SECTION 01100 – SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. The work to be performed under this contract shall consist of furnishing the following to perform the work outlined in these specifications and as indicated by Project Drawings:

1. tools
2. equipment
3. materials
4. labor
5. supplies
6. manufactured articles
7. all transportation to complete the work
8. temporary facilities

B. Location of Work: Rosebud Comprehensive Health Care Facility, Rosebud Sioux Tribe of South Dakota, Todd County South Dakota

C. Incidentals Items: All work, materials, and services not expressly listed as being provided by others or not expressly called for in the contract but are necessary for the completion of the work in good faith, shall be furnished, installed, and performed by the contractor.

1.2 SUMMARY OF WORK TO BE DONE BY CONTRACTOR

This project is to install a new double box culvert lift station, ~20 feet of 12” sewer main and ~123 feet of 4” RJDI sewer force main, with modifications to 1 existing manhole. The work will be completed in the on the premises of the Rosebud Comprehensive Health Care Facility on the Rosebud Indian Reservation.

1.3 ADDITIONAL INFORMATION

A. For information regarding the technical aspects of the project, contact the Project Engineer:

Logan Gayton, EI
General Engineer
Indian Health Service
3200 Canyon Lake Drive
Rapid City, SD 57702
Telephone: 605-945-5451

B. For information regarding contracting information, contact the Hospital Facility Manager for this project:

Edward Arcoren
Maintenance Supervisor
400 Soldier Creek Drive
Rosebud, SD, 57570
Telephone: (605) 747-0424

C. Comply with all Tribal regulations related to the completion of the work including the acquisition of necessary permits and the payment of Tribal taxes.

END OF SECTION

SECTION 01270 – PRICE AND PAYMENT

PART 1 - **GENERAL**

1.1 SUMMARY

A. Work covered by this section includes method of measurement and basis of payment for all divisions included.

B. Payment for the various items of the Bid Schedules shall include all compensation to be received by the Contractor for furnishing all tools, equipment, materials, labor, supplies, manufactured articles, transportation, and temporary facilities required to complete the work in accordance with contract documents including incidentals.

C. Respective prices and payment shall constitute full compensation for all work completed including incidentals.

D. All items not expressly listed as being provided by others that are necessary for the completion of work shall be furnished and installed by the Contractor.

1.2 ESTIMATED QUANTITIES

A. All quantities stipulated in the bid schedule or other contract documents are approximate and are to be used: (1) as a basis for estimating the probable cost of the work and (2) for the purpose of comparing the bids submitted.

B. The Contractor shall be paid for actual quantities installed based on the quantities measured in the field. The actual amounts of work completed and materials furnished may differ from estimated quantities. The Contractor shall make no claim for damages, anticipated profits, or otherwise, on account of differences between the estimated amounts and the actual amount of work performed and materials furnished.

1.3 SURVEY AND MEASUREMENTS

A. All quantity measurements shall be the responsibility of the Contractor and will be verified by the Project Engineer.

B. All measurements and subsequent payments will be based on completed and accepted work performed in strict accordance with the plans, specifications, and other contract documents.

PART 2 - **BID SCHEDULE ITEMS**

2.1 GENERAL

A. Payment shall be full compensation to complete the work items in good faith, including incidental work.

B. In addition to the basis of payment described under each item, the unit price bid shall be full compensation for all of the following:

1. General requirements in Division 01, but not limited to the following.
   a. Submittals.
   b. Record drawings.
   c. Warranties.

2. Specific requirements in Division 02, including but not limited to the following (unless otherwise expressly defined as a line item in the bid schedule):
   a. Erosion control.
   b. Clearing and grubbing.
   c. Removal and replacement of obstructions.
   d. Associated trenching, excavation and backfill including the removal of any nuisance water, bedding, haunching, and compaction.
   e. Disposal of any excess material.
   f. Traffic control.
   g. Rough grading.
   h. Finish work, where called for, including finish grading, topsoiling, and landscaping.

2.2 BID ITEMS

A. Schedule A: Rosebud Comprehensive Health Care Facility Lift Station Replacement

1. Mobilization

   a. Measurement: Lump sum.

   b. Basis of Payment: Includes compensation for mobilizing equipment to the site, establishing a site office, furnishing bonds and insurance, payment of applicable Tribal taxes and permits, and payment of all applicable state and federal taxes and duties. Payment for mobilization shall be made at the time of the first progress payment.

2. 12-inch SDR 35 PVC Sewer Main W/ Bedding

   a. Measurement: By the lineal foot based on the horizontal length installed and measured over the centerline of the pipe.

   b. Basis of Payment: Includes all pipe, fittings, labor, tools, equipment and materials required to construct the sewer mains, including excavation, trenching, removal of nuisance water, laying and jointing pipe, backfilling, flushing, testing, removal and replacement of fences, culverts, protection and/or replacement or repair of utilities which may be impaired by work, disposal of excess excavated material, preparation of seed bed and seeding, bedding, and all other incidentals required to complete the work as specified.

3. Connection to Existing Manholes

a. Measurement: By each connection.

b. Basis for Payment: Includes connections to the existing manhole, reforming of sewer invert, labor, tools, equipment, excavation, backfill and compaction, fittings, pipe and all other incidentals which may be required to complete the work as specified.

4. 4-inch Restrained Joint Ductile Iron Sewer Force Main

a. Measurement: By the lineal foot based on the horizontal length installed and measured over the centerline of the pipe.

b. Basis of Payment: Includes all pipe, elbows, fittings, labor, tools, equipment and materials required to construct the sewer force mains, including excavation, trenching, laying and jointing pipe, backfill and compaction, flushing, testing, detectable warning tape, removal and replacement of fences, culverts, protection and/or replacement or repair of utilities which may be impaired by work, disposal of excess excavated material, thrust restraints, preparation of seed bed and seeding, and all other incidentals required to complete the work as specified.

5. 4-inch Gate Valve and Valve Box

a. Measurement: By each installed

b. Basis of Payment: Includes labor, tools, equipment, excavation, backfill and compaction, gate valve, extension stem, gate valve box, centering device, valve box adapter, locking lid, one pentagon key, one socket wrench for valve extension stem, polyethylene encasement, utility markers and all other incidentals required to complete the work as specified.

6. Connection to Existing Forcemain

c. Measurement: By each connection.

d. Basis for Payment: Includes connections to the existing forcemain, labor, tools, equipment, excavation, backfill and compaction, fittings, pipe and all other incidentals which may be required to complete the work as specified.

7. Lift Station

a. Measurement: By Lump Sum.

b. Basis of Payment: Includes all labor, tools, equipment and for excavation, backfill and compaction, shoring (where required), dewatering (where required), furnishing and installing the concrete structure, exterior coatings, coating of all fittings and piping within the lift station and valve vault, HDPE stud liner in the wet well, concrete cover, access covers, submersible sewage pumps and guide rails, trash basket and guide rail, crane with electric winch, furnishing and installing valve vault ladder, valve vault sump and sump pump, sump pump discharge piping, yard hydrant, all connections to power supply,

float switches, furnishing and installing the new control panel and all electrical components, emergency alarm horn, valve vault lights, pole mounted floodlight, wiring, inlet piping, ductile iron piping, (including buried ductile iron pipe) and connections to the valve vault, link seals and wall sleeves, gate valves, check valves, testing, backfill, grading, crushed rock cover, sterilant, plastic sheeting, landscape edging, borrow material, cleanup, seeding, supervision and operator instruction conducted by a factory trained serviceman, operation and maintenance manuals, and all other incidentals to complete the work as specified creating a complete and functional system.

8. Chain Link Fence with Double Swing Gate

   a. Measurement: By the lineal foot installed.

   b. Basis of Payment: Includes all labor, tools, equipment, and materials required to complete the fencing as specified.

9. Concrete Access Road

   a. Measurement: By the square yard of the concrete surface installed. This includes matching existing roadway and curb and gutter shaping.

   b. Basis for Payment: Includes cutting, removing, disposing of existing concrete surface, gravel base, concrete, compaction and all other incidentals which may be required to complete the work as specified.

10. Air/Vacuum Release Valve Manhole

    a. Measurement: By each installed

    b. Basis of Payment: Includes labor, tools, equipment, excavation, backfill and compaction, air/vacuum release valve assembly, concrete manhole and cover, piping with fittings and connections, 5-feet of 4-inch DI pipe on each side of manhole and all other incidentals required to complete the work as specified.

11. Lift Station Abandonment

    a. Measurement: By each abandoned.

    b. Basis for Payment: Includes excavation, backfill and compaction, labor, tools, equipment, pumping and disposal of contents, disposal fees, excavation, electrical disconnect and removal of components, piping removal, control panel removal, removal of pumps, hoist, chain link fence removal, fill material for the interior of the lift station to fill all voids, crushing of top slab, site clearing and cleanup, and all other incidentals required to complete the work as specified.

12. Site Electrical Service

    a. Measurement: By Lump Sum.

b. Basis for Payment: Includes furnishing labor, materials, and equipment necessary to provide the site with power from the public utility meter to the site including main circuit breaker enclosure, main circuit breaker, underground cable and conduit, and connection to the control panel required to power the site and all other incidentals which may be required to complete the work as specified.

13. Telephone Communication Line

a. Measurement: By lineal foot based on the horizontal length installed and measured over the centerline of the telephone line.

b. Basis of Payment: Includes all communication line, splice boxes, labor, tools, equipment and materials required to lay the telephone line, including excavation, trenching, laying, backfill and compaction, protection and/or replacement or repair of utilities which may be impaired by work, disposal of excess excavated material, preparation of seed bed and seeding, and all other incidentals required to complete the work as specified.

PART 3 – EXECUTION (N/A)

END OF SECTION

SECTION 01310 – PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the preconstruction conference, construction schedule, working hours/days, coordination requirements and progress meetings.

1.2 PRE-CONSTRUCTION CONFERENCE

A. Required after award of contract and prior to start of construction.

B. Representatives from the following shall attend.

1. Prime Contractor
2. Subcontractors
3. Project Engineer and/or Technical Representative
4. Owner's Representative
5. Appropriate State/Federal Agencies or other Funding Agencies
6. TERO Representative, if applicable

C. The Project Engineer will arrange a date that is mutually acceptable to all parties planning to attend.

D. Contractor shall notify subcontractors of time and date of meeting.

E. Coatings Pre-Construction Conference

1. In addition to initial conference following award.
2. Held prior to any surface preparation coatings application.
3. Representatives from the following shall attend
   a. Prime Contractor
   b. Coatings Subcontractor
   c. Owners Representative
   d. Project Engineer and/or Technical Representative
   e. Coating Manufactures' Representative.

1.3 CONSTRUCTION SCHEDULE

A. Present Owner & Project Engineer with a written preliminary construction schedule containing start and completion dates of the major items at the preconstruction meeting.

B. Notify the Owner & Project Engineer three full working days in advance of any construction.

C. Communicate major changes to the schedule to the Owner & Project Engineer in writing.

1.4 WORKING HOURS/DAYS

A. Perform all work during regularly scheduled working hours, unless approved by Owner and Project Engineer.

B. Working hours shall be defined as 7 AM to 5 PM Monday thru Friday, with the exception of holidays.

C. No work will be allowed on Saturday, Sunday, Federal holidays, and Tribal holidays without the Owner and Project Engineer's consent.

1. Holidays include, but are not limited to, New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans Day, Thanksgiving Day and Christmas Day, or on any other holidays declared by the Tribe.
2. Holidays that fall on Saturday will be observed on the preceding Friday; holidays that fall on Sunday will be observed on the following Monday, no construction will be permitted on those days.
3. Project Engineer has the option to approve overtime or holiday work upon the Contractor's request not less than 48 hours in advance of the work to be performed. Overtime and holiday requests that exceed a ten (10) hour work shift for a time period exceeding two days will not be approved by the Project Engineer.

1.5 COORDINATION WITH OTHER REQUIREMENTS

A. Coordinate work with other contractors (i.e. roads, building, etc) in the area as necessary to complete the work specified.

B. Coordinate work with local utilities (i.e. water and sewer, power, telephone). All buried utilities may not be shown on the plans.

C. Contractor is responsible for having utilities marked prior to construction and field verify utility location.

1.6 PROGRESS MEETINGS

A. Project Engineer will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

B. Progress meetings will be scheduled throughout progress of the Work at maximum monthly intervals. Frequency of meetings will be determined from Work meeting construction schedule or when Owner deems it necessary.

C. Representatives from the following shall attend:

1. Prime Contractor
2. Subcontractors
3. Project Engineer and Technical Representative
4. Owner's Representative

END OF SECTION

SECTION 01330 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes information on submittal procedures. Materials requiring a submittal are listed in the appropriate specification section.

1.2 SUBMITTAL PROCEDURES

A. Submit one electronic pdf copy or three paper hard copies of submittals to the Project Engineer, unless requested otherwise.

B. Upload all submittals to Oracle Primavera Submittal Exchange for review of project submittals.

C. Attach an acceptable submittal cover sheet for all submittal packages.

1. List all submittals included in the package in the appropriate location.
2. Signed cover sheet indicating all submittals have been reviewed prior to submission.

D. Identify each cut sheet or shop drawing with the following information:

1. Contract number
2. Supplier
3. Pertinent specification section number
4. Pertinent drawing and detail number

E. Submit the following information, as applicable:

1. Manufacturer's cut sheets indicating compliance with references (e.g. applicable ASTM, AWWA standards).
2. Laboratory results, as applicable.
3. Dimensional drawings or shop drawings, as applicable.
4. Other information necessary for the Project Engineer to determine compliance with the specifications.

F. Identify variations from the contract documents and product or system limitations that may be detrimental to successful performance of the completed Work.

G. Revise and resubmit submittals as required and identify all changes made since previous submittal.

H. Distribute copies of reviewed submittals to concerned parties (i.e. suppliers, sub-contractors). Instruct parties to promptly report inability to comply with requirements.

I. Submit written communication of any inability to comply with the Project Engineer's comments.

J. Submit information to the Project Engineer at least three weeks in advance of the Work to be performed.

K. Approval of submittals must be provided by the Project Engineer prior to installation of materials and process of any payments for the materials.

L. Approval of any submittal does not relieve responsibility for completion of the Work in accordance to the plans and specifications.

END OF SECTION

SECTION 01430 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes prerequisites and procedures, installer qualifications, control of installation, and manufactures field services to ensure the quality of the Work.

1.2 SUBMITTALS

A. Contractor Name and License Number

B. Subcontractor(s) Name and License Number

C. Name or names of the “Competent Person” in charge of safety on the jobsite, as defined by the OSHA Industry Standard 29 CFR 1926.

1.3 INSTALLER QUALIFICATIONS

A. Perform Work under the direction of personnel licensed by the state and/or reservation having jurisdiction.

B. If Work being completed is not regulated by the state and/or reservation, submit literature from the manufacturer, independent representative of the manufacturer, and/or supplier indicating the Contractor or Subcontractor’s ability to complete installation based on past experience or formal training.

1.4 CONTROL OF INSTALLATION

A. Review materials for acceptability, in accordance with the approved submittals, when delivered to the site.

B. Store and handle materials to prevent damage.

C. Review materials, services, and workmanship to ensure that Work is performed in accordance with the specifications.

D. Comply fully with manufacturers’ instructions.

E. Should manufacturers’ instructions conflict with contract documents, request clarification from Project Engineer before proceeding.

F. Should the finished product or method of completion differ in any way from the manufacturer’s written instructions or the specifications, request approval in writing from the Project Engineer before proceeding.

G. Correct defective Work to the satisfaction of the Project Engineer.

1.5 MANUFACTURER'S FIELD SERVICES

A. Provide reports on observations and documentation of workmanship to the Project Engineer within 30 days of visit for review where manufacturers' field services are provided.

1.6 WARRANTY

A. Provide a minimum one (1) year warranty for all materials and labor, covering defects in the materials or deficiencies resulting from contractor installation.

B. Provide additional warranties as required under other sections.

C. Warranty takes affect starting the date of substantial completion.

END OF SECTION

SECTION 01720 – STAKING AND CONSTRUCTION SURVEYING

PART 1 - GENERAL

1.1 SUMMARY

A. This section outlines the staking and surveying work related to provide reference points in the field. Section clarifies staking provided to the Contractor and Contractor's responsibilities.

B. Construction Surveys establish "control stakes" for basic line and grade used for project construction.

1. Control stakes are used to check work for contract compliance.

C. From control stakes set, when needed, supplemental "working stakes"

1. Working stakes are used to perform the work and are provided by the contractor.

1.2 STAKING PROVIDED TO THE CONTRACTOR

A. Water Main, Force Main and Appurtenance Staking

1. Offset of Horizontal or Centerline staking (approximately every 100 feet).
2. Appurtenance (gate valve, fittings, fire hydrant, etc.) staking on center.

B. Sewer Main and Appurtenance Staking.

1. Manhole staking on center with two offsets including elevations.

C. Project Benchmarks

1. Hubs for vertical control will be placed in various points throughout project.
2. Hubs for horizontal control (at least one per project).

1.3 CONTRACTOR'S RESPONSIBILITY

A. Notify the Project Engineer at least fourteen (14) calendar days in advance of the times and places that staking will be needed.

B. Set supplementary staking, grade staking, offsets, cut stakes, temporary bench marks, and control points necessary for contractor to complete the work in accordance with the plans and specifications.

C. Provide all staking materials for contractor supplementary staking to include hubs, lathe, flagging, paint and other material needed to provide construction staking.

D. Request clarification from the Project Engineer regarding conflicts before proceeding with installation of facilities.

E. Preserve all offset and reference staking, until such time as the pipeline or other facilities are installed.

F. Reference stakes needing replacement due to Contractor error or negligence must be replaced by Contractor, at no cost to the contract.

G. All permanent survey points/markers (i.e. property corners) and bench marks not directly in the line of work shall be preserved.

H. Replace all permanent survey markers disturbed or destroyed using a Professional Land Surveyor, at no cost to the contract.

I. Provide evidence of reestablishment of permanent survey markers to the Project Engineer and copy of stamped and approved monument re-establishment documentation from the appropriate jurisdiction (state, BIA, etc.).

END OF SECTION

SECTION 01770 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes information on closeout procedures and final cleanup.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that work is fully completed in accordance with contract documents and ready for final inspection at least five (5) working days prior to pre-final inspection.

B. Provide warranties, approved Operation & Maintenance Manuals, and approved record documents (e.g. as-built drawings) to the Project Engineer within ten (10) days after date of first beneficial use or 5 working days prior to the pre-final inspection (whichever is sooner).

1.3 PRE-FINAL CLEANING

A. Complete pre-final clean-up prior to inspection.

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

1.4 PRE-FINAL INSPECTION

A. A pre-final inspection of the facilities shall be conducted, at a minimum, by the Project Engineer and the Contractor.

B. Inspect all facilities installed under the project.

C. Complete the requirements listed in Closeout Procedures Section 1.2 prior to the pre-final inspection.

1.5 PRE-FINAL PUNCH LIST

A. Any deficiencies noted at the pre-final inspection will be communicated to the Contractor through a letter from the Tribal Contract Administrator or the Project Engineer.

B. Correct all deficiencies identified prior to scheduling a Final Inspection.

C. Full payment will not be made until all requirements of this section are met.

D. Contractor shall submit written certification that all pre-final punch list items have been completed in accordance to the contract documents and ready for final inspection at least five (5) working days prior to final inspection.

1.6 FINAL INSPECTION

A. Final inspection of all the facilities provided will be conducted, at a minimum, with the Owner, Project Engineer, and the Contractor.

B. Scheduling of the final inspection will not be allowed until all deficiencies listed in the pre-final punch list are corrected to the Project Engineer's satisfaction.

1.7 FINAL PAYMENT

A. Deficiencies noted during the final inspection will be communicated to the Contractor through a letter from the Contract Administrator or Project Engineer.

B. Correction of all deficiencies will be required prior to the final payment being processed.

C. Final Payment will follow the procedures outlined in Section 01270 Price and Payment and require the Contractor to sign a release of claims for the contract.

END OF SECTION

SECTION 01781 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes the requirements for closeout submittals including, record drawings, warranty information and general operation and maintenance information.

1.2 DELIVERY

A. Provide all closeout submittals meeting these requirements and any specific requirements of each section.

B. Closeout submittals must be received prior to final payment

C. All closeout submittals must be received in a correct and complete manner before final payment can be made. If material is deficient, the deficiencies will be indicated in punch lists.

1.3 DEFINITIONS

A. Record Drawing: A drawing showing the actual installation of facilities, showing changes from the plans, and showing detail enough that future persons can readily locate all objects.

B. Ties: Measurements from permanent easily located objects to an installed object.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 RECORD DRAWINGS

A. Provide record data in one of the following manners:

1. On a set of project drawings, neatly draw tie measurements and changes from the original design.
2. On separate 8½ X 11 sheets, neatly draw site sketches, structure sketches, etc., indicating the necessary information, such as but not limited to depth.

B. Provide three (3) swing tie measurements to all buried utility objects that may need to be located in the future, including, but not limited to:

1. Gate valves
2. Cleanouts

3. Sewer wyes.
4. Utility crossings.
5. Septic tank manholes and access covers.
6. Corners of drainfields

C. Provide offset measurements for buried utilities (e.g. water main) installed parallel to roads or other known utilities.

D. Provide revised elevation data for all items that have elevations shown on the plan drawings, including, but not limited to, the following:

1. Manhole inverts (inlet and outlet)
2. Manhole rims
3. Lift station invert
4. Lift station top
5. Lift station pipe penetrations
6. Float elevations
7. Elevations of pipe entering and leaving structures
8. Elevation of sewer service line stub (if terminated at right of way)
9. Variations from the minimum depth of bury.
10. Other elevations indicated on profiles.

E. Provide installed bid schedule items quantities for individual facilities on 8½ X 11 sheets.

1. Depending on the type of contract, standard forms may be supplied for use by the Contractor.

3.2 WARRANTIES

A. Submit all warranty information regarding the materials installed in accordance with that produces particular section.

3.3 OPERATION AND MAINTENANCE INFORMATION

A. Submit all operation and maintenance information as included in the packaging from the manufacturer regarding the materials installed.

B. Additional project specific operation and maintenance requirements are listed in applicable sections.

END OF SECTION

SECTION 02230 – SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers clearing, stripping and grubbing within the proposed areas of the Work.

1.2 RELATED WORK

A. Earthwork 02300 - Earthwork

B. Section 02315 – Excavation, Trenching and Backfill

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Obtain necessary permit from Owner prior to cutting any trees or brush (if applicable).

B. Consult with the Project Engineer and Owner to designate a temporary area for stockpiling all cleared brush and trees.

C. Ensure stockpiled material does not adversely affect drainage nor cause damage to abutting property.

D. Remove all ground vegetation and other extraneous material from the construction area to a depth of 6 inches and stockpile in the designated area.

E. Remove and dispose of all trees, stumps, brush, debris, and all other obstructions as needed in an approved manner off site.
   1. Do not burn, bury, and/or leave debris within the Work areas.

F. If possible within right-of-way and property lines, extend clearing and grubbing a minimum of 10 feet beyond all proposed structures unless otherwise directed by the Engineer.

END OF SECTION

SECTION 02300 – EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes rough and finished site grading of all areas disturbed during construction.

1.2 RELATED WORK

A. Section 02230 – Site Clearing

B. Section 02315 – Excavation, Trenching and Backfill

C. Section 02920 – Topsoiling, Seeding, Fertilizing, and Mulching

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 ROUGH GRADING

A. Grade the area in the vicinity of the excavation to prevent surface water from flowing into the excavation.

B. Maintain existing drainage.

3.2 FINISH GRADING

A. Grade site to true grades as specified on the plans after all structures and piping have been installed.

B. Provide a smooth transition between adjacent existing grades and new grades.

C. Grade sites for effective drainage away from structures and to prevent ponding.

D. Dress and trim all slopes.

E. Drag all disturbed areas utilizing a box drag or by another attachment or method submitted to and approved by the Project Engineer.

F. Hand rake areas inaccessible to mechanical means.

G. Remove all objectionable foreign matter, wood, metal, and stones over 2-inches in diameter and dispose of by an approved method off site.

END OF SECTION

SECTION 02315 – EXCAVATION, TRENCHING AND BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes excavation, trenching and backfill necessary for the construction of the facilities as indicated on the plans including, but not limited to: water mains and service lines, sewer mains and service lines, concrete manholes, septic tanks, and other structures.

1.2 RELATED WORK

A. Section 02230 – Site Clearing

B. Section 02300 – Earthwork

C. Section 02315 – Excavation, Trenching and Backfill

D. Section 2400 – Boring, Jacking & Directional Drilling

E. Section 02530 – Sanitary Sewerage

F. Section 02920 – Topsoiling, Seeding, and Mulching

1.3 REFERENCES

A. Manual on Uniform Traffic Control Devices

B. ASTM D698 – Test Methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12-in. Drop [Standard Proctor Test]

C. ASTM D2321 – Underground Installation of Flexible Thermoplastic Sewer Pipe

D. ASTM D2487 – Classification of Soils for Engineering Purposes [Unified Soil Classification System]

1.4 SUBMITTALS

A. Polystyrene Insulation

B. Compaction Method

C. Detectable Warning Tape

D. Bedding Material

1.5 DEFINITIONS

A. Bedding, Haunching and Initial Backfill zones as defined herein and on the standard pipe trench detailed drawing below:

B. Soil Materials as summarized in the table below and defined in ASTM D2321 and ASTM D2487.

PART 2 - PRODUCTS

2.1 BEDDING, HAUNCHING AND INITIAL BACKFILL MATERIAL

A. Native material if acceptable to Project Engineer.

B. Bedding: Consists of sand, sandy gravel, or fine gravel having a maximum size of ¾-inch and a Maximum Plasticity Index of 6.

2.2 INSULATION

A. Rigid extruded polystyrene insulation board, 2 inches thick, having a minimum compressive strength of 25 psi.

B. Width:
   1. 4 feet for mains up to 12 inch (nominal diameter).
   2. 3 feet for mains and service lines up to 6-inches (nominal diameter).

2.3 WARNING TAPE

A. Detectable 3 inches wide.

B. Printed with “Caution Buried Sewer Line Below” for sewer mains, sewer force mains, and service lines.

PART 3 - EXECUTION

3.1 GENERAL

A. Trenching and excavation work shall be done in accordance with proper emphasis on safety as determined by the Contractor to conform to recommended safety standards such as OSHA 1910 and 1926.

B. A Competent Person, as defined by OSHA 1926, shall be on site at all times when excavation work is being completed.

C. Provide suitable sheeting, shoring, and bracing as required in conformance with OSHA regulations.

D. In accordance with the contract, obtain all permits from appropriate road agency for construction within road right of way.

E. Repair damage resulting from settlement, slides, cave-ins, water pressure, and other causes.

F. Provide adequate signs, barricades, fences and amber lights and take all necessary precautions to protect the work and the safety of the public in all construction areas.

1. Placement of construction signs and barricades shall conform to the “Manual on Uniform Traffic Control Devices.”
2. Protect barricades and obstructions at night by amber signal lights that burn from sunset to sunrise. Barricades shall also be of substantial construction, painted white or with reflective paint to increase their visibility at night.
3. Perform work without obstruction to traffic or inconvenience to the general public and the residents in the vicinity of the work.

G. The maximum open trench allowed during the day at each location shall not exceed 200 feet, with no open trench allowed overnight unless specifically approved.

H. Road Crossing

1. Comply with all construction and material requirements of roadway authorities having jurisdiction.
2. Maintain one lane of traffic open at all times.

I. Cleared trees, brush, or rocks prior to or during construction is considered incidental to excavation work.

3.2 EXCAVATION

A. Remove trees and stumps from excavation and site.

B. Remove and stockpile existing topsoil.

C. Install facilities as staked, centered in excavation, unless otherwise approved by Project Engineer.

D. Maintain surface drainage away from trenching or excavation.

E. Remove unsuitable foundation materials from excavation as shown on the plans or as authorized by the Project Engineer.

F. Maintain a minimum 1-foot clearance between outer surface of structure being installed and wall of excavation.

G. Rock encountered shall be classified, excavated, and measured in accordance with Section 02316.

3.3 TRENCHING

A. Bottom width:

1. No less than 12 inches or more than 24 inches wider than the outside diameter of the pipe.
2. Where a chain or wheel trencher is approved for use in a rural area, the trench width shall be 4 to 6 inches greater than the outside diameter of the pipe.

B. Depth: Provide minimum cover as specified, or depths shown on plans.

3.4 BEDDING

A. If existing soil cannot provide uniform, stable bearing support, over-excavate 6 inches below bottom of pipe or structure and provide imported bedding material as directed by the Project Engineer.

1. If unsuitable soil is encountered a price for imported bedding material will be negotiated.

B. Unauthorized over excavation shall be backfilled with acceptable bedding material at the Contractor's expense.

3.5 HAUNCHING AND INITIAL BACKFILL

A. General.

1. Provide complete and uniform bearing and support for the pipe, including allowance for bell holes, or structure.
2. Work material under and around the pipe to ensure full pipe support.
3. Prevent movement of the pipe during placement of material.
4. Avoid contact between the pipe and mechanical compaction equipment.
5. Where a trencher is approved, backfill the trench from surface with selected material, free from large clods and all stones larger than 3 inches.

B. No frozen clods, saturated, foreign, or organic materials will be allowed.

C. Hand compact in 6-inch lifts from the bottom of the trench to 12 inches above the pipe crown.

3.6 BACKFILL & COMPACTION

A. All buried material shall be inspected by technical representative prior to backfilling.

B. Backfill remainder of excavation with native material, free from large clods, stones 8 inches or larger, organic material or frost chunks.

C. All backfill shall be compacted in the specified lifts utilizing mechanical equipment designed for compaction. Compaction methods utilizing mechanical equipment not designed for compaction will not be approved.

D. All methods of compaction shall be approved prior to construction.

E. Compact in 6-inch lifts to a density not less than the density of the surrounding undisturbed soil or not less than 90% of the maximum dry density, determined by ASTM D698.

F. Judgment on compaction will be determine through the use of a nuclear density gauge (comparing the unit weight of the compacted soil to the unit weight of the undisturbed soil) and/or by inspection of the Contractor's compaction effort.

G. In cases where the Contractor performs unacceptable methods of compaction, the work on the project will cease until an acceptable method of compaction has been approved. The owner has the right to delay work until soil samples along the project alignment are taken for the purpose of developing a proctor for testing the compaction of the soil backfilled in the trench.

H. Conform to Section 02705 for backfill requirements under roadways.

   1. Compact with mechanical tamper, after initial backfill, to a density not less than 95% of the maximum dry density, determined by ASTM D698 for the entire depth of the trench through a roadway or driveway.

I. Backfill and compact around manholes, valve boxes, and other appurtenances in 6-inch lifts.
   1. Compact with a mechanical tamper to a density not less than 90% of the maximum dry density, determined by ASTM D698.

J. Backfill around septic tanks in 12-inch lifts.
   1. Compact in a manner that will not produce undue strain on the tank.

K. Repair any trenches improperly backfilled or where settlement occurs, then refill and compact.

L. Restore surface to the required grade and compaction. Conform to Section 02300 for rough grading, finish grading and site surface drainage.

M. Remove and dispose of all surplus backfill materials to a location approved by the Project Engineer.

3.7 WARNING TAPE INSTALLATION

A. Install warning tape over water, sewer or force mains and service lines in trench 2 feet below finished grade.

3.8 FROST PROTECTION

A. Place insulation in areas where water main, sewer service lines or water service lines cross a road, driveway, traveled path, or as indicated on the plans.

B. Center insulation over pipe or appurtenance with 1 foot of compacted fill between the pipe and the insulation.

C. Grade fill so insulation lays flat.

D. Insulate with a minimum of one 2 inch layer of polystyrene.

1. If a minimum bury depth is specified, install one 2 inch thick layer for each foot of backfill less than the required minimum bury depth.

E. Install 3 foot wide for pipes up to 6 inches in diameter and 4 feet wide for pipes up to 12 inches in diameter.

F. Extend insulation a minimum of 5 feet on each side of the road crossings.

G. Lap insulation by 6 inches or stagger by 6 inches if composed of two layers.

H. Minimum thickness for the first lift of backfill over the insulation is 8 inches.

1. Do not operate construction equipment directly on insulation. Do not compact first lift with backhoe-mounted compactor or any other large compaction equipment.
2. Compact remaining backfill using normal construction practices.

3.9 REMOVAL OF NUISANCE WATER

A. Remove nuisance water entering the trenches.

B. Nuisance water that can be removed through the use of sump or trash pumps is not considered dewatering.

C. Keep trenches free from water until waterlines, fittings, valves, sewer lines, manholes and other appurtenances are in place and sealed against the entrance of water.
1. Prevent all water, earth or any foreign material from entering any facility.

D. Keep trenches free from water until the facilities are in place, sealed against the entrance of water, and backfill has been placed and compacted above the water level.

3.10 LOCATE EXISTING UTILITIES

A. Field locate all existing underground utilities.

1. Utilize state “811” or “one-call” hotlines.
2. Contact all other utility owners not covered by the state “one-call” hotlines.

3.11 UTILITY CONFLICTS

A. Protect existing utilities from damage during excavation and backfilling operations.

B. Provide temporary support for existing water, gas, telephone, power, or other utility services that cross the trench until backfilling of trench is complete

1. Compact backfill to 90% of Standard Proctor Density under disturbed utilities.
2. Repair or replace any damaged existing utilities, at no additional cost to the project.

C. Water and sewer main crossing and parallel installation

1. Maintain a 10 foot horizontal separation (O.D. to O.D.) for parallel mains.
2. Upon approval by the Project Engineer, water and sewer mains may be installed closer than 10 feet, provided all of the following conditions;
   a. Vertical separation is 18 inches (O.D. to O.D.)
   b. Water main is above the sewer main.
   c. Separate trenches are maintained.

3. Maintain a minimum 18-inch vertical separation (O.D. to O.D.) for crossing mains with the water main above the sewer main.
   a. Lay pipe with joints equidistant from the point of crossing.

4. If it is impossible to meet any of the above separation distances and deviations, one of the following methods shall be adhered to.
   a. Sewer main shall be constructed to water main pressure pipe standards meeting a minimum pressure class of 150-psi.
   b. Either the water main or the sewer main may be encased in a watertight carrier pipe that extends 10 feet on both sides of the crossing. The carrier pipe shall be of materials approved by the regulatory agency for use in water main construction.
   c. The water main and sewer main installed shall be made of high density polyethylene (HDPE) pipe to eliminate the joints and possibility of leaks. Both water and sewer main shall be pressure tested in accordance to Section 02510.

D. Water and sewer service crossing and parallel installation.

1. Maintain a 30-inch horizontal separation from water and sewer services.
2. Maintain a 12-inch vertical separation for crossing water and sewer services.

E. Water service line splices or joints will not be permitted within 10 feet of a sewer line crossing.

3.12 MOVING FENCES AND MINOR STRUCTURES

A. Remove and reset culverts, drainage pipes or other minor structures that fall within the alignment of the new construction, to their original location and grade.

B. Visit the project site and determine actual conditions with regard to the existence of old car bodies, abandoned houses, fences, driveways, trees, stumps, brush, sidewalks, approaches, and other miscellaneous obstacles to construction.

1. Unless specifically referenced in a bid item, no separate payment will be made for the removal or replacement of these items.

3.13 RECORDS

A. Conform to as-built requirements in Section 01781.

END OF SECTION

SECTION 02330 – ACCESS ROAD & CONCRETE SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the construction of new and existing gravel surfaced access roadways.

1.2 RELATED WORK

A. Section 01720 – Construction Staking

B. Section 02230 – Site Clearing

C. Section 02300 – Earthwork

D. Section 02315 – Excavation, Trenching, and Backfilling

E. Section 02920 – Topsoiling, Seeding, Fertilizing, and Mulching

F. Section 03100 – Concrete

1.3 REFERENCES

A. ASTM C117 – Standard Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing.

B. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D422 – Particle-Size Analysis of Soils

D. ASTM D698 – Standard Test Methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12-inch Drop [Standard Proctor Test].

E. ASTM D1556 – Density of Soil In-Place by the Sand Cone Method.

F. ASTM D3017 – Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Method.

G. ASTM D4318 – Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

H. ASTM D6938 – Standard Test method for In-Place Density and Water content of Soil and Soil-Aggregate by Nuclear Methods.

I. South Dakota Department of Transportation, Standard Specifications for Road and Bridge Construction

J. Manual on Uniform Traffic Control Devices for Streets and Highways

1.4 SUBMITTALS

A. Gradation test results for aggregates of Gravel Surfacing.

B. Field density test results for Subgrade and Gravel Surfacing.

C. Geotextile

D. Culvert Pipe and Flared End section.

1.5 DEFINITIONS

A. Roadways: Driveways, unimproved roads, paved streets, and highways.

B. Roadway Limits: To be established by the Project Engineer and may include highway shoulders and drainage ditches.

1.6 QUALITY ASSURANCE

A. The materials and construction methods specified herein are minimum requirements. Where the appropriate state/local codes require more stringent materials or execution methods, they shall apply.

B. Notify the Project Engineer of any planned deviation from these specifications before proceeding so any price changes or quantity adjustments may be made.

C. Furnish copies of test reports to the Project Engineer.

PART 2 - PRODUCTS

2.1 BORROW

A. As identified in the plans.

B. Shall consist of natural soils free from organic matter, frozen material, refuse, construction debris or other man-made items.

2.2 CULVERTS and CULVERT ENDS

A. Galvanized round corrugated metal Pipe (CMP) conforming to ASTM A-444

B. Minimum thickness of 16 gauge (0.064 inches)

C. Corrugation: 2 2/3” x ½”

D. Coated with 10 mil thick co-polymeric film inside and out.

2.3 GEOTEXTILE

A. Composed of long chain polymeric filaments (95 percent by weight, polyolefin, polyester, or polymide) formed into woven fabric.

B. Follow manufactures recommendations for storage on site.

C. Meet or exceed characteristics as listed:

PROPERTY & TEST METHOD	MINIMUM VALUE
Grab Tensile Strength (ASTM D4632)	315 lbs.
Grab Elongation (ASTM D4632)	15%
Mullen Burst (ASTM D3786)	600 psi.
Puncture Strength (ASTM D4833)	120 lbs.
Trapezoid Tear (ASTM D4533)	120lbs.
Ultraviolet Stability 500hrs (ASTM D4355)	70%
Permittivity (ASTM D4491)	0.05/sec
Apparent Opening Size (ASTM D4751)	40 U.S. sieve
Flow Rate Minimum (ASTM D4491)	4 gal./min./ft²

2.4 GRAVEL SUB-BASE

A. The aggregate for surfacing shall consist of sound durable particles of gravel, with which may include limited amounts of fine soil particles.

B. Meet the following characteristics:

SIEVE SIZE	PERCENT PASSING
¾ inch	100
No. 4	50-78
No. 8	37-67
No. 40	13-35
No. 200	4.0-15.0
Plasticity Index	4-12
Processing Required	crushed

1. Fraction passing the No. 200 sieve: not be greater than two-thirds (2/3) of the fraction passing the No. 40 sieve.
2. Exceeding the upper limit specified for the No. 200 sieve will not be allowed.

2.5 CONCRETE PATCH

A. Comply with Section 03100.

PART 3 - EXECUTION

3.1 GENERAL

A. Obtain all necessary permits and bonding required by the roadway authority.

B. Comply with the standards and construction requirements of the applicable local, municipal, county, state, and federal highway authorities.

C. Observe all prescribed traffic safety regulations.

D. Grade the access road to the alignment and profile as specified in the plan set and staked by the Project Engineer.

E. Scarify the top 6 inches of subgrade and compact to 90% of specified density prior to building embankment.

F. Uniformly apply water by tank truck in the amounts necessary to produce the optimum moisture content. Mix water with the soil by means of a spring tooth or disc harrows.

G. Control the moisture content of the soil to assist in obtaining the specified density. Maintain the moisture content of the soil at 2-3 percent above optimum moisture.

H. Utilize a mechanical compaction method (sheepsfoot or peg tooth roller) until the embankment becomes unyielding.

I. Re-compact final 6 inches of roadway construction to 95% of specified density requirements just prior to placement of the gravel surfacing.

J. If available, the in-place gravel may be salvaged and reused,

1. When reusing gravel mix a minimum of 50% of the total depth specified with new gravel, unless otherwise specified.

3.2 CLEARING AND GRUBBING

A. The staked limits of the access roadway shall be stripped and grubbed per Section 02230.

3.3 TOPSOIL

A. Topsoil shall be salvaged to a depth of 6 inches and stockpiled.

B. The salvaged topsoil shall be replaced on the inslopes of the completed roadway.

C. Seeding shall be accomplished per Section 02920.

3.4 EXCAVATION

A. Excavate to the specified lines and grades per Sections 02300 and 02315.

B. Make excavation true to the depths, slopes, grades, and lines as called for in the plans or as otherwise ordered and staked by the Project Engineer.

C. Bench all constructed slopes in excess of 5:1 to reduce the potential for slope failure or slippage.

D. Roadway finished grade tolerance: +/- 0.1 feet of the grade elevation.

E. Slope tolerance: +/- 0.2:1 of the slope.

F. Excavate without causing rutting, pumping or other disturbance to underlying materials.

G. Over-excavation for removal of porous or unsuitable materials must be authorized and measured by the Project Engineer at the time the work is accomplished.

3.5 BORROW

A. The Project Engineer will identify, stake, and cross-section the designated borrow area.

B. Extra materials for embankment construction that are obtained by changing back slopes, widening ditches, or otherwise adjusting dimensions or elevations shown on the plans is not considered borrow.

C. Compact borrow fill in 6-inch maximum lifts using a mechanical compactor as per the specification where the borrow soil is being placed.

3.6 WASTE MATERIAL

A. Remove and waste unsuitable or excess material in the designated area as directed by the Project Engineer.

B. Compact waste material in 1-foot lifts using earthmoving equipment to provide wheel compaction during the haul cycles.

3.7 SUBGRADE

A. Stockpile material for backfilling.

B. Compact subgrade in 6-inch lifts using a mechanical compactor.

C. Compact subgrade to a density no less than 90% of the maximum density determined by the Standard Proctor Test ASTM D698 and to within 3-feet of the finished grade.

D. Within 3-feet of the surface compact subgrade to a density no less than 95% of the maximum density determined by the Standard Proctor Test ASTM D698.

3.8 CULVERTS

A. Construct in the locations and of the sizes shown on the drawings.

B. Take care during unloading and installation.

C. Repair all damaged to the co-polymeric film coating in the field to the satisfaction of the Project Engineer.

D. Compact pipe backfill in 6-inch lifts using a mechanical compactor on both sides of the pipe to no less than 95% of the maximum density determined by the Standard Proctor Test ASTM D698.

3.9 GEOTEXTILE

A. If required, place geotextile fabric on finished subgrade to a point 1 foot beyond gravel edge.

B. Overlap geotextile fabric 3 feet in every direction.

C. Repair damaged areas by cutting and splicing fabric and overlapping 3 feet in every direction.

D. Traffic and dumping directly on the geotextile fabric is not permitted.

3.10 GRAVEL SUB-GRADE

A. Spread evenly to achieve the compacted layer of gravel as specified on the detail drawings.

B. Watering and roller compaction.

1. Roll simultaneously with the spreading and watering operations and continue in parallel overlapping strips until the entire area has been rolled at least twice.
2. Utilize pneumatic tired rollers with an effective roller weight of not less than 250 pounds per inch of roller width.
3. Vibratory compacting equipment may be used in lieu of the above specified rollers.

3.11 CONCRETE SURFACE

A. Concrete surfacing shall be installed in the following manner.

1. Form the extents of the poured area.
2. Place a compacted stabilized gravel base, 6 inches in depth.
3. Place 6 inch by 6 inch – 6X6 wire mesh reinforcement.
   a. Reinforcement placement and type of joints shall be inspected by the Project Engineer before the concrete is poured.

4. Provide a minimum 6-inch thick concrete surface.

END OF SECTION

SECTION 02511 – WATER SERVICE LINES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the installation of water service lines complete with corporation stops, curb stops, curb boxes, meter pits, freezeless risers, and other appurtenances for water systems.

1.2 RELATED WORK

A. Section 02315 – Excavation, Trenching and Backfill

1.3 REFERENCES

A. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 Inch, for Water Service

B. ASTM B88 – Standard Specification for Seamless Copper Water Tube

C. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D. ASTM D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

E. ASTM D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

F. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

G. NSF/ANSI 14 – Plastics Piping System Components and Related Materials

H. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.4 SUBMITTALS

A. Section 01330 – Submittal Procedures

B. Product Data: Submit on the following:

1. Water Service Line
2. Fittings
3. PEX & Copper Tubing
4. Corporation Stops
5. Saddles, Tees, or Tapped Couplings

6. Curb Stops and Boxes with Stationary Rod
7. Freezeless Riser
8. Yard Hydrant
9. Meter Pit with Accessories
10. Water Meter with Remote Readout
11. Meter Setter (Interior)
12. Inlet Ball Valve with Drain
13. Outlet Double Check Valve
14. Pressure Regulator
15. Heat Tape with Thermostat
16. Pipe Insulation
17. Service Saddles

1.5 ACCEPTANCE

A. Work covered by this section will not be accepted until satisfactory backfilling and testing is complete.

PART 2 - PRODUCTS

2.1 WATER SERVICE LINE AND APPURTENANCES

A. All water service line piping and appurtenances must meet the requirements of NSF/ANSI-61 and NSF/ANSI-14.

B. Polyethylene Pipe

1. AWWA C901 and ASTM D2239.
2. IPS size pipe: SDR 7 with 200 psi pressure rating.
3. High density, ultrahigh molecular weight polyethylene pipe compound PE-3408.
4. Non-flare fittings: Compression type equal to Ford Pack Joint, C66-44 or C66-55, or McDonald MAC-PAK with rigid stainless steel stiffeners.
5. Pipe equal to Cresline HD 200.

C. Copper Pipe

1. ¾-inch diameter with minimum wall thickness of 0.045 inches.
2. Type “K” soft annealed seamless copper tubing suitable for installation in public water systems conforming to ASTM B88
3. Solder or compression type connections as manufactured by A.Y. McDonald or Ford.

D. Cross-Linked Polyethylene (PEX)

1. ¾-inch with minimum wall thickness of 0.102 inches.
2. Conform to ASTM F 876.
3. Mechanical crimp typed connections.

E. PVC Pipe

1. Conform to ASTM D2241, PVC 1120, SDR 21 or SDR 17 as indicated in the bid schedule.
2. Rubber compression ring joint conforming to ASTM D3139.
3. Conform to ASTM D1785, Schedule 40.

F. Saddles.

1. Minimum pressure rating of 200 psi.
2. Buna-N rubber gaskets.
3. Stainless steel nuts and bolts
4. Minimum 4 inches wide for 3-inch diameter pipe and 5 inches wide for 4-inch diameter pipe.
5. PVC ASTM D2241 Pipe: Double bolt stainless steel equal to Romac 202BS, Romac 306 or Ford FS313.
6. PVC C900 Pipe: Stainless steel single bolt saddle clamps equal to Ford FS101 or Smith-Blair 317 or 372.
7. Ductile Iron, Asbestos Cement or HDPE Pipe: Double bolt stainless steel band equal to Ford FS20.

G. Corporation Stops

1. No-Lead Brass, meeting NSF-61, with pack joint connection.
2. Non-flare connections for all pipe types, equal to McDonald MAC-PAK with stainless steel stiffeners or Ford pack joint compression couplings with stainless steel stiffeners.
3. PE Service line: A.Y. McDonald 74701B-33, Ford FB1001-NL, Mueller H15009N, or equal.
4. PVC Service line: Ford FB 1002-NL, A.Y. McDonald 74701B-44, or equal.

H. Curb Stops

1. No-lead Brass, meeting NSF-61, with pack joint connections.
2. Non-flare connections for all pipe types.
3. Minneapolis pattern.
4. IPS polyethylene service line: Ford B66-444M-NL, A.Y. McDonald 76104 – 33, or equal with stainless steel stiffeners.
5. IPS polyethylene service line greater than 1-inch diameter: Ford B11-555M-NL or A.Y. McDonald 76104-33 with stainless steel stiffeners.
6. PVC service line: Ford B77-666M-NL or B77-777M-NL, A.Y. McDonald 76104-44, or equal.

I. Curb Boxes with Stationary Rod

1. Cast iron Minneapolis pattern, length to match bury depth.
2. Stainless steel stationary rod.
3. Pentagon plug.
4. A.Y. McDonald 5614, or equal.
5. Curb box lids: A.Y. McDonald 5607L or equal.
6. Supply one pentagon wrench and one combination key equal to A.Y. McDonald Catalog #304B, 36 inches long or equal.

2.2 FREEZELESS RISERS AND FITTINGS

A. Constructed from only no-lead brass

B. No galvanized fittings are allowed.

C. Provided with a swing joint and be equal to True–Temp Positive Purge Model 7PP-DB with copper riser pipe.

D. Non-thermostatically controlled heat tape equal to Frostex.

E. Foam insulation with adhesive strip equal to Imcolock.

F. Supply one 25-foot, 14 gauge heavy duty outdoor extension cord with temperature rating down to -40°F.

2.3 YARD HYDRANTS

A. Frost proof buried to depths indicated in plans.

B. Inlet: ¾” NPT.

C. Outlet: ¾” brass house thread.

D. Rod: Stainless steel operating rod thru Teflon packing.

E. Automatic self-adjusting plunger.

F. Stand Pipe: 1” brass.

G. Model Any Flow as manufactured by Merrill Manufacturing of Storm Lake, Iowa.

H. Accessories:

1. Hydrant assist kit provided by Seppman Enterprises, model HAK 750.
2. Vacuum breaker, model NF8 as manufactured by Watts of North Andover, Massachusetts.

2.4 METER PIT

A. Minimum 15-inch diameter.

B. All no-lead brass appurtenances.

C. Included with the pit: meter setter, meter, regulator, inlet angle shut off valve, outlet dual check valve, coiled polybutylene tubing, and pressure regulator if required.

D. Equal to Mueller Thermal-Coil 203 CT 1584 FSBL.

E. Depth as required for minimum bury of pipe.

F. Center Locking lid with 4-inch thick foam insulating pad and corrosion resistant bottom plate.

2.5 METER

A. 5/8-inch x 3/4-inch with thermoplastic, no-lead brass case and frost proof design.

B. Read in U.S. gallons equipped with an absolute encoder sealed register.

C. Capable of producing electronic signal and supplied with remote readout.

D. Must meet the approval of the local water utility.

1. Purchase from local utility if required to do so.

2.6 REMOTE METER READOUT

A. 25 feet of signal transmitting cable.

B. 4-inch x 4-inch treated wooden post, 5 feet long.

C. ¾ - inch rigid PVC conduit with solvent weld fittings.

2.7 INTERIOR METER ASSEMBLY WITH PRESSURE REGULATOR

A. No-Lead brass meter setter equal to Ford WS88-233B-NL.

B. Inlet ball valve equal to Ford B11-233D-NL with handle and drain.

C. Double check valve equal to Ford HHC11-333-NL.

D. Ford Pack Joint C86-33 for ¾ inch copper or C86-34 for 1 inch PE water service, or equal.

2.8 INTERIOR METER ASSEMBLY

A. No-Lead brass meter setter equal to Ford PB-2 Plumbhorn.

B. ¾ inch Inlet ball valve equal to Ford B11-233D-NL with handle.

C. Double check valve equal to Ford HHC11-333-NL.

D. Ford Pack Joint C86-33 for ¾ inch copper or C86-34-NL for 1 inch PE water service, or equal.

2.9 PRESSURE REGULATOR

A. Utilize a ¾-inch pressure reducing valve with outlet pressure of 60 psi.

B. Adaptable to 5/8-inchx3/4-inch meter setters.

C. No-Lead construction with stainless steel seat, adjustment and cage screws as well as an integral strainer screen.

D. Equal to Watts LFU5B-Z3.

2.10 WARNING TAPE

A. Supply detectable warning tape that is a minimum of 3 inches wide, blue or striped blue.

B. Printed with “Caution Buried Waterline Below.”

2.11 PIPE HANGERS

A. Made of a material compatible with piping material.

B. Sufficient strength to support the pipe at full capacity.

C. Will not affect pipe integrity by abrading, cutting or bending of pipe.

2.12 ACCESSORIES

A. Pentagon Wrenches.

1. One shut off key for curb stop used with air release pit.
2. Equal to A.Y. McDonald 304K2.

B. Combination keys.

1. 36 inches long and suitable for the curb stop.
2. Equal to A.Y. McDonald 304B.

PART 3 - EXECUTION

3.1 WATER SERVICE LINE AND APPURTENANCES

A. Install water service line of the size and material indicated on the Bid Schedule.

B. Install at the locations shown on the plans.

C. Provide sufficient slack in the water service line to prevent pulling joints apart and to allow for contraction due to temperature changes.

D. Refer to Section 02315 for excavation, trenching, backfilling, compaction, separation distance, and insulation requirements.

E. Install service line:

1. From the main to a location into or near each home.

a. Connect to the homes existing water stub out if provided outside the home.
b. If sleeve provided, run water line through the sleeve and leave a minimum of 12-inches of piping in the home. Seal space between piping and sleeve to prevent groundwater from entering the home.
c. If no stub-out is provided, cap service line and mark with steel post.
d. For connecting beneath the home, install pipe hangers at a maximum spacing of 6 feet apart for all horizontal copper tubing and 2 feet apart for all horizontal PE pipe inside the home.

2. Bury line consistent with water main depth. Insulate where installed above recommended frost line.
3. Install warning tape 2 feet below finished grade
4. Use compression couplings for all connections.
5. Use stainless steel insert stiffeners for compression connections to PE pipe.
6. No splices or joints are allowed from the point of connection to the main to a point 10 feet beyond any sewer line crossing.

F. Install saddle at each corporation stop tapping location.

1. Connections shall be live tapped through the corporation stop with an approved tapping machine, unless specified below.
2. Dry taps are allowed only during new water main installation, before main disinfection.
3. For connections to mains smaller than 3 inch diameter, use saddle with ¾ inch tap and transition for 1 inch diameter water service line.

G. Curb stops and boxes with stationary rod.

1. Set curb stops on a solid concrete block 4 inches thick by 8 inches wide by 16 inches long placed on undisturbed earth.
2. Install stationary rod on curb stop.
3. Set the top of curb boxes flush with finished grade elevation.
4. Support curb box during the backfilling operation to prevent movement and maintain a vertical position.
5. Provide one curb wrench and one pentagon key.

H. Install water meter assemblies as shown on the standard details and in accordance with manufacturer's recommendations.

3.2 WATER METER PIT INSTALLATION

A. Install meter pit in the location designated on the plans or as instructed by the Project Engineer in accordance with manufacturers recommendations.

B. Level meter pit on two 4"x8"x2" concrete blocks.

C. Install remote readout as shown in the detail drawing.

D. Connect remote readout with wires from meter in a rigid 3/4-inch Sch. 80 PVC conduit.

1. Install conduit for the full depth of the meter pit as indicated in the detail drawings.
2. Seal top of conduit and protect wire between the conduit and remote register.

3.3 UTILITY CONFLICTS

A. Refer to Section 02315.

3.4 FREEZELESS RISERS

A. Install freezeless risers below each mobile home and other homes where required, at the locations established by the Project Engineer.

B. Install directly below the point of connection to the house plumbing whenever possible.

C. Set risers vertical except for freezeless riser containing a rigid heating element. .

1. Set risers at an angle that will allow for the removal of the interior components of the riser without moving or excavating the freezeless riser.

D. Install copper or PEX tubing from the riser to the house plumbing.

E. Install elbows or make long radius bends at 90-degree bends.

F. Kinks in the tubing are not allowed.

G. Solder copper joints with lead free solder.

H. Install heat tape and continuous foam insulation on all exposed tubing beneath mobile homes or within a crawl space.

3.5 YARD HYDRANTS

A. Install yard hydrants at the locations shown on the plans.

B. Set coupler vertical on precast concrete block.

C. Place 5 cubic feet of clean crushed rock around base of hydrant with minimal amount of rock above the valve body for drainage.

D. Pour 36” square concrete pad with concrete meeting requirements of Section 03100.

3.6 TESTING

A. Turn on each corporation stop and apply main pressure to the service line in the presence of the IHS representative before backfilling.

1. Option: If a new water main is pressure tested, test the water service lines at the same time and pressure as the water main.

B. Repair all visible leaks and retest the line until test is successfully completed at no cost to the contract.

3.7 DISINFECTION

A. If water service facilities are installed and connected to newly installed water main, disinfect the service line at the same time as the water main.

B. Refer to Section 02510 for water main disinfections procedures if water main is depressurized.

C. If water service facilities are connected to an existing water main by live tap:

1. Disinfect the new water service facilities prior to connecting to the corporation stop and the home. Near the home, at a location approved by the project engineer, the water service line will be extended to the surface and capped with a lead free brass ball valve.
2. Introduce sufficient chlorine solution into the corporation stop end to the water service line to produce a minimum chlorine residual of 200 ppm when filled.
3. After connection to corporation stop and pressurizing, flush the service line at the ball valve after three hours.
4. After service line is sufficiently flushed, obtain a water sample for bacteriological testing. Repeat process until a negative bacteriological report is received.
5. Connect the water service line to the home upon receiving a negative bacteriological report.

D. Flushing chlorinated water in accordance with AWWA C651.

1. Waste flushed disinfection water in an environmentally safe manner. The method used is subject to the approval of the Project Engineer.

E. No additional payment will be made for any equipment, material, testing or labor required to disinfect the service line. Include all costs associated with disinfection in the contract bid prices for water service lines.

3.8 AS-BUILTS

A. Provide as-built information on each system in accordance with Section 01781. Use standard forms, if supplied.

END OF SECTION

SECTION 02530 – SANITARY SEWER

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the construction of sanitary sewer mains, sewer main cleanouts, sewer line testing, and connection to existing sewage collection systems.

1.2 RELATED WORK

A. Section 01720 – Staking and Construction Surveying

B. Section 02315 – Excavation, Trenching and Backfill

C. Section 02532 – Sanitary Sewer Manholes

D. Section 02920 – Topsoiling, Seeding, Fertilizing, and Mulching

1.3 REFERENCES

A. ANSI/AWWA C110 / A21.10 – Ductile-Iron and Gray-Iron Fittings, 3 Inch Through 48 Inch, for Water and Other Liquids

B. ANSI / AWWA C111 / A21.11 – Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe Fittings

C. ANSI / AWWA C151 / A21.51 – Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids

D. ASTM D2239 – Polyethylene (PE) Plastic Pipe Based on Controlled Inside Diameter.

E. ASTM D2321 – Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

F. ASTM D3034 – Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings

G. ASTM D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

H. ASTM D3261 – Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

I. ASTM D3350 – Polyethylene Plastic Pipe and Fittings Material

J. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe

K. ASTM F1417 – Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

1.4 SUBMITTALS

A. Sewer Main Pipe

B. Ductile Iron Sewer Pipe, Coating and Liner

C. Frame and Cover for Sewer Main Cleanouts

D. Sewer Main Cleanout Female Adaptor and Threaded Plug

E. Sanded Manhole Adaptors

1.5 ACCEPTANCE

A. The Work will not be accepted until satisfactory pipe installation, backfilling, testing, and cleanup is complete.

B. If the Work does not meet the specified requirements of this section and related sections, remove, replace, and retest at no additional cost to the Contract.

PART 2 - PRODUCTS

2.1 SEWER PIPE

A. Polyvinyl Chloride (PVC) Sewer Pipe.

1. Conform to ASTM D3034.
2. Pipe Class: SDR-35 unless otherwise specified on the design drawings.
3. Bell ended joints conforming to ASTM D3212.
4. Elastomeric gaskets conforming to ASTM F477.
5. Each length of pipe shall be clearly marked with the following:
   a. Manufacturer.
   b. Nominal Pipe Size.
   c. The PVC Cell Classification.
   d. Type PSM PVC Sewer Pipe.
   e. ASTM Designation.
   f. Pipe Class.

B. Ductile Iron Sewer Pipe.

1. Conform to AWWA C151.
2. Pipe Thickness Class: 50 unless otherwise specified on the design drawings.
3. Exterior Coating: asphaltic coating, 1 mil thick, minimum.
4. Rubber gasket, push on joints conforming to ASTM C111.
5. Interior Lining: Calcium aluminate mortar (minimum 125 mils thick) equal to SewperCoat or ceramic epoxy (minimum 40 mils thick) fusion bonded equal to Protecto 401.
6. Each length of pipe shall be clearly marked with the following:
   a. Manufacturer.
   b. Nominal Pipe Size.

c. ASTM Designation.
d. Pipe Class.

C. Polyethylene Pipe and Fittings
1. Conform to ASTM D2239 and ASTM D3350
2. Pipe Thickness Class: SDR-11 unless otherwise specified on the design drawings.
3. Polyethylene Material: Conform to standard PE code designations PE 3408/3608.
4. Fusion bonded joints and fittings conforming to ASTM D3261.
5. Each length of pipe shall be clearly marked with the following:
   a. Manufacturer.
   b. Nominal Pipe Size.
   c. Dimension Ratio.
   d. Pressure Rating.
   e. AWWA Designation.
   f. Material Classification.
   g. Green Striping designating Sanitary Sewers

6. PVC Manhole Adapter
   a. Gasketed PVC sleeve.
   b. Abrasive exterior.
   c. GPK Sanded manhole adapter or equal
   d. Grout: Non-Shrink equal to Sikagrout 212.

2.2 SEWER APPURTENANCES

A. Manholes: Refer to Section 02532.

B. Sewer Main Cleanouts.

1. Riser Pipe:
   a. Conform to ASTM D3034.
   b. Pipe Class: SDR-35.
   c. Elastomeric gasket joints conforming to ASTM D3212.
   d. Same diameter as main unless otherwise specified.
   e. Gasketed air-tight plug, same diameter as riser.

2. Concrete Collar: Refer to Section 03120 for cast-in place concrete requirements.
3. Frame and Cover:
   a. Heavy duty slab type.
   b. Machined bearing surfaces.
   c. Neoprene gasket seal.
   d. Lockable with stainless steel bolts.
   e. Neenah R-6461-CH or approved equal.

4. Sewer Main Cleanout
   a. PVC Female Adaptor with threaded plug
   b. 10-inch diameter PVC riser sleeve.
   c. Sewer wye with non-structural concrete

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that dimensions and elevations are as indicated on the plans.

B. Inspect pipe and fittings for defects.

C. Remove materials from the site that are defective, damaged, used, unsound, or that otherwise do not meet the specifications.

3.2 UTILITY CONFLICTS

A. Refer to Section 02315.

3.3 STAKING FOR LINE AND GRADE

A. Refer to Section 01720.

3.4 SEWER MAIN INSTALLATION

A. Pipe Installation.

1. Adhere to the excavation, trenching and backfill requirements of Section 02315.
2. Install pipe and fittings in accordance with these specifications and the manufacturer's recommendations.
3. Dewater trench as necessary to prevent the accumulation of groundwater or other unacceptable water in trench.
4. Lay pipe of the size, material, pressure class and to the line and grade indicated on the drawings.
   a. Ensure vertical alignment does not deviate more than ½ inch from the design grade as shown on the plans.
   b. Ensure horizontal alignment does not deviate more than 1 inch from the design as shown on the plans.
5. Install pipe beginning at the lowest elevation and proceeding to the highest elevation.
6. Point the spigot end in the direction of flow.
7. Protect pipe interior from soil, trench water and foreign objects.
8. Temporarily plug the exposed end of pipes whenever the trench is left unattended or when trench conditions necessitate. Open trenches may not be left overnight without approval from the Project Engineer.
9. Wrap ductile iron pipe with 8 mil polyethylene encasement, according to manufacturer's recommendations.
10. Water Main Crossing Requirements: Refer to Section 02315.

B. Connections to Manholes:
1. Existing: Make connection in conformance with Section 02532.
2. New: See "Connection to Existing Manhole" this Section.

C. Pipe Cutting

1. When cutting is required do so in a manner approved by pipe manufacturer.
2. Produce smooth ends at right angles to the axis of pipe.
3. Bevel pipe to produce a smooth end without sharp edges.
4. Welding, flame cutting or flame tapping are not allowed.

3.5 SEWER MAIN CLEANOUTS

A. Install sewer wye encased in nonstructural concrete with 24-inch length of gravity main stub, female adaptor and threaded plug.

B. Install 45 degree long sweep and PVC riser to finished ground surface.

C. Place larger PVC diameter sleeve over riser pipe. Mount frame and cover on sleeve and set in 30-inch square by 6-inch thick concrete pad.

3.6 CONNECTION TO EXISTNG MANHOLE

A. Core or hammer drill opening in existing manhole wall to the size recommended by the manhole adapter manufacturer.

B. Grout adapter into opening with non-shrink Grout to accommodate invert elevations shown on the drawings.

C. Remove existing channel as required and form, re-shape and provide a smooth channel in the manhole floor in conformance with Section 02532.

D. Fill any existing flow channels and pipe to be abandoned with concrete.

3.7 SEWER MAIN TESTING

A. General.
1. Furnish all materials, labor and equipment to perform the required tests.
2. Perform all tests in the presence of the Project Engineer or his/her representative.
3. Repair all sections not passing the tests, at no cost to the contract.
4. Retest sewer until tests pass the requirements, at no cost to the contract.

B. Alignment.
1. Perform lamping and/or camera after the sewer line has been backfilled.
2. Contractor to provide lamping and camera equipment.
3. Sewer main out of alignment with respect to line or grade, by more than 1 inch or ½ inch, respectively, shall be reinstalled at no expense to the contract.

C. Air Test.

1. All gravity sewers and appurtenances shall successfully pass a low-pressure air test prior to acceptance.
2. Preparation: Clean all sewer pipe before the test.
3. Testing Equipment:
   a. Plugs: mechanical or pneumatic type. One shall have an inlet tap for adding air to the sewer line.

b. Air Compressor.
c. Main Shutoff Valve.
d. Pressure Relief Valve: 9 psig relief.
e. Input Pressure Gauge.
f. Continuous Monitoring Pressure Gauge: Minimum divisions of 0.10 psi with an accuracy of +/- 0.04 psi.

4. Testing Procedure: Test according to the Time-Pressure Drop Method outlined in ASTM F1417.
   a. Plug all pipe outlets with test plugs capable of holding under the test pressures.
   b. Install plugs and brace as necessary to ensure that the plugs will not blow out when the main is under pressure.
   c. Inspect sewer main pipe integrity in the area that will not be tested due to the plug, and report any possible defects to the Project Engineer.
   d. Ensure test apparatus and gauges are accessible to Owner's representative without entry into the manhole.
   e. Pressurize Pipe:
      1) Introduce air slowly until air pressure reaches 4.0 psig greater than any backpressure resulting from groundwater over the pipe, where the pressure equals:
      2) 4.0 psi + (0.43 psi X Depth of Groundwater over Pipe Invert in Feet).
      3) Never exceed a pressure of 9.0 psig.
   f. Do not enter manhole once pipe is pressurized.
   g. Maintain pressure for at least two (2) minutes.
   h. Disconnect air supply after the initial two (2) minutes have passed.
   i. Adjust pressure to test pressure.
      1) Decrease air pressure to 3.5 psig greater than any pressure resulting from groundwater over the pipe, where the test pressure equals:
      2) 3.5 psi + (0.43 psi X Depth of Groundwater over Pipe Invert in Feet).
   j. Determine elapsed time for the pressure to drop 1.0 psig and use Table 1, or determine the elapsed time for the pressure to drop 0.5 psig from the test pressure and use Table 2.

TABLE 1: Minimum Specified Time Required for a 1.0 psig Pressure Drop

Pipe Dia. (in.)	Min. Time (min:sec)	100 Feet	150 Feet	200 Feet	250 Feet	300 Feet	350 Feet	400 Feet	Time for Longer Pipe Lengths (Seconds)
4	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	.380*L
6	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	.854*L
8	7:34	7:34	7:34	7:34	7:34	7:36	8:52	10:08	1.520*L
10	9:26	9:26	9:26	9:26	9:53	11:52	13:51	15:49	2.374*L
12	11:20	11:20	11:20	11:24	14:15	17:05	19:56	22:47	3.418*L
15	14:10	14:10	14:10	17:48	22:15	26:42	31:09	35:36	5.342*L
18	17:00	17:00	19:13	25:38	32:03	38:27	44:52	51:16	7.692*L

TABLE 2: Minimum Specified Time Required for a 0.5 psig Pressure Drop

Pipe Dia. (in.)	Min. Time (min:sec)	100 Feet	150 Feet	200 Feet	250 Feet	300 Feet	350 Feet	400 Feet	Time for Longer Pipe Lengths (Seconds)
4	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	.190*L
6	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:51	.427*L
8	3:47	3:47	3:47	3:47	3:47	3:48	4:26	5:04	.760*L
10	4:43	4:43	4:43	4:43	4:57	5:56	6:55	7:54	1.187*L
12	5:40	5:40	5:40	5:42	7:08	8:33	9:58	11:24	1.709*L
15	7:05	7:05	7:05	8:54	11:08	13:21	15:35	17:48	2.671*L
18	8:30	8:30	9:37	12:49	16:01	19:14	22:26	25:38	3.846*L

k. The time interval recorded in the field must be greater than the time listed for the length and pipe diameter being tested and for the pressure drop recorded.
l. If the pressure drop time is less than that in the appropriate table, for the pipe diameter and the length being tested, the test shall be considered failed.
m. No variance in the time allowances shall be granted for the fact that sewer service lines have been installed.

5. Individual service lines need not be tested unless otherwise specified. If Contractor elects to install sewer service line saddles and riser pipes on the sewer main prior to low pressure air testing, it is the Contractors responsibility to ensure that the ends of the sewer service line connection stub out are adequately capped and thrust blocked to conduct the air testing for the entire main.
6. In lieu of low-pressure air testing of the sewer system, the Project Engineer may approve a hydrostatic exfiltration testing procedure to test the lines.
   a. Approval of the procedure, equipment and basis of acceptance for this testing method will be sent in writing by the Engineer prior to the initiation of testing.

END OF SECTION

SECTION 02532 – SANITARY SEWER MANHOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work covered by this section includes standard and shallow concrete manholes, standard manholes, drop manholes, adjustment rings, frames and covers for community wastewater collection systems.

1.2 RELATED WORK

A. Section 02300 – Earthwork

B. Section 02315 – Excavation, Trenching and Backfill

C. Section 02530 – Sanitary Sewer

D. Section 3100 – Concrete

1.3 REFERENCES

A. ASTM A48 – Standard Specification for Gray Iron Castings

B. ASTM C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

C. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections

D. ASTM C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

E. ASTM C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

F. ASTM C1244 – Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test

1.4 SUBMITTALS

A. Manhole frame and cover

B. Manhole steps

C. Precast manhole sections

D. Precast manhole base sections

E. Joint sealing material

F. Mastic Wrap

G. Pipe to manhole connections

1.5 DEFINITIONS

A. Shallow Manhole: Manholes with a depth from rim to outlet pipe invert equal to 7-feet or less, and with a flat top.

B. Standard Manhole: Manholes with a depth from rim to outlet pipe invert greater than 7-feet but not more than 8 -feet, and with a conical top section.

PART 2 - PRODUCTS

2.1 MANHOLES

A. Design and fabricate reinforced concrete manholes to conform to ASTM C478.

B. Concrete compressive strength will meet or exceed 4000 pounds per square inch at 28 days.

C. Base Section:

1. 8-Inch thick precast concrete bottom section with monolithic barrel section and precast channels for standard manholes.
2. Bases poured onsite with channels are acceptable with written approval by the Project Engineer and shall conform to Section 3100
3. Channel (or invert) shape:
   a. Smooth.
   b. Semicircular.
   c. Same diameter as adjoining sewer pipe.
   d. Ogee shaped, so there is no free drop.
   e. Make transitions in size and grade of channels gradually and evenly.

4. Drop:
   a. Minimum: 0.10 feet through manholes measured from any invert in to the invert out.
   b. Maximum: 2 feet through manholes measured from any invert in to the invert out.

D. Barrel Sections:

1. 48-Inch inside diameter with 5-inch thick concrete walls, unless otherwise specified.

E. Cone Sections:

1. Eccentric cone sections with 5-inch thick concrete walls, unless otherwise specified.

F. Shallow Manhole Top Slab Sections:

1. Provide manhole opening eccentrically located to allow positioning over the outlet.

G. Manhole Floor

1. Slope manhole floor from manhole wall to the channel.
2. Smooth finish,
3. Minimum drop of 1-inch; Maximum drop of 2-inches.

H. Manhole Steps:

1. Conform to ASTM A48.
2. Cast and anchor steps in concrete sections, aligned to form a continuous ladder.
3. Install steps so they are horizontal, protruding 5-inches, minimum.
4. Material: minimum 1/2-inch grade 60 steel steps encased in neoprene or polypropylene.
5. Width: 12-inches, minimum.
6. Space rungs 16-inches apart.
7. Maximum spacing from the top of the cone to the first rung shall be 6-inches.
8. Center steps over the manhole outlet.

I. Manhole Adjustment Rings:

1. Concrete rings.
2. HDPE rings

J. Sewer Pipe Connection:

1. Connect pipe to manhole using a watertight pipe to structure gasket precast into the manhole wall conforming to ASTM C923.
2. PSX Positive Seal Gasket System or approved equal.

K. Joints:

1. O-ring or flexible gasket conforming to ASTM C443.
2. Use plastic cement putty meeting Federal Specification SS-C-153 or a non-shrink hydraulic cement mortar on all interior and exterior joints.
3. 8” mastic wrap for exterior joints.
4. Exterior joint collars equal to Cretex Exterior Joint Sealer.

2.2 FRAMES AND COVERS

A. Fabricate from cast iron.

1. Clean and smooth.
2. Free from distortion, shrinkage or other defects.
3. Conform to detail drawings.

B. Combined Weight: 325 pounds, minimum conforming to ASTM A 48.

C. Frame:

1. Designed for use with covers without open pickholes.
2. Machined, horizontal bearing surfaces.

D. Cover:

1. Machined horizontal bearing surfaces.
2. Neoprene ring gasket.
3. Solid cover with concealed pickhole.
4. No vented lids.
5. Cast with lettering “SEWER”.

E. Equal to East Jordan 1045 or Neenah R-1760.

F. Hydrophilic Butyl Rubber Water Stop

PART 3 - EXECUTION

3.1 INSTALLATION

A. Construct manholes at the locations and elevations shown on the plans.

B. Refer to Section 02315 for excavation and backfill requirements.

C. Install manholes so that the walls are vertically plumb.

D. Bed precast manhole bases in a minimum of 6 inches of compacted clean sand or crushed rock.

E. Construction of Invert:

1. PVC Pipe Invert Channel:
   a. Install a full length of pipe through the manhole.
   b. Form a concrete bench up to the spring-line of the pipe.
   c. Slope the concrete bench toward the channel at a 1-inch per foot, minimum.
   d. Cut the top hemisphere of the pipe off for the entire length of the pipe through the manhole.

2. Formed Concrete Channel:
   a. Ensure that the channel is smooth and free of rough patches.
   b. Changes in Pipe Size or Grade: Make changes in size and grade of channels gradually and evenly.
   c. Changes in Direction: Smooth curve of as large a radius as the size of the manhole will permit with the intersection of the lines occurring at the center of the manhole.
   d. Benches: Construct the manhole floor, outside of the channel, smooth and slope toward the channel not less than 1-inch per foot but not more than 2-inches per foot.

F. Connection of Sewer Main Pipe:

1. Install sanitary sewer main in accordance with pipe to manhole gasket manufacturer's recommendations.
2. Outside Drop Construction:
   a. Install an outside manhole drop where the invert of the inlet pipe is more than 24-inches higher than the invert of the outlet pipe.
   b. Use the same material as was used for the sewer main pipe to construct the drop.
   c. Construct according to the detail drawings.

G. Top Slab Section Installation:

1. Install with the opening over the outlet of the manhole.
2. Use on shallow manholes only.

H. Conical Section Installation:

1. Install with the opening over the outlet of the manhole.
2. Install 4-feet of manhole section with cylindrical configuration before installing a conical section.
3. Use on standard manholes.

I. Joint Sealants:

1. Install flexible joint gaskets around entire circumference of each manhole joint.
2. Seal interior and exterior joints with non-shrink hydraulic cement mortar or plastic cement putty.
3. Ensure that a watertight seal is provided at all joints.
4. Install 8" mastic wrap on all exterior joints per manufacturers written recommendations.

J. High Groundwater

1. Install exterior joint collars in areas where high groundwater is encountered.
2. Install in accordance with manufacturers recommendations.
3. Where unexpected groundwater is encountered payment will be made at the negotiated cost per joint sealed.

K. Adjustment Rings:

1. Group adjustment rings in place when the manhole is constructed.
2. Install at least one adjustment ring, and no more than 12-inches of adjustment rings.
3. Grout/seal manhole rings inside and outside at the time when the manhole is constructed.

L. Frame and Cover:

1. Set manhole frames and covers to the elevation indicated on the plans.
2. If a road finish grade exists, set manhole frames and covers to the finish grade of the road.
3. Seal frame with hydrophilic butyl rubber water.

M. Refer to Section 02300 for finish grading requirements.

3.2 PRESSURE AND LEAKAGE TESTING

A. Test all manholes using a low pressure vacuum or hydrostatic exfiltration/infiltration test.

B. Provide all testing equipment and water and perform tests in the presence of an approved project representative.

C. Manholes will not be accepted prior to passing an approved leakage test.

D. Preparation:

1. Plug all lift holes.
2. Temporarily plug all pipes entering the manholes.
3. Secure all plugs to prevent them from being drawn into or blown out of the manhole.

E. Vacuum Testing Procedure: Test according to ASTM C1244.
1. Place test head at the top of the manhole in accordance with manufacturer's recommendations.
2. Pressurize manhole to 4.9 psi (10 inches of mercury).
3. Determine elapsed time for the pressure to drop 0.5 psi (1 inch of mercury) from the test pressure and use the following table to determine acceptability.

Minimum Test Times for Various Manhole Diameters (ASTM C1244)

Diameter, in									
Depth (ft)	30	33	36	42	**48**	54	60	66	72
	Times, s								
8	11	12	14	17	**20**	23	26	29	33
10	14	15	18	21	**25**	29	33	36	41
12	17	18	21	25	**30**	35	39	43	49
14	20	21	25	30	**35**	41	46	51	57
16	22	24	29	34	**40**	46	52	58	67
18	25	27	32	38	**45**	52	59	65	73
20	28	30	35	42	**50**	53	65	72	81
22	31	33	39	46	**55**	64	72	79	89
24	33	36	42	51	**59**	64	78	87	97
26	36	39	46	55	**64**	75	85	94	105
28	39	42	49	59	**69**	81	91	101	113
30	42	45	53	63	**74**	87	98	108	121

4. The time interval recorded in the field must be greater than the time listed for the depth and manhole diameter being tested and for the pressure drop recorded.
5. If the pressure drop time is less than that in the table for the diameter of manhole being tested, the test shall be considered failed.
   a. Repair manhole and retest until the test passes.

F. Hydrostatic Infiltration/Exfiltration

1. Visible manhole leakage will not be allowed
2. Hydro static head must exceed maximum estimated groundwater level by at least 12-inches.
3. Fill manholes to within 6-inches of cover frame.
4. Manholes may be filled 24 hours in advance of testing to allow for absorption.
5. Allowable leakage for a 4 foot diameter concrete manhole not to exceed 0.2gallons per foot of depth per hour.
6. Perform test for minimum of 2 hours.
7. Project Engineer has the authority to extend test in 2 hour increments up to 6 hours.

G. Repair all leakage or seepage that appears during the warranty period.

3.3 ABANDONMENT OF EXISTING MANHOLE

A. Remove and dispose of the existing frame and cover.

B. Crush in cone or top section.

C. Fill remaining void with granular fill, compacting every 1-2 feet.

D. Top soil and seed the disturbed area.

END OF SECTION

SECTION 02538 – COMMUNITY LIFT STATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the installation of precast double box culvert lift station, lift station coatings, sewage pumps, piping, lift station piping, valves, control panel, and other appurtenant items for a community sewage lift station.

1.2 RELATED WORK

A. Section 01720 – Staking and Construction Surveying

B. Section 02315 – Excavation, Trenching and Backfill

C. Section 02511 – Water Service Lines

D. Section 02530 – Sanitary Sewer

E. Section 02539 – Sewage Force Main

F. Section 02821 – Chain Link Fencing

G. Section 02920 – Topsoiling, Seeding, Fertilizing, and Mulching

H. Section 02950 – Concrete Protective Liners

I. Section 16010 – General Electrical

1.3 REFERENCES

A. ACI International (ACI):

1. ACI 318/318R Building Code Requirements for Structural Concrete and Commentary

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO H 20 LFRD Bridge Design Specifications

C. American Society of Mechanical Engineers (ASME):

1. ASME B16.12 Cast Iron Threaded Drainage Fittings
2. ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings
3. ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges
4. ASME B18.2.1 Square and Hex Bolts and Screws, Inch Series
5. ASME A112.3.1 Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above- and Below Ground

D. American Water Works Association (AWWA):

1. AWWA C151/A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

2. AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings for Water
3. AWWA C153/A21.53 Ductile-Iron Compact Fittings for Water Service
4. AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances
6. AWWA M41 Ductile-Iron Pipe and Fittings

E. ASTM International (ASTM):

1. ASTM A 48 Standard Specification for Gray Iron Castings
2. ASTM A 53/A 53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 153/A 153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
4. ASTM A 185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
5. ASTM A 615/A 615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
6. ASTM A 746 Standard Specification for Ductile Iron Gravity Sewer Pipe
7. ASTM B 221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
8. ASTM B 584 Standard Specification for Copper Alloy Sand Castings for General Applications
9. ASTM B 632/B 632M Standard Specification for Aluminum-Alloy Rolled Tread Plate
10. ASTM B 584 Standard Specification for Copper Alloy Sand Castings for General Applications
11. ASTM C 33 Standard Specification for Concrete Aggregates
12. ASTM C 150 Standard Specification for Portland Cement
13. ASTM C 443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
14. ASTM C 478 Standard Specification for Precast Reinforced Concrete Manhole Sections
15. ASTM C 748 Standard Test Method for Rockwell Hardness of Graphite Materials
16. ASTM C 890 Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
17. ASTM C 891 Standard Practice for Installation of Underground Precast Concrete Utility Structures
18. ASTM C 913 Standard Specification for Precast Concrete Water and Wastewater Structures
19. ASTM C 923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
20. ASTM C 990 Standard Specification for Jonts for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
21. ASTM F 2329 Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

F. National Fire Protection Association (NFPA):

1. NFPA NEC 70 – National Electrical Code.

G. National Electrical Manufacturers Association (NEMA):

1. NEMA MG 1 Motors and Generators
2. NEMA 250 Enclosures for Electrical Equipment (100 Volts Maximum)

H. Underwriters Laboratories (UL):

1. UL 98 Standard for Safety Enclosed and Dead-Front Switches
2. UL 508 Industrial Control Equipment.
3. UL 489 Molded Case Circuit Breakers
4. UL 698 Industrial Control Equipment for Use in Hazardous (Classified) Locations.

1.4 SUBMITTALS

A. Section 01330 – Submittal Procedures

B. Operation And Maintenance Manual:

1. Provide three (3) bound approved manuals in three ring binders.
2. Submit to Project Engineer for review prior to official start up.
3. Upon acceptance provide Tribe with three (3) USB flash drives of sufficient size to store a PDF version of the entire O&M manual and all drawings, Word Documents, and Excel Spreadsheets.
4. Index or Table of Contents with section tabs.
5. Include illustrations of each element, explanation of operation of complete control system, troubleshooting method for repairs, and maintenance checklist.
6. Provide O&M sheets indicating standard O&M and maintenance items for each element completed daily/weekly/monthly/quarterly/and yearly. Include these in digital format (Excel) on the supplied USB flash drives.
7. Control Systems:
   a. Illustration of the physical layout of the different elements of the control system and a wiring schematic which can also be used as a reference when following the explanation of the operation and maintenance.
   b. A list of test instruments required to trouble shoot the panel and detect normal or abnormal operation of the separate elements of the control panel.

8. Submersible Pumps:
   a. Instruction and maintenance manuals written by the pump manufacturer for the pump model supplied.
   b. Regular maintenance, service, repair, and parts list.
   c. Warranty information.

9. Valves:
   a. Instruction and maintenance manuals written by the valve manufacturer for the valve models supplied.
   b. Regular maintenance, service, repair, and parts list.
   c. Warranty information.

10. Sump Pump:
    a. Instruction and maintenance manuals written by the pump manufacturer for the pump model supplied.
    b. Regular maintenance, service, repair, and parts list.

c. Warranty information.

11. Crane and Winch:
    a. Instruction and maintenance manuals written by the manufacturer for the crane and winch model supplied.
    b. Regular maintenance, service, repair, and parts list.
    c. Warranty information.

12. Sewage Grinder
    a. Provide instructions and maintenance manuals written by the manufacturer for the sewage grinder model supplied.
    b. Specifically cover regular maintenance, service, and repair of the sewage grinder as well as a parts list.
    c. Warranty information.

13. Parts breakdown of all equipment in the station.
14. A discussion of the procedures to follow and observations to make in performing routine maintenance.
15. A preventative maintenance schedule for all equipment covered by the operation and maintenances manual. Include all maintenance as recommended by the various equipment manufacturers.

C. Submersible sewage pumps, discharge connections, guide rail system, stainless steel chains
D. Intermediate guide rail brackets
E. Wet well and valve vault concrete structure
F. Wet well valve vault piping locations, piping sleeves and annular seal
G. Concrete sump and aluminum grate
H. Polystyrene insulation
I. Valve vault ladder with safety post
J. Sump pump with float controls
K. 1½-inch stainless steel pipe
L. 1½-inch PVC pipe
M. PVC union
N. PVC check valve
O. Strut channel system with pipe brackets for sump pump line
P. Concrete structure cover castings, access doors and safety grate
Q. Lift station Piping coatings
    1. Include lot numbers for coatings purchased.
    2. Application Equipment & Method
    3. Contractors' Certification
    4. Coating Schedule
R. Geotextile and Geogrid
S. Concrete Protective Liner (Wet Well)
T. Backfill gravel material at base of lift station concrete structure
U. Non-shrink grout and floor repair mortar
V. Electrical disconnect & USE cable
W. Electrical control panel with system components
X. Electrical components
Y. Float switches and mounting hardware
Z. Operation and alarm lights
AA. Floodlight and switch

BB. Alarm horn
CC. Ductile iron pipe and fittings, link seals & wall sleeves, 8 mil polyethylene encasement, SST cam-lock with dust cap and security chains, & pipe supports
DD. Gate valves
EE. Check valves
FF. Water service line & compression connection
GG. Yard hydrant with vacuum breaker and check valve
HH. Curb stop w/box
II. Crane and winch with pendant controls
JJ. Chain link fencing and gate
KK. Sterilant
LL. 10 mil polyethylene sheeting
MM. Landscape Edging
NN. Crushed rock
OO. Polyethylene inlet pipe
PP. Trash basket and rail system
QQ. Ductile Iron pipe coating
RR. Engineered Fill
SS. Air Release Valve
TT. Valve Vault Ventilation Blower
UU. Level Transducer
VV. SCADA Unit
WW. Magnetic Flow Meter

1.5 AUTHORIZED SERVICE

A. Lift station pump & control supplier will have the ability to provide full time repair service on call 24 hrs.

B. Factory trained authorized serviceman and service vehicle equipped with tools and component parts necessary to make repairs available without undue delay.

1.6 QUALITY ASSURANCE

A. Coating Contractor specializes in performing the work specified with a minimum of three (3) years' experience.

B. Coating Contractors approved by manufacturer to install coatings.

1. Champion Coatings – Savage, MN.
2. Oxentenko Inc. – Bismarck, ND.
3. Protech Contracting Services Inc. – Fargo, ND
4. Mongan Painting – Cherokee, IA
5. Joes Sandblasting – Rapid City, SD
6. Blankenship Meier Painting – N Sioux City, IA 57049

C. Unlisted Coating Contractors: Submit, within thirty (30) days prior to coating preconstruction meeting, the following to the Engineer and Owner:

1. A qualification letter from the coating manufacturer.

2. Certification that all aspects of the project will be performed on their own. Sub-Contracting any portion of the project is not allowed.

3. On-Site foreman has been trained by the manufacturer in the installation of the products specified.

PART 2 - PRODUCTS

2.1 HARDWARE

A. Unless specifically stated otherwise all hardware supplied to be stainless steel including but not limited to anchors, screws, supports straps, bolts, nuts and washers.

2.2 WET WELL AND VALVE VAULT

B. Precast Concrete Structures

1. Design precast concrete structures in accordance with ASTM C 913 and ASTM C 890 for AASHTO HS20, heavy traffic, structural loading.
2. Double box style with interior wall as indicated in the plans.
3. Minimum 10-inch base cast monolithically with the first wall section and 6-inch x 3/8-inch dumbbell type PVC water stop, equal to Southern Metal & Plastic Products 15DB.
4. Tongue and groove joints.
5. Joint sealant meeting ASTM C 990, Earth Shield type 10 butyl rubber.
6. Mastic wrap on all joints minimum 12-inches wide.
7. Precast concrete according to ACI 318/318R.

C. Insulated Panel Accessories

1. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.55 pcf or VI, 1.80 pcf, minimum R value of 4.5 per inch.

D. Structural Base
1. Geogrid equal to Mirafi BXG 110
2. 3 - 5 inch Crushed Rock and not more than 5% passing No. 4 sieve.
3. Crushed Rock passing 1-1/2 -inch screen and not more than 50% passing No. 4 sieve, and not more than 10% passing the #200 sieve
4. Geotextile equal to Mirafi 180N.

E. Exterior Coating

1. Non-Shrink Grout: equal to Sikagrout 212.
2. Polyamide epoxy – coal tar, Series 46H-413 Hi-Build Tneme-Tar as manufactured by Tnemec of North Kansas City, Missouri, or Approved Equal.
    a. Usage: corrosion resistant coating providing protection for concrete in a variety of chemical, immersion and underground conditions.
    b. Thickness: Single coat at 30 mils.

F. Wet Well Interior Liner:

1. Coating Option #1
   a. Cement Based Epoxy: equal toTnemec Series 218 Mortar Clad.
   b. Fiber-reinforced modified polyamine epoxy, Series 436 Perma-Shield as manufactured by Tnemec or Approved Equal.
      1) Usage: Chemical resistant, high tensile strength, puncture-resistant, designed for wastewater immersion and fume environments.
      2) Thickness: 80 mils.

2. Coating Option #2
   a. Cement Based Epoxy: equal toTnemec Series 218 Mortar Clad.
   b. Modified epoxy mortar, Series 434 Perma-Shield as manufactured by Tnemec or Approved Equal.
   c. Modified polyamine epoxy, Series 435 Perma-Glaze as manufactured by Tnemec or Approved Equal.
      1) Usage: Chemical resistant, high tensile strength, puncture-resistant, designed for wastewater immersion and fume environments.
      2) 434 Perma-Shield Thickness: 125 mils.
      3) 435 Perma-Glaze Thickness: 20 mils.

3. Polysulfide Joint Sealant equal to THIOKOL 2235M

G. Pipe Openings:

1. Furnish openings at pipe penetrations as indicated on Drawings.
2. Annular Seal: Non shrink grout shall be placed in the annular space around the pipe and troweled smooth.
3. The wet well liner shall be patched utilizing by overlapping liner material and extrusion welded as specified in Section 02950 – Concrete Protective Liner.

2.3 ACCESS DOORS AND FRAMES

A. Pump Access

1. Single leaf, 36-inch by 60-inch
2. Cover leaf(s): 1/4-inch aluminum diamond plate.
3. Angle Frame: 1/4-inch with continuous anchor flange.
4. Load Rating: 300 psf uniform live load with a maximum allowable deflection of the 1/150 span.
5. Locking System: non-corrosive locking bar used in conjunction with an owner supplied padlock.
6. Cover equipped with the following: Type 316 stainless steel heavy duty hinges and hardware, tamper proof attaching hardware, automatic hold open arm that automatically locks door open at 90 degrees, and latch.
7. Hinged aluminum grating panel, equal to Halliday Products Series X Retro-Grate or approved equal.
8. S1R (single leaf) series access frames and covers as manufactured by Halliday Products, Inc. or Approved Equal.

B. Debris Basket Access

1. Single leaf, 24-inch by 24-inch
2. Cover leaf(s): 1/4-inch aluminum diamond plate.
3. Angle Frame: 1/4-inch with continuous anchor flange.
4. Load Rating: 300 psf uniform live load with a maximum allowable deflection of the 1/150 span.
5. Locking System: non-corrosive locking bar used in conjunction with an owner supplied padlock.
6. Cover equipped with the following: Type 316 stainless steel heavy duty hinges and hardware, tamper proof attaching hardware, automatic hold open arm that automatically locks door open at 90 degrees, and latch.
7. S1R (single leaf) series access frames and covers as manufactured by Halliday Products, Inc. or Approved Equal.

C. Valve Vault Access

1. Single leaf, 30-inch by 36-inch
2. Material: 11 gauge aluminum cover and frame.
3. Cover: Break formed, hollow-metal design with 1-inch concealed fiber glass insulation, 3-inch beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf live load.
4. Curb: 12-inch in height with integral cap flashing, 1-inch fiberboard insulation, fully welded at corners, and 3-1/2 inch mounting flange with 7/16-inch holes provided for anchoring to concrete.
5. Gasket: extruded EPDM rubber gasket permanently adhered to cover.
6. Hinges: Heavy-duty pintle hinges with 3/8-inch” Type 316 stainless steel hinge pins.
7. Latch: Slam latch with interior and exterior turn handles and padlock hasps.
8. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
9. Finish: Type 304 stainless steel with bead blast finish.
10. Hardware: Type 316 stainless steel.
11. Type S Roof Hatch – Ladder Access manufactured by The BILCO Company or Approved Equal.

2.4 SEWAGE PUMPS

A. Wet-Well Waste Water Pumps: Non-clog submersible type centrifugal pump with auto coupling, designed to handle raw, unscreened sewage, storm water, sludge, or similar contaminated liquid, with induction type electric motor assembled in a single body, watertight NEMA Type B chamber, and capable of repeatedly passing spherical solids up to 3-inches in diameter.

B. Provide units as a complete system with guide rail assembly and piping.

C. Designed to automatically connect to discharge piping when lowered into place on the discharge connection.

D. Easily removable for inspection service requiring no bolts, nuts or fasteners.

E. Removable without the need for personnel to enter wet well.

F. Pump Performance Requirements:

1. Capacity: 95 gpm.
2. Motor Size: 15 hp.
3. Total Dynamic head: 63 feet.
4. Motor Performance: Motor sized so that pump is non-overloading through pump performance curve from shut-off through run-out.
5. Pump Performance: Continuous duty handling pumped media up to 104 deg. F with up to 15 evenly spaced starts per hour.
6. Watertight Performance: Continuous leak-free submergence to 65 feet.
7. Motor Cooling System Performance: Capable of allowing motor to run continuously under full load while in unsubmerged condition.
8. Equal to Vaughan Model S3P Chopper Style Pump with 1745 RPM and 9.70" Impeller.

G. Pumping Station Electrical Characteristics:

1. Volts: 480 V.
2. Phases: Three.
3. Frequency: 60 Hz.

H. Motor and Pump Construction

1. Stator casing, oil casing, volute, impeller material, and bottom plate: Cast Iron, ASTM A 48 Class 35B, smooth cast, free of porosity or other irregularities. Coated with Rubber asphalt paint on the entire exterior except for nameplate and SS hardware.
2. External nuts, bolts, washers and hardware shall be stainless steel.
3. Single Piece Motor and Pump Shaft: Stainless steel, AISI Type 420.
4. Lifting Loop: Stainless steel, AISI Type 316.
5. Impeller: 2 vane chopper style.
6. Bearings: Permanently grease lubricated upper ball bearing, lower two-row angular contact bearing, sized to transfer radial and thrust loads to pump housing, with L-10 bearing life of 1,000,000 hours at ½ to 1-1/2 BEP flow.
7. O-rings: Nitrite rubber (NBR).
8. Shaft Seals: Double tungsten carbide/ carbide mechanical seals. Seals independent of rotation direction and resistant to temperature shock. Seal oil inspection done without need for disassembly. **Single seals are not acceptable.**
9. Seal Failure System: Moisture probe mounted in moisture sensing chamber designed for detecting presence of water and signals an inspection alert if there is a leakage at the shaft seals.
10. Protective Coating: High solids epoxy, for components in contact with pumping media not required to be stainless steel.
11. Cables: SOOW and sealed against moisture migration.
12. Cable Length: Minimum 50 feet.

I. Motor:

1. Description: Enclosed submersible air-filled.
2. Efficiency: IEC rated.
3. Voltage Tolerance: +/- 10 percent.
4. Rotor: Squirrel cage.
5. Temperature Rise: NEMA Class A.
6. Insulation: Class F moisture resistant.

7. Capable of continuous operation when totally, partially or non-submerged.
8. Auto resetting bi-metallic temperature monitor on each phase within stator windings.

J. Auto Coupling And Guide Rail Assembly:

1. Sliding single or double rail design with machined yoke connected to discharge connection.
2. Two inch diameter, standard weight, type 304 stainless steel pipe.
3. Stainless steel upper guide holders for mounting on access frame.
4. Intermediate stainless steel guide rail brackets for depths over 20 feet.
5. Auto Coupling System: Cast iron ASTM A 48, Class 40B, 90 degree bend, same manufacture as pump.
6. All stainless steel bolts, nuts, washers, fasteners and accessories.

K. Safety Chain and Hanging Hook:

1. ¼-inch, Type 304 stainless steel safety chain rated for lifting, with 305 stainless steel bolt pin and cotter key used to connect pump handle. Length to extend from pump to access opening. Provide one chain for each pump.
2. Provide stainless steel hanging hooks mounted on the interior of the access opening in the number required in the drawings and as requested by Project Engineer.

2.5 WET-WELL ACCESSORIES

A. Debris Basket:

1. Material: Type 316 stainless steel, 16 gauge all welded construction.
2. Perforated sheets for sides and back with 2-inch diameter holes spaced at 6-inch on center.
3. Bar screen bottom with 2-inch clear opening between ¼-inch x 2-inch flat bars. Stainless steel hinge welded to bottom and back to allow easy emptying of basket with stainless steel hasp and eye.
4. Guide Rails: 1-1/2 inch, schedule 40, Type 316 stainless steel pipe and support brackets, height to extend from invert inlet to access frame.

B. Ventilation: 4-inch stainless steel pipe and mounting flange, #4 stainless steel mesh screen.

2.6 SUMP PUMP

A. Valve Vault Sump Pump: Non-clog submersible type centrifugal pump, 1 1/2-inch outlet, induction type electric motor assembled in a single body, and capable of repeatedly passing spherical solids up to 3/4-inches in diameter. Provide unit as a complete system with piping and splice box.

B. Pump Performance Requirements:

1. ABS Model Scavenger EF-04W.

C. Discharge Piping And Valves:

1. 1½ -inch Schedule 80 PVC pipe conforming to ASTM D 1785, with solvent weld fittings.
2. 1½-inch Schedule 40 stainless steel, with threaded fittings.
3. All fittings solvent welded.
4. 1½ -inch PVC check valve with compression coupling on both ends, Series 1500 as provided by Flow Control.
5. 1½ -inch solvent weld PVC union.

D. Splice Box: PVC, NEMA 4X rated, water tight cord grips, Model SB-3 manufactured by Orenco Systems, Inc. or approved equal.

2.7 VALVE VAULT ACCESSORIES

A. Ladder:

1. Meet all OSHA requirements under 1910.27.
2. Material: All ladder components 6061-T6 extruded aluminum. All floor plates, mounting hardware, nuts, bolts, and washers Type 304 stainless steel.
3. Steps: 1-1/4 inch wide flat surface with no-slip tread welded to ladder, 16-inch net interior width between ladders rails, spaced 12-inch on center.
4. Ladder Rails: Maximum 20-inch sections, design capable of mounting a fall safety device on either side of ladder.

B. Ladder Safety Post:

1. Material: Aluminum
2. Hardware: All mounting hardware Type 316 Stainless Steel.
3. Ladder Up Safety Post as provided by The BILCO Company or Approved Equal.

C. Ventilation:

1. Two (2) 4-inch stainless steel pipe and mounting flange, two 90 degree bends and #4 stainless steel mesh screen opening.
2. Blower: direct driven by a shaded pole, explosion proof, 1 phase, 60-hertz, 115-volt motor
   a. Statically balanced to assure quiet performance.
   b. High efficiency type blower with a capacity of 458 cubic feet per minute at 0.2 inches static pressure.

2.8 PUMPING STATION CONTROLS

A. Motor Controllers: Magnetic, full voltage, non-reversing. Include under voltage release, thermal overload heaters in each phase, manual reset button, and hand-off-automatic (H-O-A) selector switches. Include circuit breakers to provide branch-circuit protection for each controller.

B. Install labels to identify switches and controls; laminated wiring schematic mounted on the inside of the control panel door.

C. Control Panel: Complying with UL 508A, weatherproof enclosure, covered compartments sized to accommodate controllers, circuit breakers, transformers, alternators, and programmable logic controller.

1. Enclosure: NEMA 250, Type 4X, Stainless steel AISI Type 304 or 316L, pad-lockable provision with hold open latch.
   a. Pocket secured to inside of outer door for storage of panel information.

2. Dead front Inside Door: Limit direct access to the electrical devices, components, and wiring with 14 gauge stainless steel dead front door. Provide openings for reset push-buttons, Hand-Off-Automatic selector switches, Indicating Lights, and other appurtenances as necessary.
3. Panel Listing: UL 698A.
4. Main Disconnect Switch: Non-fusible, touch-safe, with through the door operator, UL 98- and UL 508- listed, Square D Class 650 or equal.
5. Circuit Breakers: Molded case thermal magnetic type, DIN rail mounted, UL 489. Provide one breaker for each pump power circuit, one breaker for control power, one breaker for convenience outlet, and one for sump pump; Square D Class 650 or equal. Square D Q0, or approved equal, for single phase loads.
6. Control Power Transformer: Panel mounted, UL listed, 480 VAC primary and 120 VAC input and output, sized as required for controls and accessory components.
7. Connect the grounding lug in the control panel to a 9-foot long copper plated steel core driven adjacent to the control panel with a #6 AWG copper wire, in accordance with NEC requirements.
8. Lightning Arrester: For incoming power line, Delta 300 series or approved equal.
9. Cord and Cable Connectors: Nema 4X, watertight; polyamide body, nut, and locknut; neoprene bushing. One sealing locknut for each cord running through enclosure.
10. Install cables not entering the wet well within Sch. 80 solvent weld conduit up to their entrance to the panel and seal gas tight.
11. Terminal Blocks: Numbered, #26-4 AWG capacity.
12. Power outlet for winch motor: GFCI single receptacle in weatherproof housing sized to accommodate motor size.
13. Convenience Outlet: 20A GFCI duplex receptacle in weatherproof mounting on exterior of panel and inside valve vault.
14. Floor Stand Kits: Stainless steel, 24-inch in height, mounting to concrete pad, louvered skirting allowing for venting the space below the enclosure, and stainless steel bolts.
15. Lighting: LED light, waterproof fixture, 24-inch length, 12V DC power supply, average life of 50,000 hours as manufactured by Super Bright LEDs Inc. model WFL-WW60SMD or approved equal.
    a. Activated upon opening exterior panel door.

16. Properly sized generator plug-in mounted in a weatherproof box attached to the exterior of the control enclosure. Coordinate with Tribal Department to ensure compatibility between generator plug-in and the make and model of the Department's generator.

D. Motor Starters:

1. Motor Contactor: NEMA rated, with one (1) normally-open auxiliary contact for each pump. Each contactor shall be connected to a Hand-Off-Auto (H-O-A) module mounted on the deadfront inner door. Contactor faults shall be capable of being reset via push-button on the H-O-A module without opening the deadfront inner door.

2. Provide one H-O-A selector switch for each pump Square D Class 9001 corrosion-resistant Type SK or approved equal.
3. Overload Relay: Solid state type Square D Class 9065 Type S or approved equal.
4. Provide a lead pump selector switch, operable through the inner door, Square D Class 9001 corrosion-resistant Type SK or approved equal. This switch shall provide manual override of pump lead designation to the PLC.
5. Pump lead/lag alternation shall be performed by the PLC/SCADA system. No physical alternating relay shall be provided.The PLC shall provide automatic alternation of pumps based on runtime (or duty cycle) and shall allow for manual lead selection via the lead pump selector switch. Alternation logic and status shall be integrated into the SCADA system.

E. Control Relays:

1. General Purpose Relays: 12A contacts, DIN-rail mounted, touch safe socket, coil pilot light.
2. Three-Phase Voltage Monitor Relay: Standard plug-in base with DIN-rail mounted socket and SPDT isolated 10A contacts.
3. Seal Failure Sensor Relay: DIN-rail mounted SPDT conductivity-based liquid-level control with adjustable sensitivity and LED indicator.
4. Intrinsically Safe Relay: UL 698a, utilizing transformer isolated barrier circuit to determine float switch status and relate status to controller module via electromechanical output.
5. Current Sensor: UL-listed with selectable amperage range, to convert monitored AC current to proportional DC voltage range of 0 to 5 volts.
6. Float Switch Relays: Square D Type KU or approved equal.
7. Alarm Relay: Square D Type KU or approved equal.

F. Operator Interface Devices: Provide the following, with pre-programmed operator interface terminal:

1. Elapsed Time Meter: 6 digits, non-resettable, reading in hours of operation, for each pump, Cramer or approved equal.
2. Cycle Counter: 6 digits, non-resettable pump start counters for each pump, Redington or approved equal.
3. Indicating Lights: 30mm, heavy-duty, oil-tight, push-to-test circuitry mounted on dead front door, Square D Class 9001 corrosion resistant type SK or approved equal. For each pump provide green indicating light for Pump On/Running. For each pump provide red indicating light for Pump Failure for overload condition, Pump Over Temperature, and Pump Seal Failure.
4. Failure Alarm: UL listed for wet location, green and red polycarbonate globe, alarm mounted on the outside of the control panel, RAB Permaglobes or approved equal.
5. Push-To-Silence Switch with Audible Alarm: NEMA Type 4x, semi-flush panel mounting to outside of control panel, Edwards Signaling 870P-NS or approved equal. Provide push to silence button on outside of panel, Square D Class 9001 corrosion resistant Type SK or approved equal.
6. Flood light: General Electric Model QHFP500A halogen 120 volt 500 watt lamp with adjustable swivel or equal. On/off switch mounted on outside of panel in weather proof housing.

G. Heat Sensor contacts (motor Interrupt): Supplied for motors with required external over-temp connection. Default disabled with terminal link.

H. Programmable Logic Controller: SCADA capable, with dedicated phone line and the following system data screens:

1. Elapsed Time Meter for Each Pump (logs data in Auto mode).
2. Even Counter for Each Pump (logs data in Auto mode).
3. Lag Counters (Pumps on Cycles event counter in lag mode).
4. High Level Counter (Float event counter after alarm delay).
5. Low Level Counter (Float even counter).
6. Power Fault Counter.
7. Operating Hours (POH).
8. Soft Touch keys.
9. Alternator and lead pump selector.

I. Level Control System: Control the pumps based on the wet well level using a four float system. As the level increases, the lead pump starts when the level reaches the Lead Float. If the level continues to increase, the lag pump starts when the level reaches the Lag Float. When the level decreases, all pumps stop when the level reaches the Off Float.

1. Control Type: Float switches (four-float system)
2. Control Levels: Off Float, Lead Float, Lag Float, and High Water Level Float

J. Provide a SCADA system integrated with the control system PLC. The control platform shall be based on an Allen-Bradley CompactLogix 5069 Series PLC or approved equal, capable of supporting SCADA communications and remote monitoring.

The SCADA system shall transmit information to a Human Machine Interface (HMI) and/or remote monitoring platform accessible by the Owner. At a minimum, the system shall provide the following data:

1. Lift station instantaneous and total flow
2. Flow meter empty detection
3. Wet well elevation (from transducer)
4. High level alarm
5. Pump status (on/off/fail/alarm)
6. Pump daily and total run times
7. Pump designation (lead or lag)
8. Pump alternation enabled/disabled
9. The SCADA system shall not provide control of any of the aforementioned functions at the HMI and shall be for monitoring only.
10. System Requirements
    a. The SCADA system shall be capable of remote monitoring via Ethernet and/or cellular communication.
    b. The system may utilize a cloud-based SCADA platform or equal, provided it meets the functional requirements specified herein.
    c. The system shall provide alarm notification capability, including user-configurable callouts (text, email, or equivalent)

d. All data points listed shall be accessible to the Owner through the SCADA interface.
e. The SCADA system shall be configured for monitoring only; no remote control of pumps or process equipment shall be permitted unless otherwise specified.

11. Compatibility and Integration
    a. The SCADA system shall be fully integrated with the PLC and provided as a complete, functional system by the control system supplier.
    b. All communication hardware (including modem, router, or gateway if required) shall be included to provide a complete and operational system.

K. Level Transmitter: Transmitter shall be 2-wire, 4-20mA Level Rat by KPSI, Dwyer PBLT2 Series, or approved equal.
1. The specific model shall be selected to accommodate a minimum pressure range of 0–15 psi (or as required by site conditions).The transmitter shall be located in a suitable location as specified in the plans.
2. The transmitter shall be provided with sufficient factory cable length for installation.
3. The transmitter shall be installed in a location as shown on the plans and suitable for accurate and reliable level measurement.
4. The transmitter shall provide the primary level signal to the PLC for continuous level monitoring and pump control.
5. Backup Level Control (Floats):
    i. Provide discrete level float switches for backup control, including at a minimum:
        1. Pump Off (Low Level)
        2. Lead Pump Start
        3. Lag Pump Start (If applicable)
        4. High Level Alarm
    ii. Float switches shall be wired to the PLC and configured to provide redundant control in the event of level transmitter failure or out-of-range signal.
6. Control Integration:
    i. The PLC shall utilize the level transmitter as the primary control input for normal pump operation, including start/stop and alternation functions.
    ii. Float switches shall serve as backup control and alarm inputs and shall automatically assume control if the level transmitter signal is lost, fails, or exceeds defined limits.
    iii. Both analog (transducer) and discrete (float) signals shall be fully integrated into the PLC and SCADA system
7. Compatibility and Supply:
    i. All level transmitters, float switches, and associated hardware shall be provided by the pump control manufacturer to ensure full compatibility with the PLC and control system.

L. Communication: Provide communication method (cellular, Ethernet, or telephone) as required to support the SCADA system.

M. Electromagnetic Flow Meter: Badger Meter M-Series Model M2000 detector with remote amplifier or approved equal. The detector shall be wired into the PLC so that its information can be communicated to the HMI.

Communication wires between the detector and remote amplifier shall be inserted through rigid non-metallic Schedule 80 conduit, which shall be supported with stainless steel pipe clamps manufactured by B-Line Systems or approved equal. Stainless steel anchors shall be used for fastening all electrical conduits to concrete.

The detector shall include three measuring electrodes that allows for empty pipe condition detection that switches the detector to stop measuring to maintain accuracy. The detector shall require the following features:

1. Type 316 stainless steel electrode materials
2. Type 316 stainless steel pipe spool material
3. Type 316 stainless steel flanges drilled and faced per ANSI B16.5 Class 150
4. Required minimum straight pipe lengths of 3x's and 2x's the pipe diameter up and downstream of the detector measured from the centerline of the unit, respectively
5. Remote signal ability
6. Measurement largely independent of flow profile
7. NSF listed
8. Junction box enclosure protection powder coated die-cast aluminum, NEMA 4
9. Cable entry via 1/2-inch NPT cord grip

The remote amplifier shall require the following features and be mounted in the control panel:

1. AC power supply
2. 20VA or 15 Watts power
3. ±0.25% accuracy independent of fluid viscosity, density, and temperature for velocities greater than 1.64 feet per second
4. ±0.004 feet per second for velocities less than 1.64 feet per second
5. Flow range of 0.1 to 39.4 feet per second
6. Programmable and scalable analog output 4-20 mA
7. Wall mountable
8. Three 1/2-inch NPT cord grips cable connections
9. NEMA 4X cast aluminum powder coated housing
10. 0-10 percent of max. flow programmable low-flow cut off
11. US gallons unit of measure
12. 4x20 character display with backlight

2.9 HOIST

A. Design Factor: Design all components including the lifting winch and base with a factor of 3:1 or greater.

B. Load Capacity: 1000 lbs. when boom is fully extended and load is 59 feet below surface. 2000 lbs. at the boom's shortest length.

C. Clearance: Minimum 36 inches between surface and boom.

D. Boom Angle: Adjustable at all times up to 45 degrees, screw jack operated.

E. Rotation: Capable of rotating 360 degrees in the base on pin bearing and bearing sleeve.

F. Portability: Crane capable of breaking down into single components not weighing more than 100 pounds.

G. Winch Motor: Electric motor, non-ventilated or fan cooled, with anti-friction bearings, minimum Class B insulation, reversible with torque characteristics suitable for the hoist service, operating at specified loads, NEMA 4 pendant control on a minimum 6 foot control cord.

H. Supply with power cord of sufficient length to connect to designated control panel receptacle and operate hoist without restriction.

I. Pedestal Base: Capable of mounting on lift station lid, 16-inchx16-inchx0.5-inch base plate, extend 15 inches above surface.

J. Series 5PA10 crane, Series E2X electric winch, model 5PA10 base as manufactured by Thern Inc. or approved equal.

K. Accessories: Stainless steel bolts and nuts, minimum ¼-inch stainless steel wire, additional galvanized steel clevis grab hook on boom, ¼-inch stainless steel chain, two steel slip hooks large enough to be lowered into the wet well and hook on to the top of the pumps.

2.10 PIPING AND VALVES

A. Ductile Iron Pipe And Fittings

1. Pipe: Conform to AWWA C151 and AWWA C150 for thickness class.
2. Flanged Ends: Conform to AWWA C115.
3. Fittings: Conform to AWWA C110.
4. Provide stainless steel nuts, bolts, and washers.
5. Shop Applied Interior Lining And Exterior Coating: modified polyamine epoxy, Series 431 Perma-Shield PL as manufactured by Tnemec or Approved Equal.
6. Pipe Supports: Stainless steel, floor mounted, adjustable.
   a. Plant & Flanged Equipment Co., Minneapolis, Minnesota, or approved equal.

B. Gate Valves

1. Conforming to AWWA C515.
2. Flange ends conforming to AWWA C115 where indicated in Drawings.
3. Valve wedge constructed of ductile iron in sizes 4 inches-12 inches.
4. Triple O-ring stem seals.
5. Supply valves with mechanical joints.
6. A non-rising stem (NRS), 2-inch square operating nut, opening counter clockwise. Provide hand wheel on gates valves inside valve vault.

7. Interior Lining And Exterior Coating: Fiber-reinforced modified polyamine epoxy, Series 431 Perma-Shield PL as manufactured by Tnemec or Approved Equal.
8. Equal to Mueller 2360 Series, Waterous Series 500 or American Flow Control Series 2500.

C. Check Valves

1. Conforming to AWWA C508.
2. Flange ends conforming to ANSI B16.1, Class 125.
3. Capable of passing a 3-inch solid.
4. One-piece EPDM disc construction, precision molded with an integral O-ring type sealing surface and reinforced with alloy steel.
5. Series 500 Swing Flex check valve, Val-Matic Valve and Manufacturing Corporation or approved equal.

2.11 CRUSHED ROCK COVER

A. Plastic Sheeting: 10 mil thickness

B. Soil Sterilant: Pramitol or approved equal

C. Landscape Edging

1. Rigid “L” shaped edging.
2. Mill finish aluminum strip, 6063 alloy with T-6 hardness.
3. Dimensions: 1/8” x 3-1/2” x 16’.
4. Loops every 2 feet with 8-inch sliding connection piece.
5. 12-inch aluminum stakes.
6. PermaStrip as manufactured by the PermaLoc Corporation or approved equal.

D. Crushed Rock: 1½-inch washed crushed rock.

2.12 FROST PROOF YARD HYDRANT

A. Frost proof buried to depths indicated in plans.

B. Inlet: ¾-inch NPT.

C. Outlet: ¾-inch brass house thread.

D. Rod: Stainless steel operating rod thru Teflon packing.

E. Automatic self-adjusting plunger.

F. Stand Pipe: 1-inch brass.

G. Model Any Flow as manufactured by Merrill Manufacturing of Storm Lake, Iowa.

H. Accessories:

1. Hydrant assist kit provided by Seppman Enterprises, model HAK 750.

2. Vacuum breaker, model NF8 as manufactured by Watts of North Andover, Massachusetts.
3. 50’ heavy duty 5/8-inch rubber hose with brass hose connection.
4. Metal Hose Hanger mounted on interior of valve vault.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

C. Coordinate power service with local utilities and owner.

D. Contact and coordinate with local utility for connections of new sewage collection facilities

E. No temporary bypass pumping will be paid for under this contract. Maintain continuous sewage collection with minimal down time throughout construction.

1. Submit plan for maintaining sewage flow for approval to Project Engineer.

F. Form, pour and finish all precast structures in a manner so as to protect access covers from damage or concrete splatter.

3.2 PRECAST CONCRETE STRUCTURE INSTALLATION

A. Excavate:

1. Excavate for structure in accordance with Section 02315 in locations and to depth shown. Provide clearance around sidewalls of structure for construction operations.
2. When groundwater is encountered, prevent accumulation of water in excavations. Place structures in dry excavations.

B. Lift precast structures at lifting points designated by manufacturer.

C. When lowering structures into excavations and joining pipe to units, take precaution to ensure interior of pipeline and structure remains clean.

D. Set structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 02315 or on other support system shown on Drawings.

E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly.

F. Assemble multi-section structures by lowering each section into excavation. Install rubber gasket joints between precast sections in accordance with manufacturer's recommendations.

1. Lower, set level, and firmly position base section before placing additional sections.
2. Prior to backfilling but after coal tar coating has been applied install 12-inch mastic wrap on all joints in accordance with manufacturer's recommendations.

G. Verify structures installed satisfy required alignment and grade.

1. Ensure access openings are aligned with incoming and outgoing piping perforations to allow for installation of guide rails and pumps.

H. Exterior Lift Station Coating

1. Prior to any coating activities taking place the Project Engineer will conduct a coating pre-construction meeting.
2. Allow precast structures to cure for a minimum of 28 days at 75 degrees F prior to coating.
3. Clean and sand blast exterior of precast structure to expose and remove all holes, honeycombs or structural defects to a minimum CSP-2 surface profile.
4. Fill all exposed holes, honeycombs and defects with non-shrink grout.
5. Prepare and apply exterior surfaces to receive coating in accordance with the manufacturer's recommendations at the thickness specified in section 2.1.D.
6. Exclude the top and sides of the cover slabs from this process.

I. Interior Wet Well Lining
1. Install lining prior to concrete pout in accordance with provisions of Section 02950.
2. Use extrusion welder or patches on areas that may have been damaged during installation of appurtenances.
3. Upon completion of seam welding but prior to putting into service test liner with High Voltage Discontinuity (spark) tester equal to Tinker & Rasor AP/W High Voltage Holiday Tester.
4. Contact liner manufacturer for test procedures and voltage recommendations.
5. Install 9-inch grout ring on the interior bottom of wet well upon complete cure of coating system.
6. The wet well liner shall be applied by the manufacturer in a controlled facility. The Contractor shall not apply the wet well liner in the field.

J. Attach piping at location indicated in planes and firmly anchor before backfilling around structure.

K. Prepare valve vault interior to elevations shown on plans. Use engineered backfill in accordance with Section 02315.

L. Pour concrete slab in valve vault in accordance with Section 03100.

M. Backfill in accordance with Section 02315.

3.3 VALVE VAULT APPURTENANCES

A. Pipes Fittings Valves:

1. Prepare all DI piping in accordance with the coating manufacturer's recommendations.
   a. Factory coat all piping prior to installation.
   b. Take care not to overcoat pipe spigot end to allow insertion in to bell with gasket installed.
   c. Connect flanged fittings with stainless steel nuts, bolts and washers and protect coating from damage.
   d. Repair damaged coatings with the same product supplied by manufacturer.

2. Install at locations and configurations shown in Drawings.
3. Lower pipe and fittings into structure with suitable equipment to prevent damage to the material, lining, or coating. Do not drop or dump material into structure.
4. Coat all fitting bolts with anti-seize lubricant. Use washers between all nuts and bolts.
5. Mount piping on painted steel floor supports and anchor to concrete.
6. Apply touch up coats to pipe and fittings in areas that may have been damaged during installation.

B. Ladder:

1. Install at locations shown in Drawings.
2. Install ladder and safety device in accordance with manufacture's recommendation.
3. Install ladder safety post in accordance with manufacture's recommendations.

C. Sump pump:

1. Install at location shown in Drawings.
2. Secure discharge piping to wall at evenly spaced intervals.
3. Wire sump pump to control panel in accordance with National Electric Code.
4. Run cables though non-metallic tubing securely attached to wall.
5. Locate splice boxes as high as possible on vault wall.

D. Electrical:

1. Install lighting fixtures at elevations shown in Drawings and a maximum of 8 inches from edge of ladder.
2. Wire all fixtures and switches in accordance with National Electric Code. Run cables through non-metallic tubing securely attached to wall.
3. Wire ventilation blower to operate upon opening of valve vault access hatch.

3.4 WET WELL APPURTENANCES

A. Pipes Fittings Valves:

1. Install at locations and configurations shown in Drawings.
2. Align guide rails with access opening and incoming and outgoing piping penetrations. Ensure piping transitions from the wet well through the valve vault straight and true without the need of external stress on piping or fittings.

3. Lower pipe and fittings into structure with suitable equipment to prevent damage to the material, lining, or coating. Do not drop or dump material into structure.
4. Coat all fitting bolts with anti-seize lubricant. Use washers between all nuts and bolts.
5. Apply touch up coats to pipe and fittings in areas that may have been damaged during installation.

B. Debris Basket:

1. Install at locations shown in Drawings and in accordance with manufactures recommendation.
2. Maximum 6 foot for edge anchors.

3.5 CONTROL PANEL

A. Control Sequence of Operation: Cycle each pump on and off automatically to maintain well wastewater level. Automatic control operates both pumps in parallel if well level rises above starting point of low-level pump, until shutoff level is reached. Automatic alternator, with manual disconnect switch, changes sequence of lead-lag sewage pumps at completion of each pumping cycle.

B. Installation:

1. Install control panel in location shown on Drawing and in accordance with manufactures recommendations.
2. Connect to power and equipment in accordance with National Electric Code.
3. Mount laminated wiring schematic on inside of the control panel door.
4. Attach Waterproof LED light fixture to the front interior top of the control panel with industrial strength double sided tape.
   a. Mount so LED casts light on both the dead front panel and interior.
5. Install flood light in locations shown on the plans or as directed by Project Engineer and aim at so that control panel and hatch area are illuminated.

C. Start-up Service:

1. Provide skilled factory trained technician when lift station is put into service and turned over to the Tribe.
2. Lift station is the property of the contractor until it is fully functional and an official start-up has been completed.
3. Notify Engineer minimum 1 week prior to scheduling start-up.
4. Submit O&M manuals prior to scheduling start-up.
5. Record all running amps, complete pump flow calibration and provide results to utility manger in digital format.

3.6 GENERAL ELECTRICAL

A. In accordance with Section 16010.

B. Mount light switch and alarm silence button on the exterior of the control panel.

3.7 YARD HYDRANT

A. Install hydrant at location indicated in Drawings and in accordance with manufactures recommendations.

B. Refer to Section 02511 for water service line installation instructions.

C. Set coupler vertical on a precast concrete block.

D. Place 5 cubic feet of crushed rock around hydrant for drainage.

E. Pour 36-inch square concrete pad with concrete meeting requirements of Section 03100.

3.8 FENCING

A. In accordance with Section 02821 and Section 02822.

3.9 CRUSHED ROCK

A. Grade, shape, smooth and compact entire site around lift station including 2 feet outside of fence foot print to a depth of 3 inches below finished grade.

B. Sterilized entire graded site prior to placement of plastic sheeting.

C. Completely cover area with plastic sheeting overlapping any seams by a minimum of 12 inches.

D. Place landscape edges in the locations indicated in the plans and secure with 12-inch aluminum spikes spaced every 2 feet. Cut base edge to permit shaping to existing site.

E. Placing less than or in excess of the required 3-inch thickness in order to meet finished grade due to improper finished grading will not be allowed.

F. Maximum 2-inch gap between bottom of fence and crushed rock cover.

3.10 TOPSOILING AND SEEDING

A. In accordance with Section 02920.

3.11 ABANDONMENT OF EXISTING LIFT STATION

A. Disconnect electrical service and remove junction box

B. Remove all piping, cable, pumps, controls, etc. and dispose of per owner’s request.

C. Remove access hatches and crush in top slab of lift station and valve vault.

D. Fill remaining void with granular fill and compact in 1-2 foot lifts.

E. Cover with top soil and seed disturbed area.

3.12 HYDROSTATIC LEAK TEST

A. Contractor to perform hydrostatic leak test to ensure wet well of lift station is leak free.

B. Fill interior of wet well with water to a point above the sump pump pipe penetration. That elevation shall be above all wall joints and link seal wall penetrations.

C. Perform Test for a minimum of 2hrs.

D. No water shall enter into the valve vault during the testing period. If it does, test failed and Contactor shall correct the issue to make sure the valve vault is sealed leak proof.

END OF SECTION

SECTION 02539 – SEWAGE FORCE MAIN

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the installation of sewage force mains, valves, and other appurtenant structures for community sewage force mains.

1.2 RELATED WORK

A. Section 01720 – Staking and Construction Surveying

B. Section 02315 – Excavation, Trenching and Backfill

C. Section 02532 – Sanitary Sewer Manholes

D. Section 02920 – Topsoiling, Seeding, Fertilizing, and Mulching

1.3 REFERENCES

A. ANSI/AWWA C104/A21.4 – Cement-Mortar Lining for Ductile Iron Pipe and Fittings

B. ANSI/AWWA C110/A21.10 – Ductile Iron and Gray Iron Fittings

C. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

D. ANSI/AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings

E. ANSI/AWWA C150/A21.50 – Thickness Design of Ductile Iron Pipe

F. ANSI/AWWA C151/A21.51 – Ductile Iron Pipe, Centrifugally Cast

G. ANSI/AWWA C153/A21.53 – Ductile Iron Compact Fittings for Water Service

H. AWWA C512 - Air Release, Air/Vacuum, and Combination Air Valves

I. ANSI/AWWA C509 – Resilient Seated Gate Valves for Water Supply Service

J. ANSI/AWWA C515 – Reduced Wall, Resilient Seated Gate Valves for Water Supply Service

K. ANSI/AWWA C550 – Protective Epoxy Interior Coatings for Valves and Hydrants

L. ANSI/AWWA C600 – Installation of Ductile Iron Mains and Their Appurtenances

M. ANSI/AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

N. ANSI/AWWA C651 – Disinfecting Water Mains

O. ANSI/AWWA C900 – PVC Pipe and Fabricated Fittings, 4 Inch Through 12 Inch for Water Transmission and Distribution

P. ANSI/AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 Inch Through 3 Inch, for Water Service

Q. ANSI/AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 Inch Through 63 Inch, for Water Distribution and Transmission

R. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

S. ASTM D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

T. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

U. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

V. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

W. ANSI/AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In., for Water Distribution and Transmission

X. Plastics Pipe Institute, Incorporated – Handbook of Polyethylene Pipe

Y. Standard Methods for Examination of Water and Wastewater

1.4 SUBMITTALS

A. Force main pipe and fittings

B. PE Pipe: Pipe Butt Fusing Equipment and Transmission Main Couplings

C. Gate Valves with Boxes, Adaptors, and Stem Extensions

D. Air Release/Vacuum Valve and Vault

E. Air Release Vault Frame and Cover

1.5 ACCEPTANCE

A. Work covered by this section will not be accepted until the backfilling and testing connected with the work has been completed satisfactorily.

B. Any section of sewer force main that is found defective in material, alignment, or joints before acceptance must be corrected.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Pipe size, material, and pressure rating as indicated on the bid schedule.

B. Ductile Iron Pipe

1. Conform to AWWA C151 and AWWA C150 for thickness class.
2. Pipe Thickness Class: 50 unless otherwise specified.
3. Exterior Coating: Tenemec 431, 40 mil thick, minimum.
4. Rubber gasket, push on joints conforming to ASTM C111.
5. Interior Lining: Calcium aluminate mortar (minimum 125 mils thick) equal to SewperCoat or ceramic epoxy (minimum 40 mils thick) fusion bonded equal to Protecto 401.
   a. Adhere to coating manufacturer's specifications when completing surface preparation and coating.

6. Each length of pipe shall be clearly marked with the following:
   a. Manufacturer.
   b. Nominal Pipe Size.
   c. ASTM Designation.
   d. Pipe Class.

C. Polyvinyl Chloride Pipe

1. Bell and spigot push on pipe conforming to ASTM D2241, SDR included in bid schedule.
2. Integral bell joint system conforming to ASTM D3139 and elastomeric seals conforming to ASTM F477.

D. High Density Polyethylene Pipe and Fittings

1. PE 3408, conforming to ASTM D2239, DR included in bid schedule.
2. Joints:
   a. Butt fusion.
   b. Fusion process conforming to U.S. Department of Transportation, DOT Title 49, Part 192.

3. Transitions to PVC Pipe:
   a. Polyethylene mechanical joint adapter with stainless steel bolts.
   b. Butt fused coupling conforming to AWWA C906.
   c. Type 316 stainless steel T bolts and nuts with anti-seize.

E. Yelomine PVC
1. Meets requirements of ASTM 2241.
2. Minimum wall thickness of SDR 21.
3. Joints: Precision machined grooves with restrained joint coupling.

a. Equal to Permanent Use Certa-Lok Joints.

F. Fittings.
1. Ductile Iron and PVC pipe 6 inches and larger.
   a. Conform to AWWA C110 and AWWA C111 for ductile and gray iron fittings.
   b. Conform to AWWA C153 for ductile iron compact fittings.
   c. Interior and exterior fusion bonded epoxy coating conforming to AWWA C116, equal to PERMAFUSE®.
   d. 250 psi pressure rating.
   e. Type 316 stainless steel T bolts and nuts with anti-seize or approved equal high performance anti-corrosion bolt.

2. SDR PVC pipe 4 inches and smaller:
   a. IPS PVC gasketed fittings with a 200 psi minimum pressure rating.
   b. Joints conforming to ASTM D 3139 and ASTM F477.
   c. Equal to Harco PVC fittings.

G. Thrust Restraint.
1. Concrete Thrust Blocks:
   a. One part Portland cement, 2 1/2 parts of fine aggregate, 3 1/2 parts coarse aggregate and just enough water for a workable consistency.
   b. #4 rebar.

2. Anchoring Retainer Glands:
   a. Ductile iron: Equal to Megalugs, EBAA Iron, Inc.
   b. PVC: Equal to 2000PV, EBAA Iron, Inc.

3. Joint Restraint Rodding:
   a. 3/4 inch mild steel threaded rods.
   b. Tie bolts.
   c. Duc lugs.

2.2 GATE VALVES AND VALVE BOXES

A. Gate Valves

1. Conforming to ANSI/AWWA C515.
2. Valve wedge constructed of ductile iron in sizes 4 inches-12 inches.
3. Triple O-ring stem seals.
4. Supply valves with mechanical joints.
5. Type 316 stainless steel T bolts and nuts with anti-seize.
6. A non-rising stem (NRS), 2 inch square operating nut, opening counter clockwise.
7. All internal and external ferrous surfaces fusion-bonded epoxy coated, complying with ANSI/AWWA C550.
8. Equal to Mueller 2360 Series, Waterous Series 500 or American Flow Control Series 2500.

B. Valve Boxes

1. Class 35 cast iron valve boxes for 4 inch -12 inch valves.

a. Conforming to ASTM A48 as provided by TYLER UNION® Series 6850 or Approved Equal.
b. Screw type, 2 piece adjustable height ranging from 19 inches to 60 inches; 3 piece for heights greater than 60 inches.
c. Match height of valve box with cover over pipe.
d. 5 ¼ inches inside diameter shaft and an 8 inch inside diameter bottom section.
e. Locking lid **marked "SEWER"**, with brass cotter pin and rod.

2. Supply valve boxes with Valve Box Adaptor II as provided by Adaptor Inc. or Approved Equal.
3. Include a steel valve stem extension with centering device compatible with valve box. Length extends from gate valve to within 2 feet the valve box lid.

2.3 AIR RELEASE /VACUUM VALVES AND VAULT

A. Air Release and Vacuum Valves
1. 2 inch - 4 inch single body Wastewater Combination providing the functions of both air release and air/vacuum.
a. Conforming to AWWA C512.
b. All stainless steel components with Buna-N resilient seats.
c. Full size NPT inlets and outlets equal to the nominal valve size.
d. Hexagonal body inlet connection for a wrench connection.
e. 2 inch NPT cleanout and 1 inch NPT drain connection on the side of the casting.
f. Resilient bumper on 4 inch to cushion the float during sudden opening conditions.
g. Full port orifice, a double guided plug, and an adjustable threaded orifice button. The plug protected against direct water impact by an internal baffle and an extended float stem.
h. Full flow stainless steel ball valve with NPT inlet and outlet size equal to the nominal air/vacuum valve size on the inlet for isolation.
i. Backwash accessories provided by the manufacture.
j. ½ inch, 1-inch, and 2-inch brass ball valves equal to Apollo 70-100.
k. All nipples and fittings to be made from stainless steel.
l. Val-Matic Series 800 model 802BW or Approved Equal.

B. Concrete Manhole Vault

1. 5 foot precast manhole sections in accordance with Section 02532.
2. Cast iron frame and cover in accordance with ASTM A48, Class 35B as provided by Neenah Foundry R-1758-G Frost-Retardant Frame, Solid Lid and Inner Lid or Approved Equal.
a. Labeled with lettering "SEWER".
b. Type G locking device with pentagon head bolts.

3. Insulation: Extruded polystyrene insulation with R of 4.5 per inch.

C. All flange bolts, nuts and miscellaneous hardware to be stainless steel.

2.4 WARNING TAPE

A. Warning Tape

1. Refer to Section 02315 - Excavation, Trenching and Backfill.

2.5 UTILITY MARKERS

A. Utility Markers

1. Green dual sided marker as provided by Carsonite Composites or Approved Equal.
2. Decal with “CAUTION SEWER PIPELINE” printed on green background.

2.6 FROST PROTECTION

A. Refer to Section 02315.

2.7 ACCESSORIES

A. Supply one 5 foot gate valve key.

B. Supply one valve box cover key.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify dimensions and elevations are as indicated on the plans.

B. Remove products from the site that are defective, damaged, used, unsound, or that otherwise do not meet the specifications.

C. Verify trench is ready to accept Work.

3.2 UTILITY CONFLICS

A. Refer to Section 02315.

3.3 STAKING FOR LINE, GRADE, AND OTHER APPURTENANCES.

A. Refer to Section 01720.

3.4 BEDDING

A. Refer to Section 02315 for excavation, trenching, bedding, and backfill requirements and for minimum separation distances.

B. Excavate to lines and grades shown on Drawings or required to accommodate installation.

3.5 PIPE AND FITTING INSTALLATION

A. Install in the locations and of the sizes and materials shown on the bid schedule or in the drawings.

B. Install with minimum bury depth as listed on the bid schedule or as shown in the Drawings.

C. Installation depth may exceed minimum bury depth to eliminate high points in the main, except at locations of air release mechanisms shown on the plans.

D. Lower the pipe and fittings into trench with suitable equipment to prevent damage to the material, lining, or coating. Do not drop or dump material into the trench.

E. Begin pipe laying at the discharge end with the bell end in the direction of laying unless directed otherwise.

F. Prevent foreign material from entering the pipe while it is being placed in the trench. Remove foreign material that enters the pipe before pushing the spigot end “home”.

G. Ensure pipe spigot and bell are clean prior to joining pipes.

H. Cut the pipe for inserting valves, fittings, or closure pieces in accordance with manufactures’ instructions so as not to damage the pipe, lining, or coating. Produce smooth ends at right angles to the axis of the pipe. Welding, flame cutting, or flame tapping is not allowed.

I. Coat all stainless steel fitting bolts with anti-seize lubricant.

J. Ductile Iron Pipe and fitting installation.

   1. Encase buried ductile iron pipe and fittings with 8 mil polyethylene encasement.
   2. Tape and seal encasement in accordance with manufacturer’s recommendations.

K. PE Pipe Installation

   1. HDPE Pipe Cold Bending:
      a. Maximum bending radius: the lesser of 30 times the outside diameter of the pipe or 50% of the manufacturers’ recommendation.
      b. Make necessary provisions to ensure that localized curvature is within the tolerances over the length of curve.
      c. For tighter curve requirements, use prefabricated HDPE fittings of the same DR and OD as the pipe.

   2. Butt Fused Joints: Butt-fuse all HDPE joints, except as otherwise indicated.
      a. Strictly follow manufacturers’ recommendations.
      b. Ensure that HDPE pipes are of the same grade and dimensions.
      c. Do no remove bead unless determined necessary. If bead is removed, do not remove below pipe outside diameter.

3.6 GATE VALVE AND VALVE BOX INSTALLATION

A. Install in accordance with these specifications and manufacturers' instructions.

B. Install in the locations and of the sizes and materials shown on the Bid Schedule or in the Drawings.

C. Install with minimum bury depth as listed in the Bid Schedule or as shown in the Drawings.

D. Support gate valves on a poured concrete block with rebar as shown on the plans.

E. Set valves plumb and provide with a valve box.

F. Install steel valve stem extension with a centering device to the gate valves to within 2 feet of the finished grade.

   1. Secure valve stem extension to the valve stem with a set screw.

G. Wrap valves with 8 mil polyethylene encasement.

H. Install valve box using a valve adaptor.

I. Center the valve box over the valve with the box cover:

   1. Flush with finished grade elevation.
   2. Flush with the surfaced street.
   3. 3 inches below the level of an unimproved street.

3.7 AIR RELEASE AND VACUUM VALVE INSTALLATION

A. Connect to sewage force main with ductile iron tee fitting.

B. When force main is not ductile iron, transition to ductile iron pipe on both sides of fitting a minimum of 10 feet outside of vault.

C. Assemble accessories and maintenance valves as directed by manufactures instructions unless noted on the Drawings.

D. Coat all threaded connections and fittings with PVC thread sealant.

3.8 AIR REALEASE/ VACUUM VAULT INSTALLATION

A. Install in accordance with Section 02532.

B. Core drill 4 inch diameter hole through precast base to allow water drainage out. Unless directed by Project Engineer, do not provide 4 inch hole when high ground water is present.

C. Bed base section in a minimum of 12 inches of compacted clean gravel or crushed rock passing 1-1/2 inch screen but no more than 10% passing No. 40 sieve.

D. Set frame and cover so it is slightly above finished grade.

1. Raise frame and cover to an elevation that maximizes water exclusion if surface drainage is an issue.
2. Secure insulation below interior lid with stainless steel fasteners and washers.

3.9 CONCRETE THRUST BLOCK AND JOINT RESTRAINT INSTALLATION

A. Install concrete thrust blocks and retainer glands on all fittings and appurtenances including in-line valves.

B. Pour thrust blocks against the fitting and undisturbed earth.

C. Place thrust blocks so that the pipe and joints will be accessible for repair.

D. Install anchoring retainer glands in accordance with manufacturers' instructions.

3.10 CONNECTION TO EXISTING MANHOLE

A. Refer to Section 02532 .

3.11 BACKFILLING

A. Backfill in accordance with Section 02315.

3.12 WARNING TAPE INSTALLATION

A. Refer to Section 02315.

3.13 UTILITY MARKER INSTALLATION

A. Install utility markers at each gate valve, air release pit, and manhole.

B. Place markers at the fence line or as designated by the Project Engineer.

3.14 PRESSURE AND LEAKAGE TESTING – PVC

A. Whenever practical, before backfill is fully placed or joints fully covered, test pipe for leaks in the presence of an IHS representative.

B. Furnish necessary material, equipment, and labor for testing including, but not limited to: water, pump, water storage vessel, piping, pressure gauge, valve, hydrant, and corporation stop.

1. Utilize liquid filled pressure gauges with 5 psi increments or less.

C. Test duration: 2 hours minimum.

D. Testing Procedure – Test in accordance with the Hydrostatic Testing Method outlined in ANSI/AWWA C605.

1. Slowly fill test section with water and expel air from mains.
2. Install corporation stops at high points to facilitate removal of air, if necessary.
   a. Remove corporation stops and plug prior to pressure testing.

3. Verify all hydrant lead valves and main valves within the test section are open.
4. Place test section under constant pressure as shown in the table below, as measured at the lowest point of the section.

Classification of PVC Pipe	Test Pressure
ASTM D-2241 SDR-26	150 psi
ASTM D-2241 SDR-21	175 psi
ASTM D-2241 SDR-17	200 psi
AWWA C-900	Equal to Pressure Class

Note: In no case shall test pressure exceed the rating of valves, fittings or any components of the system being tested.

5. If pressure drops more than 5 psi during the test, immediately re-pressurize the line to the original test pressure and continue test.
   a. Record amount of water required to re-pressurize the line.

6. At the end of the test, re-pressurize the line to the original test pressure.
   a. Record amount of water required to re-pressurize the line.

7. Add total amount of water required to re-pressurize the line during and at the end of the test and compare with the allowable leakage as calculated below.
   a. If leakage is greater than allowable leakage, test fails.

E. Allowable Leakage Determination.

$$L = (N*D*P^{1/2})/7400$$

L = Allowable Leakage (gph)
N = Total Length Tested Divided by
The Standard Pipe Length
D = Nominal Diameter of Pipe (inches)
P = Test Pressure (psi)

Example Allowable Leakage Chart Using Formula Above
PVC Pipe with 20-foot sections

	Allowable Leakage/ 1000 feet (gph)				
Pipe Diameter, D	P = 100 psi	P = 150 psi	P = 175 psi	P = 200 psi	P = 250 psi
1 ½ inch	0.10	0.12	0.13	0.14	0.16
2 inch	0.14	0.17	0.18	0.19	0.22
4 inch	0.27	0.33	0.36	0.38	0.43
6 inch	0.41	0.50	0.54	0.57	0.64
8 inch	0.54	0.66	0.72	0.76	0.85
10 inch	0.68	0.83	0.89	0.96	1.07
12 inch	0.81	0.99	1.07	1.15	1.28

F. Repair, at no cost to contract, any section of the line that fails this test.

1. Retest all repaired sections of line, at no cost to contract, until pressure test is successfully completed.

3.15 PRESSURE AND LEAKAGE TESTING – DUCTILE IRON

A. Whenever practical, before backfill is fully placed or joints fully covered, test pipe for leaks in the presence of an IHS representative.

B. Furnish necessary material, equipment, and labor for testing including, but not limited to: water, pump, water storage vessel, piping, pressure gauge, valve, hydrant, and corporation stop.

1. Utilize liquid filled pressure gauges with 5 psi increments or less.

C. Test duration: 2 hours minimum.

D. Testing Procedure – Test in accordance with the Hydrostatic Testing Method outlined in ANSI/AWWA C600.

1. Slowly fill test section with water and expel air from mains.
2. Install corporation stops at high points to facilitate removal of air, if necessary.
   a. Remove corporation stops and plug once test completed.

3. Verify all hydrant lead valves and main valves within the test section are open.
4. Place test section under constant pressure.
   a. 1.5 times working pressure or 150 psi, whichever is greater.
   b. Do not exceed 115% of pipe pressure rating at the lowest point in the test section.
   c. Test shall not be less than 1.25 times the working pressure at the highest point in test section.

5. If pressure drops more than 5 psi during the test, immediately re-pressurize the line to the original test pressure and continue test.
   a. Record amount of water required to re-pressurize the line.

6. At the end of the test, re-pressurize the line to the original test pressure.
   a. Record amount of water required to re-pressurize the line.

7. Add total amount of water required to re-pressurize the line during and at the end of the test and compare with the allowable leakage as calculated below.
   a. If leakage is greater than allowable leakage, test fails.

E. Allowable Leakage Determination.

L = (S*D*P1/2)/133,200

L = Allowable Leakage (gph)
S = Total Length of Pipe Tested (feet)
D = Nominal Diameter of Pipe (inches)
P = Test Pressure (psi)

Example Allowable Leakage Chart Using Formula Above
Ductile Iron Pipe per 1,000 feet of pipe

	Allowable Leakage/ 1000 feet (gph)			
Pipe Diameter, D	P = 100 psi	P = 150 psi	P = 200 psi	P = 250 psi
4 inch	0.30	0.37	0.43	0.47
6 inch	0.45	0.55	0.64	0.71
8 inch	0.60	0.74	0.85	0.95
10 inch	0.75	0.92	1.06	1.19
12 inch	0.90	1.10	1.28	1.42

F. Repair, at no cost to contract, any section of the line that fails this test.

   1. Retest all repaired sections of line, at no cost to contract, until pressure test is successfully completed.

3.16 PRESSURE AND LEAKAGE TESTING – PE

A. Whenever practical, before backfill is fully placed or joints fully covered, test pipe for leaks in the presence of an IHS representative.

B. Furnish necessary material, equipment, and labor for testing including, but not limited to: water, pump, water storage vessel, piping, pressure gauge, valve, hydrant, and corporation stop.
   1. Utilize liquid filled pressure gauges with 5 psi increments or less.

C. Test duration: 4 hours expansion phase; 1 hour test phase.

D. Testing Procedure – Test in accordance with the recommendations from the Plastic Pipe Institute.

   1. Slowly fill test section with water and expel air from mains.
   2. Install corporation stops at high points to facilitate removal of air, if necessary.
      a. Remove corporation stops and plug once test completed.

   3. Verify all hydrant lead valves and main valves within the test section are open.
   4. Place test section under constant pressure.
      a. 1.5 times working pressure at the lowest elevation or 150 psi, whichever is greater.

b. Do not exceed 115% of pipe pressure rating at the lowest point in the test section.

5. To allow for pipe expansion, add water as required to maintain test pressure at 10 psi over target test pressure for four (4) hours.
6. Reduce pressure by 10 psi to target test pressure to begin test phase.
   a. If pressure remains within 5% of target test value for 1 hour, test passes.

END OF SECTION

SECTION 02821 – CHAIN LINK FENCING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the furnishing and installation of a 6 foot chain link fabric fence with barbed wire and gates.

1.2 RELATED WORK

A. Section 02300 – Earthwork

1.3 REFERENCES

A. AASHTO M279 – Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric

B. ASTM A121 - 13 – Standard Specification for Metallic-Coated Carbon Steel Barbed Wire

C. ASTM A123/A123M - 12 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

D. ASTM A392 - 11a – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric

E. ASTM A1011/A1011M - 12b – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

1.4 SUBMITTALS

A. Steel posts

B. Fence fabric

C. Smooth wire and fabric fasteners

D. Barbed wire

E. Braces

F. Vehicle gate

PART 2 - PRODUCTS

2.1 STEEL POSTS

A. Product of a manufacturer specializing in fence products.

B. Conform to ASTM A123 and ASTM A1011.

C. Line Posts.

1. 2 ½ inch nominal diameter SS40 galvanized steel tubing.
2. Drive type.
3. Minimum outside diameter: 2.375 inch.
4. Minimum weight: 3.12 pounds per foot.
5. Minimum bending strength: 338 pounds
6. Minimum length: 11 feet.

D. Top and Brace Rail.

1. 1 5/8 inch nominal diameter SS40 galvanized steel tubing.
2. Minimum outside diameter: 1.66 inch.
3. Minimum weight: 1.84 pounds per foot.
4. Minimum bending strength: 327 pounds
5. Minimum length: 18 feet.

E. Terminal, Corner, Gate, and Pull Posts.

1. 4” nominal diameter SS40 galvanized steel tubing.
2. Minimum outside diameter: 4.0 inch.
3. Minimum weight: 6.56 pounds per foot.
4. Minimum bending strength: 1187 pounds
5. Minimum length: 12 feet 6 inches.
6. Supplied with Galvanized post tops.

2.2 FENCE FABRIC

A. Conform to ASTM A392 - 11A Class 1.

B. Galvanized No. 9 gauge steel wire.

C. 2 inch diamond pattern mesh.

D. Minimum breaking strength: 1200 lbs.

E. Heavily zinc coated, after weaving, by hot dip spelter process

2.3 SMOOTH WIRE AND FABRIC FASTENERS

A. Tie wires: No. 12 gauge zinc coated steel or No. 9 gauge aluminum.

B. Hog rings: No. 9 gauge zinc coated steel or No. 7 gauge aluminum.

C. Bottom Tension wire: No. 7 gauge zinc coated steel or No. 6 gauge aluminum.

2.4 BARBED WIRE

A. Conform to ASTM 121 Class 3.

B. No. 12 1/2 gauge double strand coated twist wire.

C. Large 14 gauge, 4 point barbs spaced approximately 5 inches apart.

D. Zinc coated with a minimum coating of 0.80 ounces per square foot of surface area on 12 1/2 gauge wire and 0.60 ounces per square foot of surface area on 14 gauge wire.

E. Mark splices in the barbed wire with a crimping tool and sleeves equal to Nicopress.

2.5 BRACE ASSEMBLY

A. Corner, End, and Pull Post Bracing

1. See part 2.1D

B. Diagonal Truss Rod Assembly.

1. 3/8 inch galvanized steel with turnbuckle.

2.6 GATES

A. 12 foot double swing gate

1. Provide padlockable latching device as manufactured by Dakota Fence Products, Bismarck, ND, or equal.
2. Buried receiver pipe locking system not allowed.
3. Provide two semi-automatic outer catches to secure the gates in open position.

B. 15 foot rolling cantilever gate

1. Provide padlockable latching device as manufactured by Dakota Fence Products, Bismarck, ND, or equal.

C. Structural Steel Tubing:

1. Minimum 2 inch nominal diameter SS40 galvanized steel tubing.
2. Minimum outside diameter: 1.90 inch.
3. Minimum weight: 2.28 pounds per foot.
4. Minimum bending strength: 195 pounds
5. Jointed at coroners by arc welding to form solid one piece panel.

D. Fence Fabric: see part 2.2 above.

E. Barbed Wire: see part 2.4 above.

F. Diagonal Bracing: see part 2.5 above.

G. Zinc coat all portions of the gate by the hot-dip spelter process.

H. Provide padlocks with four sets of keys.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fence to the dimensions, spacing, and locations shown on the plans provided by the Project Engineer.

B. Install all posts as indicated in the plans and have no post greater than 10 feet on center from the nearest post.

1. Set posts plumb and in line with the side where the fabric is to be fastened.
2. Set posts a minimum of 5 feet in the ground as indicated on plans.
3. Drive Line posts vertically to full depth without cutting off the top to avoid rock or other obstructions.

C. Install fence fabric and barbed wire on the side of the post away from the facility.

D. Attach fence fabric to steel posts using zinc coated fabric ties.

1. Line post maximum tie spacing: 15 inches.
2. Top post maximum tie spacing: 24 inches.

E. Install fence fabric even with finished grade with a maximum gap of 2 inches.

F. Install tension bars on all corner, gate and pull posts

G. Install bottom tension wire, fastened to chain link fabric, at maximum 24 inch intervals with hog rings.

H. Install top rail with galvanized couplings for connecting the lengths into a continuous run not less than 18 feet.

I. Install barbed wire arms at the top of each post with holes suitable for through passage of top rail and provide means to connect to corner and gate posts.

J. Connect 3 lines of barbed wire to each barbed wire arm.

1. Install top barbed wire 12 inches above top of fence fabric
2. Space wires uniformly.
3. Extend corner and gate posts vertically to accommodate attaching the 3 strands of barbed wire by suitable means.

K. Install brace assembly on all corner, end, and gate posts.

1. Supply two brace assemblies, one in each direction for each corner post.
2. Attach 3/8 inch adjustable truss rod diagonally to the first ensuing line post.
3. Install braces so that posts are plumb and true when diagonal rod is under proper tension.

L. Construct and install all gates as shown on the plans.

1. Provide tension bars with bands at vertical edges and tie wires at a maximum of 12 inches on center along top and bottom edges.
2. Provide diagonal bracing to ensure frame rigidity without sag or twist.
3. Provide a 2 ½ inch maximum gap between gate bottom and finished grade.
4. Ensure gate will fully open without obstruction.

3.2 PREPARATION

A. Clear fence line of obstructions.

B. Grade surface to provide uniform distance between the fence and finished grade.

END OF SECTION

SECTION 02920 – TOPSOILING, SEEDING, FERTILIZING, AND MULCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers topsoiling, seeding, fertilizing, mulching, and punching areas disturbed by construction activities.

1.2 RELATED WORK

A. Section 02300 – Earthwork

B. Section 02315 – Excavation, Trenching, and Backfill

C. Section 02316 – Rock Excavation

1.3 SUBMITTALS

A. Fertilizer, methods and materials

B. Seed mixture, methods and materials

C. Mulch – methods and materials

1.4 QUALITY ASSURANCE

A. The materials and construction methods specified herein are minimum requirements. Where the appropriate state/local codes require more stringent materials or execution methods, they shall apply.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Native topsoil from stockpiles within project area.

2.2 FERTILIZER

A. Conform to applicable state and tribal laws.

B. Packaged in suitable containers.

1. Labeled with manufacturer’s guaranteed analysis.

C. Dry and free from lumps.

D. Nutrients in the following proportions.

1. Plant available nitrogen 18 pounds
2. Plant available phosphoric acid 46 pounds
3. Plant available potash 0 pounds

E. Apply fertilizer at the rate of 100 pounds per acre.

2.3 SEED MIXTURE

A. Rural / Road Ditch Mixture

1. Permanent seed mixture meeting the latest state/local standards.
2. Conforms to following mixture:

GRASS SPECIES	PURE LIVE SEED (PLS) (POUNDS/ACRE)
Western Wheatgrass	20
Intermediate Wheatgrass	20
	40

B. Urban / Lawn Mixture

1. Permanent seed mixture meeting the latest state/local standards.
2. Conforms to following mixture:

GRASS SPECIES	PURE LIVE SEED (PLS) (POUNDS/ACRE)
Kentucky Bluegrass	1.4
Perennial Ryegrass	1.4
Creeping Red Fescue	1.4
Chewings Fescue	1.4
Alkali Grass	1.4
	7

2.4 MULCHING MATERIAL

A. Straw without excessive moisture content.

B. Free of noxious weeds or other foreign matter.

PART 3 - EXECUTION

3.1 GENERAL

A. Topsoiling, fertilizing, seeding, and mulching will only be permitted when soil and weather conditions are favorable.

1. Satisfactory periods for planting are between April 1 and June 1, and between August 1 and September 15.
2. Dormant late fall seeding may be completed with approval from the Project Engineer.
3. No seed shall be sown when the wind velocity exceeds 15 miles per hour.
4. No seed shall be sown in standing water or frozen ground.

3.2 TOPSOILING

A. After grading is complete spread topsoil over all disturbed areas.

1. Apply to a depth of 6 inches.

B. Remove surface irregularities within the area to be seeded by blading or by other suitable method.

C. Till soil to a depth of approximately 2 inches, but do not exceed 3 inches.

1. Complete tillage in a manner eliminating clumps of dirt larger than 2 inches in diameter.

D. Seedbed shall be prepared smooth.

1. Remove foreign matter including weeds, grubbed material, wood, metal, or stones 2 inches in diameter or larger.

2. Accomplish final landscaping by harrowing, dragging, and raking to ensure uniform slope across the disturbed area.

3. Leveling of a trench or site utilizing the bucket of a skid steer will not be approved.

3.3 FERTILIZING

A. Apply fertilizer uniformly at a rate of 100 pounds/acre using mechanical spreading equipment, blowers, or hydraulic equipment approved by the Project Engineer.

B. Incorporate fertilizer into the seedbed by harrowing, dragging, or other satisfactory method to a depth of 1 to 3 inches.

C. Apply prior to seeding. Application after seeding is not

D. Never mix fertilizer with the seed, but it may be applied at the same time as the seed if a suitable fertilizer attachment on the drill is used.

E. Fertilizer may be mixed into a Hydro-Mulch mixture as it is applied.

3.4 SEEDING

A. Sow seed within 48 hours of completion of seedbed preparation.

B. Sow with mechanical seeding equipment that will provide uniform distribution at the specified rate.

1. Seeders shall have agitators to provide continuous mixing of seed.
2. Grain drills may be used only if equipped with seed attachments.
   a. Operate to eliminate the effect of distinct rows of seeding.

C. Seed shall be covered with topsoil to a depth of ¼ inch.

D. Compact soil by rolling.

1. Compact all seeded areas by rolling immediately following the sowing and covering of the seed, shall be compacted by rolling.
2. Seed shall be firmly embedded.
3. Seeding and rolling shall be done along the contours, at right angles to existing slopes.

3.5 MULCHING

A. Place mulch within 48 hours of seeding.

1. Mulch all seeded areas including the top surfaces of embankments, ditches, and all cut and fill slopes 6:1 or steeper.
2. The Project Engineer may vary application rates to provide a more stable mulch cover, to prevent erosion, and/or to encourage turf establishment.

B. Blow mulch uniformly at a rate of 4,000 pounds of mulch per acre.

1. Use a mulch blower designed for the purpose.
2. Break straw bales before feeding into blower.

C. Allow approximately 10% of the soil surface to be visible through the mulch blanket.

D. Avoid excessive mulch cover which will smother seedlings.

E. Do not apply mulch during periods of excessively high winds.

F. Begin mulching on the windward side of the areas to be covered.

3.6 PUNCHING

A. Punch mulch into soil immediately after application using a mulch tiller having:

1. A series of dull flat disks with notched or cutout edges.
2. Disks 20 inches in diameter and ¼ inch thick.
3. Disks spaced approximately 8 inches apart and fitted with scrapers.
4. The total working width of the tiller shall not exceed 6 feet per section, but may be operated in gangs of up to 3 sections.
5. Ballast tiller members as necessary to push straw into the soil approximately 3 inches with the ends of the straw exposed above the soil surface.

B. The mulch tiller shall follow as closely as possible behind the mulch blower.

C. Operate the mulch tiller along the contour.

D. Multiple or diagonal mulch tiller passes may be required to ensure adequate anchoring of the mulch.

E. Prohibit unnecessary foot, equipment, and vehicular traffic over the seeded and mulched areas.

END OF SECTION

SECTION 02950 – CONCRETE PROTECTIVE LINER

PART 1 - GENERAL

1.1 SCOPE

This specification covers the technical requirements for the Manufacturing and Installation of the concrete protection product. All materials meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications.

1.2 RELATED WORK

A. Section 02532 – Sanitary Sewer Manholes

B. Section 02538 – Community Lift Stations

C. Section 03120 – Non-Structural Concrete

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
2. D 1603 Test Method for Carbon Black in Olefin Plastics
3. D 5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
4. D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
5. D 6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
6. D 1204 Standard Test Method for Linear Dimensional Changes of Nongrid Thermoplastic Sheeting or Film at Elevated Temperature
7. D 696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer
8. D 746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
9. D 570 Standard Test Method for Water Absorption of Plastics
10. E 96 Standard Test Method for Water Vapor Transmission of Material

1.4 POST AWARD AND SUBMITTALS

A. Install, field seam and weld joints in strict conformance with the liner manufacturer instructions.

B. Line walls, ceiling and pipe penetrations within the wet well of the lift station with GSE StudLiner as manufactured by GSE Lining Technology, Inc. or approved equal.

C. Provide at the request of the Project Engineer, Pre-Caster or End User, samples, datasheets, installation instructions, etc.

D. Submit certified test reports that the liner and materials are manufactured in accordance with standards specified herein.

1.5 QUALIFICATIONS

A. HDPE liner furnished by a manufacturer who is fully experienced, reputable and qualified in the manufacturing of the materials.

1. Minimum 10 years of manufacturing experience.

B. Manufactured or produced in the United States of America.

C. Extrude locking devices on the sheet as a one step process.

D. GSE StudLiner as manufactured by GSE Lining Technology, Inc. or approved equal.

PART 2.0 - PRODUCT

2.1 MATERIAL DIMENSIONS

A. 8.0 ft (2.4 m) in width and a thickness of 80 mils (2.0 mm) in thickness.

B. Locking studs of the same material as that of the liner and integrally extruded with the sheet.

C. Stud spacing: approximate 1.25 in (30 mm) centers, such that there are approximately 110 studs per square foot (1200 per square meter).

2.2 MATERIAL PROPERTIES

A. Made of 97-98% virgin high density polyethylene produced and 1.5-3% carbon black or pigmentation for the purpose of an otherwise specified color.

B. Adding plasticizer to the resin formulation Is not allowed.

C. Free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

D. Manufacture HDPE cap strips: from coextruded conductive HDPE to facilitate spark testing,

E. Elongation of material sufficient to bridge up to 1/4 inch settling cracks.

F. Cap strips shall be 6 inches wide or greater and shall be equivalent to that of the liner.

G. Material shall maintain a repairable state through it's lifecycle by methods approved and recommended by the manufacturer.

H. Concrete protection product physical properties:

Table 2.2 G: Concrete Protection Liner

TESTED PROPERTY	TEST METHOD	FREQUENCY	NOMINAL VALUE
Thickness, mm (mil) Density, g/cm^3	ASTM D 5199 ASTM D 1505	Every 5th roll 1/1 00,000 ft^2	2.00 (80) 0.94
Tensile Properties (each direction) Strength at Yield, lb/in^2 (MPa) Elongation at Break, %	ASTM D 6693, Type IV Dumbell G.L. = 2.0 in (50 mm)	1/100,000 ft^2	2,200 (15.2) 500
Stud Pull-Out Strength[1], lb/ft^2 (kN/m^2)		1/product	>14,000 (669.89)

Carbon Black Content/Pigment Content, % Black (carbon) Gray (pigment)	ASTM D 1603*/421 8 ASTM D 5630, Modified	[2] 1/100,000 ft	2-3 1.5-2.5
Carbon Black Dispersion[2]	ASTM D 5596	1/100,000 ft^2	Note 2
Notched Constant Tensile Load, hours	ASTM D 5397	1/formulation	1,000
Coefficient of Linear Thermal Expansion, per °C	ASTM D 696	1/product	1 .20E-04
Low Temperature Brittleness, °C	ASTM D 746	1/product	-77
Dimensional Stability, % (each direction)	ASTM D 1204	1/product	±1.0
Water Absorption, %	ASTM D 570	1/product	0.1
Water Vapor Transmission, (g/m^2/day)	ASTM E 96	1/product	<0.01
Roll Width, ft (m)			8 (2.44)
Roll Length, ft (m)			246 (74.97)
Roll Area, ft^2 (m^2)			1,968 (182.83)

NOTES:
[1]Note: Concrete must have compressive strength of at least 5,000 lb/in^2 (34,500 kPa).
[2]Note: Dispersion only applies to near sherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from category 3.

I. Raw resin properties:

Table 2.2 H: Raw Material Properties

Property	Test Method	Value	Testing Frequency
Density, g/cm3	ASTM D 1505	0.932	1/ resin lot
Melt Flow, g/10 min	ASTM D 1238 (190/2.16)	≤ 1.0	1/ resin lot
OIT, minutes	ASTM D 3895 (1atm/200°C)	100	1/ formulation

2.3 MATERIAL SUPPLY

A. Supplied in roll form, sheets, pre-fabricated tubes or panels.

2.4 MATERIAL HANDLING AND STORAGE

A. Materials are to be handled as to prevent damage.

B. The on-site storage location for geomembrane material, provided by the CONTRACTOR to protect the liner from punctures, abrasions and excessive dirt and moisture.

C. Storage area characteristics:

1. level (no wooden pallets)
2. smooth
3. dry
4. protected from theft and vandalism

PART 3.0 - EXECUTION

3.1 PRECAST INSTALLATION GUIDELINES

A. Material Handling and Storage

1. Unloading of HDPE liner rolls with equipment that will lift the roll from the center core.
2. Place rolls on a firm, smooth surface free of large, sharp stones.

B. Pipes, Manholes, and Structures

Before applying liner, the form should be clean of any defects or protrusions, and any concrete residue which may damage the liner when form is expanded.

1. Sheet Materials: If bulk material is provided, cut to the proper dimension and wrap the liner around the inner form and secure using mechanical devices such as banding or wire. Bands should be located in the interstitial space between studs to prevent crushing or tilting of the embedment studs. It should not be necessary to cut or remove any of the embedment material in order to accommodate banding. Seams can be welded prior to placing metal reinforcement cage to prevent migration of concrete between overlapped longitudinal seams.

   a. Butt Welding
      1) Maximum joint gap of 0.2 in.
      2) Make weld by applying an extrusion bead to the back of the butt joint or by some other method acceptable to prevent concrete from migrating between overlapped surfaces.
      3) Apply second extrusion weld bead After the forms have been stripped over the butt joint on the smooth face of the liner.

   b. Overlap Weld
      1) Remove the studs on the underlying portion of the liner that is to be welded.
      2) Utilize a sharpened chisel and a small hammer.
      3) Take care not to damage the parent liner when removing the studs.
      4) 4-inch overlap fused together by an extrusion weld or some other acceptable method.
      5) Concrete migration under the overlapped sheet is not allowed.
      6) Apply extrusion welded on the internal overlap once forms are removed.

2. Prefabricated Materials

   a. If the material is provided in prefabricated tubular form, lower the liner over and around the collapsed inner form. The form should then be expanded until liner is taught over form.
   b. Monitor the expansion of the form to avoid over-stressing the liner during this process as over-stressing may lead to unwanted elongation of the liner material.
   c. The liner should sit flush with the inner edge of the bell or spigot end of a pipe section. If needed or desired the liner may extend beyond the opposite end approximately 4-inches depending upon the type of lining joint to be made with the adjoining concrete pipe.
   d. Remove embedment studs within the 4-inches to produce a smooth layer for overlap lining joint.
   e. Take care when using a vibration method during the pouring of the concrete in order to avoid damaging the liner.
   f. Follow standard curing procedures once concrete has been poured.

3.3 SEAM WELDING AND TESTING

A. Seaming

HDPE liner is manufactured from virgin high density polyethylene to produce a flexible, but strong finished product with excellent stress crack resistance. These characteristics allow for the material to be re-welded or patched, at any time during the life of the system provided that proper surface preparation is performed. Field seaming involves bonding of adjacent panels using approved thermal methods such as extrusion welding, wedge welding or electro-fusion welding. Testing and verification of the resulting welds are imperative to producing a quality installation.

1. Installation Equipment: Standard HDPE Geomembrane welding equipment is used for welding of joints between HDPE liner sheets and concrete formwork. This typically requires extrusion welder, wedge welder or by use of the electro-fusion process.
2. Seaming Method: weld filed seams to provide a continuous impermeable barrier. This is typically done by use of an extrusion welder.
3. Surface Preparation:

    a. As form work is stripped, identify all penetrations, tie rods, nail holes, and any damage in the HDPE liner.
    b. clean, dry and ensure surface is free of debris prior to welding.
    c. Slightly score the liner using a grinder and proper techniques as recommended by manufacturer.
    d. A copper wire can be inserted prior to welding so holiday spark testing can be performed on extrusion weld seams.
    e. Vacuum test all welds.
    f. Boot and weld all pipe penetrations in accordance with manufacturer's drawings.
    g. When wedge welding or electro-fusion welding wipe-down with a clean wet (water) rag and completely dry surface..

B. Trial Seams

Prior to any field welding of lined surface, it is advantageous to perform a trial seam to ensure that the technician and method is adequate. Trial seams should be performed on materials from the current project; three feet in length is adequate. Trial weld seams should then be tested to ensure equipment settings are sufficient to produce quality welds. Testing can consist of both non-destructive and destructive methods.

1. Non-Destructive Seam Testing

    a. Non-destructive testing consists of primarily vacuum box testing.
    b. Vacuum box testing per ASTM D5641-94 (01)e1 will be performed on all accessible welds according to procedures set forth by manufacturer. Typically, a negative pressure of approximately 5 psi shall be applied to the seam. A defect in the weld will be noted by the presence of bubbles along the seam. The defect shall be marked and repaired with methods approved by the manufacturer.
    c. Repairs of pinholes and defective areas should be performed by extruding a bead of molten plastic over the surface, or if too large, a patch shall be utilized. Once complete, retest using the vacuum box.
    d. Spark testing of the finished seams is required per ASTM D6365-99, a copper wire may be set into the weld joint prior to welding. This will allow for spark testing for the welded seam for determination of the presence of possible leaks in the weld. This process is not necessary but may provide an alternative method for non-destructive testing of the welds. Spark testing can be performed with approved instrumentation when set at approximately 20,000 to 35,000 volts depending upon thickness of material/extrusion weld. Any defects found should be marked and repaired according to approved repair methods.
    e. ASTM D4437 – 99 (known as the screwdriver test) may also be used in conjunction with spark testing or vacuum testing.

2. Destructive Testing

   a. Destructive testing is not advised once product has been embedded in concrete.

3. HDPE liner Final Sheet Test

   a. Spark test 100% of the HDPE liner sheet to ensure all construction damage has been repaired.
   b. Spark test in accordance with ASTM 6365 – 99.

END OF SECTION

SECTION 03100 – CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers structural and non-structural concrete cement finish work, including cast-in-place concrete, concrete reinforcement, and concrete accessories used for structural cast-in-place concrete.

B. Non-Structural Concrete: thrust blocks, concrete patches, sidewalk, curb and gutter and small concrete pads.

1.2 RELATED WORK

A. Section 03110 – Concrete Formwork

1.3 REFERENCES

A. ACI 301 – Specifications for Structural Concrete

B. ACI 304R – Measuring, Mixing, Transporting, and Placing Concrete

C. ACI 305R – Hot Weather Concreting

D. ACI 306R – Cold Weather Concreting

E. ACI 308R – Guide for Curing Concrete

F. ACI 309R – Guide for Consolidation of Concrete

G. ACI 318 – Building Code Requirements for Structural Concrete

H. ACI 350 – Environmental Engineering Concrete Structures

I. ACI 614 – Standard Practice for Measuring, Mixing and Placing Concrete

J. ASTM A82 – Standard Specification for Cold Drawn Steel Wire, Plain, for Concrete Reinforcement

K. ASTM A184 – Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

L. ASTM A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

M. ASTM A493 – Standard Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging

N. ASTM A496 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

O. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

P. ASTM A706 – Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

Q. ASTM A775 – Standard Specification for Epoxy-Coated Steel Reinforcing Bars

R. ASTM A996 – Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

S. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

T. ASTM C33 – Standard Specification for Concrete Aggregates

U. ASTM C55 – Standard Specification for Concrete Building Brick

V. ASTM C94 – Standard Specification for Ready Mixed Concrete

W. ASTM C143 – Standard Test Method for Slump of Portland Cement Concrete

X. ASTM C150 – Standard Specification for Portland Cement

Y. ASTM C233 – Standard Test Method for Air-Entraining Admixtures for Concrete

Z. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete

AA. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

BB. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete

CC. ASTM D994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)

DD. ASTM D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable

EE. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

FF. ASTM D1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

GG. ASTM D6690 – Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

HH. CRSI – Concrete Reinforcing Steel Institute

1.4 SUBMITTALS

A. One copy with each bid

1. Sampling and Testing Laboratory
   a. Name of testing firm
   b. Location of testing firm

2. On-site batch plant
   a. Batch plant owner
   b. Mailing address
   c. Phone number

3. Ready Mix supplier (if being utilized)
   a. Name of supplier
   b. Location of ready mix plant
   c. Route from plant to construction site
   d. Delivery time

B. Reinforcing steel test certificates of manufacturer's laboratory, identifying chemical and physical analysis of each load of reinforcing steel.

C. Reinforcing steel bending, fabrication, setting drawings, and bar lists according to ACI 318 prior to placing the reinforcement steel. These drawings shall also show size and location of all openings.

D. Concrete Mix Design

1. All submittals shall represent materials used in proposed mix design.
2. Mixed proportions
3. Aggregate sieve analysis
4. Source of aggregate and mixing water used
5. Type and brand of cement
6. Results of all tests required to show that the proposed mix and materials are in compliance with the specifications.
   a. Test materials in accordance with ASTM C143, ASTM C192, and ASTM C231
   b. Design the mix in accordance with ACI 613
   c. Strength tests on the proposed mix design prior to placement of any concrete.

E. Delivery tickets for each load of concrete delivered to the site and other information as specified under ASTM C94.

F. Cement manufacturer's certificates of conformance with ASTM C150.

G. Product data for concrete admixtures.

H. Location and type of control joints.

I. Joint Filler

J. Joint Sealant

K. Waterstops

1.5 QUALITY ASSURANCE

A. The Contractor shall comply with all requirements of the codes and standards mentioned in Section 1.3 “References”, as applicable.

B. Obtain cement and aggregate from the same source for all work.

1.6 FIELD QUALITY CONTROL

A. Contractor is responsible for demonstrating compressive strength of concrete actually used in the completion of the work.

B. The laboratory shall test job specimens in accordance with applicable ASTM Standards, and perform other tests requested by the Project Engineer.

C. Non-Structural Concrete: Testing: Not Required

D. Structural Concrete Testing:

1. Advanced Concrete Testing:
   a. A minimum of 6 standard 6-inch compression test cylinders shall be made in the proportions and from the materials proposed to be used.
   b. The slump of the concrete used in making these test cylinders shall not be less than the greatest slump expected for the work.
   c. Half of the cylinders shall be tested at an age of 7 days, as a check on the specified strength. The other half of the cylinders shall be tested at an age of 28 days.
   d. No concrete shall be placed in any structure until the 7-day age test has been made.
   e. If the 7-day strength test results fall below the specified minimum, the Contractor shall redesign his mix and additional tests shall be made to verify the revised concrete design.

2. Job Testing of Concrete:
   a. The job slump, air and temperature tests shall be performed by an independent ACI Certified Technician at the Contractor’s expense, under the direction of the Project Engineer.
   b. Samples shall be obtained for job tests in accordance with ASTM C172. Slump test shall be performed in accordance with ASTM C143 throughout any pour as required to maintain constant quality.
   c. Slump tests on samples which have an aggregate larger than 1 ½ inches shall be performed after wet screening through a screen having 1 ½-inch square openings.
   d. Air test shall be performed in accordance with ASTM C231 and temperature tests shall be performed in accordance with ASTM C1064.

3. Job Sampling of Concrete:
   a. Job sampling of concrete shall be performed by an independent ACI Certified Technician at the Contractor's expense, as approved by the Project Engineer.
   b. Samples shall be obtained for cylinders in accordance with ASTM C31 and ASTM C172.
   c. The Contractor shall take one set of four cylinders from each truck.
   d. The concrete used in making the job slump or air test shall not be used in making the test cylinders.
   e. Compressive strength tests shall only be performed on samples which have had aggregates larger than 1 ½ inches removed by screening through a screen having 1 ½-inch square openings.
   f. The test specimen shall be molded immediately after the sample is taken and cured for 24 hours at the job site under the same conditions as provided for the concrete work.
   g. The cylinder shall be packed in crates padded with foam rubber, saw dust, etc., to keep continuously moist and delivered to the laboratory immediately after the one day "on the job site" curing period.

4. Laboratory Testing of Job Samples:
   a. Compressive strength test cylinders shall be tested in accordance with ASTM C39 at an independent ACI Certified Laboratory at the Contractor's expense.
   b. The cylinders shall be cured in the laboratory under moist conditions at 70 degrees F.
   c. A set of 4 cylinders shall be tested as follows; 1 cylinder shall be tested at 7 days and 2 shall be tested at 28 days. The 4th cylinder shall be held as a spare. If the previous breaks indicate low strength concrete, the spare shall be tested, under the direction of the Project Engineer.

5. In-Place Testing:
   a. Concrete which has been allowed to cure for 7 days or more may be tested for strength by the "Swedish Hammer" method by the Project Engineer.
   b. If the strengths indicated by this test are consistently more than 20% below the specification requirements, the Contractor will be required to take core samples after 28 days of curing and have them tested at his own expense and provide results to the Project Engineer.

E. The Contractor is responsible to pay all costs for providing test cylinders, making and transporting cylinders to laboratory, slump tests, and air content tests and shall pay the cost of laboratory services for breaking the test cylinders.

F. Provide core test or load tests at no additional cost to the contract if cylinder test results do not comply with the specified requirements and the latest edition of ACI 301.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement:

1. All cement used in concrete work shall be Portland Cement Type II, conforming to all requirements of the “Standard Specifications for Portland Cement” (ASTM C150)

2. Total alkali content less than 0.6%, expressed as Na_2O equivalent.

3. Storage:
   a. Store in suitable, dry, weatherproof buildings on floors raised above the ground, or in weather-tight, moisture and damp proof bins. No cement shall be used which has become caked or lumpy.

B. Aggregates:

1. Fine Aggregates:
   a. Natural sand, composed of clean, hard, durable, uncoated, well rounded grains, preferably of siliceous materials.
   b. Conform to “Standard Specification for Concrete Aggregates” (ASTM C33) except as follows:

      1) Deleterious substances shall not be in excess of: (by weight)
         a) Clay lumps 0.25%
         b) Material finer than #200 sieve 2%
         c) Coal and Lignite 0.25%
         d) Other deleterious materials 0.25%

      2) Aggregates shall have approved service records of at least 3 years.
      3) Aggregates shall show loss of weight no greater than 8% after 5 cycles of sodium sulphate soundness testing.
      4) Manufactured sand may be used in place of natural sand with the written approval of the Project Engineer provided the test of the material for organic impurities (ASTM C40) does not show the color darker than standard.
      5) Free from injurious amounts of alkali and organic impurities.
   c. Well graded from coarse to fine according to ASTM C33 to the below sieve analysis gradation:

SIEVE SIZE	PERCENT PASSING
3/8-inch	100
No. 4	95-100
No. 16	50-85
No. 50	10-30
No. 100	2-10

   d. Store materials in such a manner as to prevent deterioration or intrusion of foreign matter.

2. Coarse Aggregates:
   a. Crushed limestone, trap rock, granite, or other approved inert materials having clean, hard, strong, durable pieces, free from adherent coatings.

b. Conform to “Standard Specification for Concrete Aggregates” (ASTM C33).
c. The maximum percentage of deleterious substances are not exceed the following values:
   1) Material finer than 200-mesh sieve 1% by weight
   2) Coal and lignite 1 ¼% by weight
   3) Clay lumps 1 ¼% by weight
   4) Soft fragments 3% by weight
   5) Other deleterious substances 3% by weight
d. Well graded between the limits specified according to ASTM C33 and to the below sieve analysis gradation:

Nominal Maximum Size of Aggregate in Inches	Percentages by Weight Passing Standard Laboratory Sieves Having Square Openings					
	1 ½-inch	1-inch	¾-inch	½-inch	⅜-inch	No. 4
1 ½-inch	95-100	95-100	35-79	35-79	10-30	0-5
1-inch	95-100	95-100	25-60	20-55	0-10	

e. Unless otherwise authorized by the Project Engineer, 100% of coarse aggregate used in walls or slabs 6 inches or less in thickness shall pass a standard 1-inch screen; and 100% of coarse aggregate used in walls or slabs more than 6 inches thick shall pass a standard 1 ½-inch screen.
f. Store materials in such a manner as to prevent deterioration or intrusion of foreign matter.

3. Storage:
   a. Store concrete aggregates so that the inclusion of foreign materials is prevented. Stored and piled so that coning and segregation cannot occur.

C. Mixing Water:

1. Clean and free from injurious amounts of mud, oil, acid, alkali, organic matter or other deleterious substances, and shall produce concrete strengths at least 95% of that of similar specimens made with water approved by the Project Engineer.
2. Non-potable water may be used if mortar cubes made with the mixing water in question have 7-day and 28-day strength equal to at least 95% of the companion specimen in which potable water was used.

D. Admixtures:

1. Water Reducing:
   a. Conform to ASTM C494, Type A, and be used in strict accordance with the manufacturer’s recommendations.
   b. Possess approved service record of not less than 5 years.

2. Air Entraining:
   a. Conform to ASTM C260, and be used in strict accordance with the manufacturer's recommendation. Provide technical assistance of the manufacturer's field representative upon request of the Project Engineer.
   b. Air entrained in the following amount:
      1) 1½-inch to 2-inch maximum size aggregate: 4-6%
      2) ¾-inch to 1-inch maximum size aggregate: 5-7%

3. Other Admixtures may be necessary and may be used upon written approval from of the Project Engineer.

E. Concrete Mix:

1. Structural Concrete:
   a. Ultimate strength of 3,000 psi at 7 days and 4,000 psi at 28 days, and contain a minimum of 6 sacks of cement per cubic yard of concrete.
   b. Water or moisture contained in the aggregate must be included as part of the mixing water in determining the water content of the concrete.

2. Non-Structural Concrete:
   a. Ultimate strength of 3,000 psi at 7 days and 4,000 psi at 28 days, and contain a minimum of 6 sacks of cement per cubic yard of concrete.
   b. Testing will not be required.

F. Reinforcement Steel:

1. Bars:
   a. Conform to the requirements of the Standard Specification for deformed Billet-Steel Bars for Concrete Reinforcement with 60,000 psi Minimum Yield Strengths ASTM A615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement".
   b. Epoxy coated reinforcement steel bars shall conform to the requirements of ASTM A775 "Standard Specification for Epoxy-Coated Steel Reinforcing Bars".

2. Wire Mesh Fabric:
   a. Conform to the requirements of ASTM A185 "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete".

3. Bolsters, Chairs, and Accessories:
   a. Provision for all spacers, bolsters, bar chairs, ties and other devices necessary to properly space, place, support and fasten reinforcements shall be made by the Contractor and as approved of by the Project Engineer.
   b. Rocks, broken bricks, wood blocks or concrete fragments are not to be used for reinforcement support.

4. Pre-cast Concrete Block Bar Supports:
   a. Contain a minimum of nine sacks of cement per cubic yard and shall attain a strength of 6,000 psi in 7 days.
   b. Pre-cast concrete blocks can only be used for bar supports for slabs on ground.

c. Minimum of 9 square inches of bearing area and shall be adjusted for the particular conditions of weight, bearing surface and rigidity of the reinforcing steel called for.

5. Storage:
   a. Store on platforms, or other supports which will prevent contact of the steel with the ground or surface water.

G. Curing Materials.

1. Do not use curing compound where additional finishes such as hardeners, paintings, and other special coatings are required. Use water curing as specified instead.
2. Provide absorptive cover by using burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard and complying with AASHTO M182, Class 2.
3. A moisture retaining cover to comply with one of the following:
   a. Waterproof paper, ASTM C 171 or AASHTO M 171.
   b. Polyethylene film, ASTM C 171.
   c. Resin based curing compound conforming to ASTM C309, as recommended by the Wes Chemical Products, Inc., or approved equal.

2.2 ACCESSORIES

A. Joint Filler:

1. Provide expansion joint materials consisting of asphalt impregnated fiber strips, ½-inch thick, for the full depth of concrete slabs.

B. Joint Sealer:

1. Seal joints with self-leveling urethane sealant equal to Sonolastic SL-1, as manufactured by Chemrex Inc., Minneapolis, Minnesota, or approved equal.

C. Water Stops:

1. Fabricated from a plastic compound, the basic resin of which shall be polyvinyl chloride. Durajoint and/or Duraseal as manufactured by Electrovert Incorporated, or approved equal.

PART 3 - EXECUTION

3.1 PLACEMENT OF REINFORCEMENT

A. Place in accordance with ACI 318, Chapter 7. Fabricate all reinforcement steel with cold bends conforming to the recommended dimensions shown in ACI 318.

B. Field fabrication will be allowed only if the Contractor has equipment to properly fabricate steel and is approved in writing by the Project Engineer.

C. Thoroughly clean all reinforcing steel of mill and rust scale and of coatings that will destroy or reduce the bond.

D. Carefully form steel to the dimensions indicated on the plans. Do not bend or straighten in a manner that will injure the materials. Use of bars with kinks or bends is not allowed.

E. Accurately place and secure against displacement by using annealed wire of not less than No. 18 gauge, or suitable clips at intersections and where necessary by metal chairs or spacers or metal hangers.

F. Splicing of reinforcing bars at points of maximum stress is not allowed.

G. Make all joints or splices by using approved clamps, welding or by lapping the ends of the bars a distance of at least 40 times their nominal diameters unless otherwise noted on the plans.

H. Place in the position and at the spacings shown on the plans. The minimum cover for reinforcing steel is as follows:

Location of Reinforcing Steel Bars	**Minimum Cover**
Bottom bars on soil bearing foundations	3 inches
Bar adjacent to surfaces to exposed to weather saturated air in tanks, earth backfill, or water	2 inches
For bars more than 5/8-inch in diameter	1 ½ inches
Bars in other locations, not less than diameter of bar	¾ inches

I. Lace reinforcement with wire, in accordance with current CRSI standard, to supports or reinforcing to prevent displacement during concrete placement.

3.2 MIXING CONCRETE

A. Measurement of Materials:

1. By the sack or bag containing 94 pounds of Portland cement.
2. Measure aggregates by weight, and based on the weight of the dry aggregate, corrected by the water content in the aggregate used. Complete weighing by means of a weighing device of an approved type and design. Provide separate bins or compartments for fine aggregate, for the different sizes of coarse aggregate, and for bulk cement when used.
3. Measure water by means of a suitable measuring device, attached to the mixer and of such design that the quantity fed into the mixer can be closely controlled during the process of the work, and readily checked by the Project Engineer.

B. Job Site Mixing:

1. Thoroughly mix in a batch mixer of an approved type and capacity for a period of not less than 2 minutes after all the materials, including the water, have been placed in the drum. Operate the drum, during the period of mixing, at the speed specified by the manufacturer of the equipment. Discharge the entire contents of the mixer before recharging. Clean the mixer frequently.
2. Mix only the quantity of concrete required for immediate use. Re-tempering of concrete is not permitted.
3. Hand mixed concrete is not permitted except by special written approval of the Project Engineer.

C. Ready Mix:

1. Produce and deliver in conformity with ASTM C94, as applicable.
2. Continuously mixed from the time the water is added until the time of use. Deliver concrete to the site of the work, and discharge from the truck mixer or truck agitator within 45 minutes after the cement comes in contact with the mixing water, or with the aggregates which are surface wet. If placement times cannot be met, admixtures may be used to slow the rate of hydration and must be approved by the Project Engineer before use.
3. The organization supplying ready mixed concrete shall have sufficient plant and transportation facilities, to assure continuous delivery of concrete at the required rate.
4. Conform to mixer and agitator standards of the truck mixer manufacturer's bureau, National Ready Mix Concrete Association. While in transport, the truck mixer shall turn at agitation speeds only.
5. Do not add water to the mix except at the direction of the Contractor and under the supervision of the Project Engineer. The driver shall provide the Project Engineer on the job site with a ticket indicating time of adding initial mixing water.
6. Provide free access to the mixing plant at all times.

3.3 CONCRETE CONSISTENCY

A. Maintain a uniform consistency for each class of work and verify by means of slump tests.

B. The slump for vibrated or tamped concrete: 1½ inches and not more than 3 inches.

C. Slump for when hand puddling is permitted without vibration or tamping: not less than 3 inches or more than 6 inches.

D. Vary the consistency of the concrete as directed by the Project Engineer.

E. If, through accident, intention or error in mixing, any concrete is too wet, such concrete shall not be incorporated in the work, but shall be discarded as waste material.

3.4 CONCRETE PROPORTIONING

A. The proper proportioning of aggregates and cement will be determined by the Contractor. The proportioning of aggregates will be the most suitable combination of

aggregates which will give the necessary workability and desired consistency when mixed with water and cement as specified.

B. The ratio of cement to dry fine aggregate shall be that necessary to provide the maximum density of the mixture when used with the minimum amount of water required to produce the specified slump in the resulting concrete. This determination of the proper ratio shall be made by a testing laboratory at the Contractor's expense, using representative samples of the aggregates approved by the Project Engineer.

C. The water-cement ratio shall not exceed the maximum water-cement ratio established for the mix design.

D. The batch proportions used shall be such that full bags of cement are used in each batch.

3.5 PLACING CONCRETE

A. Initial Requirements:

1. Place in accordance with ACI Code 318.
2. Clean all bonding surfaces, free of laitance and foreign materials before depositing concrete.
3. All horizontal bonding surfaces shall be faced with a coat of fresh mortar.
4. Place concrete on a properly prepared and unfrozen sub-grade and only in a dewatered excavation or forms.
5. The Contractor will not be allowed to deposit concrete which is partially hardened or has been contaminated with foreign materials.
6. The Contractor will not allow entrance of mud or foreign materials into the concrete during placement operations.
7. Notify Project Engineer a minimum of 24 hours in advance of concrete placement.

B. Conveying:

1. Convey concrete from the mixture and deposit it at the place for final use by methods which will prevent segregation or loss of the materials.
2. Equipment for sheeting, pumping and pneumatically conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete at delivery end.

C. Deposit:

1. Place concrete in continuous horizontal lifts not to exceed 12 inches and place concrete against bulk heads and key ways at vertical joints.
2. The maximum free drop of concrete: 5 feet for 10-inch or thinner walls and one foot additional drop for each inch of wall thickness over 10 inches, with a maximum drop of 10 feet.
3. Before depositing new concrete or mortar on or against concrete which has set, the forms shall be re-tightened, the surface of the set concrete shall be roughened, thoroughly cleaned of foreign matter and laitance and saturated with water. The clean and saturated surfaces of the hardened concrete shall be

coated with a layer of thick, neat, cement grout, thoroughly worked into the surfaces of the hardened concrete by means of a steel brush or broom. The new concrete shall be placed before the grout has attained its initial set.

4. Deposited all concrete in forms at such rate that the forms will be filled at any point with a vertical rise of concrete surface of not less than 2 feet per hour.

D. Consolidating Concrete:

1. During and immediately after depositing, thoroughly consolidate concrete by means of suitable tools. All concrete, except floor slabs 8 inches and less in thickness not poured against form lining, shall be either tamped or vibrated.
2. Except for vibration of forms only to the extent necessary to remove air bubbles, all concrete shall be internally vibrated. Care shall be taken in vibrating concrete to vibrate only to bring a continuous film of mortar to the surface.
3. Stop vibration before any segregation of the concrete occurs.
4. Do not use vibrators to move fresh concrete.
5. Utilize immersion-type vibrators operating at 7,000 vibrations per minute with tip of 1¾-inch maximum for 6-inch to 11-inch walls, and 2¾-inch maximum for 12-inch or thicker walls.
6. Insert vibrators to a depth which will insure penetration of the previous lift and consolidate a maximum of 12 cubic yards per hour for each vibrator.

E. Time Requirements:

1. Place immediately if lifts below have not taken initial set.
2. Place all concrete within 15 minutes after discharging unless the Project Engineer otherwise extends this period through the use of approved admixtures.

F. Conform to ACI 305R for Hot Weather Concreting and ACI 306R for Cold Weather Concreting.

3.6 CONSTRUCTION JOINTS

A. Provide construction joints at the locations indicated on the plans, or at such other locations as designated or approved by the Project Engineer.

B. Prepare joints as specified in ACI 318.

C. No vertical joints will be made in walls at or near corners.

D. Provide keys in all joints where required to provide for either shear or water tightness. The width of the keys shall be approximately one half the thickness of the section at that point, and they shall be one half as deep as they are wide.

E. If any concrete is allowed to stand at any elevation below the finished grade or top surface for more than 2 hours without fresh concrete being applied thereon, the top surface shall be considered a construction joint, and be constructed in accordance with these specifications and provided with keys and water sealing strips.

F. Furnish and install water stops in all construction joints. The water stops shall be of the dimensions and types shown in the drawings. The water stop shall be thoroughly

embedded in the concrete on each side of the joint. Take care to keep the material clean and free from dirt, and from being damaged in any way during the process of placing the concrete. Utilize continuous sealing strips throughout the length of each construction joint including around corners. All water stops shall be accurately located in the construction joint.

G. At the direction of Project Engineer, Provide a slight angle for vertical construction joints, not to exceed ½ inch per foot, in such manner that the freshly deposited concrete will overhang the hardened concrete, allowing the new concrete to settle upon the old during the process of hardening.

3.7 FINISH OF FORMED SURFACES

A. Finish all formed surfaces in accordance with ACI 301 and ACI 318.

B. Rough Form Finish:

1. Provide a rough form finish for concrete surfaces buried from view by backfill in the finish work or covered by other construction, unless otherwise shown or specified.
2. The standard rough form finish leaves the concrete surface with the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and all fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
3. Fill snap-tie holes with nonshrink, non-metallic grout. Patch honeycomb areas and rock pockets. Small air holes do not require patching.

C. Smooth Form Finish (trowel finish):

1. This finish includes formed concrete surfaces which will be exposed to the air in the completed structure or to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete, such as water proofing, damp-proofing, painting, or other similar system.
2. A smooth form finish provides a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams.
3. Patch all defective areas and repair with all fins or other projections completely removed and smoothed.
4. For smooth form finish walls:
   a. Fill snap-tie holes with approved non-shrink, nonmetallic color matched grout.
   b. Grind off projections, fins, and rough spots.
   c. Repair other defects such as honeycomb areas, rock pockets, and rough spots resulting from form release agent failure or other reason with color matched non-shrink grout.
5. For smooth form trowel finish slabs:
   a. Finish by screeding and floating with straightedges to bring surface to required finish elevation shown.
   b. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.
   c. Use sufficient pressure on wood floats to bring moisture to surface.

d. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
e. Burnish surface with an additional troweling. Final troweling shall produce a ringing sound from trowel.
f. Do not use dry cement or additional water during troweling. No excessive troweling will be permitted.
g. Power finishing:
    1) An approved power machine may be used in lieu of hand finishing for finishing concrete floors and slabs in accordance with directions of machine manufacturer.
    2) Do not use power machine when concrete has not attained the necessary set to allow finishing without introducing high and low spots in slab.
    3) Do first steel troweling for slab by hand.

D. Broomed Finish:

1. Finish all exposed horizontal surfaces as specified for trowel floor finish, except omit final troweling and finish surface by drawing a fine-hair broom lightly across the surface.
2. Brooming shall be completed in same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope.

E. Edging

1. All exposed edges of mortar topped surfaces shall be finished with an edging tool having an edge radius not to exceed 3/8 inch.

3.8 ADMIXTURES

A. Water Reducing Type

1. Use in accordance to manufacturer’s recommendations.

B. Air Entraining Type

1. Use in accordance to manufacturer’s recommendations.
2. Test in accordance with ASTM C233.

3.9 CURING

A. Cure by one of the following methods:

1. Leaving forms for a minimum of 7 days. Keep form wet to prevent drying of concrete.
2. Using a saturated bath, soaker hoses, or sprinkler for a minimum of 7 days to keep the concrete continuously wet.
3. Using one or more coats of a liquid curing membrane, conforming to ASTM C309.
4. Using polyethylene sheets applied in full contact with surfaces and maintained in an appropriate manner for a minimum of 7 days.

5. Follow curing methods recommended in ACI 305R and ACI 306R for concrete placing during hot or cold weather.
6. Curing will not be required longer than 72 hours, if high early strength concrete is used. All concrete which is to support a direct load such as a foundation or wall shall be cured a minimum of 7 days (72 hours in the case of high early strength concrete) before any loading shall be applied.

3.10 COLD WEATHER PROTECTION

A. When concrete is placed at temperatures below 40ºF, or when the temperature is likely to fall below 40ºF, during the 24-hour period after placement, provide satisfactory methods and means to protect the mix from injury by freezing in conformance with practices recommended by ACI 306R.

B. Heat aggregates or water or both in order to place the concrete at temperatures between 50ºF and 70ºF.

C. Placing of concrete may be started in the morning but discontinued at 3:00 p.m. of the same day if freezing weather threatens.

D. Protect concrete or aggregates during transit, mixing and before and after placing as directed by the Project Engineer, to retain all heat possible in the concrete mix.

E. Provide sufficient protective cover after the concrete has been placed, such as canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50ºF, until at least 60% of the design strength has been attained.

F. The use of an accelerating agent in lieu of proper cold weather protection will not be authorized.

3.11 HOT WEATHER REQUIREMENTS

A. In hot weather when the temperature is 100ºF or above, or when the temperature is likely to rise above 100ºF during the 24-hour period after placement, suitable precautions shall be taken to avoid drying of the concrete prior to the finishing in conformance with the practices recommended by ACI 305R.

B. Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperatures shall be less than 90ºF.

3.12 CONCRETE ACCESSORIES

A. Preparation.

1. Correct any defects or conflicts that will affect proper performance prior to placement of joint filler, joint sealer, or waterstops.
2. Joint Sealants.
   a. Prime surfaces in accordance with manufacturer’s recommendations.

B. Installation.

1. Joint Fillers.
   a. Install joint filler as indicated on the plans or as directed by the Project Engineer.
   b. Install according to manufacturer's recommendations.

2. Joint Sealants.
   a. Do not seal joints when air or concrete temperature is below 40 degrees Fahrenheit.
   b. Install bond breaker and backup material as indicated on the plans.
   c. Install according to manufacturer's recommendations.

3. Waterstops.
   a. Locate as indicated on the plans in a manner to permanently retain flexibility.
   b. Splice by heat sealing in length or at intersections, in accordance to manufacturer's recommendations.
   c. Reform splices with a remolding iron having ribs or corrugations to match the pattern of the waterstop.
   d. Provide support, protection, and suitable guards for waterstops and partially embedded waterstops during the progression of work and after placement has discontinued.
   e. Replace or repair any punctured or damaged waterstops.

3.13 DEFECTIVE CONCRETE

A. Defective concrete is defined as concrete in place, which does not conform to the strength, shapes, alignments, appearances and/or elevation, as shown on the drawings and/or presents faulty surface areas.

B. Concrete surfaces not finished or cured in accordance with specifications are classified as defective concrete.

C. Defective concrete shall be removed and replaced at no additional cost.

D. Formed surfaces larger or smaller than the specified dimensional tolerances shall be deemed defective concrete. If the Project Engineer permits the Contractor to correct the error, such correction shall be as directed and in such a manner as to maintain the strength, function, and appearance of the structure.

E. Inaccurately formed surfaces exposed to view may be rejected and shall be repaired or removed and replaced and no additional cost.

F. The strength of the structure in place will be considered defective if it meets any of the following requirements:

   1. Actual laboratory strength is less than the strength specified.
   2. Reinforcing steel size, quantity, strength, position, or arrangement differs from the drawings.
   3. Concrete, which differs from the required dimensions or locations in such a manner as to reduce the strength of the structure.

G. Potentially defective concrete shall remain accessible with no other work performed that relates to or depends upon the questionable concrete until a final decision as to the final deposition of the concrete is made by the Project Engineer.

END OF SECTION

SECTION 16010 – GENERAL ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Work covered by this section includes the requirements for circuit breaker load centers, wire, receptacles, junction boxes, fasteners, grounding rod, cables, rigid and flexible non-metallic conduit and fittings.

1.2 RELATED WORK

A. Section 02315 – Excavation, Trenching and Backfilling

B. Section 02538 – Community Lift Station

1.3 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code.

B. ANSI C2 – National Electrical Safety Code.

C. NECA "Standard of Installation."

D. NEMA TC 2 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

E. ASTM F512 and NEMA TC 3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

F. NEMA TC 6 & 8 – PVC Conduit for Direct Burial

1.4 SUBMITTALS

A. Main Circuit Breaker Enclosure

B. Rigid Non-Metallic Conduit and Fittings

C. Flexible Conduit and Fittings

D. Wall Anchors

E. Electrical Conductors

F. Splice Boxes

G. Receptacles

H. Circuit Breakers

1.5 QUALITY ASSURANCE

A. The materials and construction methods specified herein are minimum requirements. Where the appropriate state/local electrical codes require more stringent materials or execution methods, they shall apply.

B. Notify the Project Engineer of any planned deviation from these specifications before proceeding so any price changes or quantity adjustments may be made.

C. The Engineer's plans are intended to indicate only diagrammatically the extent, general character, and approximate locations of the work included. The complete electrical installation is not shown in every detail, but it is required that all facilities be properly interconnected and correctly supplied with power.

D. Furnish and install items or work omitted or obviously needed from the Project Engineer's plans to create a properly functioning system at no additional cost to the Contract.

E. Provide new and UL products and materials (with labels) listed in this Section when under UL jurisdiction. Conform to NEMA and ANSI as required for the intended use.

PART 2 - PRODUCTS

2.1 MAIN CIRCUIT BREAKER ENCLOSURE

A. Manufacturer's

1. Square D
2. General Electric
3. or equal

B. Minimum integrated short circuit rating: 10,000 amperes rms symmetrical, Type 3R.

C. Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal trip circuit breakers with common trip handle for all poles.

D. Enclosure: General purpose outdoor.

2.2 RIGID NON-METALLIC CONDUIT AND FITTINGS

A. Sized as shown on the Project Engineer's plans.

B. NEMA TC 2; Schedule 40 or 80 PVC as indicated on the Project Engineer's plans.

C. Fittings and conduit bodies: NEMA TC 3

2.3 WALL ANCHORS

A. 304 stainless steel

B. Wedge type

2.4 ELECTRICAL CONDUCTORS

A. Manufacturer's

1. Southwire
2. General Cable
3. or equal

B. UL 854, ANSI/NFPA 70, Type USE-2

C. Insulation Voltage Rating of 600 Volts

D. Copper or aluminum or industry standard

E. Sized for less than 2% voltage drop

2.5 SPLICE BOXES

A. PVC, NEMA 4X

B. Watertight cord grips

2.6 RECEPTACLES

A. Manufacturer's

1. Leviton
2. or equal

B. UL943 GFCI Safety Standard

C. 20 Amp, Duplex connections, with watertight enclosure

2.7 CIRCUIT BREAKERS

A. MAIN CIRCUIT BREAKERS

1. Manufacturer's
   a. Square D Class 650
   b. or equal

2. Through the door operator

B. SINGLE PHASE CIRCUIT BREAKERS

1. Manufacturer's
   a. Square D Q0
   b. or equal

2. Plug-on style

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring and energization.

B. Verify the power source.

3.2 INSTALLATION

A. Install products within the manufacturer's instructions.

B. Ground electrical equipment in accordance with ANSI/NFPA 70.

C. Make electrical connection in accordance with manufacturer's instructions.

D. All electrical work shall be certified by a licensed electrician.

3.3 CONDUIT

A. Mechanically cut conduit with pipe cutters, saws, or abrasive wheels only. De-bur cut ends.

B. Clean pipe ends to be joined immediately prior to joining.

3.4 UNDERGROUND CABLE

A. Protect exposed cable form damage.

B. Reference section 02315 for Excavation, Trenching and Backfilling.

C. Bury cable 18 inches deep minimum.

END OF SECTION