contractor shall protect adjacent and downstream properties from damage or pollution caused by erosion. The Contractor is responsible for erosion control measures and methods and shall conduct earthwork operations to ensure the protection of all downstream and adjacent properties. The Contractor shall implement any additional erosion control measures to prevent damage.

D. Existing Utilities:

1. The Contractor shall verify the location and depth of all utilities a minimum of 24 hours prior to construction. The Contractor may utilize the toll free number for the "Missouri One Call System" 1-800-344-7483. This number is applicable anywhere within the state of Missouri. Prior to commencement of work the Contractor shall notify all those companies which have facilities in the vicinity of the construction.

2. Coordinate removal or relocation of existing utilities with their Owner.

3. Locate, identify and protect utilities that remain from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or negligent actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.
4. Abandoned pipes which the Drawings indicate shall be capped or filled do not need to be removed. All other abandoned pipe conduit within the limits of grading shall be removed by the Contractor

E. Existing fences: Fences within the construction grading area shall be removed and reconstructed to equal or better quality than that of the fence removed. It shall be the sole responsibility of the Contractor to maintain all gates, fences, cattle guards and the like encountered during construction, as required to prevent the straying of pets and livestock.

3.2 CLASSIFICATION OF MATERIALS: No classification of excavated materials, regardless of type or condition, will be made for purposes of payment. All excavation shall be unclassified unless designated otherwise. Excavation and trenching work shall include the handling and removal of all materials, regardless of its nature, excavated or removed from the site in performance of the Work.

3.3 SITE CLEARING

A. Clearing and stripping: All stumps, roots, buried logs, foundations, drainage structures, or other miscellaneous debris occurring within the limits of the excavation and site grading shall be removed as part of the grubbing operations and disposed of by, and at the expense of, the Contractor. Like-wise, six inches of topsoil shall be stripped from the disturbed construction areas and stockpiled for later use in final grading.

B. Stumps and roots in excavated or fill areas where depth of fill does not exceed 3 feet shall be removed to a depth of 18 inches below subgrade. In fill areas where more than 3 feet of fill is required, roots and stumps shall be cut off at the face of the excavation.

3.4 SUBGRADE PREPARATION

A. Proof-roll subgrade below building slabs, tank slabs, and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
4. Subgrades under building slabs shall be compacted in place to ninety-five percent (95%) of maximum density as determined by ASTM D-698, at a moisture content within plus or minus two percent (±2%) of optimum.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.5 EARTHFILLS AND EMBANKMENTS

A. Material and Compaction Requirements:
1. Fill areas which are below structures, concrete slabs, or paved areas, and within 5 horizontal feet of a structure or concrete slab shall be filled with select fill material, as specified herein, unless otherwise indicated on the Drawings. The select fill material shall be placed in lifts not exceeding 12 inches in compacted thickness, and shall be compacted

to a minimum 95 percent of maximum density as determined by ASTM D-698. Fill shall be placed and compacted at a moisture content within ± 2 percent of optimum.

2. Fill areas which are outside the envelope described above shall be filled with random fill material, as specified herein, unless otherwise indicated on the Drawings. The random fill material shall be placed in lifts not exceeding 12 inches in compacted thickness, and shall be compacted to a minimum 90 percent of maximum density as determined by ASTM D-698. Fill shall be placed and compacted at a moisture content within ± 3 percent of optimum.
    a. For areas which will be surfaced with gravel, the top two feet of random fill shall be compacted to a minimum of 95 percent of maximum density as determined by ASTM D-698. Fill shall be placed and compacted at a moisture content within ± 2 percent of optimum.

B. All vegetation and topsoil, and any loose, unstable or unsuitable material shall be removed from the existing surface to receive fill material. After stripping, the area shall be proof-rolled with a loaded tandem axel dump truck, or other equipment acceptable to Engineer. Unstable materials located by proof-rolling, shall be removed and replaced with suitable compacted fill material.

C. Before placing any fill the existing surface shall be scarified, moisture conditioned as required and the top 6 inches compacted to 90 percent of the maximum density for that material in accordance with ASTM D-698.

D. When embankments, regardless of height, are placed against hillsides or existing embankments having a slope steeper than 1 vertical to 4 horizontal, the existing slope shall be benched or stepped in approximately 24 inch rises. The material shall be bladed out and the bottom area cut to form benches and the embankment material being placed shall be compacted to the specified density. Formation and compaction of benches shall not be measured and paid for directly but will be considered incidental work.

E. Where embankments of two feet or less are placed over existing pavement, the existing pavement shall be removed and the cleared surface compacted to the specified density. Where embankments greater than two feet are placed over existing pavement, the pavement shall be broken into pieces with a maximum dimension of 24 inches and the pieces left in place.

F. Do not place fill material over porous, wet, frozen or spongy surfaces. Embankment construction shall not be performed when fill material is frozen or contains frost or snow.

G. Placement: Place earth embankments in successive horizontal lifts uniformly distributed over the full width of the fill area. Each lift shall not exceed the specified thickness and shall be compacted to the specified density prior to placing any additional lifts. As compaction of each layer progresses, continuous blading and dozing will be required to level the surface and insure uniform compaction.

H. No rocks or stones shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the size limit may be incorporated in the remainder of fills and embankments, provided they are distributed so they do not interfere with proper compaction, as determined by the Engineer.

3.6 LAGOON CONSTRUCTION NOT USED

3.7 EXCAVATION

A. General:

1. Where necessary, satisfactory sheeting and bracing shall be used to hold the sides of the excavation at all points where damage might result from slides.
2. All sheeting and bracing shall be removed as the backfill is placed, unless otherwise directed in writing by the Owner or shown on the Drawings. All voids left or caused by the withdrawal of sheeting shall be filled immediately with suitable material and tamped.
3. Excavation below structure or trench subgrade:
   a. Over excavation of pipe trenches due to Contractor's oversight, shall be backfilled with granular embedment material compacted in 8-inch lifts to 90 percent of the maximum density for that material in accordance with ASTM D-698, as required at no additional cost to the Owner.
   b. Over excavation of structure subgrades due to the Contractor's oversight, shall be replaced with concrete placed monolithic with the structure above at no additional cost to the Owner.
   c. When unstable or unsuitable material is encountered in the subgrade, such material shall be removed, replaced with crushed rock (for structures) or granular pipe embedment material (for trenches) and compacted to the density equal to or greater than required for subsequent backfill material. Such excavation and backfill shall be paid for at the contract unit price.
   d. When the subgrade bottom is soft and in the opinion of the Engineer cannot support the foundation, a further depth and/or width shall be excavated and refilled to the desired pipe or foundation grade with crushed rock, as required by the Engineer to assure a firm foundation. Such excavation and backfill shall be paid for at the contract unit price.
4. Use of Explosives: The Contractor shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use of explosives, and the protection of life and property. The Contractor shall be responsible for all damage caused by his blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench. Pre and post-blast surveys and blast monitoring are required.
5. Dewatering: Each excavation shall be kept dry during subgrade or pipe embedment preparation, and continually thereafter until the structure or pipe is completely installed, to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
   a. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level at least 12 inches below the bottom of the excavation.
   b. Trenches shall be drained so that workmen may work efficiently. The discharge of pumps used for draining the trenches shall be led to natural drainage courses or drains.

B. Structure Excavation:

1. Excavation for structures shall be performed to the limits indicated on the Drawings.
2. All suitable material removed by excavation shall be used as far as practicable for backfill and embankment as required to complete the work. The Contractor shall sort all excavated material and stockpile suitable material as necessary. Stockpile excavated material to be used as fill and backfill in area designated on site and remove excess material or unsuitable material not being reused, from site.

C. Trenching:

1. All pipeline excavation shall be open cut. The Contractor shall not open more trench in advance of the pipe laying than is necessary. The length of open trenches shall be limited depending on the nature of the soil and safety considerations. All open trenches shall be adequately protected using fencing, barricades, etc. as required.

2. Trenches shall be excavated within the limits of public right-of-way in conformance with the requirements herein. Trenches shall be excavated to the width and depth necessary to install pipelines to the lines, grades, and elevations shown on the Drawings.
3. In those areas designated to be landscaped, seeded or sodded, the top soil shall be excavated, stockpiled and replaced as specified herein.
4. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One city block or 300 feet, whichever is the shorter, shall be the maximum allowable length of open trench ahead of pipe laying.
5. Limiting trench widths: Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and placement and compaction of embedment. Unless otherwise noted on the drawings, the limiting trench widths below an elevation 12 inches above the top of the installed pipe shall be as follows:

Pipe Size (inches)	Minimum Trench Width (inches)	Min. Clearance on Each Side of Pipe (inches)	Maximum Trench Width (inches)
< 4	20	6	26
4 - 6	22	6	30
8	22	6	30
10	24	6	32
12	27	6	36
15	30	6	38
16	32	6	40
18	34	6	42
20	36	6	44
36	50	6	60
48	62	6	72

6. Unauthorized trench widths: Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing table, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the expense of the Contractor.
7. Trench bottom in earth: The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to the grade to which the embedment is to be laid. The surface shall be graded to provide a uniform bearing and continuous support. No part of the bell shall be in contact with the trench bottom.
8. The Contractor shall sort and stockpile excavated material so that suitable material is available for backfill. Excavated material shall be deposited on the side of the trenches and beyond the reach of slides. Excavated material not suitable for backfill shall be promptly removed from the site.
9. Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes, but sloping trench walls shall not extend lower than 1 foot above the top of the pipe.
10. Trench Shields: Where trench shields are used by the Contractor, no part of the shield shall exceed lower than 6 inches above the top of the pipe, nor shall the maximum allowable trench width be exceeded.

3.8 PIPE EMBEDMENT

A. Embedment Classes: Unless otherwise indicated on the drawings, embedment classes shall be as follows, and as detailed on the Drawings. All lifts are given in compacted thickness. All compaction percentages refer to maximum dry density as determined by ASTM D-698. Select fill material shall be compacted within 2% of optimum moisture content. Select fill material shall be replaced with granular fill material if granular fill material is required for trench fill to ground surface.

1. Class A Embedments:
   a. Class A-1 embedment shall provide a cradle of concrete with a compressive strength of at least 3,000 psi, as specified in Division 3 - Concrete. After the initial set of the concrete, granular embedment material shall be placed in 6-inch lifts and compacted to a minimum of 90%, above the top of pipe.
   b. Class A-2 embedment shall provide an arch of concrete with a compressive strength of at least 3,000 psi, as specified in Division 3 - Concrete. Granular embedment material shall be placed in 6-inch lifts and compacted to a minimum of 90%, up to the centerline of the pipe. A concrete arch shall be placed on the granular embedment. After the concrete has set, one foot of select fill material shall be placed above the top of pipe, compacted in 8-inch lifts to a minimum of 85%.
2. Class B Embedments:
   a. Class B-1 embedment shall provide an encasement of granular embedment material, extending below the pipe to above the top of pipe. Granular embedment material shall be placed in 6-inch lifts and compacted to a minimum of 90%.
   b. Class B-2 embedment shall provide a cradle of granular embedment material which shall be placed in 6-inch lifts and compacted to a minimum of 90%. Select fill material shall then extend above the top of the pipe, placed in 8-inch lifts and compacted to 85%.
3. Class C Embedment: Materials and compaction requirements shall be as for Class B-2.
4. Class D Embedment: Shall allow the pipe to rest on a flat or restored trench bottom. Pipe embedment shall be select fill material extending from the bottom of the pipe to above the top of pipe, placed in 12-inch lifts and compacted to 85%.

B. Concrete Encasement: Where indicated on the Drawings, concrete encasement shall be provided instead of the pipe embedment classes specified herein. Requirements for concrete encasement are detailed on the Drawings. Concrete and reinforcement shall be as specified in Division 3 - Concrete, for 3,000 psi concrete.

C. Pipe Embedment Class Schedule: Unless otherwise noted on the Drawings, pipe embedment classes shall be provided according to the following schedule:

Pipe Material	Depth over pipe (feet)	Embedment class
SDR-35 PVC	All	B-1
Class 200 PVC in soil	All	D
Class 200 PVC in rock	All	C
SDR-PR PVC, SCH 40/80 PVC	All	B-1
C-900 PVC	All	B-1
HDPE (polyethylene)	All	B-2
DIP in soil up to 12-inch	minimum 3 ft	D
DIP in soil over 12-inch	minimum 3 ft	C
DIP in rock, all sizes	minimum 3 ft	C
Copper	All	C
Reinforced Concrete Pipe (RCP)	All	B-2
Other types not listed here	All	B-2

D. Placement of Embedment:

1. Place embedment material at the trench bottom with proper allowance for bell joints. Level materials in continuous layers not exceeding 6 inches in compacted depth. Shovel slicing of embedment shall be performed along the sides of the pipe as embedment is placed, to consolidate the bedding and haunching below the pipe.
2. Consolidate granular embedment by rodding, spading and compacting as necessary to provide uniform pipe support and meet the compaction requirement.

3.9 CRUSHED ROCK: Crushed rock shall be placed when shown on the Drawings or specified herein. Crushed rock shall be placed on suitably prepared subgrade and compacted by vibration. Crushed rock shall be kept free from dust, clay or trash. Crushed rock shall be compacted to not less than 90 percent of the maximum density for that material in accordance with ASTM D-1557.

3.10 BACKFILLING

A. General:

1. All trenches and excavations around structures shall be backfilled to finish grade according to the Drawings. Backfill with material as specified herein.
2. Large compaction equipment, including self-propelled compaction equipment, bulldozers, loaders, and boom-mounted vibratory plates, shall not be used within 3 feet above the top of pipe, or within 3 feet of new or existing structures.
3. If backfilling operations do not meet the specifications, the material shall be removed, replaced and re-compacted at the Contractor's expense.
4. Backfill shall not be placed when material is frozen, contains frost, snow, waste material, trees, organic matter and rubbish or when the surface to receive backfill is snow
5. No backfill shall be placed over or around any structure until the concrete or mortar has attained a minimum compressive strength of 2,000 psi and can support the loads imposed by backfilling and traffic.

B. Trench backfill: Backfill for all pipeline trench excavation shall be placed by the end of each working day around all pipe laid that day, leaving only the working end of the pipe uncovered. Any trenches excavated in advance of pipe laying shall also be backfilled at the end of each working day.

1. For trenches beneath proposed structures, slabs, or in areas which have or will have a paved or chip-and-seal surface, or where indicated on the Drawings to use granular fill material:
   a. Granular fill material shall be shall be placed on the compacted pipe embedment, in layers not to exceed 12 inches in compacted thickness.
   b. Granular fill material shall be compacted by vibratory means. Each lift of granular fill shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D-698. Backfill shall be placed and compacted at a moisture content within plus 2 or minus 2 percent of optimum. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.
2. For trenches in graveled areas, or other vehicle traveled ways which are neither paved nor surfaced with chip-and-seal material:
   a. Select fill material shall be placed on the compacted pipe embedment, in layers not to exceed 12 inches in compacted thickness.
   b. Select fill material shall be compacted to a minimum of 90 percent of maximum density as determined by ASTM D-698. Backfill shall be placed and compacted at a moisture content within plus 3 or minus 3 percent of optimum. Select backfill may be compacted by vibratory plates, tracks or wheels of graders, tractors, high loaders or similar equipment, subject to the restrictions above. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.

3. For trenches in other areas, including grassed areas and parkways which are not in vehicle traveled ways:
   a. Random fill material shall be placed on the compacted pipe embedment, in layers not to exceed 18 inches in compacted thickness.
   b. Random fill material shall be compacted to a minimum of 85 percent of maximum density as determined by ASTM D-698. Backfill shall be placed and compacted at a moisture content within plus 3 or minus 3 percent of optimum. Backfill may be compacted by vibratory plates, tracks or wheels of graders, tractors, high loaders or similar equipment, subject to the restrictions above. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.

C. Structure backfill:
1. All structures shall be backfilled to the lines and grades shown on the Drawings. In no instance shall backfill be dumped, bulldozed or otherwise deposited in bulk upon the structure. Backfill shall be kept at approximately the same elevation on all sides of the structure as backfilling proceeds.
2. Structure backfill which will be beneath paved areas, slabs, or structures shall be granular fill material, compacted in place to 95% of maximum density as determined by ASTM D-698, at a moisture content within plus 2 or minus 2 percent of optimum. Granular fill shall be placed in lifts not to exceed 8 inches in compacted thickness, and compacted by careful pneumatic or vibratory tamping.
3. Backfill in all other areas shall be select fill material, placed in lifts not to exceed 12 inches in compacted thickness, and compacted in place to 90% of maximum density as determined by ASTM D-698, at a moisture content within plus 3 or minus 3 percent of optimum.

3.11 SURFACE RESTORATION

A. All areas disturbed by construction operations shall be restored by paving, gravel surfacing, or seeding, as indicated on the Drawings and specified. For areas which are seeded, minimum depth of topsoil shall be six inches. Topsoil shall be a dark, friable, organic soil free of clay lumps and rocks larger than one and half inches in largest dimension.

3.12 IMPERVIOUS TRENCH CHECK

A. Trench checks shall be placed where indicated on the Drawings, or at a maximum interval of 400 feet. If a pipeline segment is at least 100 feet but less than 400 feet, one trench check shall be provided in a location acceptable to the Engineer.

B. Trench checks shall extend the full width of the trench, and the length and depth shall be as indicated on the Drawings. Trench check material shall be placed completely under, around and above pipe, and shall be placed in maximum compacted lifts of 8 inches in thickness and compacted to 95% of maximum density as determined by ASTM D-698. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.

3.13 DISPOSAL OF MATERIALS

A. All unused excess excavated material, together with all debris, removed pipe, stones, stumps, roots, and other unsuitable materials shall be removed from the site and disposed of by the Contractor, at the expense of the Contractor.

B. Material to be disposed of, including excess material, shall be promptly removed from the site by Contractor. If Contractor desires to set aside excess excavated material free from contamination by sewage or other hazardous substances, he shall do so only in an area approved by the Owner.

3.14 SOIL TESTING: All materials, for fills and for impervious trench checks (if required), shall be sampled and tested in accordance with Section 01400 - Quality Control.

A. Laboratory Tests:
   1. Two initial gradation tests and two initial moisture-density (Proctor) tests shall be made for each type of embedment, backfill, and trench check material, including job excavated materials.
      a. Initial tests on materials which are imported (not job excavated) shall be provided by Contractor and the results submitted as product data for review in accordance with the submittals section.
   2. One additional gradation test and one additional moisture-density test shall be made for each additional 400 tons of imported material, and such tests shall be paid for by Contractor.

B. Field Tests:
   1. During the progress of the work of filling and backfilling, in-place density tests will be performed with a nuclear density gage by a qualified laboratory technician.
   2. The number of tests to be taken and the locations thereof shall be determined by the Engineer based upon observation of the filling or backfilling process. A minimum of two (2) tests per 100 cubic yards of fill/backfill and two (2) tests per 300 feet of trench will be taken unless otherwise directed by the Engineer. One additional test will be performed on each trench check (if required).
   3. If the tests indicate the compaction is not sufficient, the Contractor shall increase the compactive effort on all such inadequately compacted areas.

END OF SECTION

SECTION 02530

PIPING SYSTEM PRODUCTS

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish all required piping, fittings, and all accessories for complete and functional piping systems as shown on the Drawings and specified herein.

B. Section Includes:
1. Piping materials for water distribution piping, sanitary sewer piping, piping outside of buildings, and other services.
2. Pipe fitting and accessories.

C. This section does not cover piping installation. See Section 02535 - Piping Systems Installation

1.2 RELATED SECTIONS

A. Section 02320 - Earthwork and Trenching: For trenching, embedment, and backfill.

B. Section 02535 - Piping Systems Installation: For installation of products specified herein.

1.3 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the requirements of this section shall govern.

A. American Society for Testing Materials (ASTM):
1. A-193 - Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
2. A-194 - Specification for Carbon and Alloy Steel nuts for bolts for High-Pressure and High-Temperature Service.
3. A-194 - Specification for Carbon and Alloy Steel nuts for bolts for High-Pressure and High-Temperature.
4. A-746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
5. B-88 - Specification for Seamless Copper Water Pipe.
6. D-1784 - Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds.
7. D-1785 - Poly (Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, 120.
8. D-2241 - Poly (Vinyl Chloride) Pressure-Rated Pipe (SDR Series).
9. D-2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
10. D-2464 - Threaded Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80.
11. D-2467 - Socket-type Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80.
12. D-2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
13. D-2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
14. D-2837 - Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
15. D-3034 - Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
16. D-3139 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
17. D-3212 - Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals.
18. F-405 - Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings
19. F-437 Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

20. F-439 Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. F-441/F-441M Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
22. F-493 Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
23. F-477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
24. F-606 - Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators and Rivets.
25. F-679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
26. F-1970 Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems.

B. American National Standards Institute (ANSI)/American Water Works Association (AWWA):
1. C104/A21.4 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
2. C105/A21.5 - Polyethylene Encasement for Ductile Iron Pipe Systems.
3. C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 3 In. through 48 In.
4. C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
5. C115/A21.15 - Flanged Ductile Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges.
6. C150/A21.50 - Thickness Design of Ductile Iron Pipe.
7. C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
8. C153/A21.53 - Ductile Iron Compact Fittings 3 In. through 24 In. and 54 In. through 64 In. for Water Service.

C. American Water Works Association (AWWA):
1. C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. for Water Distribution.
2. C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. for Water Transmission and Distribution.

D. Uni-Bell PVC Pipe Association:
1. Uni-B-13-92 - Uni-Bell PVC Pipe Association Recommended Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride (PVC) Pipe.

1.4 DEFINITIONS

A. Embedment: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS: The Contractor shall submit the following items required by this division in accordance with Section 01300 - Submittals.

A. Product Data for Review:
1. Pipe and joint materials and details.
2. Details and materials of fittings, pipe accessories, and specials.
3. Specifications, data sheets, and affidavits of compliance for protective shop coatings and linings.
4. Pressure gauge certification and calibration data.

B. Manufacturer’s Certificates: Contractor shall furnish the following prior to shipment:
1. Affidavit of compliance with applicable standard.
2. Test certificates.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

1.6 PROJECT RECORD DOCUMENTS

A. Requirements for project record documents are covered under section 02535 - Piping Systems Installation.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. Notes on Materials: Each pipe material below is given an alphanumeric abbreviation shown in parentheses, which is shown on the Drawings to denote the applicable specified material for the given size and service.

B. Type PSM Polyvinyl Chloride Sewer Pipe and Fittings (SDR-35 PVC): Shall meet the requirements of ASTM D-1784 cell classification 12454-B for PVC compounds, and ASTM D-3034 for poly vinyl chloride (PVC) sewer pipe.
   1. Minimum wall thickness shall conform to Standard Dimension Ratio 35 (SDR 35), except for 4-inch diameter pipe which shall conform to SDR 26.
   2. The Contractor shall install the maximum pipe lengths manufactured by the supplier.
   3. Joints: Flexible gasketed joints for PVC pipe and fittings shall be compression type joints with the gasket confined in either the spigot or the bell end of the pipe. Rubber gasket rings shall be neoprene or other synthetic material and conform to ASTM D-3212 and ASTM F-477. Natural rubber gaskets will not be acceptable.
   4. Fittings: Fitting joints shall be bell and spigot with elastomeric gaskets conforming to ASTM D-3212, unless indicated on the Drawings to be solvent cemented joints, in which case the joint shall conform to ASTM D-2855. Fittings shall not be used unless directed by the Engineer or indicated on the Drawings.

C. Polyvinyl Chloride Plastic Pressure Pipe, Joints, and Fittings (SDR 21 PVC or Class 200): Shall meet the requirements of ASTM D-1784 cell classification 12454-A or 12454-B for PVC compounds, and ASTM D-2241 for (PVC) pressure pipe.
   1. Minimum wall thickness shall conform to Dimension Ratio 21 for Class 200.
   2. The Contractor shall install the maximum pipe lengths manufactured by the supplier.
   3. Joints: Joints shall be push-on type with integral bell and spigot and elastomeric gaskets meeting the requirements of ASTM D-2122 and ASTM D-3139. An integral wall-thickened bell end or an integral sleeve-reinforced bell end will be acceptable. Rubber gasket rings shall be neoprene or other synthetic material and conform to ASTM F-477. Natural rubber gaskets will not be acceptable.
      a. Bell restraint clamps: Clamps for restraining bell and spigot joints shall consist of clamping rings and rods, and shall meet the requirement of Uni-B-13-92. Restraint devices shall be of ductile iron, ASTM A536, Grade 65-45-12, with connecting bolts of high strength, low alloy metal in accordance with ANSI/AWWA C111-A21.11. All ferrous metal surfaces shall be shop coated with an epoxy coating for corrosion resistance. Bell restraint clamps shall be Ford Meter Box "Series 1350 Uni-Flange Block Buster", Romac "Series 611", or approved equal.
   4. Joints for wastewater forcemain piping shall be groove& spline coupling with O-rings (flexible elastomeric seal). This piping shall be Certa-Lok Yelomine as manufactured by CertainTeed or Engineer approved equal.
   5. Thrust restraints shall be concrete thrust blocks where possible. Where blocks are not possible, Contractor may use bell restraint clamps.

D. Polyvinyl Chloride Plastic Pipe and Fittings (SCH 40 PVC): PVC piping shall meet the requirements of ASTM D-1784 cell classification 12454-B for PVC compounds, and ASTM D-1785 for Schedule 40 PVC pipe.

1. Fittings shall be solvent welded socket-type, in accordance with ASTM D-2467. Threaded fittings, in accordance with ASTM D-2464, shall be used only where indicated on the Drawings or specifically allowed by the Engineer.
2. Primer and solvent cement shall conform to ASTM F656 and ASTM D2564, respectively.
3. Flange adapters shall be socket-type solvent welded, with diameter and drilling conforming to ANSI/ASME B16.5, Class 150. Flange gaskets shall be full face, chemical resistant elastomeric material. Flange bolts shall be ASTM Grade B, galvanized or stainless steel.

E. Polyvinyl Chloride Plastic Pressure Pipe and Fittings (SCH 80 PVC): PVC pressure piping shall meet the requirements of ASTM D-1784 cell classification 12454-B for PVC compounds, and ASTM D-1785 for Schedule 80 PVC pipe.

1. Fittings shall be solvent welded socket-type, in accordance with ASTM D-2467. Threaded fittings, in accordance with ASTM D-2464, .shall be used only where indicated on the Drawings or specifically allowed by the Engineer.
2. Primer and solvent cement shall conform to ASTM F656 and ASTM D2564, respectively.
3. Flange adapters shall be socket-type solvent welded, with diameter and drilling conforming to ANSI/ASME B16.5, Class 150. Flange gaskets shall be full face, chemical resistant elastomeric material. Flange bolts shall be ASTM Grade B, galvanized or stainless steel.

F. High Density Polyethylene DR-PR Plastic Pipe (HDPE): Shall meet the requirements of ASTM F-714 The polyethylene material shall be classified as Type III, Grade P34. The polyethylene pipe shall meet the requirements of ASTM D-3350 for cell classification 345444-C.

1. Forcemain: Wall thickness shall conform to ASTM F-714 for SDR-9, minimum working pressure of 200 psi, ductile iron pipe size. Pipe shall be Phillips Driscopipe “1000 (PE3408)” or Engineer approved equal.
2. Joints: Joints in HDPE pipe, fittings, and adapters shall be thermally welded by butt fusion.
3. Fittings: HDPE fittings shall be fabricated of pipe with a wall thickness at least as thick as the adjacent pipe, or greater as required by AWWA C906. Mitered bends shall have a minimum of five segments for 90 degree bends, a minimum of three segments for 45 degree bends.
4. Flange Adapters: Flange adapters for connecting HDPE pipe to PVC pipe shall consist of a stub of polyethylene pipe which is integrally molded with a polyethylene flange. Minimum flange face thickness shall be 1.5 times the pipe wall thickness, and the flange diameter and drilling shall match that of the mated ductile iron flange. A flange gasket shall be used. A flange backer ring of ductile iron or stainless steel shall be used. Flange bolts shall be stainless steel.
5. Mechanical Joint Adapters: Flange adapters for connecting HDPE pipe to ductile iron pipe shall consist of a stub of polyethylene pipe which is integrally molded with a polyethylene retaining ridge which is designed to fit against a ductile iron pipe mechanical joint bell and gasket. A ductile iron follower gland shall be provided. Joint bolts shall be stainless steel

2.2 PIPE ACCESSORIES

A. Banded Couplings: Banded couplings for gravity piping shall be synthetic rubber repair couplings with stainless steel clamping ring bands, BANDSEAL by Dickey, Fernco coupling or approved equal. Banded couplings shall be provided to transition between different materials and sizes as required.

B. Pipe grouting rings: Pipe grouting rings shall be synthetic rubber, with stainless steel take-up clamps. Ring and clamps shall meet or exceed the requirements of ASTM C-923. Grouting rings

shall be matched to the outside diameter of the carrier pipe. Grouting rings shall be Press-Seal Gasket Corporation "WS Series WaterSTOP Grouting Rings" or approved equal.

C. Mechanical couplings: Mechanical couplings shall be gasketed, sleeve-type, sized to properly fit the pipes to joined, with steel or ductile iron middle ring, steel or ductile iron follower rings, and synthetic rubber gaskets. Gaskets shall be SBR, Buna-N, or EPDM. All ferrous metal surfaces shall be shop coated with an epoxy coating for corrosion resistance. All hardware shall be 300 series stainless steel. Mechanical couplings shall be Ford Meter Box "Style FC1, Style FC2A, Style FC3, or Style FC23", Dresser "Style 38, Style 153, or Style 162", Smith-Blair "441 or 411", or equal.

D. Flange Adapters: Flange adapters shall be the cast iron slip-on type retained by set screws. Flange body shall be ductile iron, ASTM A-536, Grade 65-45-12. Set screws shall be manufactured form AISI 4140 steel, heat treated to Rockwell C 42-50 and zinc plated. Set screws shall have break away torque heads. Flange adaptors shall conform to ANSI B16.1 for machining and drilling. Gaskets shall be standard mechanical joint gaskets, EPDM or Buna-N. All non-plated ferrous metal parts shall be shop primed with an epoxy primer, for finish painting in the field. Flange adaptors shall be Ford Meter Box Corporation "UNI-Flange Series 200" or equal.

E. Flexible Expansion Sleeves: Flexible expansion sleeves shall be synthetic butyl rubber. The body shall consist of fabric and various rubber compounds reinforced with steel rings. The cover shall be suitable for service conditions, formed from natural rubber or synthetics and coated with a Hypalon paint. All materials shall be suitable for temperatures up to 250° F for pressure and vacuum service. Flexible expansion sleeves shall be single arch configuration, Redflex "SL-50" or equal.

F. Arch Expansion Joints and Reducers: Arch expansion joints and reducers shall be Neoprene, Hypalon, or Buna-N. Joint shall allow 3/4-inch elongation. The tube shall be a leak-proof lining of natural rubber or synthetic. The body shall consist of fabric and various rubber compounds reinforced with steel rings. The cover shall be suitable for service conditions, suitable for 250°F, formed form natural rubber or synthetics and coated with a Hypalon paint. Flanges shall be made of duck and rubber construction and full-faced with 150 lb ANSI standard drilling. Standard or tapered reducing arch expansion joints shall be provided indicated on the Drawings.

2.3 GRANULAR EMBEDMENT MATERIAL

A. Granular embedment material shall be as specified in Section 02320 - Earthwork and Trenching.

2.4 BACKFILL MATERIALS

A. Backfill materials shall be as specified in Section 02320 - Earthwork and Trenching.

2.5 TRACER WIRE

A. A tracer wire of 12 gauge TW copper shall be installed with all plastic mains. The tracer wire shall be installed in the trench with the plastic pipe as detailed on the Drawings.

PART 3 EXECUTION

3.1 Refer to Section 02535 - Piping Systems Installation

END OF SECTION

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SECTION 02535

PIPING SYSTEM INSTALLATION

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall install all required piping, fittings, embedment materials, and all accessories for complete and functional piping systems as shown on the Drawings and specified herein.

1.2 SECTION INCLUDES

A. Installation of piping, fittings, and accessories.

B. Process piping/waterline acceptance testing.

1.3 RELATED SECTIONS

A. Section 02320 - Earthwork and Trenching: For trenching, embedment, and backfill.

B. Section 02530 - Piping System Products: For products installed herein.

1.4 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the requirements of this section shall govern.

A. American Society for Testing and Materials (ASTM):
   1. D-2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
   2. D-2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping
   3. D-2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

B. American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME):
   1. B1.20.1

C. American Water Works Association (AWWA):
   1. C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. for Water Distribution.
   2. C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. for Water Transmission and Distribution.

D. Uni-Bell PVC Pipe Association:
   1. Uni-B-13-92 - Uni-Bell PVC Pipe Association Recommended Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride (PVC) Pipe.

E. American National Standards Institute (ANSI):
   1. B31.1

F. American Public Works Association (APWA):
   1. Section 2500 Sanitary Sewers

1.5 DEFINITIONS

A. Embedment: Fill placed under, beside, and directly over pipe prior to subsequent backfill operations.

1.6 SUBMITTALS

A. Submittals for piping system products are covered under Section 02530 - Piping System Products.

1.7 PROJECT RECORD DOCUMENTS

A. Record location of pipe runs, connections, and invert elevations.

B. Record type of pipe material installed.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable codes and ordinances for disposal of debris.

B. Contractor shall notify utility companies prior to commencement of construction and coordinate work with utilities as required.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated on the Drawings.

PART 2 PRODUCTS

2.1 Refer to Section 02530 - Piping System Products

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the pipeline lines and grades are as shown on the Drawings.

3.2 PREPARATION

A. The Contractor shall verify the location and depth of all utilities prior to construction. Prior to commencement of work the Contractor shall notify all those companies which have facilities in the vicinity of the construction.

3.3 PROTECTION

A. Locate, identify, and protect utilities that remain, from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or neglectful actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.

B. Relocation of an existing utility which is within the public right-of-way shall be performed by the respective utility owner at no cost to the Contractor. Relocation and protection of an existing utility which is within a utility easement shall be the responsibility of the Contractor.

C. Any private facilities damaged or disturbed by the Contractor's work shall be repaired by the Contractor prior to close of the working day. Repairs shall be made in a manner sufficient to restore utility service to that property.

D. Protect trees, plant growth, and features designated to remain as final landscaping.

E. Protect all property or lot corner pins and stakes from damage or displacement. If property or lot corner markers must be moved, they shall be properly referenced prior to removal and reset by the Contractor upon completion of the project.

F. Protect from damage or displacement all project benchmarks and existing structures within or adjacent to the construction limits that are not to be removed or demolished.

3.4 SEPARATION OF WATER AND SEWER UTILITIES

A. Gravity Sanitary Sewers: When potable water pipes (excluding service water pipes downstream of a backflow preventer) and gravity sanitary sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 ft. The distance shall be measured from edge to edge. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them. In cases where it is not practical to maintain a 10 ft. separation, the Engineer will consult with MDNR to consider equivalent protection by other methods.
   1. When a water pipe and a sanitary sewer cross and the sewer is 18 inches for MDNR or more (clear space) below the water pipe, no special requirements or limitations are provided herein. At all other crossings, the Engineer will consult with MDNR to consider equivalent protection by other methods.
   2. Joints in the sewer pipe shall be located as far as practical from the intersected water main.

B. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole.

C. Storm Sewers: The separation distance between a storm sewer (which is not a combined storm/sanitary sewer) and a water main, if encountered, shall be determined by the Engineer based on geotechnical considerations. Required separation distances between water mains and combined storm/sanitary sewers are equivalent to those for water mains and gravity sanitary sewers.

D. Drains: Underground drains from fire hydrants or valve pits should not be directly connected to sanitary or storm drains.

3.5 PIPE EMBEDMENT/ENCASEMENT

A. Material and installation for pipe embedment and concrete encasement shall be provided as indicated on the Drawings and specified in Section 02320 - Earthwork and Trenching.

3.6 PIPE INSTALLATION

A. All pipe shall be protected during transport, storage and installation from shock and free fall. Pipes shall be installed without cracking, chipping, breaking, bending or damaging the materials. Damaged pipe shall be replaced with new materials except when repairs are permitted by the Engineer. Use slings, lifting lugs, hooks and other protection devices during handling.

B. Install pipe of the size, material, strength class, and joint type as specified or indicated on the Drawings. Every pipe fitting is not called out on the Drawings. Contractor shall provide fittings required to connect piping as shown on piping plans, and plan and profile Drawings. Additional fittings required to make vertical changes in elevation to avoid utilities or to meet connections shall be provided at no additional cost to Owner.

C. The maximum fitting bend for force mains and pressurized process piping shall be 45 degrees. When multiple fittings are assembled adjacent to make deflections in alignment, adequate piping shall be provided between for thrust restraint.

D. Where cutting of pipe is allowed, pipe shall be cut from measurements taken at the site and not from the Drawings.

E. Install gravity pipelines beginning with the lowest point of the pipeline and install pipe with the spigot or tongue end downstream. Install pressure pipelines with the bell ends facing the direction of laying, except when reverse laying is specifically authorized by the Engineer.

F. Install pipe to the line and grades indicated on the drawings. Unless otherwise noted on the Drawings, minimum cover over top of pipe shall be 42 inches. Maximum slope variation from true slope shall be one inch between structures for gravity sewers. The maximum variation from alignment between structures shall be two inches. Joint deflection shall not exceed the maximum allowable deflection per joint according to the governing standard. The pipe manufacturer=s maximum recommended deflection limits, if more stringent, shall govern over the referenced standards.
   1. Only one correction for alignment and/or grade shall be made between structures.
   2. The Contractor shall establish such grade control devices necessary to maintain the specified tolerance. All pipe shall have a continuous slope free of depressions.

G. Pipe installation shall be in accordance with applicable standards, such as ASTM C-12, D-2321 and ANSI/AWWA C600, except where conflicts with this section occur, in which case this section shall govern.

H. Clean the interior of all pipe fittings and joints prior to installation. Protect pipe against the entrance of debris and foreign matter during discontinuance of installation and at the close of the working day by installing a close fitting plug at the open end. Plugs shall be water tight against heads up to 20 feet of water.

I. The Contractor shall take whatever means necessary to keep the trenches free of water and as dry as possible during pipe installation, bedding and jointing operations.

J. After each pipe has been brought to grade, aligned and placed in final position, place sufficient embedment material under the haunches and on each side of the pipe to hold the pipe in proper position during subsequent pipe jointing, bedding and backfilling operations. Place embedment material uniformly and simultaneously on each side of the pipe to prevent lateral displacement. Embedment material shall be compacted as specified in Section 02320 - Earthwork and Trenching.

K. Pipe Jointing: Locate joints to provide for differential movement at changes in type of embedment, concrete collars and encasement and structures. Pipe jointing shall be according to the following specifications:
   1. Clean and lubricate all joint and gasket surfaces as recommended by the manufacturer.
   2. Examine all materials prior to installation for soundness and compliance with specifications.
   3. Check joint position and condition after assembly prior to installing additional pipe sections.
   4. Check joint opening and deflection for specification limits.

L. Pipe cutting shall be performed in a neat and workmanlike manner without damage to the pipe. Main taps for service saddle tees shall be made with a tapping tool specifically designed for that purpose. Cut edges shall be smoothed by power grinding to remove burrs and shape edges.

M. Pipe connection to structures: Pipe connection to new structures shall be as shown on the Drawings.

3.7 REQUIREMENTS FOR PIPE JOINTS: Pipe joints shall be carefully and neatly made, in accordance with the requirements which follow.

A. Threaded: Pipe threads shall conform to ANSI/ASME B1.20.1, NPT, and shall be full and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed, after threading and before assembly, to remove all burrs.
   1. Threaded joints, in plastic piping, shall be made up with Teflon thread tape applied to all male threads. Threaded joints, in stainless steel piping, shall be made up with Teflon thread tape applied to all male threads. At the option of the Contractor, threaded joints in other piping may be made up with Teflon thread tape, thread sealer or a suitable joint compound.

B. Flared: Ends of annealed copper tubing shall be cut square, and all burrs shall be removed prior to flaring. Ends shall be uniformly flared without scratches or grooves. Fittings shall be tightened as required, to produce leak-tight connections.

C. Solvent Welded: All joint preparation, cutting and jointing operations shall comply with the pipe manufacturer's recommendations and ASTM D-2855. Pipe ends shall be beveled or chamfered to the dimensions recommended by the manufacturer. Pressure testing, of solvent welded piping systems, shall not be performed until the applicable curing time, set forth in Table X2.1 of ASTM D-2855, has elapsed.

D. Flanged: Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but not so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly. Connecting flanges shall have similar facings, i.e., flat or raised face.

E. Welded: Welding shall conform to the specifications and recommendations contained in the "Code for Pressure Piping", ANSI B31.1. The following requirements shall also apply for stainless steel piping:
   1. High purity inert welding gases and cover gases shall be used. Weld surfaces shall be sliver, light gold or straw color at worst, after welding. Black welds are not acceptable.
   2. Prior to welding, all surfaces shall be clean and free of all organic materials, moisture and dirt.
   3. Welds shall be dressed using aluminum oxide grinding wheels. Silicon carbide is not acceptable.

F. Push-on: Gasket installation and other jointing operations shall be in accordance with the recommendations on the manufacturer. Each spigot end shall be suitable beveled to facilitate assembly. All joint surfaces shall be lubricated with a heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean.

G. Rubber Gasketed: When rubber-gasketed joints are used for hub and spigot type cast iron soil pipe, spigot ends shall be plain, without beads. Cut ends of all pipe shall be cut square and all burrs removed. Spigot ends shall be coated with a lubricant recommended by the gasket manufacturer and fully seated in the gasket. Clamps for hubless cast-iron soil pipe shall be installed in accordance with the manufacturer's recommendations.

3.8 PLASTIC PRESSURE PIPE (PVC)

A. Pipe joints shall be assembled according to manufacturer's instructions. Joints shall be restrained with bell restrained clamps in locations where restrained joints are required, as specified herein.

B. Mechanical joint fittings shall be assembled as specified herein for ductile iron pipe.

3.9 JOINT RESTRAINT FOR PRESSURE PIPING: Joint restraint shall be provided for portions of buried piping which will serve in a pressure flow application, including: water lines and pump discharge lines.

A. Joint restraint for all pressure pipe shall be accomplished by means of thrust blocks, as shown and detailed on the Drawings.
   1. All plugs, caps, tees, bends and hydrants shall be provided with thrust blocks according to the details in the plans, and using 3,000 psi concrete.
   2. The concrete shall extend from the fitting or hydrant to undisturbed soil and poured or formed so that joints are accessible. If adequate soil support cannot be obtained, a mechanical restraining assembly shall be installed.

B. Where specifically indicated on the Drawings, concrete thrust blocks shall be provided in place of mechanical restraint.

C. Joint restraint for pressure pipe shall be accomplished using bell restraint clamps for joints between pipes, and fitting restraint devices at joints with fittings, as specified herein. Joints shall be restrained for a minimum distance as recommended by the manufacturer of the joint restraint device being used and for the conditions in which the pipe is installed.

3.10 HDPE PLASTIC PIPE

A. Thermally welded joints shall me made in accordance with the manufacturer's recommendations. Pipe ends shall be properly cut, faced, heated, and joined to provide a tight and thoroughly fused joint with uniform bead thicknesses. The thickness of each bead on a finished joint shall be of uniform diameter.

3.11 DIRECTIONALLY DRILLED CROSSINGS

A. Directionally drilled crossings shall be performed in accordance with industry practice, and shall include all labor, equipment and consumables necessary to accomplish the following:
   1. Clearing, grading, and general site/access preparation necessary for construction operations;
   2. Transportation of all equipment, labor, consumables, and Owner supplied materials to and from the jobsite;
   3. Erection of horizontal drilling equipment at the drill site;
   4. Reaming the pilot holes to a diameter suitable for installation of the prefabricated pull sections;
   5. Installation of the prefabricated pull sections along the reamed holes;
   6. Fabrication of the pull sections; and
   7. Clean-up and restoration of all work areas.

B. Horizontal directional drilling type machines shall be used when a minimum bend radius is specified on the project "Drawings". Contractor shall not bore a radius smaller than specified on the project "Drawings". Wash boring is not permitted.

C. Sodium Bentonite and/or gel type drilling muds are permitted for cuttings removal, borehole stabilization and carrier pipe lubrication on pullback.
   1. No fluid shall be approved or used that does not comply with permit requirements and environmental regulations. Drilling fluid shall not contain any additives that impart taste, odor, or contain hazardous materials.
   2. Disposal of drilling fluids shall be the responsibility of the Contractor and shall be conducted in compliance with all relative environmental regulations, right-of-way and workspace agreements, and permit requirements.
   3. Mud pits shall be suitably lined and bermed to prevent leakage to the surrounding area. All barrels, tanks, connections, valves, lines, etc. shall be maintained in good condition so that

leaks do not occur. Should a leak occur, any spillage shall be cleaned up immediately and the cause of the leak remedied.

4. The drilling Contractor shall be responsible for mud containment/disposal.
5. The Contractor is responsible for securing permits and transporting all excess fluids to an approved disposal site.

D. Pulling:

1. Before inserting a plastic pipe through a bored hole, ensure that the size of the bore is of sufficient diameter to prevent stress during insertion.
2. The pull section shall be supported during pull back so that it moves freely.
3. A swivel shall be used to connect the pipeline pull section to the reaming assembly to minimize torsional stress on the pipeline pull section.
4. A leader or fuse link approximately four feet long of the next smaller size PE pipe shall be added to the pulling hitch.
5. The pull section shall be installed in 1 continuous length with no tie-in welds, if possible. If this is not possible, tie-in welds shall be minimized.
6. The leading end of the inserted pipe shall be closed to prevent entrance of dirt and water.
7. After insertion, the leading end shall be examined in the exit bell hole to see if there are any scratches or gouges which would indicate contact with sharp objects.
8. If the pipe is damaged or distorted, remove the pipe and pull a plug through the bore to clean the hole. Repeat this process as many times as necessary until the leader passes through the bore undamaged.
9. The maximum allowable pulling force on the pipeline pull section shall not exceed 5,500 pounds.
10. The Contractor shall at all times provide and maintain instrumentation which will accurately locate the pilot hole and measure drilling fluid flow discharge rate and pressure. The Owner shall have access to these instruments and their readings at all times.
11. Polyethylene has elastic properties, and if the pulling load on the pipe does not exceed the Safe Pull Strength, the pipe will relax back to its original pre-pull length. After the pull is complete, a relaxation period of several hours is necessary before final tie-in. The pipe shall be pulled slightly past the tie-in point to accommodate pipe contraction and facilitate final tie-in.

E. Tracer Wire: In an “uncased” insertion of plastic pipe through a bored hole, a 12-gage copper tracer wire shall be attached to the leading pipe and inserted along with the pipe. Care shall be used to try and minimize the twisting of the wire around the pipe.

3.12 PIPE ACCESSORIES

A. Mechanical couplings: Mechanical couplings shall be carefully installed in accordance with the manufacturer's recommendations. Pipe ends shall be separated by a space of at least 1/4 inch but not more than 1 inch. Pipe and coupling surfaces which contact gaskets shall be clean and free from dirt during assembly. Following installation of the coupling, damaged areas of shop coatings on the pipe and couplings shall be repaired.

3.13 PRESSURE PIPING ACCEPTANCE TESTING

A. All new pressure piping will be subject to hydrostatic pressure testing under this subpart. Force mains and pressure sewers shall be tested from the point of discharge to the isolation valves in the corresponding lift station(s). New segments of pipelines which will be connected to existing lines shall be pressure tested prior to connection.

B. Water lines, including potable water and service water, shall be tested in accordance with Section 02725 - Water Line Testing and Flushing, and shall be disinfected after hydrostatic testing in accordance with AWWA C651 and Section 02726 - Water Line Disinfection.

C. Notification: Contractor shall notify Engineer at least 48 hours in advance of the scheduled time for testing. Resident Project Representative shall be present for acceptance testing and approval.

D. Test Conditions:
1. Test pressure shall be 100 psi (gauge) for the sewage forcemain, for process piping and for other pressure pipes. This pressure will not exceed the thrust-restraint design pressure.
2. The hydrostatic test shall be of at least a 2 hour duration. Test pressure shall not vary by more than ∀5 psi for the duration of the test.
3. Contractor shall pressure test new forcemain in segments or increments not to exceed 3,000 feet.
4. If Contractor chooses to test in segments, provide AWWA resilient seated gate valves or temporary valves.

E. Test materials: Contractor shall supply all of the necessary plugs, hose, riser pipe, pumps, gauges, and other equipment as required for the testing. The Contractor shall obtain permission from the Owner for use of Owner's water supply from an existing fire hydrant.

F. Pressurization: After the pipe has been laid and backfilled, the section of pipe shall be isolated. The pipe shall be slowly filled with water. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so that the air can be expelled as the line if filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place as directed by the Engineer. The specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied by means of a pump connected to the pipe. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. The system will be allowed to stabilize at the test pressure before the leakage test is conducted.

G. Examination: All exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until satisfactory results are obtained.

H. Leakage: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time. Allowable leakage shall be as follows:

Pipe Size (inches)	Allowable Loss 50 psig test pressure (gallons per hour per 1,000 feet)	Allowable Loss 100 psig test pressure (gallons per hour per 1,000 feet)
1.5	0.080	-
2	0.106	-
4	0.212	0.30
6	0.319	0.45
8	0.425	0.60
10	0.531	0.75
12	0.637	0.90
14	0.743	1.05
16	0.849	1.20
18	0.956	1.35
20	1.063	1.50

I. Acceptance of Installation: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe discloses leakage greater than that specified above, repairs or replacements shall be accomplished in accordance with the specifications. All visible leaks shall be repaired regardless of the amount of leakage.

3.14 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

B. Compaction and soil testing will be performed in accordance with Section 02320 - Earthwork and Trenching.

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SECTION 02922

SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: This section covers the operations necessary to establish and maintain a grass cover for stabilizing soils on new slopes and swales, and in areas damaged by trenching and construction operations.

B. Contractor shall perform all clearing, grading, fertilizing, preparing of seedbed, seeding, covering and firming of seed into the soil, application of mulch, and maintenance.

1.2 RELATED SECTIONS

A. Section 02320 - Earthwork and Trenching

1.3 SUBMITTALS: The Contractor shall submit the following items required by this division in accordance with the Submittals Section.

A. Product data for review:
1. Representative label bearing the composition of seed mixtures.
2. Label indicating the composition of the fertilizer.

B. Product data for information:
1. Copies of supplier's invoices for all seed, mulch, and fertilizer showing the weight purchased for the project.

1.4 GUARANTEE

A. The Contractor shall unconditionally guarantee a stand of grass that is reasonably uniform in density and reasonably free of weeds, and otherwise acceptable to the Owner for eight weeks after seed has been planted.

PART 2 PRODUCTS

2.1 SEED

A. Seed: All seed shall be labeled in accordance with U.S. Department of Agriculture Federal Seed Act. Seeds shall be free of prohibited weed seeds and shall contain no more than one percent of noxious weed seeds.
1. Seeds shall be delivered to the site in convenient, fully labeled containers bearing the name, trade name or trademark and warranty of the manufacturer with a certificate of the purity and germination of each kind of seed.

2. Type "A" seed mixture shall be used for established yards, shoulders and slopes in street right-of-way and other areas designated on the Drawings. Type "A" seed mixture shall be as follows:

Table 1: Type "A" Seed Mixture

Kind of Seed	Minimum Pure Live Seed (%)	Rate of Pure Live Seed (lb/acre)
Turf Type Tall Fescue	80	105
Perennial Rye Grass	80	65
Kentucky Blue Grass	75	50
Creeping Red Fescue	85	30
Total		250 lb/acre

3. Type "B" seed mixture shall be used for areas outside of the street right-of-way which are not maintained and other areas designated on the Drawings. Type "B" seed mixture shall be as follows:

Table 2: Type "B" Seed Mixture

Kind of Seeds	Minimum Pure Live Seed (%)	Rate (Lbs. per Acre)
Alta Fescue or Kentucky 31 Fescue (Festuca Elatior Var. Arundinces)	75	90
Rye Grass (Lolium Perenne or L. Multiflorum)	80	50
Total		140 lb/acre

2.2 FERTILIZER: Fertilizer shall be a complete commercial grade, minimum 12-12-12 water soluble, fertilizer.

2.3 MULCH: Mulch shall be hay or straw with no viable seeds of noxious weeds.

PART 3 EXECUTION

3.1 PREPARATION

A. Clearing and stripping, earthwork, grading, and placement of topsoil shall be performed as specified in Section 02320 - Earthwork and Trenching.

B. Areas to be seeded containing excess weeds shall be sprayed with a non-selective herbicide, such as Roundup or equal. Follow herbicide manufacturer's instructions for application rates and time after application before seeding can be completed.

3.2 SEEDING

A. Seeding: Seeding shall be performed on all areas disturbed by construction that are not reestablished by sodding, pavement, gravel, driveways and other methods of reestablishment. Included shall be seeding, fertilizing, mulching, preparation of seed bed, and maintenance.
   1. Fertilizer shall be evenly distributed before tilling, at a rate of six hundred (600) pounds per acre (7 pounds per 500 square feet) and incorporated into the soil to a depth of at least two inches by discing or harrowing.
   2. Those areas designated to be seeded shall be cleared and graded prior to tilling. The surface shall be tilled to a depth of at least two inches by discing or other approved methods until

the surface is suitable for seeding. The prepared surface shall be maintained until seeding and mulching is completed to prevent excessive weeds, gullies, and depressions.

3. Seeding and fertilizing shall be performed between February 15 and April 15 or between August 15 and October 15. The specified seed shall be sowed using a mechanical spreader or drill at the application rate. Successive seeding strips shall be overlapped to provide uniform coverage. Seed sown by broadcast type seeders shall be raked in or otherwise covered with soil to a depth at least one-quarter inch and rolled to obtain a firm seed bed.
4. Seed that is wet, moldy or otherwise damaged in transit or storage shall not be used. Seeding shall not take place when wind velocity exceeds five (5) miles per hour.
5. Immediately following completion of seeding, if in the Engineer's judgment the seed bed is too loose or contains clods, the entire area shall be compacted using a roller weighing at least sixty (60) but not more than ninety (90) pounds per lineal foot of roller.
6. Within 24 hours of seeding, mulch shall be spread over all seeded areas. Mulch shall be spread uniformly with a mechanical spreader or other approved methods at a rate of 2 tons per acre. Mulch shall be spread in a loosened condition with no lumps of compacted material. Mulch shall be anchored into the soil a minimum of 2 inches using a heavy disc harrow by not more than two passes of the harrow. Discs of the anchoring tool shall be set approximately nine inches apart. Mulch shall be anchored not cut.
7. Seeded areas shall be watered immediately following application of mulch, to a depth of at least two (2) inches. Care shall be taken not to cause erosion. Watering shall be repeated daily until a flourishing grass coverage is achieved.
8. The seeded area shall be protected against damage by vehicle and pedestrian traffic by use of barriers and warning signs. If at any time before completion and acceptance of the seeding work any portion becomes gullied, damaged or destroyed shall be repaired or re-established to the specified condition at the Contractor's expense prior to acceptance by the Owner.
9. Maintenance: Maintenance shall include watering, as required of the seed bed and resulting growth, and replacement of any areas eroded by any causes.

END OF SECTION

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SECTION 03300

MISCELLANEOUS CONCRETE

PART 1 GENERAL

1.1 GENERAL

A. The Contractor shall provide all concrete work as required to complete the concrete construction as specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

1.3 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the section requirements shall govern.

A. American Concrete Institute (ACI):
1. 302 - Guide for Concrete Floor and Slab Construction.
2. 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
3. 305 - Committee Report on Hot-Weather Concreting.
4. 306 - Committee Report on Cold-Weather Concreting.
5. 309 - Recommended Practice for Consolidation of Concrete.
6. 318 - Building Code Requirements for Reinforced Concrete.
7. 347 - Recommended Practice for Concrete Formwork.

B. American Society for Testing and Materials (ASTM):
1. A-615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement
2. C-31 Making and Curing Concrete Test Specimens in the Field.
3. C-33 Concrete Aggregates.
4. C-39 Compressive Strength of Cylindrical Concrete Specimens.
5. C-94 Ready-Mixed Concrete.
6. C-143 Slump of Portland Cement Concrete.
7. C-150 Portland Cement.
8. C-185 Test Method for Air Content of Hydraulic Cement Mortar

C. Midwest Concrete Industry Board (MCIB).

1.4 SUBMITTALS

A. Contractor shall submit product data for review on the following items required by this Division:
1. Laboratory name.
2. Aggregate testing and gradation.
3. Design mix.

B. Product data shall be submitted in accordance with Section 1300 - Submittals.

PART 2 PRODUCTS

2.1 CEMENT: Cement shall conform to ASTM C-150, Type I. Cement may be bagged or bulk. Cement shall be used from only one mill throughout the entire project.

2.2 FINE AGGREGATE: Fine aggregate shall conform to ASTM C-33 and have the following gradation:

Sieve	% Passing	% Retained
3/8"	100	0
No. 4	95-100	0-5
No. 8	80-100	0-20
No. 16	50-85	15-50
No. 30	25-60	40-75
No. 50	5-30	70-95
No. 100	0-10	90-100

2.3 COARSE AGGREGATE

A. Coarse aggregate shall conform to ASTM C-33 and have the following gradation:

Sq. Sieve	% Passing	% Retained
1"	100	0
3/4"	90-100	0-10
3/8"	20-55	45-80
No. 4	0-10	90-100
No. 8	0-5	95-100

2.4 WATER

A. Treated and filtered water from a municipal or other public water supply district shall be used.

2.5 REINFORCING STEEL

A. All bars shall conform to ASTM A-615, Grade 60. Bending details shall conform to ACI 318.

2.6 FORMS

A. The forms shall be true and rigid and conform to shape, line and dimensions as shown on the Drawings. All forms shall be rigidly constructed, braced and tied to prevent any deflection or displacement during placing of concrete. All exposed corners and edges shall have 3/4-inch fillets or chamfers. All joints shall be mortar tight; open joints shall be sealed as required.

2.7 CONCRETE MIX

A. Proportioning: Concrete shall conform to the following:
   1. Cement: 6 sacks per cubic yard, minimum.
   2. Water: Water shall be kept to an absolute minimum to maintain slump as specified.
   3. Aggregate: The sand factor shall be as required to give the best workable mix within the range of 46 to 52 percent of total aggregate by weight.
   4. Strength: Minimum 4000 psi at 28 days.

B. Slump: The maximum slump shall not exceed 4 inches. Determination of slump shall conform to ASTM C-143.

C. Mixing: Contractor shall use ready-mixed concrete, mixed and delivered in conformance with ASTM C-94.

D. Admixtures: Air entraining agents shall be added to the concrete to provide 4 to 6 percent entrained air when placed, in conformance with ASTM C-185.

PART 3 EXECUTION

3.1 PLACING REINFORCING STEEL

A. All bars are to be accurately placed and securely tied at all intersections.

B. Reinforcing steel shall be free from flaky or scaly rust which will destroy or reduce the bond strength at the time concrete is placed.

C. Unless shown otherwise on the Drawings, the following minimum concrete coverage shall be maintained:
1. Against earth: 3 inches
2. Against forms or when exposed to water or weather: 2 inches

3.2 PLACING CONCRETE

A. No concrete shall be deposited below water. The excavation may be damp but shall contain no free water.

B. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Re-tempering of concrete is not permissible.

C. All concrete shall be thoroughly compacted during placement by means of vibrators in conformance with ACI 309.

D. For formed surfaces, the Contractor shall break off ties, grout voids which are deeper than 1/2-inch and chip out honeycombed areas to solid concrete and grout flush with formed surface.

E. Curing shall be maintained continuously for seven days after placing concrete or until forms are removed and the surface finished. Concrete surface temperature is to be maintained between 50EF and 100EF for at least seven days.

F. Concrete shall not be placed on iced or frozen subgrade or when the air temperature is below 20EF. Concreting shall not be continued when the air temperature is below 45EF unless the following conditions are attained:
1. Mixing water shall be heated (to a maximum of 150EF).
2. Aggregates shall be heated until free of all ice and frost.
3. The concrete temperature after mixing shall be between 50EF and 70EF if the air temperature is 20EF to 45EF.
4. After the concrete is placed, it shall be covered, protected, and heated so as to maintain a minimum of 70EF air temperature for the first 24 hours and 50EF air temperature for the next six days. Open-flame type heaters are not permitted. Heating equipment not vented outside of the covering will not be permitted.
5. Moist conditions shall be maintained during the heating period.
6. All covering, heating equipment, etc., shall be on hand and approved by the Engineer before any concrete is placed.

G. Admixtures, such as calcium chloride, shall not be used.

H. Exposed concrete is not to be placed in air temperatures above 100EF. Cover, protect and cool work as required to maintain the temperature of the concrete below 100EF. The concrete temperature, after mixing, shall not be greater than 85EF. Spray and/or shade aggregate piles and cool mixing water as required.

3.3 FINISHING

A. Unformed Surfaces:

1. Screed Finish:
   a. Use as first stage for all concrete finishes.
   b. Use as final finish on surfaces that will be covered by additional concrete, grout placement, or mortar setting bed except as otherwise specified.
   c. Immediately after screeding, use a wood float, darby, or bull float to eliminate high and low spots and to embed large aggregate. This shall be done in a manner to produce even, uniform surfaces so that surface irregularities do not exceed 3/8 inch in 10 feet when used as final finish.
2. Floated Finish:
   a. Use as second stage of broomed, troweled, or magnesium-troweled finish.
   b. Use as final finish on all areas to receive built-up roofing.
   c. Float with mechanical float. Hand floating will be permitted only in areas inaccessible to mechanical float.
   d. On surfaces not to receive troweled or magnesium-troweled finish, finish with wood or cork float after mechanical floating to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.
3. Broomed Finish:
   a. Use as final finish on all outdoor slabs including pavements and sidewalks.
   b. After floated finish, draw a stiff bristle broom across the surface making uniform corrugations, perpendicular to the direction of traffic, not more than 1/16 inch deep.
4. Troweled Finish:
   a. Use as final finish on inside floors and on all other unformed surfaces not otherwise indicated or specified.
   b. Trowel with steel trowel, mechanical or hand, to obtain a smooth, dense finish. The final troweling shall be done after the concrete has become hard enough so that no mortar adheres to the edge of trowel and a ringing sound is produced as the trowel passes over the surface.
   c. Do not trowel before surface water has evaporated or has been removed with a squeegee.
   d. Finish to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.
   e. Do not add sand or cement to the floor surface.
5. Magnesium-Troweled Finish:
   a. Perform as specified for Troweled Finish, this Section, except use a magnesium trowel by hand instead of a steel trowel to obtain a dense, but not slick, finish.
   b. Use where floor will receive protective coating after curing.
6. Stair-Tread Finish:
   a. Apply to all interior and exterior concrete stair treads and landings that do not have abrasive nosings.
   b. Spread fine abrasive aggregate uniformly on concrete before it has set, in the amount of not less than 1/4-pound aggregate per square foot, and steel trowel into surface of concrete.
   c. Expose abrasive aggregate slightly by rubbing with an abrasive brush after concrete finish has set and cured.
   d. Aggregate and application shall conform to Specification “A” of the Norton Company.

7. Contraction Joints:
   a. Locate as indicated.
   b. Maintain true alignment with straightedge.
   c. Joints shall be grooved except where sawed joints or preformed joints are indicated.
   d. Grooved Joints:
      1) Perform during the finishing process.
      2) Width of groove shall not exceed 1/4 inch.
      3) Depth of groove shall be at least 1 inch.
   e. Sawed Joints:
      1) Cut joints with power blade as soon as concrete surface is firm enough to resist tearing or damage by the blade and before random shrinkage cracks can occur. (Usually required within 4 to 12 hours after finishing.)
      2) Make joints approximately 1/8 inch wide with depth as indicated.
      3) Seal with the same type sealant specified for expansion joint sealant.
   f. Preformed Joints:
      1) Install preformed joints as recommended by manufacturer.

B. Formed Surfaces:
   1. Repair surface defects as specified under Repair of Defective Surfaces, this Section.

C. Repair of Defective Surfaces:
   1. Defined as any concrete surface showing misalignment, rock pockets, poor joints, holes from ties, voids, honeycomb, or any other defective area.
   2. Repairing:
      a. Repair as soon as forms have been removed.
      b. Chip surface back to minimum depth of ½ inch, chip edges perpendicular to surface, pre-wet depression and brush with heat cement immediately before patching.
      c. Patch surfaces using still mortar with same sand-cement ratio as original concrete and with minimum water for placing. Blend with white cement to match concrete color.
      d. Compact mortar into depressions so that after curing, hole is filled and mortar is flush with surface. Use hammer and rod for compacting the holes.
      e. Moist-cure for 3 days or use curing compound.
      f. Engineer shall be notified of areas containing defects or where reinforcing steel is exposed, prior to determination of repair method.

3.4 FLOOR SURFACE TREATMENT

A. Apply sealer in accordance with manufacturer's instructions on scheduled floor surfaces.

B. Prior to placing floor sealer, all stains from oils, greases, etc. shall be removed.

3.5 CONCRETE TEST CYLINDERS

A. All concrete test cylinders shall be provided by the Contractor, using a licensed testing laboratory. The making and testing of test cylinders, including transportation and all expenses, shall be paid for by the Contractor.

B. The Contractor's testing laboratory shall make at least four (4) test cylinders for each day's pour in excess of 6 cubic yards of each class of concrete, and two test cylinders for each additional 50 cubic yards or major fraction thereof, as directed by the Engineer.

C. The Contractor shall ship the test cylinders to the laboratory on the fourth day, where the laboratory shall proceed to cure until tested. One cylinder shall be tested on the seventh day, and two cylinders tested on the 28th day (leaving one spare cylinder). The test cylinders shall be identified at the time cast, and as to which pour is represented. Unsatisfactory tests of cylinders shall make the concrete represented subject to rejection, with consequent removal and replacement required.

D. Concrete test cylinders shall be cast and tested in accordance with ASTM C-31 and C-39. The testing laboratory shall furnish four (4) copies of test reports for test cylinders for slump, air, temperature and compressive strength and distributed as follows:
1. 2 copies - Engineer
2. 2 copies - Contractor

END OF SECTION

SECTION 11300

LOW PRESSURE GRINDER PUMP STATION

PART 1 GENERAL

1.1 SUMMARY

A. General: The Contractor shall furnish and install three (3) complete factory-built and tested simplex grinder pump stations for each location indicated in the Drawings. The Contractor shall confirm the proper operation of the pump system. Grinder pumps shall be Progressive Cavity type pumps which are specifically designed and intended for service in pressure sewer systems. All pumps supplied on the project for this service shall be of the same manufacturer. Centrifugal pump hydraulic characteristics do not conform to engineered pipe line sizes in the LPS system and will not be acceptable.

B. Acceptable System Components: Submersible pumps shall be furnished complete with pump casings, shafts, bearings, seals, lubrication, piping assemblies, pump support, anchor bolts, motors, controls, power cable, and all other parts and accessories indicated, specified or required for proper installation, operation, and maintenance of a complete system.

C. Coordination Responsibility: The pump manufacturer shall be responsible for ensuring that the pumps, motors, and controllers are fully compatible for operation as specified.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 01750 - Starting of Systems

C. Section 02320 - Earthwork and Trenching

1.3 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the section requirements shall govern.

A. American Society for Testing and Materials (ASTM):
   1. A36 - Standard Specification for Carbon Structural Steel
   2. A48 - Standard Specification for Gray Iron Castings
   3. D883 - Definitions of Terms Relating to Plastics
   4. D3753 - Glass Fiber Reinforced Polyester Manholes and Wetwells

B. American Iron and Steel Institute (AISI).

C. National Electrical Manufactures Association (NEMA).

D. National Fire Protection Association (NFPA):
   1. 70 - National Electrical Code (NEC).

E. National Safety Council.

1.4 SUBMITTALS: The Contractor shall submit the following items required by this division in accordance with Section 01300 - Submittals:

A. Product data for review:
   1. Performance curves for each pump model furnished.
   2. Report of factory tests, as specified herein under "QUALITY ASSURANCE".
   3. Control System
   4. Submersible Motors

B. Warranty for pumps and controls, on manufacturer's letterhead.

C. The Pump manufacturer shall provide approved Operation and Maintenance Instructions, which includes the following:
   1. Each set of O&M Instructions shall include separate performance criteria and unique characteristics of pump. Information which applies to all pumps may be provided only once per set, if clearly identified as applying to all units.
   2. Manuals shall include the required service training information listed above and shall include detailed drawings with detailed parts listing, wiring diagrams and schematics for all pump components. Operation and maintenance manuals shall be submitted for Engineers approval.

1.5 QUALITY ASSURANCE

A. Factory Tests and Reports:
   1. Include all manufacturer's standard factory tests on equipment and material per ANSI/HIS standards.
   2. Submit results of tests in accordance with DIVISION 1.
   3. Perform standard tests on all motors in accordance with IEEE.

1.6 MANUFACTURER'S FIELD SERVICES: In accordance with Section 01750 - Starting of Systems, an authorized representative of the manufacturer shall provide the following:

A. Start-up Services: As required, for each of the three (3) grinder pump stations supplied

B. Demonstration and Training: One 4-hour session shall be provided.

1.7 FACTORY ASSEMBLY

A. Pump/motor units shall be completely shop assembled and aligned prior to shipping.

B. After completion of the specified factory tests, pumps shall be prepared for shipment with the minimum amount of disassembly, and such that no field disassembly, cleaning, or flushing is required.

C. Any components removed for shipping shall be match-marked prior to removal and shipment.

D. Prepare surfaces and provide paint system standard of the manufacturer and suitable for service intended.

1.8 WARRANTY

A. Pumping Equipment: The pump manufacturer shall provide a warranty with coverage as given below. Warranty shall not commence before startup of all pumping units by manufacturer's authorized representative, in accordance with Division 1 of the Specifications.
   1. The controls shall be covered for two (2) years against defects. Warranty shall cover 100 percent of the cost of both parts and labor for repair or replacement, with no prorating over this term.
   2. Pumping units shall be covered for two (2) years against defects in materials and workmanship. Wear items including mechanical seals and bearings shall be covered under the warranty. Wearing rings may be excluded from the warranty. Obligation of manufacturer under warranty shall be to cover the cost of both parts and labor for replacement. Coverage shall be full and not pro-rated. Owner shall cover the cost of pump delivery to manufacturer's local service center in the Kansas City area. Manufacturer shall cover return shipping. Owner will re-install equipment.

B. Service Calls:
   1. Pump manufacturer or his authorized representative may visit the installation as he sees fit to troubleshoot and inspect the pumps during the warranty period. Manufacturer's service personnel shall contact the Owner at least one working day prior to such visits.
   2. When Owner has notified the manufacturer of a problem, manufacturer shall respond promptly. If a pump is out of service or if the controls system is experiencing problems, manufacturer shall arrive to service the installation not more than 48 hours after notification by Owner. A factory trained and authorized technician shall be available to address problems with the pumps and controls.
   3. Manufacturer may elect to try and direct Owner's personnel to correct the problem, if the problem is simple and Owner is able to assist. If unsuccessful, such efforts shall not eliminate manufacturer's responsibility to make a service call.
   4. Manufacturer shall maintain a log of all service performed on the equipment during the warranty period, and shall furnish Owner a copy of this log upon request, and at the end of the warranty period.
   5. Manufacturer shall provide Owner with necessary forms to accurately keep records of maintenance.

C. Effective Date: The warranty shall become effective upon Final Acceptance of the Work, or the date which the last of the pumps are started. Warranty shall not commence on the date of delivery nor of shipment.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers
   1. E-One Corporation
   2. Flygt (Xylem)
   3. Engineer Approved Equal

B. Equivalent Products: Subject to the requirements of Section 01600.

2.2 MATERIALS AND CONSTRUCTION

A. Grinder Pump Station
   1. Performance: Pumps shall be capable of delivering 15 gpm against a rated total dynamic head (TDH) of 0 feet, 11 gpm against a TDH of 40 feet, and 7.8 gpm against a TDH of 80

feet. The pumps must also be capable of operating at negative total dynamic head without overloading the motor(s). Minor variances between manufacturers will be acceptable.

2. Wiring:
   a. Pump power and level control wiring shall be field installed by a certified electrician. All electrical cables penetrating or passing through the conduit flange of the pump station must be water-tight and sealed by the electrician immediately upon installation. Color coded insulated wire for power cord, and insulated wire for float level sensors if required.
   b. Cable connection shall be one of the following options:
      1) Junction Box: The pump power cable shall be connected directly into a NEMA 4X water tight junction box and spliced connected with the appropriate color coded wire gage for proper terminal strip placement.
      2) The power cable shall connect to the pump by means of a NEMA 6P Electrical Quick Disconnect which enters the tank through a watertight strain relief connector.
3. Check Valves:
   a. Pump discharge pipe shall be equipped with a factory-installed gravity-operated check valve. The valve will provide a fully ported passageway when open and shall introduce a friction loss of less than six inches of water at maximum rated flow. Working parts shall be made of heavy duty cast iron or 300 series stainless steel.
   b. Each basin package will require a redundant check valve for installation provided by the contractor in the service lateral between the grinder pump station and the low pressure sewer main. Valves shall be 1.25 inch NPT and only require 0.5 pounds of backpressure for complete closure.
   c. Redundant check valve will be identified on a separate line item bid sheet and provided by the manufacturer of the grinder pump.
4. Level Detection:
   a. Level detection for controlling pump and alarm operation shall be controlled by one of the following.
      1) By use of mechanical float switches. Switches utilized in the system shall be hermetically sealed in a submersible watertight protective housing securely attached to a PVC float tree with wire tie. Float switch cord will be securely tightened 4 inches maximum above float.
      2) By use of level sensing controls which monitor the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater. Level sensing controls shall be housed in a separate enclosure from motor starting controls.
   b. Level detection device shall be designed to be protected from solids, greases, oils, fats and corrosive sewer gases. Switch shall have high impact, corrosion resistant housing for use in sewage and water up to 140°F (60C).
5. Shut-Off Valve: The pump discharge pipe connection shall be equipped with a shut-off valve and a quick disconnect. The valve shall be fully ported, constructed of bronze with stainless steel ball, stainless steel stem and hardware, and Teflon seats, with a minimum rated pressure of 150 PSI. A 304 stainless steel extension valve handle will be supplied for manual operation from top of basin secured with stainless steel support bracket.
6. Anti-Siphon Valve: The pump discharge shall be equipped with a factory-installed integral anti-siphon valve built into the discharge piping after the check valve.
7. Fiberglass Tank: The tank shall be a wetwell design consisting of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present. The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified

burial depth for each available tank height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation.

B. Pumps

1. Design
   a. Each grinder pump shall be a heavy duty pump used as a grinder. Each grinder pump shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects", such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter discharge piping.
   b. The cutter materials shall provide maximum corrosion and abrasion resistance. The remaining portion of the grinder pumps, with the exception of seal materials and wet end, shall be similar to the heavy duty pumps used in larger pump stations for daily operation.
   c. Each pump shall be equipped with a 1 to 2 HP submersible electric motor connected for operation on 240 volts, 1 phase, 60 hertz, with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA approval.
2. Construction: All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel.
3. Motor cooling system is sufficiently cooled by the surrounding environment or pumped media. Oil filled motors will not be acceptable.
4. Electric Submersible Motor:
   a. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 15 evenly spaced starts per hour. Motor will be suited for LPSS hydraulic conditions. The rotor bars and short circuit rings shall be made of cast aluminum.
   b. 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.
   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 motor and cable shall be capable of continuous submergence without loss of watertight integrity. 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.

C. Alarm/Control Panels

1. Each grinder pump station shall include a NEMA 4X, UL-listed alarm/control panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester or fiberglass to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.
2. All conduit entrances shall be made in a NEC approved manner. The conduits to the wet well shall have approved seal-off fittings installed and properly sealed to protect the control panel from adverse damage from the wet well. Electrical contractor will furnish and install.
3. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability.

4. The visual alarm lamp shall be inside a shatter-resistant red lens. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB at 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

2.3 SPARE PARTS

A. The following spare parts shall be provided:
1. Supply one (1) spare grinder pump core for the three pump stations installed, complete with all operational controls, level sensors, check valve, anti-siphon valve, pump/motor unit, and grinder.

2.4 ELECTRICAL EQUIPMENT AND CONTROLS

A. Conform to NEC, NEMA, IEEE and DIVISION 16 on all electrical equipment and controls.

B. Refer to DIVISION 16 for electrical control panel, motor starters, and pump controls.

PART 3 EXECUTION

3.1 INSTALLATION: The grinder pump station and related components shall be installed in accordance with the manufacturer’s recommendations.

A. Installation shall be accomplished so that 1-inch to 4-inches of the tank, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor.

B. A concrete anti-flotation ballast, as shown in drawing details and sized according to the manufacturer's instructions, shall be required for all pump stations and shall be precast to the pump station or poured in place. Each grinder pump station with its pre-cast concrete ballast shall have a minimum of three (3) lifting eyes for loading and unloading purposes. If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8-inch sleeve is required over the inlet prior to the concrete being poured.

3.2 START-UP AND TESTING

A. The manufacturer shall provide the services of a qualified factory trained technician who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the Owner's personnel in the operation and maintenance of the equipment before the stations are accepted by the Owner.

B. All equipment and materials necessary to perform testing shall be the responsibility of the Contractor. This includes, as a minimum, a portable generator and power cable (if temporary power is required), water in each basin (filled to a depth sufficient to verify the high level alarm is operating), and opening of all valves in the system. These steps shall be completed prior to the qualified factory trained technician(s) arrival on site.

3.3 ON-SITE PERFORMANCE TESTS

A. Conducted by pump manufacturer's authorized representative in presence of Contractor and Engineer.

B. Equipment Tests:
   1. Check performance of all components as a functioning unit.
   2. Check alignment of each unit.
   3. Confirm proper rotation of impeller.

C. Operational Tests:
   1. Conduct such operational tests as necessary to determine that the performance of equipment and controls is as specified.
   2. Tests will generally consist of placing equipment in operation under varying conditions and verifying performance (including no-load).
      a. Test all control sequences and functions.
      b. Perform complete meg-ohm testing.
      c. Take amperage and voltage readings.
   3. Dry Run Test: No liquid is to be allowed to enter the inlet of the pump. The exterior of the pump shall be dry and remain dry during test. Test duration shall be a minimum of 30 minutes.

D. Submit a written test report to General Contractor (with one copy to Engineer) in a letter form stating operations performed and results obtained for each unit.

END OF SECTION

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SECTION 13330

WASTE HOLDING TANK AND SEPTIC TANK DECOMMISSIONING

PART 1 GENERAL

1.1 SUMMARY

A. This section includes the requirements for removing existing septic tanks from service and divert the wastewater flows to new grinder pump stations to abandon the waste holding tank and septic tanks. The waste holding tank at the truck wash building will be cleaned and remain in service as an oil/water separator tank.

B. This section is written under the following premises and the Contractor shall prepare the bid accordingly.
1. The Contractor shall provide the dewatering of the holding tank and septic tanks and complete the final cleaning of the tanks to remove heavy solids from the bottom and solid materials that have built up on the walls and ceiling of the tanks.
3. The Contractor shall haul all of the wastewater and solids materials off site for disposal.
4. Once the new pressure system is installed, tested and ready for service the Contractor shall connect to the existing waste service lines and divert the flow to the new pump stations.
5. The orientation of the waste holding tank and septic tanks (and waste service lines) are indicated on the Drawings. The tanks are located adjacent to the building it serves, with a buried top with access to the connecting waste line.

1.2 RELATED SECTIONS

A. Section 01100 - Summary of Work.

B. Section 01330 - Submittal Procedures.

C. Section 02320 - Earthwork and Trenching.

D. Section 02922 - Seeding

1.3 DESCRIPTION OF EXISTING FACILITIES

B. A. The existing on-site wastewater system for the MoDOT Nashua Maintenance Facility consists of a waste holding tank for the truck wash building that is periodically pumped out and hauled off site. The office building and maintenance buildings are served by on-site systems that include a septic tank and lateral field. The office building also has a pump to convey the wastewater from the septic tank into the lateral field. 0The MoDOT plans to install a new low pressure sewer system with three (3) grinder pump stations to decommission the existing and septic tanks. The waste holding tank at the truck wash building will be cleaned and remain in service as an oil/water separator tank.

B. Septic and Holding Tank Contents
1. Source: Water and solids in the existing septic tanks is from individual facility sources such as faucets, toilets, showers, and other miscellaneous household sources.
2. Average solids content of material in the tanks is unknown.

C. Ancillary Facilities: The Drawings illustrate related components, including piping and valves.

1.4 SUBMITTALS: The Contractor shall submit the following items required by this Section in accordance with Division 1. Submittals shall include but not necessarily be limited to the following:

A. With Contractor's Bid: List of previously performed projects.

B. Prior to Tank Cleaning:
   1. Methodology on pumping liquid, cleaning tanks, and hauling sludge.

C. Following cleaning, within 30 days after final application, but not later than Final Acceptance:
   1. Log of loads of material hauled with date, time, volume, and final destination.

1.5 QUALITY ASSURANCE

A. Contractor shall be knowledgeable of current local, Federal, and State regulations in project locality regarding the removal and transportation of sludge.

B. Contractor shall maintain neat and accurate records, as specified herein.

C. Contractor shall perform all work in accordance with applicable requirements of EPA, and all other applicable Federal, State, and local requirements.

D. Contractor shall have previously performed projects of this type.

1.6 SCHEDULING

A. Refer to Section 01100 for Summary of Work.

B. The schedule for decommissioning individual waste holding tank and septic tanks require close coordination with the installation and startup of the low pressure sewer pipe and grinder pump stations. Generally the sequence of work shall be as follows:
   1. Install and pressure test the low pressure sewer pipe.
   2. Install and test the grinder pump stations and discharge piping.
   3. Intercept the waste service line, divert the waste flow to the grinder pump station and commission the grinder pump station into service.
   4. Clean the holding tank and leave in service.
   5. Decommission or abandon the two septic tanks after the grinder pump station is in full operation.

1.7 MAINTENANCE

A. Contractor shall be responsible for maintaining and restoring all nonpublic roads to a condition at or better than initial conditions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 REROUTING THE WASTE SERVICE LINES

A. After the low pressure sewer pipe and pump stations are installed, tested and ready to be put in service, the Contractor shall begin the process of locating the three (3) waste service line connection points. These are the points at which the existing waste water flow shall be intercepted and diverted to the grinder pump station wet well for conveyance through the new low pressure sewer system. The connection point for the waste holding tank at the truck wash building will be at the discharge of the holding tank

B. Connection Points Outside the Waste Holding and Septic Tanks
   1. The Contractor shall schedule and coordinate with the Owner at least 48 hours before the Work begins.
   2. For each tank configuration the Contractor shall excavate and expose the existing waste service line. Before making the service connection, a new service line shall be routed from the pump station to the connecting point. The new service line shall be uniformly graded to drain to the pump station wet well. After the new service line is installed, the Contractor shall cut the existing service line and splice the two lines together with a fitting or sleeve.

3.2 DEMOLITION OF SEPTIC TANKS

A. After the waste service line is re-routed to the new grinder pump station, the septic tanks shall be demolished as specified herein and as shown on the Drawings:

B. Remove all or part of the lid to allow access for cleaning the tank.

C. Use a high pressure jet spray to clean the interior surfaces of the tank. Collect the spray water and sludge with a vacuum truck and haul off site for disposal.

D. Demolish the septic tank lid and remove the tank walls down two (2) feet below existing grade. Break the concrete floor to allow any accumulated groundwater to drain. Demolished concrete may be deposited inside the tanks or hauled offsite. Concrete debris used for backfill shall be pieces small enough to mix with other backfill material and avoid air cavities in the backfill. Backfill tanks with sand, gravel or flowable fill to match existing grade as specified in Section 02320. The top 12-inches of backfill shall be topsoil suitable to support grass or plantings.

E. Restore site to match surrounding grades, seed and mulch as specified in Section 02922.

3.3 REHABILITATE WASTE HOLDING TANK

A. As the waste service line is routed from the holding tank to the pump station, the waste holding tank shall be cleaned and rehabilitated as specified herein and shown on the Drawings:

B. Empty the holding tank of all waste and solids and haul off site for disposal.

C. Use a high pressure jet spray to clean the interior surfaces of the tank. Collect the spray water and sludge and haul off site for disposal.

D. Connect the new service line from the pump station to the capped tank connection.

E. Backfill the disturbed area at the waste holding tank with rock to match the existing gravel surface.

END OF SECTION
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DOCUMENT 00005
CERTIFICATIONS PAGE

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Missouri. Signature: _____ Date: 9-28-15 Name: Stephen Thomas Baker Missouri License No.: PE-029494 My license renewal date is December 31, 2016. Pages, Sheets, or Divisions covered by this seal: Division 01, Division 02, Division 03, and Division 11

END OF DOCUMENT 00005

MoDOT

NASHUA MAINTENANCE FACILITY
SEWER IMPROVEMENTS

KANSAS CITY, MISSOURI

SEPTEMBER 2015

Prepared By:
Shafer, Kline & Warren, Inc.
11250 Corporate Avenue
Lenexa, KS. 66219
913-888-7800

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contract Description.

B. Work by Owner.

C. Cash Allowances

D. Salvage of Materials and Equipment

E. Contractor use of site and premises.

F. Work Sequence.

G. Owner occupancy.

H. Lines and Grades.

I. Connections to Existing Facilities.

J. Cutting and Patching.

1.2 CONTRACT DESCRIPTION

A. Contract Type: Lump Sum, as set forth in the Bid Form and Agreement

B. Description of Work under this Contract: Construction of the Nashua Maintenance Facility Sewer Improvements will generally include the following:

1. The project consists of the installation of three (3) simplex, grinder pump stations with a common 2-inch force main that will discharge wastewater into an existing manhole of the KCMO First Creek Interceptor Sewer. Each grinder pump station will include a 1 Hp motor and pump with a rated capacity as specified; installed into a 40 gallon wetwell, as specified and recommended by the pump manufacturer. All the necessary appurtenances shall be furnished and installed to provide a complete and functional pressure sewer system. The two existing septic tanks and pump stations will be removed from service in accordance with the Project Documents.

1.3 WORK BY OWNER

A. The Owner will not be performing any work on this project.

1.4 CASH ALLOWANCES NOT USED

1.5 SALVAGE OF MATERIALS AND EQUIPMENT

A. Existing materials and equipment removed and not reused or retained by Owner shall be disposed of by Contractor. Owner will notify Contractor of construction project items which Owner desires to retain.

1.6 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow:
   1. Owner occupancy, operations, and maintenance.
   2. Work by Owner.

B. Construction Operations:
   1. Limited to areas within general limits shown on the Drawings, inside Owners properties and, easements, except where specifically noted on the Drawings.
   2. Contractor may use the areas noted on the Drawings for storage and staging, or designated by the Owner.

C. Time Restrictions: No work shall be done on Sunday, legal holidays, or at night, without the approval of Owner in each case, except such work as may be necessary for the proper care, maintenance and protection of work already done or of equipment and public property covered by the Contract, or to meet demanding time limitations on specific work activities called for under this contract. Approval of Owner shall be sought at least forty-eight (48) hours in advance of such work whenever practicable.
   1. Before Contractor requests work to take place on Sundays, or legal holidays on a repeated basis to expedite the Work or make up for lost progress, Contractor shall first schedule and work five weekdays and Saturdays for at least two weeks prior.

D. Unfavorable Construction Conditions: During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine his operations to Work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

E. Utility Outages and Shutdown: Brief shutdown of utilities, other than described herein, will be acceptable to Owner provided that the duration does not exceed one-half hour, and at least 48 hours prior notice has been given by Contractor.

1.7 WORK SEQUENCE

A. The suggested construction sequence specified herein has been developed to serve as a guide to Contractor for development of a complete and comprehensive construction schedule in accordance with Section 01300 - Submittals. The Contractor shall expand the construction schedule from the suggested sequence of construction presented herein. Contractor shall address in his construction schedule, the sequence of construction to be followed for each of the elements of Work identified herein and any other construction activities required for completion of the Work required by the Contract Documents. Alternatives to the suggested sequence of construction will be considered only if they offer advantages of fewer disruptions to facility operation, fewer or shorter duration shutdowns for facility tie-ins, or reduced risk of permit violations. The suggested sequence of construction shall not relieve Contractor from any Work required by the Contract Documents nor from meeting the Contract Times specified in the Agreement.

B. Suggested Sequence of Construction:
   1. Install the pressure system force main as indicated on the Drawings,
   2. Install the three grinder pump stations, with connections made to the common force main.
   3. Test the new pressure sewer system and place in service to transfer the three sewer services over to the new pressure system.

1.8 CRITICAL ACTIVITIES: Critical Activities: The following portions of the work relate to modifications of the existing facilities which will require careful advance planning and coordination with Owner. Contractor shall notify Owner and Engineer at least three days prior to the commencement of the following activities, and shall discuss the work plan with Owner and Engineer. The following time limitations shall also apply. All days are calendar days.

A. Contractor shall work with Owner to schedule tasks that limit the down time of the following:
   1. Minimize the sewer service down time to the existing buildings and vehicle wash down facility as services are transferred to the pressure sewer system.

B. Contractor shall make every effort to meet the above mentioned time limitations, recognizing that Owner may encounter fines, financial loss, or additional operating costs if these limitations are not met. It is understood that if Contractor does not meet these limitations, Contractor shall reimburse Owner for the resultant costs incurred, or Contractor shall make and pay for alternate arrangements to avoid loss on the part of Owner, excepting delays beyond Contractor's control, as provided under Paragraph 12.03 of the General Conditions. Alternate arrangements shall be acceptable to Engineer. Engineer shall be the judge of what constitutes fair and reasonable losses which shall be reimbursable by Contractor. If Contractor and Engineer cannot agree upon the monetary amount, then liquidated damages will be assessed as for failure to meet Final Acceptance, as set forth in the Agreement.

1.9 OWNER OCCUPANCY

A. The Owner will periodically require access to the facility during the entire period of construction. To the extent possible, Owner's personnel will restrict activities to not interfere with construction.

B. Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

1.10 LINES AND GRADES

A. All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

B. Basic horizontal and vertical control points will be established or designated by Engineer. Such control points shall be used as datum for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as part of the Work.

C. Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement of the Work. In addition, Contractor shall furnish, without charge, competent persons from his force and other tools which Engineer may require in checking survey, layout, and measurement work performed by Contractor.

D. Contractor shall keep Engineer informed, a reasonable time in advance, of the times and places at which he wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by Engineer may be done with minimum inconvenience to Engineer and minimum delay to Contractor.

1.11 CONNECTIONS TO EXISTING FACILITIES

A. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, telephone, and electric. In each case, Contractor shall receive permission from Owner or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

B. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Overtime work shall be scheduled with and approved by Owner in advance, as required within.

C. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

1.12 CUTTING AND PATCHING

A. As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

B. Contractor shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:
   1. Removal of improperly timed Work.
   2. Removal of samples of installed materials for testing.
   3. Alteration of existing facilities.
   4. Installation of new Work in existing facilities.

C. Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without Engineer's concurrence.

D. Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvageable shall be removed from the site by Contractor.

E. All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

F. Restoration of pavement and other surface construction shall be performed in accordance with the applicable specification section.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01019

CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Schedule of values.

B. Application for payment.

C. Change procedures.

D. Defect Assessment.

1.2 RELATED SECTIONS

A. Section 01600 - Material and Equipment: Product substitutions and options.

1.3 SCHEDULE OF VALUES

A. Submit a printed schedule on Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 10 days after date of Owner-Contractor Agreement.

C. Schedule of values shall represent a fair, reasonable, and equitable dollar cost allocation for each major work activity on Contractor's construction schedule. Schedule of values shall not be imbalanced. Engineer may declare a work task imbalanced and require Contractor to adjust values if the scheduled value differs significantly from an industry standard value or commonly accepted unit price guide.
   1. The work activities shall be subdivided in sufficient detail to serve as the basis for progress payments during construction.
      a. Items of equipment shall be itemized to divide bare equipment shipped to site, installation, and start-up services.
   2. With the exception of major equipment items, no single work activity or unit in the schedule of values shall be assigned a cost greater than ten thousand dollars ($10,000.00).

D. Revise schedule to list approved Change Orders, and resubmit with each Application for Payment.

E. Schedule of Values may serve as basis for estimating credits to Work for items deleted or reduced, or for pricing of items added to the Contract of a similar nature.

1.4 APPLICATIONS FOR PAYMENT

A. Submit five copies of each application. Contractor shall use FM07A-D form for payment.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Payment Period: Monthly.

D. Include an updated construction progress schedule; monthly.

1.5 CHANGE PROCEDURES

A. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by the General Conditions by issuing a Field Order. Contractor shall execute the form and return to Engineer within 2 working days.

B. The Engineer may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within 15 days.

C. The Contractor may propose changes by submitting a request for change to the Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01600 - Material and Equipment.

D. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Engineer.

E. Work Change Directive: Engineer may issue a directive, on Form FM01D, Work Change Directive, signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute the change.

F. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract. Engineer will determine the change allowable in Contract Price and Contract Time as provided in the Contract Documents.

G. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work. Time charges for labor and equipment must be approved and initialed by the Resident Project Representative.

H. Change Order Forms: Form FM01A, Change Order Form.

I. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.6 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct an appropriate remedy or adjust payment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal Procedures.

B. Construction Progress Schedules.

C. Proposed Products List.

D. Submittal of Shop Drawings and Data.

E. Resubmittal of Shop Drawings and Data

F. Product Data.

G. Shop Drawings.

H. Certificates.

I. Manufacturer's Instructions.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal with submittal form acceptable to Engineer.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix. For example, the first submittal under Section 15100 would be numbered "15100-01", and a re-submittal of the same item(s) would be numbered "15100-01a".

C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. If Contractor affixes a stamp to the submittal which says "exceptions noted" or a clause to similar effect, Contractor shall specifically list all exceptions.

E. Submittal Checklist: Where specification sections list specific items to be included in the submittal, manufacturer or supplier shall make a copy of the list and include it as a checklist. Each item shall be checked that it is included. If an item is not included, an explanation as to why it was not included must be attached. If items are not included and/or an explanation why that item is not included is not attached, Engineer will return the submittal without review marked as "Revise and Resubmit". If no checklist is present, the submittal will not be reviewed until a manufacturer or supplier generated checklist is received.

F. Schedule submittals to expedite the Project, and deliver to Engineer at business address. Coordinate submission of related items.

G. Submittal Review Period by Engineer: For each submittal for review, allow fifteen (15) days excluding delivery time to and from Contractor, provided submittals are complete.

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

I. Provide space for Contractor and Engineer review stamps.

J. Conform with specific submittal requirements given in the individual sections of the specifications.

K. When revised for re-submission, identify all changes made since previous submission.

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

M. Submittals not requested will not be recognized or processed.

1.3 CONSTRUCTION PROGRESS SCHEDULES

A. Submit initial schedule in duplicate within fifteen (15) days after date established in Notice to Proceed.

B. Revise and resubmit on a monthly basis with the application for payment.

C. Submit a horizontal bar chart with separate line for each major portion of Work or operation, identifying first work day of each week.

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

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

F. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.

1.4 PROPOSED PRODUCTS LIST

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

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

1.5 SUBMITTAL OF SHOP DRAWINGS AND DATA

A. Submittals of shop drawings and data pertaining to equipment, materials, and products to be incorporated into the work shall be submitted to Engineer well before such equipment, materials, and products are incorporated into the Work. Payment will not be made for equipment, materials, and products delivered to the site or incorporated into the Work until submittals pertaining to such are acceptable to Engineer.

B. Engineer's review of shop drawings and data is for the limited purpose of checking for general conformity with the design concept expressed in the Contract Documents. Engineer's review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment,

device or item shown. Engineer's review shall not relieve Contractor of Contractor's responsibility for errors, omissions, or deviations in the drawings and data, nor of the sole responsibility for compliance with the Contract Documents.

C. It shall be Contractor's responsibility to see that submittals which require revisions or re-submission receive such in a timely manner.

1.6 RESUBMITTAL OF SHOP DRAWINGS AND DATA

A. Contractor shall accept full responsibility for the completeness of each re-submittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided in the re-submittal.

B. Requirements specified for initial submittals shall also apply to re-submittals. Re-submittals shall bear an identification number as specified herein.

C. When corrected copies are re-submitted, Contractor shall in writing direct specific attention to all revisions and shall list separately any revisions made other than those called for by Engineer on previous submissions.

D. If more than one re-submission is required because of failure of Contractor or supplier to provide all previously requested corrected data or additional information, Contractor shall reimburse Owner for the charges of Engineer for review of the additional re-submissions. This does not include initial submittal data such as shop tests and field tests which are submitted after initial submittal, or additional information requested by Engineer that is not an item required by the project manual.

E. Re-submittals shall be made within 40 days of the date of the transmittal returning the material to be modified or corrected, unless within 30 days Contractor submits a written request for an extension of the stipulated time period, listing the reasons the re-submittal cannot be completed within that time.

F. Any need for more than one re-submission, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Times unless delay of the Work is directly caused by a change in the Work authorized by a Change Order or by failure of the Engineer to review any submittal within the submittal review period specified herein and to return the submittal to Contractor.

1.7 PRODUCT DATA

A. Product Data for Review:
   1. Submitted to Engineer for review.
   2. After review, provide copies and distribute in accordance with submittal procedures article above and for record documents purposes described in Section 01700 - Contract Closeout.

B. Product Data for Information:
   1. Submitted for Engineer's knowledge as contract administrator or for Owner.

C. Product Data for Project Close-out:
   1. Submitted for Owner's benefit during and after project completion.

D. Submit the number of copies which Contractor requires, plus three (3) copies which will be retained by Engineer.
   1. In lieu of hardcopy submittals, Contractor may submit to Engineer electronically in Adobe PDF format. Submittals will be reviewed and returned to Contractor electronically in Adobe PDF format.

E. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

F. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

G. After review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01700 - Contract Closeout.

1.8 SHOP DRAWINGS

A. Shop Drawings for Review:
   1. Submitted to Engineer for review.
   2. After review, produce copies and distribute in accordance with submittal procedures article above and for record documents purposes described in Section 01700 - Contract Closeout.

B. Shop Drawings for Information:
   1. Submitted for Engineer's knowledge as contract administrator or for Owner.

C. Shop Drawings for Project Close-out:
   1. Submitted for Owner's benefit during and after project completion.

D. Submit the number of opaque reproductions which Contractor requires, plus three (3) copies which will be retained by Engineer.

E. Upon agreement of both Owner and Engineer, Contractor may submit shop drawings electronically in Adobe Acrobat (.pdf) format in lieu of hard copies as specified in Paragraph D above.

1.9 CERTIFICATES

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

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

1.10 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer, as specified in Section 01700 - Contract Closeout.

B. Manufacturer's instructions (Operation and Maintenance Data) shall be submitted in timely manner as set forth in Section 01700 - Contract Closeout.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

D. Submit the number of copies set forth in Section 01700 - Contract Closeout.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality Assurance - Control of Installation.

B. References and Standards.

C. Testing Services.

D. Resident Observation.

E. Offsite Inspection.

F. Examination.

G. Preparation.

1.2 RELATED SECTIONS

A. Section 01010 - Summary of Work.

B. Section 01300 - Submittals: Submission of manufacturers' instructions and certificates.

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

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

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

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

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

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

1.4 REFERENCES AND STANDARDS

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

1) Conform to reference standard by date of issue current on date for receiving bids, except where a specific date is established by code.

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

C. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 TESTING SERVICES

A. All testing shall be performed by an independent materials testing firm, approved by the Owner and Engineer. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified or applicable standards.

B. Testing Services paid for by Contractor. Unless otherwise specified, Contractor shall pay for all testing services in connection with the following, as incidental to the Work.
   1. Concrete materials and mix designs. Submit in accordance with Section 01300 - Submittals.
   2. Soils testing (materials gradation and moisture density tests, field compaction tests, etc.) in accordance with Section 02320 - Earthwork and Trenching.
   3. Concrete job cylinders, as specified.
   4. Concrete on-site testing. Perform concrete testing as required in Section 03300 - Cast-in-Place Concrete.
   5. All other tests and engineering data required for Engineer's review of materials and equipment proposed to be used in the Work.

C. Testing, including sampling, will be performed by the testing firm's laboratory personnel, in the general manner indicated in the Specifications. Owner or Engineer, if present, shall determine the exact time, location, and number of tests, including samples.

D. Contractor shall arrange for delivery of samples and specimens for tests to the testing firm's laboratory. The testing firm's laboratory shall perform all laboratory tests within a reasonable time consistent with the specified standards and shall furnish a written report of each test.

E. Contractor shall furnish all sample materials and cooperate in the sampling and field testing activities, including sampling. Contractor shall interrupt the Work when necessary to allow testing, including sampling, to be performed. Contractor shall have no claim for an increase in Contract Price or Contract Times due to such interruption. When testing activities, including sampling, are performed in the field by Engineer or the testing firm's laboratory personnel, Contractor shall furnish personnel and facilities to assist in the activities.

F. Written reports of tests shall be submitted to Engineer. Testing lab shall submit the number of copies which Contractor requires, plus three (3) copies which will be retained by the Engineer.

G. Owner may elect to provide additional testing services for the sole benefit of Owner. Testing services provided by Owner are for the sole benefit of Owner; however, test results shall be available to Contractor. Testing necessary to satisfy Contractor's internal quality control procedures shall be the sole responsibility of Contractor.

1.6 RESIDENT OBSERVATION

A. Owner will provide the Resident Project Representative or Resident Observer to perform resident observation services of all Work.

B. Cooperate with Resident Observer; furnish safe access and assistance by incidental labor as requested.
   1. Notify Owner twenty-four (24) hours prior to expected time for construction operations requiring observation services.

C. Resident Observation does not relieve Contractor to perform Work to contract requirements.

1.7 OFFSITE INSPECTION

A. When the Specifications require inspection of materials or equipment during the production, manufacturing, or fabricating process, or before shipment, such services will be performed by Engineer or an independent testing firm or inspection organization acceptable to Owner.

B. Contractor shall give appropriate written notice to Owner and Engineer not less than 10 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

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

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

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

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

3.2 PREPARATION

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

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

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

END OF SECTION

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SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, ventilation, telephone service, water and sanitary facilities.

B. Temporary Controls: Barriers, fencing, protection of the Work, damage to existing property, and water control.

C. Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary buildings.

1.2 RELATED SECTIONS

A. Section 01700 - Contract Closeout: Final cleaning.

1.3 TEMPORARY ELECTRICITY

A. Cost: By Owner; connect to Owner's existing power service. Do not disrupt Owner's use of service. Owner will pay cost of energy used. Exercise measures to conserve energy.

B. Provide temporary electric feeder from electrical service at location indicated on the Drawings. Owner's utility personnel will make service connection.

C. Power Service Characteristics: Power service and requirements may differ by site. See Drawings for electrical service at each location. Coordinate with local electrical utility.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

E. Provide main service disconnect and over-current protection at meter.

F. Permanent convenience receptacles may not be utilized during construction.

G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.4 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Temporary lighting, if required by Contractor, shall be provided by Contractor.

1.5 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.6 TELEPHONE SERVICE

A. Provide, maintain, and pay for telephone service to field office at time of project mobilization. Engineer and Resident Project Representative shall be allowed use of Contractor’s telephone facilities, unless separate telephone service is provided by Contractor for this purpose.

1.7 FACSIMILE SERVICE

A. Provide, maintain and pay for facsimile service and a dedicated telephone line to field office at time of project mobilization.

B. A mobile fax machine and cellular phone service, assigned to Contractor's Personnel, will be acceptable in lieu of the above.

1.8 TEMPORARY WATER SERVICE

A. Connect to existing water source for construction operations at time of project mobilization.

B. Owner will pay for cost of water used. Make efforts to conserve water.

1.9 TEMPORARY SANITARY FACILITIES

A. Contractor shall furnish temporary sanitary facilities at each site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

B. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent.

C. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the site.

1.10 BARRIERS

A. Provide barriers to prevent unauthorized entry to hazardous construction areas to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.11 FENCING

A. All existing fences, affected by the Work, shall be maintained by Contractor until completion of the Work.

B. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the Engineer and alternative temporary fencing has been agreed upon.

C. Prior to final acceptance, Contractor shall restore all fences to their original or to a better condition, as specified in the fencing specifications, and to their original location, unless indicated otherwise on the Drawings.

1.12 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.13 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.14 PROTECTION OF INSTALLED WORK

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

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

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

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

F. Prohibit traffic from landscaped areas.

1.15 DAMAGE TO EXISTING PROPERTY

A. Contractor will be held responsible for any damage to existing structures, Work, materials or equipment, because of his operations, and shall repair or replace any damaged structures, Work, materials or equipment to the satisfaction of, and at no additional cost to Owner.

B. Contractor shall protect all existing structures and property from damage, and shall provide bracing, shoring or other work necessary for such protection.

C. Contractor shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or men to or from the Work. Contractor shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

1.16 PARKING

A. Arrange for temporary parking areas to accommodate construction personnel.

B. When site space is not adequate, provide additional off-site parking.

1.17 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.18 PROJECT IDENTIFICATION

A. Contractor, at his/her option, may erect one project sign on the site for the duration of the Project. Sign shall be no larger than 25 square feet in size and shall meet all applicable local codes. Sign shall give project title, and names of the Contractor, Owner, and Engineer.

B. Erect on site at location acceptable to Owner.

C. No other signs are allowed without Owner permission except those required by law.

1.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Final Application for Payment.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

D. Installation and Operation.

E. Product options.

F. Substitutions.

G. Equipment Function and Controls.

H. Lubricants.

I. Warranties.

J. Extended Warranties.

1.2 RELATED SECTIONS

A. Instructions to Bidders: Product options and substitution procedures.

B. Section 01750 - Starting of Systems

1.3 PRODUCTS

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

B. Provide interchangeable components of the same manufacturer for components being replaced.

1.4 TRANSPORTATION AND HANDLING

A. Transport and handle Products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION

A. Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.

B. Store and protect Products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive Products in weather tight, climate controlled enclosures, in an environment favorable to Product.

E. Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings, shall be stored in weather tight structures maintained at a temperature above 60°F. Equipment, controls and insulation shall be protected against dust, moisture and water damage.

F. For exterior storage of fabricated Products, place on sloped supports above ground.

G. Provide insured off-site storage and protection when site does not permit on-site storage or protection.

H. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

I. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

J. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement or damage.

K. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.6 INSTALLATION AND OPERATION

A. Equipment shall not be installed or operated, except by or with the guidance of qualified personnel having the knowledge and experience necessary to obtain proper results. When so specified, or when employees of Contractor or his Subcontractors are not qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.

B. Qualified field representatives shall be provided by the equipment manufacturers, as required, to perform all manufacturer's field services called for in the Specifications.

C. Manufacturer's field representatives shall observe, instruct, guide and direct Contractor's erection or installation procedures, or perform an installation check, as required. The field representative shall revisit the site as often as necessary to attain installation satisfactory to Engineer.

D. All equipment installed under this Contract shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.

E. Acceptance of Work, in connection with the installation of equipment furnished by others, will be subject to approval of the field representative. Contractor shall be responsible for planning,

supervising and executing the installation of Work, and the approval or acceptance of Engineer will not relieve Contractor of responsibility for defective Work.

1.7 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers where substitutions are not prohibited: Submit a request for substitution for any manufacturer not named, in accordance with the following article.

C. Products Specified by Naming One or More Manufacturers and Prohibiting Substitutions: No substitutions shall be permitted.

D. Products Designated as Base Bid Equipment in the Bid Form: No substitutions will be permitted for base bid equipment after execution of the Agreement. Proposed substitutes for base bid equipment, may be submitted to Engineer for consideration during the bid advertisement period, subject to the time limitations and requirements set forth in the Instructions to Bidders. In such case, the following article shall not apply to substitutes for base bid equipment items.

1.8 SUBSTITUTIONS

A. The term "Substitutions", as discussed under this subpart, applies to any product which is not named in the specifications and which is proposed by Contractor as an "or-equal" item or a "substitute" item. Substitutions are discussed in Article 6.05 of the General Conditions.

B. No substitutions will be permitted for base-bid equipment. Bidders may propose substitutes for base bid equipment items during the advertisement period, as set forth in the Instructions to Bidders.

C. Engineer will consider requests for Substitutions only within 45 days after date established in Notice to Proceed.

D. Substitutions may be considered at any time after Notice to Proceed when a Product becomes unavailable through no fault of the Contractor.

E. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents. Contractor shall indicate if his request is intended as an "or-equal" item or a "substitute" item.

F. A request constitutes a representation that the Contractor:
1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.
2. Will provide the same warranty for the Substitution as for the specified Product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner and Engineer for review or redesign services associated with re-approval by authorities.

G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require revision to the Contract Documents.

H. Substitution Submittal Procedure: As set forth in Article 6.05 of the General Conditions, and as modified below:
   1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Engineer will notify Contractor, in writing, of decision to accept or reject request.

1.9 EQUIPMENT FUNCTION AND CONTROLS

A. The Contract Drawings and Specifications present operational descriptions, sequences of operation, circuit diagrams, and component requirements for automated equipment and control systems. These have been prepared by Engineer to communicate the design intent and aid in bidding the Work. This information is not necessarily detailed enough to serve as installation guides for wiring equipment and controls components. It is the responsibility of Contractor and Contractor's electrical subcontractor to:
   1. Coordinate among themselves and the various suppliers to provide a system which functions as specified.
   2. Review shop drawings and submittals to ensure compatibility and avoid conflicts and duplication.
   3. Employ on the site at least one supervisor who is knowledgeable and experienced in electrical wiring and controls, and who can read and interpret circuit schematics and wiring diagrams, in accordance with the General Conditions. Copies of all pertinent shop drawings and submittals shall be kept on hand by workers.

B. If a supplier takes exception to the Drawings and Specifications, or proposes to modify the equipment and controls to provide what he believes is a more functional and serviceable system, Contractor shall bring such proposed changes to the attention of Engineer as early as possible, but not later than the submittal review process. By affixing his stamp of approval, Contractor certifies that he approves of all changes proposed and required by the submittal, and agrees that such changes will be made at no additional cost to Owner. Contractor may not void this certification and acceptance of additional requirements by affixing a stamp of "exceptions noted", whether or not the exceptions are delineated. If Engineer allows such changes by virtue of submittal review, Contractor shall be responsible for the resultant changes to other systems, including but not limited to additional circuits.

1.10 LUBRICANTS

A. For each pump and individual item of mechanical process equipment, the manufacturer shall furnish to Owner all oils, greases, and other lubricants recommended for proper operation in sufficient quantities to last for two (2) years at manufacturer's suggested schedule of maintenance and lubrication, under normal operating conditions. These quantities shall be in addition to that required by Contractor for start-up and commissioning. All containers shall be clearly labeled with product name and name of associated equipment.

1.11 WARRANTIES

A. For warranties by suppliers or manufacturers of materials and equipment, it shall be understood, unless specifically stated in the individual section, that:
   1. Warranties shall be for a period of one (1) year and shall commence on the date of Final Acceptance.
   2. Warranties shall be in the name of the Owner.
   3. Replacement is full and not prorated.
   4. Manufacturer's or supplier's liability cannot be limited to some arbitrary value selected by the manufacturer or supplier.

5. Owner will cover the cost of equipment delivery to the manufacturer's or supplier's local service center in the Kansas City, MO metro area. Manufacturer or supplier shall cover return shipping.
6. If Owner makes a claim against the warranty for a defect in manufacturing or installation, it shall be the responsibility of the manufacturer or supplier to prove the claim is NOT a cause of a defect in manufacturing or installation. If the manufacturer or supplier cannot prove the claim is not a result of defect in manufacturing or installation, the claim shall be honored.

1.12 EXTENDED WARRANTIES

A. Certain items require extended warranties as set forth in individual sections. It is the intent that this extended warranty be provided by the manufacturer of the equipment or item. Contractor is directly responsible for installation and performance of equipment during the one year correction period. After the one year, Owner will pursue equipment warranty matters directly with the respective manufacturers, unless it becomes evident that the equipment was improperly installed by the Contractor.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

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SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Project record documents.

D. Operation and Maintenance Data.

E. Spare Parts and Maintenance Products.

1.2 RELATED SECTIONS

A. Section 01500 - Construction Facilities and Temporary Controls.

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.

B. Submit final Application for Payment identifying total adjusted Contract Price, previous payments, and sum remaining due.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean site, remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 PROJECT RECORD DOCUMENTS

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

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

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

D. Record information concurrent with construction progress.

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

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Details not on original Contract drawings.
   2. Record Drawings shall be maintained and updated throughout the Work, and presented at each progress meeting for review by Engineer.

G. Submit documents to Engineer with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2x11 inch (A4) text pages, in D side ring binders (binding rings mounted on back cover) with durable plastic covers. All binders shall be same size, style, and color. Binders shall be no more than 75 percent full.

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

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Information contained in Operation and Maintenance Instructions shall be specific to the products provided under this Contract. If data sheets, manuals, diagrams and other information applies to several models or types, the applicable model shall be clearly indicated and the information which does not apply shall be crossed out. Furnished options, including materials options, shall be clearly indicated.

E. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on 20 pound white paper, in three parts as specified below. Additional requirements given in individual specification sections shall also apply.
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and equipment Suppliers.
   2. Part 2: Operation and Maintenance Instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment
      c. Parts list for each component, with arrangement diagram.
      d. Spare parts
      e. Operating instructions
      f. Maintenance instructions for equipment and systems
      g. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
      h. Warranties
      i. Copies of equipment start-up reports certified by manufacturer's representative with start-up dates.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data
      b. Air and water balance reports
      c. Originals and Photocopies of warranties and any guarantees.

F. Timing of Submittals:

1. At 90 percent completion, Contractor shall assemble two (2) complete copies of Operations and Maintenance Instructions. This 90 percent draft shall contain operation instructions, maintenance data, and warranties for all equipment and other items requiring such. Contractor shall not submit Operations and Maintenance Instructions as individual sections or in a "piece meal" fashion. Contractor shall submit complete volumes of the manuals as specified herein.
   a. Note: Engineer will not begin review of draft Operations and Maintenance Instructions until shop drawing and data submittals have been submitted and corrected in accordance with Section 01300 - Submittals.
   b. This draft copy will be reviewed and returned, with Engineer comments and directions for arrangement.
   c. Revise manuals per Engineer comments. Revise 90 percent documents also to reflect changes made during start-up and commissioning.
2. Submit four (4) sets of revised final volumes, prior to final inspection. Contractor shall revise Operation and Maintenance Manuals as required and directed by Engineer to reflect changes made prior to final completion. One set will be retained by the Engineer, and three sets will be retained by Owner. Deliver final volumes to Engineer and Owner. Final volumes must be received by Engineer prior to application for final payment.

1.7 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide maintenance, and extra products in quantities specified in individual specification sections.

B. Contractor shall store and be responsible for all spare parts and furnished lubricants until acceptance by Owner at final completion. No materials shall be turned over to Owner before this time. Contractor shall organize spare parts and ensure that parts are neatly packaged and clearly and permanently labeled with description, supplier name, and project manual section number.

C. Contractor shall meet with resident project representative (or Engineer) and Owner representative to hand over spare parts all at once. Engineer will provide a written log which will be initialed by Contractor and Owner. Items missing from the list of parts required by Contract Documents shall be delivered to Owner prior to application for final payment. Items which are damaged shall be replaced by Contractor.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01750

STARTING OF SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Starting Systems.

B. Manufacturer's Field Services

C. Demonstration and Training.

D. Testing, Adjusting and Balancing.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals: Manufacturers field reports.

B. Section 01700 - Contract Closeout: System operation and maintenance data and extra materials.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer seven (7) days prior to start-up of each item.

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

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

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

F. Execute start-up in accordance with manufacturers' instructions, and under supervision of manufacturer's representative, if required.

1.4 MANUFACTURER'S FIELD SERVICES

A. An experienced, competent and authorized representative of the manufacturer of each item of equipment for which start-up services are indicated in the specification sections shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is placed in operation.

B. The manufacturer's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

C. Each manufacturer's representative shall furnish to Engineer, through Contractor, a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated

under full load conditions; and that it operated satisfactorily. Copies of this report shall be included with the O&M manuals.

D. All costs for these services shall be included in the Contract Price.

1.5 DEMONSTRATION AND TRAINING

A. Demonstrate general operation of Products to Owner's personnel at start-up.

B. Demonstrate Project equipment instructed by a qualified manufacturers' representative who is knowledgeable about the specific equipment and systems on this Project. The training session shall occur on a separate visit from start-up services, unless otherwise permitted by Engineer and Owner.

C. Timing of Training: Contractor shall schedule training sessions for all required systems.
   1. Training program may commence individually at start-up of a given system. All sessions need not be complete to meet the contract deadline for final completion, but all must be completed prior to Owner making final payment to Contractor.
   2. Contractor shall submit proposed schedule to Engineer at least two (2) weeks prior to first scheduled session. Engineer will review with Owner and may require Contractor to revise and resubmit to conform to Owner's schedule.

D. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
   1. If final Operation and Maintenance manuals are not yet available when start-up occurs, provide additional copies of draft Operation and Maintenance Instructions for use by Owner's personnel.

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

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

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

1.6 TESTING, ADJUSTING, AND BALANCING

A. Contractor shall employ services of an independent firm to perform testing, adjusting and balancing.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02320

EARTHWORK & TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall perform all excavation, embankment, trenching, backfilling, cushioning, surface dressing, dewatering, shoring, surface restoration and disposal of waste as required for site grading, structures, piping, and appurtenances as shown on the Drawings.

1.2 SECTION INCLUDES

A. Pipe Embedment Material.

B. Crushed Rock.

C. Fill Materials.

D. Impervious Trench Check Material.

E. Classification of Materials

F. Site Clearing.

G. Subgrade Preparation.

H. Earthfills and Embankments.

I. Excavation.

J. Pipe Embedment Schedule.

K. Backfilling.

L. Surface Restoration.

M. Disposal of Materials.

N. Soil Testing.

1.3 RELATED SECTIONS

A. Section 02530 - Piping System Products.

B. Section 02535 - Piping Systems Installation.

C. Section 02922 - Seeding.

D. Section 03300 - Cast In Place Concrete.

1.4 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the section requirements shall govern.

A. American Society for Testing Materials (ASTM):
1. D-698 - Moisture-Density Relations of Soils, Using 5.5 Pound (2.5 kg) Rammer and 12-Inch (304.8 mm) Drop.
2. D-1140 - Test Method for Amount of Material in Soils Finer Than the No. 200 (75μm) Sieve.
3. D-2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
4. D-3017 - Standard Test Methods for Water content of Soil and rock by Nuclear Methods.

1.5 SUBMITTALS: The Contractor shall submit the following items required by this division in accordance with Section 01300 - Submittals.

A. Product data for review: Soil test results as specified herein for soil testing.

1.6 DEFINITIONS

A. Earth excavation: Earth excavation is defined as the removal of all material whose removal is not defined as rock excavation.

B. Pipe embedment: Pipe embedment is defined as soil or stone aggregate material placed under, around, and in some cases over the pipe. The material type and extent of embedment is specified herein and shown on the Drawings.

C. Trench backfill: Trench backfill is defined as soil or stone aggregate material placed in a pipe or utility trench, above the pipe embedment and up to the existing ground surface, finished grade, or the bottom of pavement.

D. Structure backfill: Structure backfill is defined as soil or stone aggregate material placed around or above subsurface structures, such as manholes, vaults, foundations, and wetwells.

1.7 MAINTENANCE OF WORK: The Contractor shall be responsible for the satisfactory compaction and maintenance of all completed excavation, embankment, and backfill. If, prior to the expiration of the General Guaranty period stipulated in the Front End Documents, any grades or subgrades are found to have settled or eroded, they shall be reworked immediately by the Contractor and restored to the specified grades, and the surface restored.

1.8 REGULATORY REQUIREMENTS

A. The Contractor shall conform to Kansas Statute Annotated 66-1801-66-1814 for obtaining information from the various owners of underground facilities prior to performing excavation.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials shall conform to the respective references listed above and other requirements specified herein.

B. Topsoil, and material required for structural backfill and trench backfill in excess of suitable material excavated from trenching and structural excavation shall be furnished by the Contractor at no additional cost to the Owner.

2.2 PIPE EMBEDMENT MATERIAL: Granular Embedment Material: Granular embedment material for installation in pipe trenches and other locations indicated on the Drawings shall be crushed stone conforming to the 2007 MCIB Concrete Standards, Section 2.1.D for coarse aggregate meeting the gradation specified under Column IV, Table 2.1.D-1 for 2-inch aggregate with the modification that the maximum allowable percentage of material finer than No. 200 sieve shall be between 2.0% and 5.0% as determined by ASTM C-117. The gradation is repeated below for information:

Sieve Size	Percent Passing
3/4"	100
1/2"	80 - 100
3/8"	40 - 70
No. 4	0 - 15
No. 8	0 - 5
No. 200	0 - 3

2.3 CRUSHED ROCK: Crushed rock for use beneath concrete slabs and structures, and in other locations shown on the Drawings, shall be freely draining, siliceous gravel or crushed stone aggregate, conforming to 1999 Missouri Standard Specifications for Highway Construction, Section 1007, Type 1007.4.3. The gradation is repeated below for information:

Sieve Size	Percent Passing
1"	100
1/2"	55 - 90
No. 4	8 - 40
No. 10	0 - 15
No. 200	0 - 4

2.4 FILL MATERIALS

A. Random Fill Material: Random fill material for earthfills, embankments and other uses, shall be a soil material which is free from: rocks or stones larger than 6 inches in greatest dimension, brush, stumps, logs, roots, debris, top soil, and organic or harmful materials. The portion of fill material passing the No. 40 sieve shall have a liquid limit not exceeding 40 and a plastic limit not exceeding 25, when tested in accordance with ASTM D-4318. To the extent possible, site excavated material may be used. Random fill material shall be imported if suitable soil material is not available on site.

B. Select Fill Material: Select fill material shall be a sorted, job-excavated or imported soil material as specified for random backfill material, except no rocks, stones, or lumps larger than one inch in largest dimension shall be present. Select fill material, used for filling beneath or against structures, shall not contain weathered shale.

C. Granular Fill Material:

1. Granular fill material shall be a densely graded gravel of the following gradation:

Sieve Size (square opening)	Percent Passing (by weight)
1 inch	100
3/4 inch	85 - 100
3/8 inch	50 - 80
No. 4	35 - 60
No. 40	15 -25
No. 200	5 -15

2. Granular fill material shall be free from clay lumps or organic matter. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5. The fraction passing the No. 200 sieve shall not exceed 3/4 of the fraction passing the No. 40 sieve.

2.5 IMPERVIOUS TRENCH CHECK MATERIAL

A. Material for impervious trench checks shall be naturally occurring clay or a soil and sodium bentonite mixture with the permeability of the material to be no greater than $10x10^{-6}$ cm/sec.

B. Material shall be free of any stones, bricks, concrete, etc., except gravel or crushed rock of 3/4 inch size or less.

PART 3 EXECUTION

3.1 PREPARATION

A. The Contractor shall verify that required lines, levels, contours and datum are as shown in the plans.

B. Grading, excavation and backfilling shall be made to the lines, grades and cross sections indicated in the plans.

C. The Contractor shall maintain the site and conduct earthwork operations to ensure that the property is well drained at all times. The Contractor shall protect adjacent and downstream properties from damage or pollution caused by erosion. The Contractor is responsible for erosion control measures and methods and shall conduct earthwork operations to ensure the protection of all downstream and adjacent properties. The Contractor shall implement any additional erosion control measures to prevent damage.

D. Existing Utilities:

1. The Contractor shall verify the location and depth of all utilities a minimum of 24 hours prior to construction. The Contractor may utilize the toll free number for the "Missouri One Call System" 1-800-344-7483. This number is applicable anywhere within the state of Missouri. Prior to commencement of work the Contractor shall notify all those companies which have facilities in the vicinity of the construction.

2. Coordinate removal or relocation of existing utilities with their Owner.

3. Locate, identify and protect utilities that remain from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or negligent actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.
4. Abandoned pipes which the Drawings indicate shall be capped or filled do not need to be removed. All other abandoned pipe conduit within the limits of grading shall be removed by the Contractor

E. Existing fences: Fences within the construction grading area shall be removed and reconstructed to equal or better quality than that of the fence removed. It shall be the sole responsibility of the Contractor to maintain all gates, fences, cattle guards and the like encountered during construction, as required to prevent the straying of pets and livestock.

3.2 CLASSIFICATION OF MATERIALS: No classification of excavated materials, regardless of type or condition, will be made for purposes of payment. All excavation shall be unclassified unless designated otherwise. Excavation and trenching work shall include the handling and removal of all materials, regardless of its nature, excavated or removed from the site in performance of the Work.

3.3 SITE CLEARING

A. Clearing and stripping: All stumps, roots, buried logs, foundations, drainage structures, or other miscellaneous debris occurring within the limits of the excavation and site grading shall be removed as part of the grubbing operations and disposed of by, and at the expense of, the Contractor. Like-wise, six inches of topsoil shall be stripped from the disturbed construction areas and stockpiled for later use in final grading.

B. Stumps and roots in excavated or fill areas where depth of fill does not exceed 3 feet shall be removed to a depth of 18 inches below subgrade. In fill areas where more than 3 feet of fill is required, roots and stumps shall be cut off at the face of the excavation.

3.4 SUBGRADE PREPARATION

A. Proof-roll subgrade below building slabs, tank slabs, and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
4. Subgrades under building slabs shall be compacted in place to ninety-five percent (95%) of maximum density as determined by ASTM D-698, at a moisture content within plus or minus two percent (±2%) of optimum.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.5 EARTHFILLS AND EMBANKMENTS

A. Material and Compaction Requirements:
1. Fill areas which are below structures, concrete slabs, or paved areas, and within 5 horizontal feet of a structure or concrete slab shall be filled with select fill material, as specified herein, unless otherwise indicated on the Drawings. The select fill material shall be placed in lifts not exceeding 12 inches in compacted thickness, and shall be compacted

to a minimum 95 percent of maximum density as determined by ASTM D-698. Fill shall be placed and compacted at a moisture content within ± 2 percent of optimum.

2. Fill areas which are outside the envelope described above shall be filled with random fill material, as specified herein, unless otherwise indicated on the Drawings. The random fill material shall be placed in lifts not exceeding 12 inches in compacted thickness, and shall be compacted to a minimum 90 percent of maximum density as determined by ASTM D-698. Fill shall be placed and compacted at a moisture content within ± 3 percent of optimum.
    a. For areas which will be surfaced with gravel, the top two feet of random fill shall be compacted to a minimum of 95 percent of maximum density as determined by ASTM D-698. Fill shall be placed and compacted at a moisture content within ± 2 percent of optimum.

B. All vegetation and topsoil, and any loose, unstable or unsuitable material shall be removed from the existing surface to receive fill material. After stripping, the area shall be proof-rolled with a loaded tandem axel dump truck, or other equipment acceptable to Engineer. Unstable materials located by proof-rolling, shall be removed and replaced with suitable compacted fill material.

C. Before placing any fill the existing surface shall be scarified, moisture conditioned as required and the top 6 inches compacted to 90 percent of the maximum density for that material in accordance with ASTM D-698.

D. When embankments, regardless of height, are placed against hillsides or existing embankments having a slope steeper than 1 vertical to 4 horizontal, the existing slope shall be benched or stepped in approximately 24 inch rises. The material shall be bladed out and the bottom area cut to form benches and the embankment material being placed shall be compacted to the specified density. Formation and compaction of benches shall not be measured and paid for directly but will be considered incidental work.

E. Where embankments of two feet or less are placed over existing pavement, the existing pavement shall be removed and the cleared surface compacted to the specified density. Where embankments greater than two feet are placed over existing pavement, the pavement shall be broken into pieces with a maximum dimension of 24 inches and the pieces left in place.

F. Do not place fill material over porous, wet, frozen or spongy surfaces. Embankment construction shall not be performed when fill material is frozen or contains frost or snow.

G. Placement: Place earth embankments in successive horizontal lifts uniformly distributed over the full width of the fill area. Each lift shall not exceed the specified thickness and shall be compacted to the specified density prior to placing any additional lifts. As compaction of each layer progresses, continuous blading and dozing will be required to level the surface and insure uniform compaction.

H. No rocks or stones shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the size limit may be incorporated in the remainder of fills and embankments, provided they are distributed so they do not interfere with proper compaction, as determined by the Engineer.

3.6 LAGOON CONSTRUCTION NOT USED

3.7 EXCAVATION

A. General:

1. Where necessary, satisfactory sheeting and bracing shall be used to hold the sides of the excavation at all points where damage might result from slides.
2. All sheeting and bracing shall be removed as the backfill is placed, unless otherwise directed in writing by the Owner or shown on the Drawings. All voids left or caused by the withdrawal of sheeting shall be filled immediately with suitable material and tamped.
3. Excavation below structure or trench subgrade:
   a. Over excavation of pipe trenches due to Contractor's oversight, shall be backfilled with granular embedment material compacted in 8-inch lifts to 90 percent of the maximum density for that material in accordance with ASTM D-698, as required at no additional cost to the Owner.
   b. Over excavation of structure subgrades due to the Contractor's oversight, shall be replaced with concrete placed monolithic with the structure above at no additional cost to the Owner.
   c. When unstable or unsuitable material is encountered in the subgrade, such material shall be removed, replaced with crushed rock (for structures) or granular pipe embedment material (for trenches) and compacted to the density equal to or greater than required for subsequent backfill material. Such excavation and backfill shall be paid for at the contract unit price.
   d. When the subgrade bottom is soft and in the opinion of the Engineer cannot support the foundation, a further depth and/or width shall be excavated and refilled to the desired pipe or foundation grade with crushed rock, as required by the Engineer to assure a firm foundation. Such excavation and backfill shall be paid for at the contract unit price.
4. Use of Explosives: The Contractor shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use of explosives, and the protection of life and property. The Contractor shall be responsible for all damage caused by his blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench. Pre and post-blast surveys and blast monitoring are required.
5. Dewatering: Each excavation shall be kept dry during subgrade or pipe embedment preparation, and continually thereafter until the structure or pipe is completely installed, to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.
   a. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level at least 12 inches below the bottom of the excavation.
   b. Trenches shall be drained so that workmen may work efficiently. The discharge of pumps used for draining the trenches shall be led to natural drainage courses or drains.

B. Structure Excavation:

1. Excavation for structures shall be performed to the limits indicated on the Drawings.
2. All suitable material removed by excavation shall be used as far as practicable for backfill and embankment as required to complete the work. The Contractor shall sort all excavated material and stockpile suitable material as necessary. Stockpile excavated material to be used as fill and backfill in area designated on site and remove excess material or unsuitable material not being reused, from site.

C. Trenching:

1. All pipeline excavation shall be open cut. The Contractor shall not open more trench in advance of the pipe laying than is necessary. The length of open trenches shall be limited depending on the nature of the soil and safety considerations. All open trenches shall be adequately protected using fencing, barricades, etc. as required.

2. Trenches shall be excavated within the limits of public right-of-way in conformance with the requirements herein. Trenches shall be excavated to the width and depth necessary to install pipelines to the lines, grades, and elevations shown on the Drawings.
3. In those areas designated to be landscaped, seeded or sodded, the top soil shall be excavated, stockpiled and replaced as specified herein.
4. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One city block or 300 feet, whichever is the shorter, shall be the maximum allowable length of open trench ahead of pipe laying.
5. Limiting trench widths: Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and placement and compaction of embedment. Unless otherwise noted on the drawings, the limiting trench widths below an elevation 12 inches above the top of the installed pipe shall be as follows:

Pipe Size (inches)	Minimum Trench Width (inches)	Min. Clearance on Each Side of Pipe (inches)	Maximum Trench Width (inches)
< 4	20	6	26
4 - 6	22	6	30
8	22	6	30
10	24	6	32
12	27	6	36
15	30	6	38
16	32	6	40
18	34	6	42
20	36	6	44
36	50	6	60
48	62	6	72

6. Unauthorized trench widths: Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing table, either pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by loading conditions and as determined by the Engineer, shall be furnished and installed by and at the expense of the Contractor.
7. Trench bottom in earth: The trench in earth shall have a flat bottom the full width of the trench and shall be excavated to the grade to which the embedment is to be laid. The surface shall be graded to provide a uniform bearing and continuous support. No part of the bell shall be in contact with the trench bottom.
8. The Contractor shall sort and stockpile excavated material so that suitable material is available for backfill. Excavated material shall be deposited on the side of the trenches and beyond the reach of slides. Excavated material not suitable for backfill shall be promptly removed from the site.
9. Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes, but sloping trench walls shall not extend lower than 1 foot above the top of the pipe.
10. Trench Shields: Where trench shields are used by the Contractor, no part of the shield shall exceed lower than 6 inches above the top of the pipe, nor shall the maximum allowable trench width be exceeded.

3.8 PIPE EMBEDMENT

A. Embedment Classes: Unless otherwise indicated on the drawings, embedment classes shall be as follows, and as detailed on the Drawings. All lifts are given in compacted thickness. All compaction percentages refer to maximum dry density as determined by ASTM D-698. Select fill material shall be compacted within 2% of optimum moisture content. Select fill material shall be replaced with granular fill material if granular fill material is required for trench fill to ground surface.

1. Class A Embedments:
   a. Class A-1 embedment shall provide a cradle of concrete with a compressive strength of at least 3,000 psi, as specified in Division 3 - Concrete. After the initial set of the concrete, granular embedment material shall be placed in 6-inch lifts and compacted to a minimum of 90%, above the top of pipe.
   b. Class A-2 embedment shall provide an arch of concrete with a compressive strength of at least 3,000 psi, as specified in Division 3 - Concrete. Granular embedment material shall be placed in 6-inch lifts and compacted to a minimum of 90%, up to the centerline of the pipe. A concrete arch shall be placed on the granular embedment. After the concrete has set, one foot of select fill material shall be placed above the top of pipe, compacted in 8-inch lifts to a minimum of 85%.
2. Class B Embedments:
   a. Class B-1 embedment shall provide an encasement of granular embedment material, extending below the pipe to above the top of pipe. Granular embedment material shall be placed in 6-inch lifts and compacted to a minimum of 90%.
   b. Class B-2 embedment shall provide a cradle of granular embedment material which shall be placed in 6-inch lifts and compacted to a minimum of 90%. Select fill material shall then extend above the top of the pipe, placed in 8-inch lifts and compacted to 85%.
3. Class C Embedment: Materials and compaction requirements shall be as for Class B-2.
4. Class D Embedment: Shall allow the pipe to rest on a flat or restored trench bottom. Pipe embedment shall be select fill material extending from the bottom of the pipe to above the top of pipe, placed in 12-inch lifts and compacted to 85%.

B. Concrete Encasement: Where indicated on the Drawings, concrete encasement shall be provided instead of the pipe embedment classes specified herein. Requirements for concrete encasement are detailed on the Drawings. Concrete and reinforcement shall be as specified in Division 3 - Concrete, for 3,000 psi concrete.

C. Pipe Embedment Class Schedule: Unless otherwise noted on the Drawings, pipe embedment classes shall be provided according to the following schedule:

Pipe Material	Depth over pipe (feet)	Embedment class
SDR-35 PVC	All	B-1
Class 200 PVC in soil	All	D
Class 200 PVC in rock	All	C
SDR-PR PVC, SCH 40/80 PVC	All	B-1
C-900 PVC	All	B-1
HDPE (polyethylene)	All	B-2
DIP in soil up to 12-inch	minimum 3 ft	D
DIP in soil over 12-inch	minimum 3 ft	C
DIP in rock, all sizes	minimum 3 ft	C
Copper	All	C
Reinforced Concrete Pipe (RCP)	All	B-2
Other types not listed here	All	B-2

D. Placement of Embedment:

1. Place embedment material at the trench bottom with proper allowance for bell joints. Level materials in continuous layers not exceeding 6 inches in compacted depth. Shovel slicing of embedment shall be performed along the sides of the pipe as embedment is placed, to consolidate the bedding and haunching below the pipe.
2. Consolidate granular embedment by rodding, spading and compacting as necessary to provide uniform pipe support and meet the compaction requirement.

3.9 CRUSHED ROCK: Crushed rock shall be placed when shown on the Drawings or specified herein. Crushed rock shall be placed on suitably prepared subgrade and compacted by vibration. Crushed rock shall be kept free from dust, clay or trash. Crushed rock shall be compacted to not less than 90 percent of the maximum density for that material in accordance with ASTM D-1557.

3.10 BACKFILLING

A. General:

1. All trenches and excavations around structures shall be backfilled to finish grade according to the Drawings. Backfill with material as specified herein.
2. Large compaction equipment, including self-propelled compaction equipment, bulldozers, loaders, and boom-mounted vibratory plates, shall not be used within 3 feet above the top of pipe, or within 3 feet of new or existing structures.
3. If backfilling operations do not meet the specifications, the material shall be removed, replaced and re-compacted at the Contractor's expense.
4. Backfill shall not be placed when material is frozen, contains frost, snow, waste material, trees, organic matter and rubbish or when the surface to receive backfill is snow
5. No backfill shall be placed over or around any structure until the concrete or mortar has attained a minimum compressive strength of 2,000 psi and can support the loads imposed by backfilling and traffic.

B. Trench backfill: Backfill for all pipeline trench excavation shall be placed by the end of each working day around all pipe laid that day, leaving only the working end of the pipe uncovered. Any trenches excavated in advance of pipe laying shall also be backfilled at the end of each working day.

1. For trenches beneath proposed structures, slabs, or in areas which have or will have a paved or chip-and-seal surface, or where indicated on the Drawings to use granular fill material:
   a. Granular fill material shall be shall be placed on the compacted pipe embedment, in layers not to exceed 12 inches in compacted thickness.
   b. Granular fill material shall be compacted by vibratory means. Each lift of granular fill shall be compacted to a minimum 95 percent of maximum density as determined by ASTM D-698. Backfill shall be placed and compacted at a moisture content within plus 2 or minus 2 percent of optimum. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.
2. For trenches in graveled areas, or other vehicle traveled ways which are neither paved nor surfaced with chip-and-seal material:
   a. Select fill material shall be placed on the compacted pipe embedment, in layers not to exceed 12 inches in compacted thickness.
   b. Select fill material shall be compacted to a minimum of 90 percent of maximum density as determined by ASTM D-698. Backfill shall be placed and compacted at a moisture content within plus 3 or minus 3 percent of optimum. Select backfill may be compacted by vibratory plates, tracks or wheels of graders, tractors, high loaders or similar equipment, subject to the restrictions above. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.

3. For trenches in other areas, including grassed areas and parkways which are not in vehicle traveled ways:
   a. Random fill material shall be placed on the compacted pipe embedment, in layers not to exceed 18 inches in compacted thickness.
   b. Random fill material shall be compacted to a minimum of 85 percent of maximum density as determined by ASTM D-698. Backfill shall be placed and compacted at a moisture content within plus 3 or minus 3 percent of optimum. Backfill may be compacted by vibratory plates, tracks or wheels of graders, tractors, high loaders or similar equipment, subject to the restrictions above. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.

C. Structure backfill:
1. All structures shall be backfilled to the lines and grades shown on the Drawings. In no instance shall backfill be dumped, bulldozed or otherwise deposited in bulk upon the structure. Backfill shall be kept at approximately the same elevation on all sides of the structure as backfilling proceeds.
2. Structure backfill which will be beneath paved areas, slabs, or structures shall be granular fill material, compacted in place to 95% of maximum density as determined by ASTM D-698, at a moisture content within plus 2 or minus 2 percent of optimum. Granular fill shall be placed in lifts not to exceed 8 inches in compacted thickness, and compacted by careful pneumatic or vibratory tamping.
3. Backfill in all other areas shall be select fill material, placed in lifts not to exceed 12 inches in compacted thickness, and compacted in place to 90% of maximum density as determined by ASTM D-698, at a moisture content within plus 3 or minus 3 percent of optimum.

3.11 SURFACE RESTORATION

A. All areas disturbed by construction operations shall be restored by paving, gravel surfacing, or seeding, as indicated on the Drawings and specified. For areas which are seeded, minimum depth of topsoil shall be six inches. Topsoil shall be a dark, friable, organic soil free of clay lumps and rocks larger than one and half inches in largest dimension.

3.12 IMPERVIOUS TRENCH CHECK

A. Trench checks shall be placed where indicated on the Drawings, or at a maximum interval of 400 feet. If a pipeline segment is at least 100 feet but less than 400 feet, one trench check shall be provided in a location acceptable to the Engineer.

B. Trench checks shall extend the full width of the trench, and the length and depth shall be as indicated on the Drawings. Trench check material shall be placed completely under, around and above pipe, and shall be placed in maximum compacted lifts of 8 inches in thickness and compacted to 95% of maximum density as determined by ASTM D-698. Extreme care shall be used in compaction operations to prevent compacting equipment from contacting the pipe.

3.13 DISPOSAL OF MATERIALS

A. All unused excess excavated material, together with all debris, removed pipe, stones, stumps, roots, and other unsuitable materials shall be removed from the site and disposed of by the Contractor, at the expense of the Contractor.

B. Material to be disposed of, including excess material, shall be promptly removed from the site by Contractor. If Contractor desires to set aside excess excavated material free from contamination by sewage or other hazardous substances, he shall do so only in an area approved by the Owner.

3.14 SOIL TESTING: All materials, for fills and for impervious trench checks (if required), shall be sampled and tested in accordance with Section 01400 - Quality Control.

A. Laboratory Tests:
   1. Two initial gradation tests and two initial moisture-density (Proctor) tests shall be made for each type of embedment, backfill, and trench check material, including job excavated materials.
      a. Initial tests on materials which are imported (not job excavated) shall be provided by Contractor and the results submitted as product data for review in accordance with the submittals section.
   2. One additional gradation test and one additional moisture-density test shall be made for each additional 400 tons of imported material, and such tests shall be paid for by Contractor.

B. Field Tests:
   1. During the progress of the work of filling and backfilling, in-place density tests will be performed with a nuclear density gage by a qualified laboratory technician.
   2. The number of tests to be taken and the locations thereof shall be determined by the Engineer based upon observation of the filling or backfilling process. A minimum of two (2) tests per 100 cubic yards of fill/backfill and two (2) tests per 300 feet of trench will be taken unless otherwise directed by the Engineer. One additional test will be performed on each trench check (if required).
   3. If the tests indicate the compaction is not sufficient, the Contractor shall increase the compactive effort on all such inadequately compacted areas.

END OF SECTION

SECTION 02530

PIPING SYSTEM PRODUCTS

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall furnish all required piping, fittings, and all accessories for complete and functional piping systems as shown on the Drawings and specified herein.

B. Section Includes:
1. Piping materials for water distribution piping, sanitary sewer piping, piping outside of buildings, and other services.
2. Pipe fitting and accessories.

C. This section does not cover piping installation. See Section 02535 - Piping Systems Installation

1.2 RELATED SECTIONS

A. Section 02320 - Earthwork and Trenching: For trenching, embedment, and backfill.

B. Section 02535 - Piping Systems Installation: For installation of products specified herein.

1.3 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the requirements of this section shall govern.

A. American Society for Testing Materials (ASTM):
1. A-193 - Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
2. A-194 - Specification for Carbon and Alloy Steel nuts for bolts for High-Pressure and High-Temperature Service.
3. A-194 - Specification for Carbon and Alloy Steel nuts for bolts for High-Pressure and High-Temperature.
4. A-746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
5. B-88 - Specification for Seamless Copper Water Pipe.
6. D-1784 - Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds.
7. D-1785 - Poly (Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, 120.
8. D-2241 - Poly (Vinyl Chloride) Pressure-Rated Pipe (SDR Series).
9. D-2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
10. D-2464 - Threaded Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80.
11. D-2467 - Socket-type Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80.
12. D-2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
13. D-2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
14. D-2837 - Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
15. D-3034 - Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
16. D-3139 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
17. D-3212 - Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Seals.
18. F-405 - Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings
19. F-437 Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

20. F-439 Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
21. F-441/F-441M Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
22. F-493 Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
23. F-477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
24. F-606 - Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators and Rivets.
25. F-679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
26. F-1970 Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems.

B. American National Standards Institute (ANSI)/American Water Works Association (AWWA):
1. C104/A21.4 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
2. C105/A21.5 - Polyethylene Encasement for Ductile Iron Pipe Systems.
3. C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 3 In. through 48 In.
4. C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
5. C115/A21.15 - Flanged Ductile Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges.
6. C150/A21.50 - Thickness Design of Ductile Iron Pipe.
7. C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
8. C153/A21.53 - Ductile Iron Compact Fittings 3 In. through 24 In. and 54 In. through 64 In. for Water Service.

C. American Water Works Association (AWWA):
1. C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. for Water Distribution.
2. C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. for Water Transmission and Distribution.

D. Uni-Bell PVC Pipe Association:
1. Uni-B-13-92 - Uni-Bell PVC Pipe Association Recommended Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride (PVC) Pipe.

1.4 DEFINITIONS

A. Embedment: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS: The Contractor shall submit the following items required by this division in accordance with Section 01300 - Submittals.

A. Product Data for Review:
1. Pipe and joint materials and details.
2. Details and materials of fittings, pipe accessories, and specials.
3. Specifications, data sheets, and affidavits of compliance for protective shop coatings and linings.
4. Pressure gauge certification and calibration data.

B. Manufacturer’s Certificates: Contractor shall furnish the following prior to shipment:
1. Affidavit of compliance with applicable standard.
2. Test certificates.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

1.6 PROJECT RECORD DOCUMENTS

A. Requirements for project record documents are covered under section 02535 - Piping Systems Installation.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. Notes on Materials: Each pipe material below is given an alphanumeric abbreviation shown in parentheses, which is shown on the Drawings to denote the applicable specified material for the given size and service.

B. Type PSM Polyvinyl Chloride Sewer Pipe and Fittings (SDR-35 PVC): Shall meet the requirements of ASTM D-1784 cell classification 12454-B for PVC compounds, and ASTM D-3034 for poly vinyl chloride (PVC) sewer pipe.
   1. Minimum wall thickness shall conform to Standard Dimension Ratio 35 (SDR 35), except for 4-inch diameter pipe which shall conform to SDR 26.
   2. The Contractor shall install the maximum pipe lengths manufactured by the supplier.
   3. Joints: Flexible gasketed joints for PVC pipe and fittings shall be compression type joints with the gasket confined in either the spigot or the bell end of the pipe. Rubber gasket rings shall be neoprene or other synthetic material and conform to ASTM D-3212 and ASTM F-477. Natural rubber gaskets will not be acceptable.
   4. Fittings: Fitting joints shall be bell and spigot with elastomeric gaskets conforming to ASTM D-3212, unless indicated on the Drawings to be solvent cemented joints, in which case the joint shall conform to ASTM D-2855. Fittings shall not be used unless directed by the Engineer or indicated on the Drawings.

C. Polyvinyl Chloride Plastic Pressure Pipe, Joints, and Fittings (SDR 21 PVC or Class 200): Shall meet the requirements of ASTM D-1784 cell classification 12454-A or 12454-B for PVC compounds, and ASTM D-2241 for (PVC) pressure pipe.
   1. Minimum wall thickness shall conform to Dimension Ratio 21 for Class 200.
   2. The Contractor shall install the maximum pipe lengths manufactured by the supplier.
   3. Joints: Joints shall be push-on type with integral bell and spigot and elastomeric gaskets meeting the requirements of ASTM D-2122 and ASTM D-3139. An integral wall-thickened bell end or an integral sleeve-reinforced bell end will be acceptable. Rubber gasket rings shall be neoprene or other synthetic material and conform to ASTM F-477. Natural rubber gaskets will not be acceptable.
      a. Bell restraint clamps: Clamps for restraining bell and spigot joints shall consist of clamping rings and rods, and shall meet the requirement of Uni-B-13-92. Restraint devices shall be of ductile iron, ASTM A536, Grade 65-45-12, with connecting bolts of high strength, low alloy metal in accordance with ANSI/AWWA C111-A21.11. All ferrous metal surfaces shall be shop coated with an epoxy coating for corrosion resistance. Bell restraint clamps shall be Ford Meter Box "Series 1350 Uni-Flange Block Buster", Romac "Series 611", or approved equal.
   4. Joints for wastewater forcemain piping shall be groove& spline coupling with O-rings (flexible elastomeric seal). This piping shall be Certa-Lok Yelomine as manufactured by CertainTeed or Engineer approved equal.
   5. Thrust restraints shall be concrete thrust blocks where possible. Where blocks are not possible, Contractor may use bell restraint clamps.

D. Polyvinyl Chloride Plastic Pipe and Fittings (SCH 40 PVC): PVC piping shall meet the requirements of ASTM D-1784 cell classification 12454-B for PVC compounds, and ASTM D-1785 for Schedule 40 PVC pipe.

1. Fittings shall be solvent welded socket-type, in accordance with ASTM D-2467. Threaded fittings, in accordance with ASTM D-2464, shall be used only where indicated on the Drawings or specifically allowed by the Engineer.
2. Primer and solvent cement shall conform to ASTM F656 and ASTM D2564, respectively.
3. Flange adapters shall be socket-type solvent welded, with diameter and drilling conforming to ANSI/ASME B16.5, Class 150. Flange gaskets shall be full face, chemical resistant elastomeric material. Flange bolts shall be ASTM Grade B, galvanized or stainless steel.

E. Polyvinyl Chloride Plastic Pressure Pipe and Fittings (SCH 80 PVC): PVC pressure piping shall meet the requirements of ASTM D-1784 cell classification 12454-B for PVC compounds, and ASTM D-1785 for Schedule 80 PVC pipe.

1. Fittings shall be solvent welded socket-type, in accordance with ASTM D-2467. Threaded fittings, in accordance with ASTM D-2464, .shall be used only where indicated on the Drawings or specifically allowed by the Engineer.
2. Primer and solvent cement shall conform to ASTM F656 and ASTM D2564, respectively.
3. Flange adapters shall be socket-type solvent welded, with diameter and drilling conforming to ANSI/ASME B16.5, Class 150. Flange gaskets shall be full face, chemical resistant elastomeric material. Flange bolts shall be ASTM Grade B, galvanized or stainless steel.

F. High Density Polyethylene DR-PR Plastic Pipe (HDPE): Shall meet the requirements of ASTM F-714 The polyethylene material shall be classified as Type III, Grade P34. The polyethylene pipe shall meet the requirements of ASTM D-3350 for cell classification 345444-C.

1. Forcemain: Wall thickness shall conform to ASTM F-714 for SDR-9, minimum working pressure of 200 psi, ductile iron pipe size. Pipe shall be Phillips Driscopipe “1000 (PE3408)” or Engineer approved equal.
2. Joints: Joints in HDPE pipe, fittings, and adapters shall be thermally welded by butt fusion.
3. Fittings: HDPE fittings shall be fabricated of pipe with a wall thickness at least as thick as the adjacent pipe, or greater as required by AWWA C906. Mitered bends shall have a minimum of five segments for 90 degree bends, a minimum of three segments for 45 degree bends.
4. Flange Adapters: Flange adapters for connecting HDPE pipe to PVC pipe shall consist of a stub of polyethylene pipe which is integrally molded with a polyethylene flange. Minimum flange face thickness shall be 1.5 times the pipe wall thickness, and the flange diameter and drilling shall match that of the mated ductile iron flange. A flange gasket shall be used. A flange backer ring of ductile iron or stainless steel shall be used. Flange bolts shall be stainless steel.
5. Mechanical Joint Adapters: Flange adapters for connecting HDPE pipe to ductile iron pipe shall consist of a stub of polyethylene pipe which is integrally molded with a polyethylene retaining ridge which is designed to fit against a ductile iron pipe mechanical joint bell and gasket. A ductile iron follower gland shall be provided. Joint bolts shall be stainless steel

2.2 PIPE ACCESSORIES

A. Banded Couplings: Banded couplings for gravity piping shall be synthetic rubber repair couplings with stainless steel clamping ring bands, BANDSEAL by Dickey, Fernco coupling or approved equal. Banded couplings shall be provided to transition between different materials and sizes as required.

B. Pipe grouting rings: Pipe grouting rings shall be synthetic rubber, with stainless steel take-up clamps. Ring and clamps shall meet or exceed the requirements of ASTM C-923. Grouting rings

shall be matched to the outside diameter of the carrier pipe. Grouting rings shall be Press-Seal Gasket Corporation "WS Series WaterSTOP Grouting Rings" or approved equal.

C. Mechanical couplings: Mechanical couplings shall be gasketed, sleeve-type, sized to properly fit the pipes to joined, with steel or ductile iron middle ring, steel or ductile iron follower rings, and synthetic rubber gaskets. Gaskets shall be SBR, Buna-N, or EPDM. All ferrous metal surfaces shall be shop coated with an epoxy coating for corrosion resistance. All hardware shall be 300 series stainless steel. Mechanical couplings shall be Ford Meter Box "Style FC1, Style FC2A, Style FC3, or Style FC23", Dresser "Style 38, Style 153, or Style 162", Smith-Blair "441 or 411", or equal.

D. Flange Adapters: Flange adapters shall be the cast iron slip-on type retained by set screws. Flange body shall be ductile iron, ASTM A-536, Grade 65-45-12. Set screws shall be manufactured form AISI 4140 steel, heat treated to Rockwell C 42-50 and zinc plated. Set screws shall have break away torque heads. Flange adaptors shall conform to ANSI B16.1 for machining and drilling. Gaskets shall be standard mechanical joint gaskets, EPDM or Buna-N. All non-plated ferrous metal parts shall be shop primed with an epoxy primer, for finish painting in the field. Flange adaptors shall be Ford Meter Box Corporation "UNI-Flange Series 200" or equal.

E. Flexible Expansion Sleeves: Flexible expansion sleeves shall be synthetic butyl rubber. The body shall consist of fabric and various rubber compounds reinforced with steel rings. The cover shall be suitable for service conditions, formed from natural rubber or synthetics and coated with a Hypalon paint. All materials shall be suitable for temperatures up to 250° F for pressure and vacuum service. Flexible expansion sleeves shall be single arch configuration, Redflex "SL-50" or equal.

F. Arch Expansion Joints and Reducers: Arch expansion joints and reducers shall be Neoprene, Hypalon, or Buna-N. Joint shall allow 3/4-inch elongation. The tube shall be a leak-proof lining of natural rubber or synthetic. The body shall consist of fabric and various rubber compounds reinforced with steel rings. The cover shall be suitable for service conditions, suitable for 250°F, formed form natural rubber or synthetics and coated with a Hypalon paint. Flanges shall be made of duck and rubber construction and full-faced with 150 lb ANSI standard drilling. Standard or tapered reducing arch expansion joints shall be provided indicated on the Drawings.

2.3 GRANULAR EMBEDMENT MATERIAL

A. Granular embedment material shall be as specified in Section 02320 - Earthwork and Trenching.

2.4 BACKFILL MATERIALS

A. Backfill materials shall be as specified in Section 02320 - Earthwork and Trenching.

2.5 TRACER WIRE

A. A tracer wire of 12 gauge TW copper shall be installed with all plastic mains. The tracer wire shall be installed in the trench with the plastic pipe as detailed on the Drawings.

PART 3 EXECUTION

3.1 Refer to Section 02535 - Piping Systems Installation

END OF SECTION

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SECTION 02535

PIPING SYSTEM INSTALLATION

PART 1 GENERAL

1.1 SUMMARY

A. The Contractor shall install all required piping, fittings, embedment materials, and all accessories for complete and functional piping systems as shown on the Drawings and specified herein.

1.2 SECTION INCLUDES

A. Installation of piping, fittings, and accessories.

B. Process piping/waterline acceptance testing.

1.3 RELATED SECTIONS

A. Section 02320 - Earthwork and Trenching: For trenching, embedment, and backfill.

B. Section 02530 - Piping System Products: For products installed herein.

1.4 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the requirements of this section shall govern.

A. American Society for Testing and Materials (ASTM):
   1. D-2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
   2. D-2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping
   3. D-2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

B. American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME):
   1. B1.20.1

C. American Water Works Association (AWWA):
   1. C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 12 in. for Water Distribution.
   2. C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in. through 48 in. for Water Transmission and Distribution.

D. Uni-Bell PVC Pipe Association:
   1. Uni-B-13-92 - Uni-Bell PVC Pipe Association Recommended Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride (PVC) Pipe.

E. American National Standards Institute (ANSI):
   1. B31.1

F. American Public Works Association (APWA):
   1. Section 2500 Sanitary Sewers

1.5 DEFINITIONS

A. Embedment: Fill placed under, beside, and directly over pipe prior to subsequent backfill operations.

1.6 SUBMITTALS

A. Submittals for piping system products are covered under Section 02530 - Piping System Products.

1.7 PROJECT RECORD DOCUMENTS

A. Record location of pipe runs, connections, and invert elevations.

B. Record type of pipe material installed.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 REGULATORY REQUIREMENTS

A. Conform to applicable codes and ordinances for disposal of debris.

B. Contractor shall notify utility companies prior to commencement of construction and coordinate work with utilities as required.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated on the Drawings.

PART 2 PRODUCTS

2.1 Refer to Section 02530 - Piping System Products

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that the pipeline lines and grades are as shown on the Drawings.

3.2 PREPARATION

A. The Contractor shall verify the location and depth of all utilities prior to construction. Prior to commencement of work the Contractor shall notify all those companies which have facilities in the vicinity of the construction.

3.3 PROTECTION

A. Locate, identify, and protect utilities that remain, from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or neglectful actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.

B. Relocation of an existing utility which is within the public right-of-way shall be performed by the respective utility owner at no cost to the Contractor. Relocation and protection of an existing utility which is within a utility easement shall be the responsibility of the Contractor.

C. Any private facilities damaged or disturbed by the Contractor's work shall be repaired by the Contractor prior to close of the working day. Repairs shall be made in a manner sufficient to restore utility service to that property.

D. Protect trees, plant growth, and features designated to remain as final landscaping.

E. Protect all property or lot corner pins and stakes from damage or displacement. If property or lot corner markers must be moved, they shall be properly referenced prior to removal and reset by the Contractor upon completion of the project.

F. Protect from damage or displacement all project benchmarks and existing structures within or adjacent to the construction limits that are not to be removed or demolished.

3.4 SEPARATION OF WATER AND SEWER UTILITIES

A. Gravity Sanitary Sewers: When potable water pipes (excluding service water pipes downstream of a backflow preventer) and gravity sanitary sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 ft. The distance shall be measured from edge to edge. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them. In cases where it is not practical to maintain a 10 ft. separation, the Engineer will consult with MDNR to consider equivalent protection by other methods.
   1. When a water pipe and a sanitary sewer cross and the sewer is 18 inches for MDNR or more (clear space) below the water pipe, no special requirements or limitations are provided herein. At all other crossings, the Engineer will consult with MDNR to consider equivalent protection by other methods.
   2. Joints in the sewer pipe shall be located as far as practical from the intersected water main.

B. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole.

C. Storm Sewers: The separation distance between a storm sewer (which is not a combined storm/sanitary sewer) and a water main, if encountered, shall be determined by the Engineer based on geotechnical considerations. Required separation distances between water mains and combined storm/sanitary sewers are equivalent to those for water mains and gravity sanitary sewers.

D. Drains: Underground drains from fire hydrants or valve pits should not be directly connected to sanitary or storm drains.

3.5 PIPE EMBEDMENT/ENCASEMENT

A. Material and installation for pipe embedment and concrete encasement shall be provided as indicated on the Drawings and specified in Section 02320 - Earthwork and Trenching.

3.6 PIPE INSTALLATION

A. All pipe shall be protected during transport, storage and installation from shock and free fall. Pipes shall be installed without cracking, chipping, breaking, bending or damaging the materials. Damaged pipe shall be replaced with new materials except when repairs are permitted by the Engineer. Use slings, lifting lugs, hooks and other protection devices during handling.

B. Install pipe of the size, material, strength class, and joint type as specified or indicated on the Drawings. Every pipe fitting is not called out on the Drawings. Contractor shall provide fittings required to connect piping as shown on piping plans, and plan and profile Drawings. Additional fittings required to make vertical changes in elevation to avoid utilities or to meet connections shall be provided at no additional cost to Owner.

C. The maximum fitting bend for force mains and pressurized process piping shall be 45 degrees. When multiple fittings are assembled adjacent to make deflections in alignment, adequate piping shall be provided between for thrust restraint.

D. Where cutting of pipe is allowed, pipe shall be cut from measurements taken at the site and not from the Drawings.

E. Install gravity pipelines beginning with the lowest point of the pipeline and install pipe with the spigot or tongue end downstream. Install pressure pipelines with the bell ends facing the direction of laying, except when reverse laying is specifically authorized by the Engineer.

F. Install pipe to the line and grades indicated on the drawings. Unless otherwise noted on the Drawings, minimum cover over top of pipe shall be 42 inches. Maximum slope variation from true slope shall be one inch between structures for gravity sewers. The maximum variation from alignment between structures shall be two inches. Joint deflection shall not exceed the maximum allowable deflection per joint according to the governing standard. The pipe manufacturer=s maximum recommended deflection limits, if more stringent, shall govern over the referenced standards.
   1. Only one correction for alignment and/or grade shall be made between structures.
   2. The Contractor shall establish such grade control devices necessary to maintain the specified tolerance. All pipe shall have a continuous slope free of depressions.

G. Pipe installation shall be in accordance with applicable standards, such as ASTM C-12, D-2321 and ANSI/AWWA C600, except where conflicts with this section occur, in which case this section shall govern.

H. Clean the interior of all pipe fittings and joints prior to installation. Protect pipe against the entrance of debris and foreign matter during discontinuance of installation and at the close of the working day by installing a close fitting plug at the open end. Plugs shall be water tight against heads up to 20 feet of water.

I. The Contractor shall take whatever means necessary to keep the trenches free of water and as dry as possible during pipe installation, bedding and jointing operations.

J. After each pipe has been brought to grade, aligned and placed in final position, place sufficient embedment material under the haunches and on each side of the pipe to hold the pipe in proper position during subsequent pipe jointing, bedding and backfilling operations. Place embedment material uniformly and simultaneously on each side of the pipe to prevent lateral displacement. Embedment material shall be compacted as specified in Section 02320 - Earthwork and Trenching.

K. Pipe Jointing: Locate joints to provide for differential movement at changes in type of embedment, concrete collars and encasement and structures. Pipe jointing shall be according to the following specifications:
   1. Clean and lubricate all joint and gasket surfaces as recommended by the manufacturer.
   2. Examine all materials prior to installation for soundness and compliance with specifications.
   3. Check joint position and condition after assembly prior to installing additional pipe sections.
   4. Check joint opening and deflection for specification limits.

L. Pipe cutting shall be performed in a neat and workmanlike manner without damage to the pipe. Main taps for service saddle tees shall be made with a tapping tool specifically designed for that purpose. Cut edges shall be smoothed by power grinding to remove burrs and shape edges.

M. Pipe connection to structures: Pipe connection to new structures shall be as shown on the Drawings.

3.7 REQUIREMENTS FOR PIPE JOINTS: Pipe joints shall be carefully and neatly made, in accordance with the requirements which follow.

A. Threaded: Pipe threads shall conform to ANSI/ASME B1.20.1, NPT, and shall be full and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed, after threading and before assembly, to remove all burrs.
   1. Threaded joints, in plastic piping, shall be made up with Teflon thread tape applied to all male threads. Threaded joints, in stainless steel piping, shall be made up with Teflon thread tape applied to all male threads. At the option of the Contractor, threaded joints in other piping may be made up with Teflon thread tape, thread sealer or a suitable joint compound.

B. Flared: Ends of annealed copper tubing shall be cut square, and all burrs shall be removed prior to flaring. Ends shall be uniformly flared without scratches or grooves. Fittings shall be tightened as required, to produce leak-tight connections.

C. Solvent Welded: All joint preparation, cutting and jointing operations shall comply with the pipe manufacturer's recommendations and ASTM D-2855. Pipe ends shall be beveled or chamfered to the dimensions recommended by the manufacturer. Pressure testing, of solvent welded piping systems, shall not be performed until the applicable curing time, set forth in Table X2.1 of ASTM D-2855, has elapsed.

D. Flanged: Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but not so tight as to fracture or distort the flanges. A plain washer shall be installed under the head and nut of bolts connecting plastic pipe flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly. Connecting flanges shall have similar facings, i.e., flat or raised face.

E. Welded: Welding shall conform to the specifications and recommendations contained in the "Code for Pressure Piping", ANSI B31.1. The following requirements shall also apply for stainless steel piping:
   1. High purity inert welding gases and cover gases shall be used. Weld surfaces shall be sliver, light gold or straw color at worst, after welding. Black welds are not acceptable.
   2. Prior to welding, all surfaces shall be clean and free of all organic materials, moisture and dirt.
   3. Welds shall be dressed using aluminum oxide grinding wheels. Silicon carbide is not acceptable.

F. Push-on: Gasket installation and other jointing operations shall be in accordance with the recommendations on the manufacturer. Each spigot end shall be suitable beveled to facilitate assembly. All joint surfaces shall be lubricated with a heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean.

G. Rubber Gasketed: When rubber-gasketed joints are used for hub and spigot type cast iron soil pipe, spigot ends shall be plain, without beads. Cut ends of all pipe shall be cut square and all burrs removed. Spigot ends shall be coated with a lubricant recommended by the gasket manufacturer and fully seated in the gasket. Clamps for hubless cast-iron soil pipe shall be installed in accordance with the manufacturer's recommendations.

3.8 PLASTIC PRESSURE PIPE (PVC)

A. Pipe joints shall be assembled according to manufacturer's instructions. Joints shall be restrained with bell restrained clamps in locations where restrained joints are required, as specified herein.

B. Mechanical joint fittings shall be assembled as specified herein for ductile iron pipe.

3.9 JOINT RESTRAINT FOR PRESSURE PIPING: Joint restraint shall be provided for portions of buried piping which will serve in a pressure flow application, including: water lines and pump discharge lines.

A. Joint restraint for all pressure pipe shall be accomplished by means of thrust blocks, as shown and detailed on the Drawings.
   1. All plugs, caps, tees, bends and hydrants shall be provided with thrust blocks according to the details in the plans, and using 3,000 psi concrete.
   2. The concrete shall extend from the fitting or hydrant to undisturbed soil and poured or formed so that joints are accessible. If adequate soil support cannot be obtained, a mechanical restraining assembly shall be installed.

B. Where specifically indicated on the Drawings, concrete thrust blocks shall be provided in place of mechanical restraint.

C. Joint restraint for pressure pipe shall be accomplished using bell restraint clamps for joints between pipes, and fitting restraint devices at joints with fittings, as specified herein. Joints shall be restrained for a minimum distance as recommended by the manufacturer of the joint restraint device being used and for the conditions in which the pipe is installed.

3.10 HDPE PLASTIC PIPE

A. Thermally welded joints shall me made in accordance with the manufacturer's recommendations. Pipe ends shall be properly cut, faced, heated, and joined to provide a tight and thoroughly fused joint with uniform bead thicknesses. The thickness of each bead on a finished joint shall be of uniform diameter.

3.11 DIRECTIONALLY DRILLED CROSSINGS

A. Directionally drilled crossings shall be performed in accordance with industry practice, and shall include all labor, equipment and consumables necessary to accomplish the following:
   1. Clearing, grading, and general site/access preparation necessary for construction operations;
   2. Transportation of all equipment, labor, consumables, and Owner supplied materials to and from the jobsite;
   3. Erection of horizontal drilling equipment at the drill site;
   4. Reaming the pilot holes to a diameter suitable for installation of the prefabricated pull sections;
   5. Installation of the prefabricated pull sections along the reamed holes;
   6. Fabrication of the pull sections; and
   7. Clean-up and restoration of all work areas.

B. Horizontal directional drilling type machines shall be used when a minimum bend radius is specified on the project "Drawings". Contractor shall not bore a radius smaller than specified on the project "Drawings". Wash boring is not permitted.

C. Sodium Bentonite and/or gel type drilling muds are permitted for cuttings removal, borehole stabilization and carrier pipe lubrication on pullback.
   1. No fluid shall be approved or used that does not comply with permit requirements and environmental regulations. Drilling fluid shall not contain any additives that impart taste, odor, or contain hazardous materials.
   2. Disposal of drilling fluids shall be the responsibility of the Contractor and shall be conducted in compliance with all relative environmental regulations, right-of-way and workspace agreements, and permit requirements.
   3. Mud pits shall be suitably lined and bermed to prevent leakage to the surrounding area. All barrels, tanks, connections, valves, lines, etc. shall be maintained in good condition so that

leaks do not occur. Should a leak occur, any spillage shall be cleaned up immediately and the cause of the leak remedied.

4. The drilling Contractor shall be responsible for mud containment/disposal.
5. The Contractor is responsible for securing permits and transporting all excess fluids to an approved disposal site.

D. Pulling:

1. Before inserting a plastic pipe through a bored hole, ensure that the size of the bore is of sufficient diameter to prevent stress during insertion.
2. The pull section shall be supported during pull back so that it moves freely.
3. A swivel shall be used to connect the pipeline pull section to the reaming assembly to minimize torsional stress on the pipeline pull section.
4. A leader or fuse link approximately four feet long of the next smaller size PE pipe shall be added to the pulling hitch.
5. The pull section shall be installed in 1 continuous length with no tie-in welds, if possible. If this is not possible, tie-in welds shall be minimized.
6. The leading end of the inserted pipe shall be closed to prevent entrance of dirt and water.
7. After insertion, the leading end shall be examined in the exit bell hole to see if there are any scratches or gouges which would indicate contact with sharp objects.
8. If the pipe is damaged or distorted, remove the pipe and pull a plug through the bore to clean the hole. Repeat this process as many times as necessary until the leader passes through the bore undamaged.
9. The maximum allowable pulling force on the pipeline pull section shall not exceed 5,500 pounds.
10. The Contractor shall at all times provide and maintain instrumentation which will accurately locate the pilot hole and measure drilling fluid flow discharge rate and pressure. The Owner shall have access to these instruments and their readings at all times.
11. Polyethylene has elastic properties, and if the pulling load on the pipe does not exceed the Safe Pull Strength, the pipe will relax back to its original pre-pull length. After the pull is complete, a relaxation period of several hours is necessary before final tie-in. The pipe shall be pulled slightly past the tie-in point to accommodate pipe contraction and facilitate final tie-in.

E. Tracer Wire: In an “uncased” insertion of plastic pipe through a bored hole, a 12-gage copper tracer wire shall be attached to the leading pipe and inserted along with the pipe. Care shall be used to try and minimize the twisting of the wire around the pipe.

3.12 PIPE ACCESSORIES

A. Mechanical couplings: Mechanical couplings shall be carefully installed in accordance with the manufacturer's recommendations. Pipe ends shall be separated by a space of at least 1/4 inch but not more than 1 inch. Pipe and coupling surfaces which contact gaskets shall be clean and free from dirt during assembly. Following installation of the coupling, damaged areas of shop coatings on the pipe and couplings shall be repaired.

3.13 PRESSURE PIPING ACCEPTANCE TESTING

A. All new pressure piping will be subject to hydrostatic pressure testing under this subpart. Force mains and pressure sewers shall be tested from the point of discharge to the isolation valves in the corresponding lift station(s). New segments of pipelines which will be connected to existing lines shall be pressure tested prior to connection.

B. Water lines, including potable water and service water, shall be tested in accordance with Section 02725 - Water Line Testing and Flushing, and shall be disinfected after hydrostatic testing in accordance with AWWA C651 and Section 02726 - Water Line Disinfection.

C. Notification: Contractor shall notify Engineer at least 48 hours in advance of the scheduled time for testing. Resident Project Representative shall be present for acceptance testing and approval.

D. Test Conditions:
1. Test pressure shall be 100 psi (gauge) for the sewage forcemain, for process piping and for other pressure pipes. This pressure will not exceed the thrust-restraint design pressure.
2. The hydrostatic test shall be of at least a 2 hour duration. Test pressure shall not vary by more than ∀5 psi for the duration of the test.
3. Contractor shall pressure test new forcemain in segments or increments not to exceed 3,000 feet.
4. If Contractor chooses to test in segments, provide AWWA resilient seated gate valves or temporary valves.

E. Test materials: Contractor shall supply all of the necessary plugs, hose, riser pipe, pumps, gauges, and other equipment as required for the testing. The Contractor shall obtain permission from the Owner for use of Owner's water supply from an existing fire hydrant.

F. Pressurization: After the pipe has been laid and backfilled, the section of pipe shall be isolated. The pipe shall be slowly filled with water. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so that the air can be expelled as the line if filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place as directed by the Engineer. The specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied by means of a pump connected to the pipe. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. The system will be allowed to stabilize at the test pressure before the leakage test is conducted.

G. Examination: All exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until satisfactory results are obtained.

H. Leakage: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time. Allowable leakage shall be as follows:

Pipe Size (inches)	Allowable Loss 50 psig test pressure (gallons per hour per 1,000 feet)	Allowable Loss 100 psig test pressure (gallons per hour per 1,000 feet)
1.5	0.080	-
2	0.106	-
4	0.212	0.30
6	0.319	0.45
8	0.425	0.60
10	0.531	0.75
12	0.637	0.90
14	0.743	1.05
16	0.849	1.20
18	0.956	1.35
20	1.063	1.50

I. Acceptance of Installation: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe discloses leakage greater than that specified above, repairs or replacements shall be accomplished in accordance with the specifications. All visible leaks shall be repaired regardless of the amount of leakage.

3.14 FIELD QUALITY CONTROL

A. Perform field inspection and testing.

B. Compaction and soil testing will be performed in accordance with Section 02320 - Earthwork and Trenching.

END OF SECTION

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SECTION 02922

SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: This section covers the operations necessary to establish and maintain a grass cover for stabilizing soils on new slopes and swales, and in areas damaged by trenching and construction operations.

B. Contractor shall perform all clearing, grading, fertilizing, preparing of seedbed, seeding, covering and firming of seed into the soil, application of mulch, and maintenance.

1.2 RELATED SECTIONS

A. Section 02320 - Earthwork and Trenching

1.3 SUBMITTALS: The Contractor shall submit the following items required by this division in accordance with the Submittals Section.

A. Product data for review:
1. Representative label bearing the composition of seed mixtures.
2. Label indicating the composition of the fertilizer.

B. Product data for information:
1. Copies of supplier's invoices for all seed, mulch, and fertilizer showing the weight purchased for the project.

1.4 GUARANTEE

A. The Contractor shall unconditionally guarantee a stand of grass that is reasonably uniform in density and reasonably free of weeds, and otherwise acceptable to the Owner for eight weeks after seed has been planted.

PART 2 PRODUCTS

2.1 SEED

A. Seed: All seed shall be labeled in accordance with U.S. Department of Agriculture Federal Seed Act. Seeds shall be free of prohibited weed seeds and shall contain no more than one percent of noxious weed seeds.
1. Seeds shall be delivered to the site in convenient, fully labeled containers bearing the name, trade name or trademark and warranty of the manufacturer with a certificate of the purity and germination of each kind of seed.

2. Type "A" seed mixture shall be used for established yards, shoulders and slopes in street right-of-way and other areas designated on the Drawings. Type "A" seed mixture shall be as follows:

Table 1: Type "A" Seed Mixture

Kind of Seed	Minimum Pure Live Seed (%)	Rate of Pure Live Seed (lb/acre)
Turf Type Tall Fescue	80	105
Perennial Rye Grass	80	65
Kentucky Blue Grass	75	50
Creeping Red Fescue	85	30
Total		250 lb/acre

3. Type "B" seed mixture shall be used for areas outside of the street right-of-way which are not maintained and other areas designated on the Drawings. Type "B" seed mixture shall be as follows:

Table 2: Type "B" Seed Mixture

Kind of Seeds	Minimum Pure Live Seed (%)	Rate (Lbs. per Acre)
Alta Fescue or Kentucky 31 Fescue (Festuca Elatior Var. Arundinces)	75	90
Rye Grass (Lolium Perenne or L. Multiflorum)	80	50
Total		140 lb/acre

2.2 FERTILIZER: Fertilizer shall be a complete commercial grade, minimum 12-12-12 water soluble, fertilizer.

2.3 MULCH: Mulch shall be hay or straw with no viable seeds of noxious weeds.

PART 3 EXECUTION

3.1 PREPARATION

A. Clearing and stripping, earthwork, grading, and placement of topsoil shall be performed as specified in Section 02320 - Earthwork and Trenching.

B. Areas to be seeded containing excess weeds shall be sprayed with a non-selective herbicide, such as Roundup or equal. Follow herbicide manufacturer's instructions for application rates and time after application before seeding can be completed.

3.2 SEEDING

A. Seeding: Seeding shall be performed on all areas disturbed by construction that are not reestablished by sodding, pavement, gravel, driveways and other methods of reestablishment. Included shall be seeding, fertilizing, mulching, preparation of seed bed, and maintenance.
   1. Fertilizer shall be evenly distributed before tilling, at a rate of six hundred (600) pounds per acre (7 pounds per 500 square feet) and incorporated into the soil to a depth of at least two inches by discing or harrowing.
   2. Those areas designated to be seeded shall be cleared and graded prior to tilling. The surface shall be tilled to a depth of at least two inches by discing or other approved methods until

the surface is suitable for seeding. The prepared surface shall be maintained until seeding and mulching is completed to prevent excessive weeds, gullies, and depressions.

3. Seeding and fertilizing shall be performed between February 15 and April 15 or between August 15 and October 15. The specified seed shall be sowed using a mechanical spreader or drill at the application rate. Successive seeding strips shall be overlapped to provide uniform coverage. Seed sown by broadcast type seeders shall be raked in or otherwise covered with soil to a depth at least one-quarter inch and rolled to obtain a firm seed bed.
4. Seed that is wet, moldy or otherwise damaged in transit or storage shall not be used. Seeding shall not take place when wind velocity exceeds five (5) miles per hour.
5. Immediately following completion of seeding, if in the Engineer's judgment the seed bed is too loose or contains clods, the entire area shall be compacted using a roller weighing at least sixty (60) but not more than ninety (90) pounds per lineal foot of roller.
6. Within 24 hours of seeding, mulch shall be spread over all seeded areas. Mulch shall be spread uniformly with a mechanical spreader or other approved methods at a rate of 2 tons per acre. Mulch shall be spread in a loosened condition with no lumps of compacted material. Mulch shall be anchored into the soil a minimum of 2 inches using a heavy disc harrow by not more than two passes of the harrow. Discs of the anchoring tool shall be set approximately nine inches apart. Mulch shall be anchored not cut.
7. Seeded areas shall be watered immediately following application of mulch, to a depth of at least two (2) inches. Care shall be taken not to cause erosion. Watering shall be repeated daily until a flourishing grass coverage is achieved.
8. The seeded area shall be protected against damage by vehicle and pedestrian traffic by use of barriers and warning signs. If at any time before completion and acceptance of the seeding work any portion becomes gullied, damaged or destroyed shall be repaired or re-established to the specified condition at the Contractor's expense prior to acceptance by the Owner.
9. Maintenance: Maintenance shall include watering, as required of the seed bed and resulting growth, and replacement of any areas eroded by any causes.

END OF SECTION

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SECTION 03300

MISCELLANEOUS CONCRETE

PART 1 GENERAL

1.1 GENERAL

A. The Contractor shall provide all concrete work as required to complete the concrete construction as specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

1.3 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the section requirements shall govern.

A. American Concrete Institute (ACI):
1. 302 - Guide for Concrete Floor and Slab Construction.
2. 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
3. 305 - Committee Report on Hot-Weather Concreting.
4. 306 - Committee Report on Cold-Weather Concreting.
5. 309 - Recommended Practice for Consolidation of Concrete.
6. 318 - Building Code Requirements for Reinforced Concrete.
7. 347 - Recommended Practice for Concrete Formwork.

B. American Society for Testing and Materials (ASTM):
1. A-615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement
2. C-31 Making and Curing Concrete Test Specimens in the Field.
3. C-33 Concrete Aggregates.
4. C-39 Compressive Strength of Cylindrical Concrete Specimens.
5. C-94 Ready-Mixed Concrete.
6. C-143 Slump of Portland Cement Concrete.
7. C-150 Portland Cement.
8. C-185 Test Method for Air Content of Hydraulic Cement Mortar

C. Midwest Concrete Industry Board (MCIB).

1.4 SUBMITTALS

A. Contractor shall submit product data for review on the following items required by this Division:
1. Laboratory name.
2. Aggregate testing and gradation.
3. Design mix.

B. Product data shall be submitted in accordance with Section 1300 - Submittals.

PART 2 PRODUCTS

2.1 CEMENT: Cement shall conform to ASTM C-150, Type I. Cement may be bagged or bulk. Cement shall be used from only one mill throughout the entire project.

2.2 FINE AGGREGATE: Fine aggregate shall conform to ASTM C-33 and have the following gradation:

Sieve	% Passing	% Retained
3/8"	100	0
No. 4	95-100	0-5
No. 8	80-100	0-20
No. 16	50-85	15-50
No. 30	25-60	40-75
No. 50	5-30	70-95
No. 100	0-10	90-100

2.3 COARSE AGGREGATE

A. Coarse aggregate shall conform to ASTM C-33 and have the following gradation:

Sq. Sieve	% Passing	% Retained
1"	100	0
3/4"	90-100	0-10
3/8"	20-55	45-80
No. 4	0-10	90-100
No. 8	0-5	95-100

2.4 WATER

A. Treated and filtered water from a municipal or other public water supply district shall be used.

2.5 REINFORCING STEEL

A. All bars shall conform to ASTM A-615, Grade 60. Bending details shall conform to ACI 318.

2.6 FORMS

A. The forms shall be true and rigid and conform to shape, line and dimensions as shown on the Drawings. All forms shall be rigidly constructed, braced and tied to prevent any deflection or displacement during placing of concrete. All exposed corners and edges shall have 3/4-inch fillets or chamfers. All joints shall be mortar tight; open joints shall be sealed as required.

2.7 CONCRETE MIX

A. Proportioning: Concrete shall conform to the following:
   1. Cement: 6 sacks per cubic yard, minimum.
   2. Water: Water shall be kept to an absolute minimum to maintain slump as specified.
   3. Aggregate: The sand factor shall be as required to give the best workable mix within the range of 46 to 52 percent of total aggregate by weight.
   4. Strength: Minimum 4000 psi at 28 days.

B. Slump: The maximum slump shall not exceed 4 inches. Determination of slump shall conform to ASTM C-143.

C. Mixing: Contractor shall use ready-mixed concrete, mixed and delivered in conformance with ASTM C-94.

D. Admixtures: Air entraining agents shall be added to the concrete to provide 4 to 6 percent entrained air when placed, in conformance with ASTM C-185.

PART 3 EXECUTION

3.1 PLACING REINFORCING STEEL

A. All bars are to be accurately placed and securely tied at all intersections.

B. Reinforcing steel shall be free from flaky or scaly rust which will destroy or reduce the bond strength at the time concrete is placed.

C. Unless shown otherwise on the Drawings, the following minimum concrete coverage shall be maintained:
1. Against earth: 3 inches
2. Against forms or when exposed to water or weather: 2 inches

3.2 PLACING CONCRETE

A. No concrete shall be deposited below water. The excavation may be damp but shall contain no free water.

B. Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of materials. Re-tempering of concrete is not permissible.

C. All concrete shall be thoroughly compacted during placement by means of vibrators in conformance with ACI 309.

D. For formed surfaces, the Contractor shall break off ties, grout voids which are deeper than 1/2-inch and chip out honeycombed areas to solid concrete and grout flush with formed surface.

E. Curing shall be maintained continuously for seven days after placing concrete or until forms are removed and the surface finished. Concrete surface temperature is to be maintained between 50EF and 100EF for at least seven days.

F. Concrete shall not be placed on iced or frozen subgrade or when the air temperature is below 20EF. Concreting shall not be continued when the air temperature is below 45EF unless the following conditions are attained:
1. Mixing water shall be heated (to a maximum of 150EF).
2. Aggregates shall be heated until free of all ice and frost.
3. The concrete temperature after mixing shall be between 50EF and 70EF if the air temperature is 20EF to 45EF.
4. After the concrete is placed, it shall be covered, protected, and heated so as to maintain a minimum of 70EF air temperature for the first 24 hours and 50EF air temperature for the next six days. Open-flame type heaters are not permitted. Heating equipment not vented outside of the covering will not be permitted.
5. Moist conditions shall be maintained during the heating period.
6. All covering, heating equipment, etc., shall be on hand and approved by the Engineer before any concrete is placed.

G. Admixtures, such as calcium chloride, shall not be used.

H. Exposed concrete is not to be placed in air temperatures above 100EF. Cover, protect and cool work as required to maintain the temperature of the concrete below 100EF. The concrete temperature, after mixing, shall not be greater than 85EF. Spray and/or shade aggregate piles and cool mixing water as required.

3.3 FINISHING

A. Unformed Surfaces:

1. Screed Finish:
   a. Use as first stage for all concrete finishes.
   b. Use as final finish on surfaces that will be covered by additional concrete, grout placement, or mortar setting bed except as otherwise specified.
   c. Immediately after screeding, use a wood float, darby, or bull float to eliminate high and low spots and to embed large aggregate. This shall be done in a manner to produce even, uniform surfaces so that surface irregularities do not exceed 3/8 inch in 10 feet when used as final finish.
2. Floated Finish:
   a. Use as second stage of broomed, troweled, or magnesium-troweled finish.
   b. Use as final finish on all areas to receive built-up roofing.
   c. Float with mechanical float. Hand floating will be permitted only in areas inaccessible to mechanical float.
   d. On surfaces not to receive troweled or magnesium-troweled finish, finish with wood or cork float after mechanical floating to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.
3. Broomed Finish:
   a. Use as final finish on all outdoor slabs including pavements and sidewalks.
   b. After floated finish, draw a stiff bristle broom across the surface making uniform corrugations, perpendicular to the direction of traffic, not more than 1/16 inch deep.
4. Troweled Finish:
   a. Use as final finish on inside floors and on all other unformed surfaces not otherwise indicated or specified.
   b. Trowel with steel trowel, mechanical or hand, to obtain a smooth, dense finish. The final troweling shall be done after the concrete has become hard enough so that no mortar adheres to the edge of trowel and a ringing sound is produced as the trowel passes over the surface.
   c. Do not trowel before surface water has evaporated or has been removed with a squeegee.
   d. Finish to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.
   e. Do not add sand or cement to the floor surface.
5. Magnesium-Troweled Finish:
   a. Perform as specified for Troweled Finish, this Section, except use a magnesium trowel by hand instead of a steel trowel to obtain a dense, but not slick, finish.
   b. Use where floor will receive protective coating after curing.
6. Stair-Tread Finish:
   a. Apply to all interior and exterior concrete stair treads and landings that do not have abrasive nosings.
   b. Spread fine abrasive aggregate uniformly on concrete before it has set, in the amount of not less than 1/4-pound aggregate per square foot, and steel trowel into surface of concrete.
   c. Expose abrasive aggregate slightly by rubbing with an abrasive brush after concrete finish has set and cured.
   d. Aggregate and application shall conform to Specification “A” of the Norton Company.

7. Contraction Joints:
   a. Locate as indicated.
   b. Maintain true alignment with straightedge.
   c. Joints shall be grooved except where sawed joints or preformed joints are indicated.
   d. Grooved Joints:
      1) Perform during the finishing process.
      2) Width of groove shall not exceed 1/4 inch.
      3) Depth of groove shall be at least 1 inch.
   e. Sawed Joints:
      1) Cut joints with power blade as soon as concrete surface is firm enough to resist tearing or damage by the blade and before random shrinkage cracks can occur. (Usually required within 4 to 12 hours after finishing.)
      2) Make joints approximately 1/8 inch wide with depth as indicated.
      3) Seal with the same type sealant specified for expansion joint sealant.
   f. Preformed Joints:
      1) Install preformed joints as recommended by manufacturer.

B. Formed Surfaces:
   1. Repair surface defects as specified under Repair of Defective Surfaces, this Section.

C. Repair of Defective Surfaces:
   1. Defined as any concrete surface showing misalignment, rock pockets, poor joints, holes from ties, voids, honeycomb, or any other defective area.
   2. Repairing:
      a. Repair as soon as forms have been removed.
      b. Chip surface back to minimum depth of ½ inch, chip edges perpendicular to surface, pre-wet depression and brush with heat cement immediately before patching.
      c. Patch surfaces using still mortar with same sand-cement ratio as original concrete and with minimum water for placing. Blend with white cement to match concrete color.
      d. Compact mortar into depressions so that after curing, hole is filled and mortar is flush with surface. Use hammer and rod for compacting the holes.
      e. Moist-cure for 3 days or use curing compound.
      f. Engineer shall be notified of areas containing defects or where reinforcing steel is exposed, prior to determination of repair method.

3.4 FLOOR SURFACE TREATMENT

A. Apply sealer in accordance with manufacturer's instructions on scheduled floor surfaces.

B. Prior to placing floor sealer, all stains from oils, greases, etc. shall be removed.

3.5 CONCRETE TEST CYLINDERS

A. All concrete test cylinders shall be provided by the Contractor, using a licensed testing laboratory. The making and testing of test cylinders, including transportation and all expenses, shall be paid for by the Contractor.

B. The Contractor's testing laboratory shall make at least four (4) test cylinders for each day's pour in excess of 6 cubic yards of each class of concrete, and two test cylinders for each additional 50 cubic yards or major fraction thereof, as directed by the Engineer.

C. The Contractor shall ship the test cylinders to the laboratory on the fourth day, where the laboratory shall proceed to cure until tested. One cylinder shall be tested on the seventh day, and two cylinders tested on the 28th day (leaving one spare cylinder). The test cylinders shall be identified at the time cast, and as to which pour is represented. Unsatisfactory tests of cylinders shall make the concrete represented subject to rejection, with consequent removal and replacement required.

D. Concrete test cylinders shall be cast and tested in accordance with ASTM C-31 and C-39. The testing laboratory shall furnish four (4) copies of test reports for test cylinders for slump, air, temperature and compressive strength and distributed as follows:
1. 2 copies - Engineer
2. 2 copies - Contractor

END OF SECTION

SECTION 11300

LOW PRESSURE GRINDER PUMP STATION

PART 1 GENERAL

1.1 SUMMARY

A. General: The Contractor shall furnish and install three (3) complete factory-built and tested simplex grinder pump stations for each location indicated in the Drawings. The Contractor shall confirm the proper operation of the pump system. Grinder pumps shall be Progressive Cavity type pumps which are specifically designed and intended for service in pressure sewer systems. All pumps supplied on the project for this service shall be of the same manufacturer. Centrifugal pump hydraulic characteristics do not conform to engineered pipe line sizes in the LPS system and will not be acceptable.

B. Acceptable System Components: Submersible pumps shall be furnished complete with pump casings, shafts, bearings, seals, lubrication, piping assemblies, pump support, anchor bolts, motors, controls, power cable, and all other parts and accessories indicated, specified or required for proper installation, operation, and maintenance of a complete system.

C. Coordination Responsibility: The pump manufacturer shall be responsible for ensuring that the pumps, motors, and controllers are fully compatible for operation as specified.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals

B. Section 01750 - Starting of Systems

C. Section 02320 - Earthwork and Trenching

1.3 REFERENCES: The following publications form a part of these specifications to the extent indicated by references thereto. The revision in effect at the time of the Bid Opening shall be applicable. If these publications conflict with the requirements of this section, the section requirements shall govern.

A. American Society for Testing and Materials (ASTM):
   1. A36 - Standard Specification for Carbon Structural Steel
   2. A48 - Standard Specification for Gray Iron Castings
   3. D883 - Definitions of Terms Relating to Plastics
   4. D3753 - Glass Fiber Reinforced Polyester Manholes and Wetwells

B. American Iron and Steel Institute (AISI).

C. National Electrical Manufactures Association (NEMA).

D. National Fire Protection Association (NFPA):
   1. 70 - National Electrical Code (NEC).

E. National Safety Council.

1.4 SUBMITTALS: The Contractor shall submit the following items required by this division in accordance with Section 01300 - Submittals:

A. Product data for review:
   1. Performance curves for each pump model furnished.
   2. Report of factory tests, as specified herein under "QUALITY ASSURANCE".
   3. Control System
   4. Submersible Motors

B. Warranty for pumps and controls, on manufacturer's letterhead.

C. The Pump manufacturer shall provide approved Operation and Maintenance Instructions, which includes the following:
   1. Each set of O&M Instructions shall include separate performance criteria and unique characteristics of pump. Information which applies to all pumps may be provided only once per set, if clearly identified as applying to all units.
   2. Manuals shall include the required service training information listed above and shall include detailed drawings with detailed parts listing, wiring diagrams and schematics for all pump components. Operation and maintenance manuals shall be submitted for Engineers approval.

1.5 QUALITY ASSURANCE

A. Factory Tests and Reports:
   1. Include all manufacturer's standard factory tests on equipment and material per ANSI/HIS standards.
   2. Submit results of tests in accordance with DIVISION 1.
   3. Perform standard tests on all motors in accordance with IEEE.

1.6 MANUFACTURER'S FIELD SERVICES: In accordance with Section 01750 - Starting of Systems, an authorized representative of the manufacturer shall provide the following:

A. Start-up Services: As required, for each of the three (3) grinder pump stations supplied

B. Demonstration and Training: One 4-hour session shall be provided.

1.7 FACTORY ASSEMBLY

A. Pump/motor units shall be completely shop assembled and aligned prior to shipping.

B. After completion of the specified factory tests, pumps shall be prepared for shipment with the minimum amount of disassembly, and such that no field disassembly, cleaning, or flushing is required.

C. Any components removed for shipping shall be match-marked prior to removal and shipment.

D. Prepare surfaces and provide paint system standard of the manufacturer and suitable for service intended.

1.8 WARRANTY

A. Pumping Equipment: The pump manufacturer shall provide a warranty with coverage as given below. Warranty shall not commence before startup of all pumping units by manufacturer's authorized representative, in accordance with Division 1 of the Specifications.
   1. The controls shall be covered for two (2) years against defects. Warranty shall cover 100 percent of the cost of both parts and labor for repair or replacement, with no prorating over this term.
   2. Pumping units shall be covered for two (2) years against defects in materials and workmanship. Wear items including mechanical seals and bearings shall be covered under the warranty. Wearing rings may be excluded from the warranty. Obligation of manufacturer under warranty shall be to cover the cost of both parts and labor for replacement. Coverage shall be full and not pro-rated. Owner shall cover the cost of pump delivery to manufacturer's local service center in the Kansas City area. Manufacturer shall cover return shipping. Owner will re-install equipment.

B. Service Calls:
   1. Pump manufacturer or his authorized representative may visit the installation as he sees fit to troubleshoot and inspect the pumps during the warranty period. Manufacturer's service personnel shall contact the Owner at least one working day prior to such visits.
   2. When Owner has notified the manufacturer of a problem, manufacturer shall respond promptly. If a pump is out of service or if the controls system is experiencing problems, manufacturer shall arrive to service the installation not more than 48 hours after notification by Owner. A factory trained and authorized technician shall be available to address problems with the pumps and controls.
   3. Manufacturer may elect to try and direct Owner's personnel to correct the problem, if the problem is simple and Owner is able to assist. If unsuccessful, such efforts shall not eliminate manufacturer's responsibility to make a service call.
   4. Manufacturer shall maintain a log of all service performed on the equipment during the warranty period, and shall furnish Owner a copy of this log upon request, and at the end of the warranty period.
   5. Manufacturer shall provide Owner with necessary forms to accurately keep records of maintenance.

C. Effective Date: The warranty shall become effective upon Final Acceptance of the Work, or the date which the last of the pumps are started. Warranty shall not commence on the date of delivery nor of shipment.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable Manufacturers
   1. E-One Corporation
   2. Flygt (Xylem)
   3. Engineer Approved Equal

B. Equivalent Products: Subject to the requirements of Section 01600.

2.2 MATERIALS AND CONSTRUCTION

A. Grinder Pump Station
   1. Performance: Pumps shall be capable of delivering 15 gpm against a rated total dynamic head (TDH) of 0 feet, 11 gpm against a TDH of 40 feet, and 7.8 gpm against a TDH of 80

feet. The pumps must also be capable of operating at negative total dynamic head without overloading the motor(s). Minor variances between manufacturers will be acceptable.

2. Wiring:
   a. Pump power and level control wiring shall be field installed by a certified electrician. All electrical cables penetrating or passing through the conduit flange of the pump station must be water-tight and sealed by the electrician immediately upon installation. Color coded insulated wire for power cord, and insulated wire for float level sensors if required.
   b. Cable connection shall be one of the following options:
      1) Junction Box: The pump power cable shall be connected directly into a NEMA 4X water tight junction box and spliced connected with the appropriate color coded wire gage for proper terminal strip placement.
      2) The power cable shall connect to the pump by means of a NEMA 6P Electrical Quick Disconnect which enters the tank through a watertight strain relief connector.
3. Check Valves:
   a. Pump discharge pipe shall be equipped with a factory-installed gravity-operated check valve. The valve will provide a fully ported passageway when open and shall introduce a friction loss of less than six inches of water at maximum rated flow. Working parts shall be made of heavy duty cast iron or 300 series stainless steel.
   b. Each basin package will require a redundant check valve for installation provided by the contractor in the service lateral between the grinder pump station and the low pressure sewer main. Valves shall be 1.25 inch NPT and only require 0.5 pounds of backpressure for complete closure.
   c. Redundant check valve will be identified on a separate line item bid sheet and provided by the manufacturer of the grinder pump.
4. Level Detection:
   a. Level detection for controlling pump and alarm operation shall be controlled by one of the following.
      1) By use of mechanical float switches. Switches utilized in the system shall be hermetically sealed in a submersible watertight protective housing securely attached to a PVC float tree with wire tie. Float switch cord will be securely tightened 4 inches maximum above float.
      2) By use of level sensing controls which monitor the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater. Level sensing controls shall be housed in a separate enclosure from motor starting controls.
   b. Level detection device shall be designed to be protected from solids, greases, oils, fats and corrosive sewer gases. Switch shall have high impact, corrosion resistant housing for use in sewage and water up to 140°F (60C).
5. Shut-Off Valve: The pump discharge pipe connection shall be equipped with a shut-off valve and a quick disconnect. The valve shall be fully ported, constructed of bronze with stainless steel ball, stainless steel stem and hardware, and Teflon seats, with a minimum rated pressure of 150 PSI. A 304 stainless steel extension valve handle will be supplied for manual operation from top of basin secured with stainless steel support bracket.
6. Anti-Siphon Valve: The pump discharge shall be equipped with a factory-installed integral anti-siphon valve built into the discharge piping after the check valve.
7. Fiberglass Tank: The tank shall be a wetwell design consisting of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present. The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified

burial depth for each available tank height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation.

B. Pumps

1. Design
   a. Each grinder pump shall be a heavy duty pump used as a grinder. Each grinder pump shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects", such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter discharge piping.
   b. The cutter materials shall provide maximum corrosion and abrasion resistance. The remaining portion of the grinder pumps, with the exception of seal materials and wet end, shall be similar to the heavy duty pumps used in larger pump stations for daily operation.
   c. Each pump shall be equipped with a 1 to 2 HP submersible electric motor connected for operation on 240 volts, 1 phase, 60 hertz, with submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA approval.
2. Construction: All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel.
3. Motor cooling system is sufficiently cooled by the surrounding environment or pumped media. Oil filled motors will not be acceptable.
4. Electric Submersible Motor:
   a. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 15 evenly spaced starts per hour. Motor will be suited for LPSS hydraulic conditions. The rotor bars and short circuit rings shall be made of cast aluminum.
   b. 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.
   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 motor and cable shall be capable of continuous submergence without loss of watertight integrity. 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.

C. Alarm/Control Panels

1. Each grinder pump station shall include a NEMA 4X, UL-listed alarm/control panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester or fiberglass to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.
2. All conduit entrances shall be made in a NEC approved manner. The conduits to the wet well shall have approved seal-off fittings installed and properly sealed to protect the control panel from adverse damage from the wet well. Electrical contractor will furnish and install.
3. The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability.

4. The visual alarm lamp shall be inside a shatter-resistant red lens. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB at 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

2.3 SPARE PARTS

A. The following spare parts shall be provided:
1. Supply one (1) spare grinder pump core for the three pump stations installed, complete with all operational controls, level sensors, check valve, anti-siphon valve, pump/motor unit, and grinder.

2.4 ELECTRICAL EQUIPMENT AND CONTROLS

A. Conform to NEC, NEMA, IEEE and DIVISION 16 on all electrical equipment and controls.

B. Refer to DIVISION 16 for electrical control panel, motor starters, and pump controls.

PART 3 EXECUTION

3.1 INSTALLATION: The grinder pump station and related components shall be installed in accordance with the manufacturer’s recommendations.

A. Installation shall be accomplished so that 1-inch to 4-inches of the tank, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the excavated hole must be large enough to allow for the concrete anchor.

B. A concrete anti-flotation ballast, as shown in drawing details and sized according to the manufacturer's instructions, shall be required for all pump stations and shall be precast to the pump station or poured in place. Each grinder pump station with its pre-cast concrete ballast shall have a minimum of three (3) lifting eyes for loading and unloading purposes. If the concrete is poured in place, the unit shall be leveled, and filled with water, to the bottom of the inlet, to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an 8-inch sleeve is required over the inlet prior to the concrete being poured.

3.2 START-UP AND TESTING

A. The manufacturer shall provide the services of a qualified factory trained technician who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the Owner's personnel in the operation and maintenance of the equipment before the stations are accepted by the Owner.

B. All equipment and materials necessary to perform testing shall be the responsibility of the Contractor. This includes, as a minimum, a portable generator and power cable (if temporary power is required), water in each basin (filled to a depth sufficient to verify the high level alarm is operating), and opening of all valves in the system. These steps shall be completed prior to the qualified factory trained technician(s) arrival on site.

3.3 ON-SITE PERFORMANCE TESTS

A. Conducted by pump manufacturer's authorized representative in presence of Contractor and Engineer.

B. Equipment Tests:
   1. Check performance of all components as a functioning unit.
   2. Check alignment of each unit.
   3. Confirm proper rotation of impeller.

C. Operational Tests:
   1. Conduct such operational tests as necessary to determine that the performance of equipment and controls is as specified.
   2. Tests will generally consist of placing equipment in operation under varying conditions and verifying performance (including no-load).
      a. Test all control sequences and functions.
      b. Perform complete meg-ohm testing.
      c. Take amperage and voltage readings.
   3. Dry Run Test: No liquid is to be allowed to enter the inlet of the pump. The exterior of the pump shall be dry and remain dry during test. Test duration shall be a minimum of 30 minutes.

D. Submit a written test report to General Contractor (with one copy to Engineer) in a letter form stating operations performed and results obtained for each unit.

END OF SECTION

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SECTION 13330

WASTE HOLDING TANK AND SEPTIC TANK DECOMMISSIONING

PART 1 GENERAL

1.1 SUMMARY

A. This section includes the requirements for removing existing septic tanks from service and divert the wastewater flows to new grinder pump stations to abandon the waste holding tank and septic tanks. The waste holding tank at the truck wash building will be cleaned and remain in service as an oil/water separator tank.

B. This section is written under the following premises and the Contractor shall prepare the bid accordingly.
1. The Contractor shall provide the dewatering of the holding tank and septic tanks and complete the final cleaning of the tanks to remove heavy solids from the bottom and solid materials that have built up on the walls and ceiling of the tanks.
3. The Contractor shall haul all of the wastewater and solids materials off site for disposal.
4. Once the new pressure system is installed, tested and ready for service the Contractor shall connect to the existing waste service lines and divert the flow to the new pump stations.
5. The orientation of the waste holding tank and septic tanks (and waste service lines) are indicated on the Drawings. The tanks are located adjacent to the building it serves, with a buried top with access to the connecting waste line.

1.2 RELATED SECTIONS

A. Section 01100 - Summary of Work.

B. Section 01330 - Submittal Procedures.

C. Section 02320 - Earthwork and Trenching.

D. Section 02922 - Seeding

1.3 DESCRIPTION OF EXISTING FACILITIES

B. A. The existing on-site wastewater system for the MoDOT Nashua Maintenance Facility consists of a waste holding tank for the truck wash building that is periodically pumped out and hauled off site. The office building and maintenance buildings are served by on-site systems that include a septic tank and lateral field. The office building also has a pump to convey the wastewater from the septic tank into the lateral field. 0The MoDOT plans to install a new low pressure sewer system with three (3) grinder pump stations to decommission the existing and septic tanks. The waste holding tank at the truck wash building will be cleaned and remain in service as an oil/water separator tank.

B. Septic and Holding Tank Contents
1. Source: Water and solids in the existing septic tanks is from individual facility sources such as faucets, toilets, showers, and other miscellaneous household sources.
2. Average solids content of material in the tanks is unknown.

C. Ancillary Facilities: The Drawings illustrate related components, including piping and valves.

1.4 SUBMITTALS: The Contractor shall submit the following items required by this Section in accordance with Division 1. Submittals shall include but not necessarily be limited to the following:

A. With Contractor's Bid: List of previously performed projects.

B. Prior to Tank Cleaning:
   1. Methodology on pumping liquid, cleaning tanks, and hauling sludge.

C. Following cleaning, within 30 days after final application, but not later than Final Acceptance:
   1. Log of loads of material hauled with date, time, volume, and final destination.

1.5 QUALITY ASSURANCE

A. Contractor shall be knowledgeable of current local, Federal, and State regulations in project locality regarding the removal and transportation of sludge.

B. Contractor shall maintain neat and accurate records, as specified herein.

C. Contractor shall perform all work in accordance with applicable requirements of EPA, and all other applicable Federal, State, and local requirements.

D. Contractor shall have previously performed projects of this type.

1.6 SCHEDULING

A. Refer to Section 01100 for Summary of Work.

B. The schedule for decommissioning individual waste holding tank and septic tanks require close coordination with the installation and startup of the low pressure sewer pipe and grinder pump stations. Generally the sequence of work shall be as follows:
   1. Install and pressure test the low pressure sewer pipe.
   2. Install and test the grinder pump stations and discharge piping.
   3. Intercept the waste service line, divert the waste flow to the grinder pump station and commission the grinder pump station into service.
   4. Clean the holding tank and leave in service.
   5. Decommission or abandon the two septic tanks after the grinder pump station is in full operation.

1.7 MAINTENANCE

A. Contractor shall be responsible for maintaining and restoring all nonpublic roads to a condition at or better than initial conditions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 REROUTING THE WASTE SERVICE LINES

A. After the low pressure sewer pipe and pump stations are installed, tested and ready to be put in service, the Contractor shall begin the process of locating the three (3) waste service line connection points. These are the points at which the existing waste water flow shall be intercepted and diverted to the grinder pump station wet well for conveyance through the new low pressure sewer system. The connection point for the waste holding tank at the truck wash building will be at the discharge of the holding tank

B. Connection Points Outside the Waste Holding and Septic Tanks
   1. The Contractor shall schedule and coordinate with the Owner at least 48 hours before the Work begins.
   2. For each tank configuration the Contractor shall excavate and expose the existing waste service line. Before making the service connection, a new service line shall be routed from the pump station to the connecting point. The new service line shall be uniformly graded to drain to the pump station wet well. After the new service line is installed, the Contractor shall cut the existing service line and splice the two lines together with a fitting or sleeve.

3.2 DEMOLITION OF SEPTIC TANKS

A. After the waste service line is re-routed to the new grinder pump station, the septic tanks shall be demolished as specified herein and as shown on the Drawings:

B. Remove all or part of the lid to allow access for cleaning the tank.

C. Use a high pressure jet spray to clean the interior surfaces of the tank. Collect the spray water and sludge with a vacuum truck and haul off site for disposal.

D. Demolish the septic tank lid and remove the tank walls down two (2) feet below existing grade. Break the concrete floor to allow any accumulated groundwater to drain. Demolished concrete may be deposited inside the tanks or hauled offsite. Concrete debris used for backfill shall be pieces small enough to mix with other backfill material and avoid air cavities in the backfill. Backfill tanks with sand, gravel or flowable fill to match existing grade as specified in Section 02320. The top 12-inches of backfill shall be topsoil suitable to support grass or plantings.

E. Restore site to match surrounding grades, seed and mulch as specified in Section 02922.

3.3 REHABILITATE WASTE HOLDING TANK

A. As the waste service line is routed from the holding tank to the pump station, the waste holding tank shall be cleaned and rehabilitated as specified herein and shown on the Drawings:

B. Empty the holding tank of all waste and solids and haul off site for disposal.

C. Use a high pressure jet spray to clean the interior surfaces of the tank. Collect the spray water and sludge and haul off site for disposal.

D. Connect the new service line from the pump station to the capped tank connection.

E. Backfill the disturbed area at the waste holding tank with rock to match the existing gravel surface.

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DOCUMENT 00005
CERTIFICATIONS PAGE

	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Missouri. Signature: _____ Date: 9-28-15 Name: Stephen Thomas Baker Missouri License No.: PE-029494 My license renewal date is December 31, 2016. Pages, Sheets, or Divisions covered by this seal: Division 01, Division 02, Division 03, and Division 11

END OF DOCUMENT 00005

MoDOT

NASHUA MAINTENANCE FACILITY
SEWER IMPROVEMENTS

KANSAS CITY, MISSOURI

SEPTEMBER 2015

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