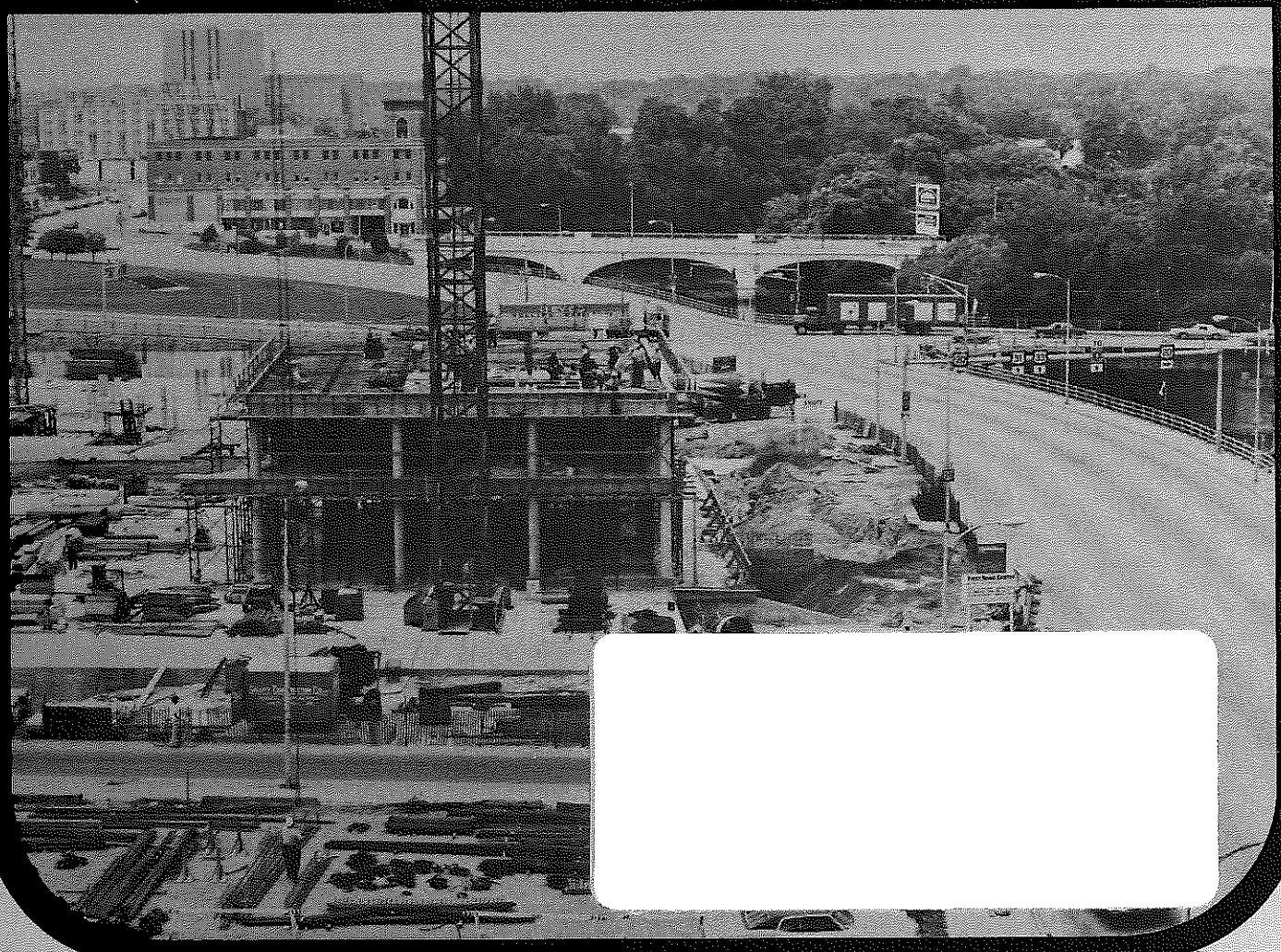
Design Enterprise Ltd.

SPECIFICATIONS



Contract No._____

SPECIFICATIONS

FOR

VILLAGE OF GROVER HILL

SEWAGE WORKS IMPROVEMENTS

December, 1987

Prepared For:

VILLAGE OF GROVER HILL

VILLAGE COUNCIL

BOARD OF PUBLIC AFFAIRS

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VILLAGE OF GROVER HILL
SEWAGE WORKS IMPROVEMENTS
BOOK 1 - DIVISION I
COLLECTION SYSTEM IMPROVEMENTS

TECHNICAL SPECIFICATIONS

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SECTION 01010

SUMMARY OF WORK

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1.02	Work Covered by Contract Documents
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1.04	Waste Materials Disposal
1.05	Barricades and Lights
1.06	Construction Facilities
1.07	Historical or Archaeological Discovery
1.08	Engineering Services

SECTION 01010

SUMMARY OF WORK

1.01 Form of Specifications:

A. Abbreviated or outlined type, includes incomplete sentences.

B. Omission of words or phrases, such as: "the Contractor shall", "in conformance with", "shall be", "as noted on the plans", "according to the plans", "a", "an", "the" and "all" are intentional.

C. Supply omitted words or phrases by inference.

D. Part numbers are not intended to be consecutive, but represent standard specification titles.

1.02 Work Covered by Contract Documents:

A. Work covers construction of improvements generally described in the Notice to Bidders and shown on the detailed project plans.

B. Contractor's Duties:

1. Pay all legally required sales, consumer and use taxes and adhere to the following:

a. Contractor shall obtain sales tax information from all subcontractors and suppliers.

b. Submit sales tax information on proper forms to Owner prior to final acceptance.

c. Contractor shall be allowed an exemption of Ohio sales tax.

1.03 Contracts:

A. Construct work under lump sum and unit price contracts as indicated.

1.04 Waste Materials Disposal:

A. Arrange for disposal of waste materials as approved by Engineer.

B. Stockpile or dispose of salvageable items as directed by Engineer.

C. Salvageable items remain property of Owner.

D. Stockpile or disposal site not on Owner's property shall require agreement between property owner and Contractor, which would relieve Grantee from any damages caused by Contractor or its agents.

1.05 Barricades and Lights:

A. Erect and maintain barricades and lights and/or watchmen for protection and warning of pedestrians and vehicles, prevent access of unauthorized persons to portions of site where work is in progress.

B. Location and arrangement: Conform to ordinances and laws. Meet approval of Engineer and Owner.

1.06 Construction Facilities:

A. Storage:

1. Arrange for storage space to suit needs.

2. Store materials and equipment in manner which will preserve their quality and fitness; provide temporary storage buildings as required.

3. Location of construction facilities, including construction plant and yard on site, shall be subject to approval by Engineer; remove upon completion of work.

B. Service: Arrange for water, electrical energy, compressed air and other services to meet own requirements.

C. Sanitary: Provide suitable non-segregated sanitary facilities for construction personnel.

D. Field Office: Shall be required and shall contain an in-service telephone with access to such provided for the Owner and Engineer.

1.07 Historical or Archaeological Discovery:

A. If during the course of construction, evidence of deposits of historical or archaeological interest is found, cease operations affecting the find and notify the Owner, who shall notify the State Historical Department. No further disturbance of the deposits shall ensue until the Contractor has been notified by the Owner that he may proceed. The Owner will issue a Notice to Proceed only after the State official has surveyed the find and made a determination of value and effect and submitted such determination to the Owner.

B. Compensation to the Contractor, if any, for loss time or changes in construction to avoid the find, shall be determined in accordance with changed conditions or change order provisions of the specifications.

1.08 Engineering Services:

A. Owner will furnish boundary surveys, establish base lines for principal components for work, and provide bench marks as shown on Drawings. Contractor shall develop and make detail surveys as required to execute the construction.

B. Preserve all monuments, bench marks, reference points and stakes established by the Engineer. In case of willful or careless destruction of same, the Contractor will be charged with the resulting expense of replacement and shall be responsible for any mistakes or loss of time that may result from their unnecessary loss or disturbance.

C. It shall be the duty of the Contractor to call to the attention of the Engineer any reference lines, points or bench marks which may have been disturbed or which seem to be off line or grade.

D. Contractor shall reimburse Owner for extra engineering cost necessitated by continuance of work beyond the completion date recognizing time extensions granted by Owner. This cost will be a part of the assessed liquidated damages, per the General Conditions.

E. Contractor shall reimburse Owner for engineering, design and inspection cost necessitated by use of equipment other than that detailed in plans and specifications.

* * * END OF SECTION * * *

SECTION 01110

GENERAL PROVISIONS

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SECTION 01110

GENERAL PROVISIONS

PART 1 - GENERAL

1.01 Summary of the Work:

A. Furnish and install equipment and materials and perform construction associated with project, as outlined in Specifications and shown on Drawings.

B. Work includes the completion of systems listed below:

1. Furnish and install 4", 6", 8" and 10" Small Diameter Gravity (SDG) sewer including all cleanouts, manholes, and individual service pumps.

2. Furnish and install septic tanks, individual service pumps and laterals as shown on drawings.

1.02 Sequence of Work:

A. The general sequence of installation for the main sewage system components is as follows:

1. The main gravity sewer lines shall be installed first, commencing at the lowest point and moving up grade from structure to structure. Sections between structures, or a maximum of 500 lineal feet, shall pass required tests before continuing on to the next section of sewer main.

2. All laterals to individual properties shall terminate at their respective right-of-way lines. The termination points shall be temporarily plugged and stake marked.

3. Temporary and permanent restoration of the work area shall be done promptly as the main lines and lateral stubs are installed. Sequence of this work shall be in accordance with the applicable specification section herein.

4. Completion of the new lateral line from the right-of-way to the new septic tank and placement of the new septic tank with a minimum 5'-0" influent connection stub shall be done on each of the private properties as shown on the drawings. The influent stub shall be temporarily plugged and stake marked. In the instances where the existing septic tank is

to be removed and replaced with the new septic tank, the Contractor shall make a permanent connection between the private property Owner's new lateral, or tested and approved existing lateral, and the septic tank influent stub. All work on private property is to be done only after the following is fully operational, tested and approved in writing by the Engineer to receive sewage: The main gravity sewer lines, the sewage treatment plant and the pump station/force main of Contract II. Also, each individual property Owner and the Engineer shall be notified in writing at least twenty-one calendar days in advance of the exact date of any work on the Owner's property.

5. Restoration of private property work area shall be started immediately and completed within two weeks after the sewer lines and septic tank installation is complete at each location.

1.03 Requirements of Regulatory Agencies:

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations.

B. In case of difference between building codes, specifications, state laws, local ordinances, industry standards and utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Engineer in writing of any such difference.

C. Non-Compliance: Should Contractor perform any work that does not comply with the requirements of applicable building codes, state laws, local ordinances, industry standards and utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Except as otherwise specified herein, all piping work and materials shall conform to American Standards Assn. Code for Pressure Piping.

E. Permits: Each Contractor shall obtain and pay for all building permits required by his work.

F. Applicable Codes and Standards shall include all state laws, local ordinances, utility company regulations and applicable requirements of following nationally accepted codes and standards. These requirements are to be considered minimum and are to be exceeded when so indicated on the Drawings or herein specified.

1. Recommended Standards for Water Works

2. Recommended Standards for Sewage Works

3. Building Officials and Code Administrators (BOCA) 1981 Edition; adopted by the State of Ohio and Amended by the following:

   a. Ohio Basic Building Code

   b. Ohio Basic Building Code (Mechanical)

   c. B.O.C.A. Basic Pump Code

   d. Ohio Fire Code

4. State Board of Health Division

5. Ohio State Fire Prevention Commission

6. AASHO: American Association of State Highway Officials

7. ACI: American Concrete Institute

8. AISC: American Institute of Steel Construction

9. AMCA: Air Moving and Conditioning Association

10. ANSI: American National Standards Institute

11. API: American Petroleum Institute

12. ASA: American Standards Association

13. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers

14. ASME: American Society of Mechanical Engineers

15. ASTM: American Society of Testing Materials

16. AWS: American Welding Society

17. AWWA: American Water Works Association

18. FIA: Factory Insurance Association

19. FM: Factory Mutual

20. MSS: Manufacturing Standards Society

21. NBS: National Bureau of Standards

22. NEC: National Electric Code

23. NEMA: National Electrical Manufacturers Association

24. NFPA: National Fire Protection Association

25. OSHA: Occupational Safety and Health Act

26. SMACNA: Sheet Metal and Air Conditioning Contractors

27. UL: Underwriters Laboratories

1.04 Supervision by Contractor:

The Contractor will supervise and direct the Work. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor will employ and maintain on the Work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be as binding as if given to the Contractor. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

1.05 Work and Workmanship:

A. Provide all required labor, materials, equipment and Contractor's services necessary for the complete installation of systems required in full conformity with requirements of authorities having jurisdiction; all as indicated on Drawings and herein specified.

B. Finished job shall be functional and complete in every detail including any and all such items required for complete system whether or not these items be specified or shown on Drawings.

C. Special attention shall be given to accessibility of working parts and controlling parts. Adjustable parts shall be within easy reach. Removable parts shall have space for removal.

D. Each Contractor shall acquaint himself with details of all work to be performed by other trades and take necessary steps to integrate and coordinate his work with the other trades.

E. It is assumed that the General Contractor is familiar with standard first class installation procedures. Therefore, these Specifications do not attempt to include every detail or operation necessary for a complete installation.

F. It should be particularly noted that the terms "furnish" and "provide" are interchangeable and that each of these terms means to provide, install and connect, unless otherwise stated.

G. When tables or schedules show quantities of materials, they shall not be used as a final count.

These figures serve only as a guide to Contractor. Each Contractor shall be responsible for furnishing all the materials on Drawings or as specified.

1.06 Drawings and Minor Deviations:

A. Construction Drawings show general arrangement of all piping, equipment and appurtenances. They shall be followed as closely as actual building construction and work of other trades will permit. Mechanical work shall conform to requirements shown on all Drawings. General and Structural Drawings shall take precedence over Mechanical Drawings. It is not possible to indicate all offsets, fittings and accessories as may be required to meet such conditions. Do not scale from Drawings.

B. In event of conflict of requirements detailed in the Drawings, General Conditions, General Provisions, and any subsequent sections of these Specifications, the Bidder shall inform the Engineer of such conflict in writing not later than ten (10) days before the bids are due. If such notification is not provided, the Contractor shall accept Architect/Engineer's decision in resolvement of such conflict without any further compensation.

C. For purpose of clarity and legibility, distribution systems are essentially diagrammatic, although size and location of equipment and piping are drawn to scale where possible. Verify Contract Documents information at the site.

1.07 Guarantee:

A. In the event of a conflict between the following and the General Provisions at the front of the Specifications, the latter shall prevail.

B. Except as otherwise specified, under individual equipment sections, all workmanship, materials and equipment shall be guaranteed for a period of one year after final acceptance of project by Owner.

C. Contractor agrees to make good all damage to construction of building or site, or equipment which in the opinion of Engineer, is result of, or incidental to the use of materials, equipment or workmanship which are inferior, defective or not in accordance with Specifications.

D. Contractor shall keep works in good repair during guarantee period. In case such repairs become necessary, Owner shall give written notice to Contractor to commence such repairs within thirty (30) days after such notice is given. Owner may make such repairs either by its own employees or by independent contract and may thereupon recover from the Contractor and his Sureties cost of repairs so made together with cost of supervision and inspection thereof. Owner shall have sixty (60) days after expiration of said guarantee period in which to notify Contractor of any such repairs necessary on date of such expiration.

E. Determination of the necessity for repairs shall rest entirely with Engineer whose decision upon the matter shall be final and obligatory upon the Contractor. Guarantee herein stipulated shall extend to the whole body of improvement and all its appurtenances.

1.08 Occupational Safety and Health Standards:

All work shall comply with the current requirements of the U.S. Department of Labor - Occupational Safety and Health Administration, entitled Occupational Safety and Health Standards; National Consensus Standards and Established Federal Standards.

PART 2 - PRODUCTS

2.01 Equipment Delivery Schedule:

Submit at pre-construction meeting a schedule listing equipment and materials required for complete installation, quantity required and delivery dates required to meet schedule. Any and all delivery delays shall be identified at the pre-construction meeting.

2.02 Product and Material Approval:

A specification followed by one or more manufacturers and "or approved equal" is open to all equal products or materials.

2.03 Shop Drawings:

A. Review of Shop Drawings does not relieve Contractor of responsibility for correct ordering of materials and equipment. Contractor review shall insure that equipment will fit in available space.

B. Information to be included in the Submittal:

1. Manufacturer's model number or catalog number, size and performance curves and data. Indicate operating point on curves and tabular data for each piece of equipment that curves or data represent.

2. Indication of all performance data, construction materials, finishes and modifications to manufacturer's standard design called for in the Specifications.

3. Location of connections for all piping required.

4. Roughing-in, foundation and support point dimensions.

5. Indicate all electrical characteristics.

6. Wiring diagrams or connection diagrams conforming to NEMA Standard 101-1.293.

7. Data shall be coordinated and included in single submittal.

8. For submissions, such as catalogs, mark information that is to be provided, including all accessories and modifications, so there is no confusion.

C. Submit minimum of eight (8) copies; one (1) will be retained, seven (7) will be returned for inclusion in Maintenance Manual.

D. Submit Shop Drawings in brochure form and include all related equipment in one brochure.

E. After award of Contract, submit within twenty (20) working days.

F. Submit Shop Drawings of all equipment in this Specification and as specifically stated in the individual sections.

G. Contractor is to affix his company name, in the form of a stamp, to all Shop Drawings and Submittals before submitting. Contractor shall stamp or mark Shop Drawings or submittals "Approved", date and initial (or sign) prior to issuing.

H. Contractor shall submit minimum 3/8" scale drawings (such as sheet metal fabrication or pump suction and discharge piping and valves) on reproducible material. Engineer will comment on reproducibles and will return prints with action marked.

2.04 Record Drawings (As-Builts):

A. During construction, maintain complete and legible set of Drawings, showing changes and deviations between actual construction and Engineer's Drawings. Submit marked-up set to Engineer for review before "As-Builts" are made.

B. Upon completion of project, this Contractor shall revise Working Drawings to "As-Built" condition, using reproducible mylar.

C. Mylars shall be obtained from Engineer at the Contractor's expense.

D. Submit two (2) copies of "As-Built" Drawings to Engineer for review. One (1) set of reviewed Drawings shall be transmitted to Owner by Engineer for their permanent record and other set will be retained by Engineer for their permanent record.

2.05 Maintenance Manual:

A. Contractor shall submit at 75% of job completion, four (4) Maintenance Manuals.

B. Maintenance Manuals are to include one approved copy of each submittal and shall show all information relative to maintenance and operating instructions for all new mechanical equipment.

C. Maintenance Manual shall be in following form:

1. First: Index of complete contents.

2. Second: Title of job, Owner, address, dates of submittal, name, address and phone number of Contractor and Engineer.

3. Third: Include description of operation and each mechanical system.

4. Fourth: Material finish schedules and recommended maintenance procedures.

5. Fifth: Each piece of equipment which is submitted for approval shall be bound into this manual in following form:

a. Name of equipment.

b. Manufacturer's model and serial number (if one exists).

c. Vendor.

d. Shop Drawings.

e. Installation, operation and maintenance instructions which are to be supplied by vendors.

6. Sixth: Any special emergency operating instructions or list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of system.

7. Seventh: Copy of valve tag list.

D. Information for each piece of equipment shall be separated by pasteboard tabbed divider, identifying equipment by same name as listed in Index.

E. All information shall be arranged in as many standard 3-ring vinyl coated notebooks as necessary.

F. General Contractor shall prepare Maintenance Manual. Electrical Contractor shall coordinate with General Contractor the assemblage order and submit to him his data with tabbed dividers for inclusion.

2.06 Inspection:

Provide in triplicate, a Certificate of Inspection at completion of the work. Inspection to be performed by local authority having jurisdiction (i.e., City Inspector, County Inspector, etc.).

2.07 Reports:

A. Submit for attachment to Substantial Completion Certificate the following:

1. Letter certifying that all mechanical installation comply with applicable codes.

2. All other test reports.

PART 3 - EXECUTION

3.01 Material Storage:

Provide suitable protection from weather and vandalism for all materials and equipment to be installed. Storage shall be dry, clean and safe. Any materials or equipment damaged, deteriorated, rusted, or defaced due to improper storage shall be fully repaired, refinished or replaced, as directed by the Owner's Representative.

3.02 Coordination Between Contractors:

A. Each Contractor and Subcontractor shall study all the Drawings applicable to this work, so complete coordination between trades will be affected.

B. It is the responsibility of each Contractor and Subcontractor to leave necessary room for other trades. No extra compensation will be allowed to cover the cost of removing piping, conduit, or equipment found encroaching on space required by others.

3.03 Electrical Connections to Equipment:

A. In event that supplier of equipment requires larger starter or disconnect than those indicated on documents, he shall reimburse Contractor supplying these items for difference.

B. Connections and wiring diagrams shown on Drawings or described in Specifications are typical and are for bidding purposes only. Detailed diagrams and instructions shall be provided by Contractor supplying equipment.

C. Additional relays, switches, contactors, conduit, wire, connections, etc., which may be required for control purposes in addition to those specified for and indicated on Drawings shall be provided by the Electrical Contractor at the General Contractor's expense. These devices shall be installed by supplier.

D. Wiring diagrams shall be specially drawn so they will apply specifically to this project. "Typical" wiring diagrams will not be acceptable for installation purposes. In event that several pieces of equipment from different suppliers are combined in one system, Contractor shall furnish complete wiring and control diagram to enable Electrical Contractor to make proper connection. Diagrams shall be submitted to Engineer for approval prior to actual wiring.

E. Contractor shall furnish to Electrical Contractor written notice of approval and acceptance of all control wiring installed for mechanical systems by Electrical Contractor. Such approval shall be given within thirty (30) days of completion of all such control wiring. Two (2) copies of letter shall be sent to Engineer.

3.04 Labeling and Tagging:

Label all electrical equipment or controls provided by Contractor by means of engraved laminated plastic plates screwed or riveted to the device. Height of letters to be not less than 1/4" unless otherwise specified or directed.

3.05 Cleaning and Touchup:

All mechanical equipment, control panels and other enclosures provided by Contractor shall be cleaned and paint touched up as necessary to duplicate factory finished appearance. Touchup paint shall exactly match color, composition and quality of factory applied finish.

3.06 General Completion, Startup:

A. Work Included: Furnish material and labor required to perform startup of equipment and systems installed in project and provide operating instructions to the Owner.

B. General Requirements:

1. Adhere strictly to following procedures in starting up of systems.

2. Inspect bearing for cleanliness and alignment and remove any foreign materials found. Grease as necessary and in accordance with manufacturer's recommendations. Replace bearings that run rough or noisy.

3. Lubricate equipment as recommended by manufacturer.

4. Adjust tension in V belt drives, adjust varipitch sheaves and drives for proper equipment speed. Change belts and sheaves if necessary to obtain proper equipment speed, remove any foreign materials from sheaves or belts before starting operations, adjust drives for alignment of sheaves and V belts. Construe proper speed as that which produces intended performance.

5. Adjust direct drives for proper alignment of flexible couplings, provide lubrication of particular couplings so required, check security of couplings to driver and driven shafts, set drive components to assure free rotation with no undesirable stresses present on coupling or attached equipment.

6. Check pump packing glands or mechanical seals for cleanliness and adjustment before running pump. Inspect shaft sleeves for scoring and proper placement of packing, replace if necessary. Inspect mechanical faces, chambers and seal rings and replace if necessary. Make sure piping system is free of dirt and scale before circulating liquid through pumps.

7. Tighten flanges and packing glands after system has been placed in operation. Replace gaskets in flanges that show any signs of leakage after tightening.

8. Inspect both hand and automatic control valves, clean bonnets and stems, tighten packing glands to assure no leakage, but permit valve stems to operate without galling. Replace packing in valves that require same to retain maximum adjustment after system is judged complete. Replace entire packing in any valve that continues to leak after adjustment, remove and repair bonnets that leak, coat packing gland threads and valve stems with surface preparation similar to MolyCote or FelPro after cleaning.

9. Inspect and make certain that all control valve seats are free from foreign material and are properly positioned for intended service.

10. Inspect screwed joints for leakage and remake each joint that appears to be faulty. Do not wait for rust to form. Clean threads on both parts, apply compound and remake joint.

11. Clean strainers, dirt pockets, orifices, valve seats and headers in all fluid systems after system has been placed in operation to assure they are being free from foreign materials.

12. Open steam traps and air vents, remove operating elements. Clean thoroughly, replace internals and put back into operation.

13. Adjust pipe hangers and supports for correct pitch and alignment.

14. Remove rust, scale and foreign materials from equipment and renew any defaced surfaces. If equipment is badly marred, Engineer shall have authority to request that new materials be provided.

15. Renew or clean air filters to like-new condition.

16. Inspect each pressure gauge and thermometer for calibration and replace those that are defaced, broken or read incorrectly.

17. Repair insulation that may be damaged.

18. After each system has been put into operation, repeat certain checks described in preceding paragraphs.

19. Complete all applicable start-up procedures described in preceding paragraphs and in the associated articles for particular systems prior to occupancy of building.

20. Provide such continuing adjustment services as necessary to insure proper functioning of all mechanical systems after building occupancy and during guarantee period.

21. Verify correct motor rotations.

C. Attend pre-startup coordination meeting for the specific purpose of achieving a coordinated systems start-up, with Engineer and Owner.

3.07 Guarantees and Warranties:

A. Performance/Payment Bond: Per Information for Bidders.

* * * END OF SECTION * * *

EQUIPMENT REFERENCE DATA

Equipment Name and Number | Type No. | ID No.

Manufacturer | Local Representative | Part or Model Number | Serial Number

Drawing | Reference Catalog | Instruction Book | Date Put in Service

Electric Motor

HP | Frame | RPM

Volts | Amps | Phase

Type

- Series
- Shunt
- Synchronous
- Induction

Specification

- Open
- Exp. proof
- Drip proof
- Totally enclosed

Bearings

- Sleeve
- Ball
- Roller

Lubricant

Pump

Capacity | TDH | RPM

Impeller | Packing

Type

- Centrifugal
- Plunger
- Diaphragm
- Gear
- Screw

Installation

- Horizontal
- Vertical
- Submerged

Lubrication

- Water
- Oil
- Grease

Bearings

- Sleeve
- Ball
- Roller

Lubricant

Drive or Reducer

HP | RPM In | RPM Out

Ratio

Type

- Gear
- V-Belt
- Chain
- Varidrive

Bearings

- Sleeve
- Ball
- Roll

Lubricant

Auxiliary Equipment

Type, Speed, Size, Capacity Range

Bearings, Lubricant

Other Features

(PROJECT TITLE)

EQUIPMENT PREVENTIVE MAINTENANCE - EXAMPLE

Equipment Name: Bar Screen

Model: "MA" Manufacturer: ABC Company

Remarks: * For use at 16° to 50°F
** For use at 51° to 110°F

	Preventive Maintenance Schedule	Frequency
Lubricate:	1. Shearing surfaces of shear pin device (A)	Monthly
	2. Drive chain (B)	Weekly
	3. Reducer (A)	Monthly
	4. Electric motor (A)	Annually
	5. Shock absorber (C)	Weekly
	6. Radius arm pivot (A)	Weekly
	7. Headshaft bearing (A)	Weekly
Inspect:	1. For overheating, excessive noise, vibration, loose bolts, cracks, etc.	Daily
	2. Reducers oil level (D or E)	Daily
	3. Drive chain for wear and broken parts	Weekly
Replace:	1. Oil in reducer (D or E)	After 1st 30 days then Ev. 2500 hrs.

Lubricants: (A) NLGI #2
(B) SAE #30 oil
(C) Machine oil
* (D) AGMA #7
** (E) AGMA #8

SECTION 01220

PROGRESS MEETINGS

INDEX

1.01 General
1.02 Pre-Construction Meeting
1.03 Progress Meetings

SECTION 01220

PROGRESS MEETINGS

1.01 General:

A. Schedule and administer progress meetings.

B. Engineer will attend meetings to ascertain that work is expedited consistent with construction schedule and with Contract Documents.

1.02 Pre-Construction Meeting:

A. Schedule within 5 days after date of Notice to Proceed.

B. Attendance:

1. Owner

2. Engineer and his inspector/representative

3. Other prime contractors

4. Major subcontractors of all prime contractors

5. Safety representative

6. Representatives of governmental or other regulatory agencies

C. Minimum Agenda:

1. Distribute and discuss:

a. List of major subcontractors

b. Tentative time and payment schedule

c. Construction schedule must be approved by Engineer prior to construction.

2. Critical work sequencing

3. Relation and coordination of prime contractors

4. Designation of responsible personnel

5. Processing of field decisions and change orders

6. Adequacy of distribution of Contract Documents

7. Submittal of shop drawings, project data and samples

8. Procedures for maintaining Record Documents

9. Use of premises:

   a. Office and storage areas

   b. Owner's requirements

10. Major equipment deliveries and priorities

11. Safety and first-aid procedures

12. Security procedures

13. Housekeeping procedures

1.03 Progress Meetings:

A. Schedule regular meetings as determined at Pre-Construction Conference.

B. Set location of meetings as determined at Pre-Construction Conference.

C. Attendance:

1. Engineer and his consultants

2. Other prime contractors

3. Subcontractors as pertinent to agenda

4. Safety representative

5. Representatives of governmental or other regulatory agencies

D. Minimum Agenda:

1. Review work progress since last meeting

2. Note field observations, problems and decisions

3. Identify problems which impede planned progress

4. Review off-site fabrication problems

5. Develop corrective measures and procedures to regain planned schedule

6. Revise construction schedule as indicated

7. Plan progress during next work period

8. Coordinate projected progress with other prime contractors

9. Review submittal schedules and expedite as required to maintain schedule

10. Review changes proposed by Owner for:

    a. Effect on construction schedule

    b. Effect on completion date

* * * END OF SECTION * * *

SECTION 01300

SUBMITTALS AND SUBSTITUTIONS

INDEX

1.01	General
1.02	Shop Drawings
1.03	Project Data
1.04	Submission Requirements
1.05	Resubmission Requirements
1.06	Distribution of Submittals After Review
1.07	Substitutions
1.08	Operating and Maintenance Data

SECTION 01300

SUBMITTALS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 General:

A. Submit Shop Drawings, project data and samples required by Specification Sections.

B. Designate in construction schedule proposed submittal dates.

1.02 Shop Drawings:

A. Submit Drawings prepared by Contractor, Subcontractor, supplier or distributor which illustrate some portion of the Work.

B. Show fabrication, layout, setting or erection details.

C. Identify details by reference to sheet and detail numbers shown on contract drawings.

D. Minimum sheet size: 8-1/2" x 11".

1.03 Project Data:

A. Manufacturer's standard schematic drawings:

1. Modify Drawings to delete information which is not applicable to project.

2. Supplement standard information to provide additional information applicable to project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.

1. Clearly mark each copy to identify pertinent materials, products or models.

2. Show dimensions and clearances required.

3. Show performance characteristics and capacities.

4. Show wiring diagrams and controls.

1.04 Submission Requirements:

A. Schedule submissions at least ten (10) days before reviewed submittals will be needed.

B. Submit number of copies of Shop Drawings, project data and samples which Contractor requires for distribution plus three (3) copies which will be retained by Engineer.

C. Accompany submittals with transmittal letter containing:

1. Date

2. Project title and number

3. Contractor's name and address

4. The number of each Shop Drawing, project data and sample submitted

5. Notification of deviations from Contract Documents

6. Other pertinent data

D. Submittals shall include:

1. Date and revision dates

2. Project title and number

3. The names of:

a. Engineer
b. Contractor
c. Subcontractor
d. Supplier
e. Manufacturer
f. Separate detailer when pertinent

4. Identification of product or material

5. Relation to adjacent structure or materials

6. Field dimensions clearly identified as such

7. Specification Section number

8. Applicable standards, such as ASTM number or Federal Specification

9. A blank space 4" x 5" for the Engineer's stamp

10. Identification of deviations from Contract Documents

1.05 Resubmission Requirements:

A. Shop Drawings:

1. Revise initial Drawings as required and resubmit as specified for initial submittal.

2. Indicate on Drawings any changes which have been made other than those requested by Engineer.

B. Project Data and Samples: Submit new data and samples as required for initial submittal.

1.06 Distribution of Submittals After Review:

A. Distribute copies of Shop Drawings and project data which carry Engineer's stamp as needed.

B. Distribute samples as directed.

1.07 Substitutions:

A. Approval Required:

1. The Contract is based on the standards of quality established in the Contract Documents.

2. All products proposed for use, including those specified by required attributes and performance, shall require approval by the Engineer before being incorporated into the Work.

3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the Engineer.

B. "Or Equal":

1. Where the phrase "or equal" or "or equal as approved by Engineer" occurs in the Contract Documents, means any material which, in the opinion of the Engineer, is equal in quality, durability, appearance, strength, design and performance to the material specified, and will function adequately in accordance with the general design.

2. Where in these Specifications, one or more certain materials, trade names, or articles of certain manufacture are mentioned, it is done for the express purpose of establishing a basis of durability and efficiency and not for the purpose of limiting competition.

3. The Engineer shall evaluate proposed substitutions and the decision of the Engineer shall be final.

1.08 Operating and Maintenance Data:

The Contractor shall furnish to the Engineer, prior to the completion of the work under this contract, six (6) copies of all manufacturer's drawings, parts catalogs, wiring diagrams, installation and operating instructions, guarantees and other data or information which may be needed or useful in the operation, maintenance, repair, for ordering replacements, for all items of mechanical and electrical equipment furnished under this contract. Such data shall be complete in every detail, including index, and each set shall be assembled under a suitable cover. The above noted requirements shall be furnished in addition to any specified wallmounted instructions required under the Technical Provisions of the Specifications. The cost of furnishing the above data shall be included in the applicable contract unit price or lump sum prices for the equipment furnished.

* * * END OF SECTION * * *

SECTION 01310

CONSTRUCTION SCHEDULES

INDEX

1.01	General
1.02	Form of Schedules
1.03	Content of Schedules
1.04	Updating
1.05	Submittals
1.06	Distribution

SECTION 01310

CONSTRUCTION SCHEDULES

1.01 General:

A. Coordinate schedules of other contractors.

1.02 Form of Schedules:

A. Prepare in form of horizontal bar chart.

B. Show chronological order of beginning of each item of work.

1.03 Content of Schedules:

A. Provide complete sequence of construction by activity.

1. Shop drawings, project data and samples:

a. Submittal dates.

b. Dates reviewed copies will be required.

2. Decision dates for:

a. Products specified by allowances.

b. Selection finishes.

3. Product procurement and delivery dates.

4. Dates for beginning and completion of each element of construction, specifically:

a. Concrete placement.

b. Subcontractor work.

c. Equipment installation.

d. Equipment tests.

e. Start up.

B. Identify work of separate phases, or other logically grouped activities.

C. Show projected percentage of completion for each item of work as of first day of each month.

D. Provide separate subschedule showing submittals, review times, procurement schedules and delivery dates.

E. Provide subschedules to define critical portions of entire schedule.

1.04 Updating:

A. Show all changes occurring since previous submission of updated schedule.

B. Indicate progress of each activity and show completion dates.

C. Include:

1. major changes in scope.

2. Activities modified since previous updating.

3. REvised projections due to changes.

4. Other identifiable changes.

D. Provide narrative report, including:

1. Discussion of problem areas, including current and anticipated delay factors and their impact.

2. Corrective action taken or proposed and its effect.

3. Effect of change in schedules of other prime contractors.

4. Description of narratives:

a. Effect on schedule due to change of scope.

b. Revisions in duration of activities.

c. Other changes that may affect schedule.

1.05 Submittals:

A. Submit initial schedules within twenty (20) days after date of Notice to Proceed.

1. Engineer will review schedules and return review copy within ten (10) days after receipt.

2. If required, re-submit within seven (7) days after return of review copy.

B. Submit biweekly updated schedules accurately depicting progress to first day of each month.

C. Submit the number of copies required by Contractor, plus four (4) copies to be retained by Engineer.

1.05 Distribution:

A. Distribute copies of reviewed schedules to:

1. Job site file.

2. Other prime contractors.

3. Subcontractors.

4. Other concerned parties.

B. Instruct recipients to report any inability to comply and provide detailed explanation with suggested remedies.

*** * * END OF SECTION * * ***

SECTION 01340

SHOP DRAWINGS, PROJECT DATA AND SAMPLES

INDEX

1.01	General
1.02	Shop Drawings
1.03	Project Data
1.04	Submission Requirements
1.05	Resubmission Requirements
1.06	Distribution of Submittals After Review

SECTION 01340

SHOW DRAWINGS, PROJECT DATA AND SAMPLES

1.01 General:

A. Submit shop drawings, project data and samples required by specification sections.

B. Designate in tabular form proposed submittal dates.

1.02 Shop Drawings:

A. Submit drawings prepared by Contractor, subcontractor, supplier or distributor which illustrate some portion of the work.

B. Show fabrication, layout, setting or erection details.

C. Identify details by reference to sheet and detail number shown on contract drawings.

D. Minimum sheet size: 8-1/2"x11" with a blank space 4" x 5" for Engineer's stamp.

1.03 Project Data:

A. Manufacturer's standard schematic drawings:

1. Modify drawings to delete information which is not applicable to project.

2. Supplement standard information to provide additional information applicable to project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.

1. Clearly mark each copy to identify pertinent materials, products or models.

2. Show dimensions and clearances required.

3. Show performance characteristics and capacities.

4. Show wiring diagrams and controls.

1.04 Submission Requirements:

A. Schedule submissions at least ten (10) days before reviewed submittals will be needed.

B. Submit number of copies of shop drawings, project data and samples which Contractor requires for distribution plus three (3) copies which will be retained by Engineer.

C. Accompany submittals with transmittal letter containing:

1. Date.

2. Project title and number.

3. Contractor's name and address.

4. The number of each shop drawing, project data and sample submitted.

5. Notification of deviations from Contract Documents.

6. Other pertinent data.

D. Submittals shall include:

1. Date and revision dates.

2. Project title and number.

3. The names of:

a. Engineer

b. Contractor

c. Subcontractor

d. Supplier

e. Manufacturer

f. Separate detailer when pertinent

4. Identification of product or material.

5. Relation to adjacent structure or materials.

6. Field dimensions clearly identified as such.

7. Specification section number.

8. Applicable standards, such as ASTM number or Federal specification.

9. A blank space 4"x5" for the Engineer's stamp.

10. Identification of deviations from Contract Documents.

11. Conform to the General Conditions herein.

1.05 Resubmission Requirements:

A. Shop Drawings:

1. Revise initial drawings as required and resubmit as specified for initial submittal.

2. Indicate on drawings any changes which have been made other than those requested by Engineer.

B. Project data and samples: Submit new data and samples as required for initial submittal.

1.06 Distribution of Submittals After Review:

A. Distribute copies of shop drawings and project data which carry Engineer's stamp as needed.

B. Distribute samples as directed.

* * * END OF SECTION * * *

SECTION 01580

TEMPORARY PROJECT IDENTIFICATION

INDEX

PART 1 - GENERAL

1.01 Description
1.02 Quality Assurance
1.03 Submittals

PART 2 - PRODUCTS

2.01 Structural Materials
2.02 Framing Materials
2.03 Surface material for signs
2.04 Rough Hardware
2.05 Paint

PART 3 - EXECUTION

3.01 Installation of Supports
3.02 Framing
3.03 Surfacing
3.04 Painting
3.05 Maintenance
3.06 Removal

SECTION 01580

TEMPORARY PROJECT IDENTIFICATION

PART 1 - GENERAL

1.01 Description:

A. Furnish, install and maintain project identification signs.

B. Content required on project identification sign: (One required)

1. Title of project as listed on Contract Documents.

2. Name of Owner as listed on Contract Documents.

3. Names of:

a. Engineers
b. Prime Contractors
c. Funding Agency, where appropriate

1.02 Quality Assurance:

A. Design Criteria: Support, framing, surfaces: Design to resist 50 mph wind velocity.

B. Material Standards: Those specified in respective specification sections for products used.

C. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction time.

D. Sign Painter Qualifications: Engaged as professional sign painter for type of work specified, for period of not less than three (3) years.

E. Requirements of Regulatory Agencies:

1. Comply with requirements of authorities having jurisdiction.

2. Obtain and pay for required permits.

1.03 Submittals:

A. Submit drawings showing:

1. Structure and framing
2. Sizes, grades of members
3. Foundation
4. Surface material for sign
5. Layout of sign, showing sizes and styles of letters
6. Colors
7. Lighting and controls

PART 2 - PRODUCTS

2.01 Structural Materials:

A. Supports: May be new or used, but must be sound and structurally adequate.

B. Preservative Treatment: For wood supports in contact with ground, as required to prevent deterioration during specified period of use.

2.02 Framing Materials:

A. Wood or steel.

B. May be new or used, in sound condition.

C. Grade: As required to meet structural requirements.

D. Suitable for specified finish.

2.03 Surface Material for Signs:

A. Plywood: A-C DFPA, with Medium Density Overlay.

B. Thickness: As required to provide even, level surface.

C. Sizes: Maximum standards locally available.

2.04 Rough Hardware:

A. Galvanized, aluminum or brass.

2.05 Paint:

A. Nationally recognized manufacturer.

PART 3 - EXECUTION

3.01 Installation of Supports:

A. Set pole-type supports into excavations:

1. Depths equal to 25% of height from ground to top of sign, minimum 3 feet (914 mm).

2. Plumb holes, backfill, tamp earth around poles.

3.02 Framing:

A. Frame Members, Secure to Supports: To code requirements and applicable trade standards.

B. Space members to widths of surfacing material, maximum 24 inches on centers.

3.03 Surfacing:

A. Install sheets vertical, in one piece for height of sign.

B. Butt joints, nail securely.

C. Install trim:

1. Maximum lengths of standard material

2. Miter corners

3. Splice and joints

4. Nail securely

3.04 Painting:

A. Paint all exposed surfaces, except creosoted poles.

1. Maximum lengths of standard material

2. Minimum one coat of exterior enamel

B. Paint lettering in styles, sizes, colors as indicated on reviewed submittal.

C. Paint logotypes to conform with sample furnished by Architect/Engineer.

3.05 Maintenance:

A. Repair damages to structure, framing or sign.

B. Repaint surfaces, lettering, logotypes or perspectives which show severe weathering.

C. Maintain sign and supports in neat, clean condition.

3.06 Removal:

Remove sign, framing, supports and foundations:

A. At completion of project.

B. When directed by Architect/Engineer.

* * * END OF SECTION * * *

SECTION 01700

PROJECT CLOSEOUT

INDEX

1.01	Substantial Completion
1.02	Final Inspection
1.03	Reinspection Costs
1.04	Closeout Submittals
1.05	Instruction
1.06	Evidence of Payments and Release of Liens
1.07	Final Application for Payment
1.08	Post-Construction

SECTION 01700

PROJECT CLOSEOUT

1.01 Substantial Completion:

A. Contractor:

1. Submit written certification to Engineer that project, or designated portion of project, is substantially complete.

2. Submit list of major items to be completed or corrected.

B. Engineer will make an inspection within fourteen days after receipt of certification together with Owner's representative.

C. Should Engineer consider that work is substantially complete:

1. Engineer shall prepare an amended list of items to be completed or corrected as determined by the inspection.

2. Engineer will prepare and issue a Certificate of Substantial Completion containing:

a. Date of substantial completion.

b. Amended list of items to be completed or corrected.

c. Time schedule to complete or correct work.

d. Time and date Owner will assume possession of work or designated portion thereof.

e. Signatures of:

1. Engineer
2. Contractor
3. Owner

D. Should Engineer consider that work is not substantially complete:

1. Engineer shall notify Contractor in writing stating reasons.

2. Contractor shall complete work and send second written notice to Engineer certifying that project, or designated portion of project, is substantially complete.

3. Engineer will reinspect work.

1.02 Final Inspection:

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.

2. Project has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of Owner's representative and are operational.

5. Project is completed and ready for final inspection.

B. Engineer will make final inspection within fourteen days after receipt of certification.

C. Should Engineer consider that work is not finally complete:

1. He shall notify Contractor in writing stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies and send second written notice to Engineer certifying that work is complete.

3. Engineer will reinspect work.

1.03 Reinspection Costs:

A. Should Engineer be required to perform second inspection because of failure of work to comply with original certifications of Contractor, Owner will compensate Engineer for additional services and deduct amount paid from final payment to Contractor.

1.04 Closeout Submittals:

A. Project record documents: As required by Section 01720.

B. Guarantees and Bonds specified in General Conditions.

1.05 Instruction:

A. Instruct Owner's personnel in operation of all systems, mechanical, electrical and other equipment.

1.06 Evidence of Payments and Release of Liens:

A. Submit the following documents before final payment is made:

1. Contractor's release or waiver of liens.

2. Separate releases of waivers of liens for subcontractors, suppliers and others with lien rights against property of Owner together with list of those parties.

B. All submittals shall be dully executed before delivery to Engineer.

1.07 Final Application for Payment:

A. Contractor shall submit final application in accordance with requirements of General and Supplementary Conditions.

B. Engineer will issue final certificate in accordance with provisions of General Conditions.

C. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Semi-Final Certificate for Payment, in accordance with provisions of General Conditions.

1.08 Post-Construction Inspection:

A. Prior to expiration of one year from date of substantial completion, Engineer will make visual inspection of project in company with Owner and Contractor to determine whether correction of work is required in accordance with provisions of General Conditions.

B. For guarantees beyond one year, Engineer will make inspection at request of Owner after notification to Contractor.

C. Engineer will promptly notify Contractor in writing of any observed deficiencies.

* * * END OF SECTION * * *

SECTION 01710

CLEANING

INDEX

PART 1 - GENERAL

1.01 Description
1.02 Quality Assurance

PART 2 - PRODUCTS

2.01 Cleaning Materials and Equipment
2.02 Compatibility

PART 3 - EXECUTION

3.01 Progress Cleaning
3.02 Final Cleaning
3.03 Cleaning During Owner's Occupancy

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 Description:

A. Work Included: Throughout the construction period, maintain site in standard of cleanliness as described in this Section.

B. Related Work Described Elsewhere: In addition to standards described in this Section, comply with requirements for cleaning as described in various other Sections.

1.02 Quality Assurance:

A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

PART 2 - PRODUCTS

2.01 Cleaning Materials and Equipment:

Provide personnel, equipment and materials needed to maintain specified standards of cleanliness.

2.02 Compatibility:

Use cleaning materials and equipment which are compatible with surface being cleaned.

PART 3 - EXECUTION

3.01 Progress Cleaning:

A. General:

1. Retain stored items in orderly arrangement allowing maximum access. Do not impede drainage or traffic. Provide required protection of materials.

2. Remove scrap, debris, and waste material promptly from job site.

3. Store items awaiting removel in good order. Observe fire protection requirements. Control dust and fugitive air emissions. No burning will be permitted.

B. Site:

1. Inspect site and pick up scrap, debris, and waste material daily. Remove items to place designated for storage.

2. Inspect arrangement of materials stored on site; restack, tidy, or otherwise service storage arrangements.

3. Maintain site in neat and orderly condition at all times.

3.02 Final Cleaning:

A. Definition: "Clean" shall be level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

B. General: Prior to completion of Work, remove from job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article 3.1 above.

C. Site: Broom clean paved areas on site and public paved areas adjacent to site. Remove resultant debris.

3.03 Cleaning During Owner's Occupancy:

Should Owner occupy Work or any portion thereof prior to its completion and accpetance, responsibilities for interim and final cleaning of occupied spaces shall be as determined by Engineer in accordance with Contract General Conditions.

*** * * END OF SECTION * * ***

SECTION 01720

PROJECT RECORD DOCUMENTS

INDEX

1.01 Maintenance of Documents
1.02 Recording
1.03 Submittal

SECTION 01720

PROJECT RECORD DOCUMENTS

1.01 Maintenance of Documents:

A. Maintain at job site one (1) copy of:

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Reviewed shop drawings.

5. Change Orders.

6. Other modifications to Contract.

7. Field test records.

B. Store documents in temporary field facilities apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry and legible conditions.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by Engineer and Owner.

1.02 Recording:

A. Label "PROJECT RECORD" in 2" high printed letters on each document.

B. Keep record documents current.

C. Do not permanently conceal and work until required information has been recorded.

D. Record drawings: Legibly mark in red pencil to record actual construction.

1. Depths of various elements of foundation in relation to survey datum.

2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.

3. location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

4. Field changes of dimension and detail.

5. Changes made by Change Order or field order.

6. Details not on original contract drawings.

E. Specification Addenda: Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

2. Changes made by Change Order or field order.

3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate drawings to record changes made after review.

1.03 Submittal:

A. Deliver record documents to Engineer at completion of project.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date.

2. Project title and number.

3. Contractor's name and address.

4. Tile and number of each record document.

5. Certification that each document as submitted is complete and accurate.

6. Signature of Contractor or his authorized representative.

* * * END OF SECTION * * *

SECTION 01900

MEASUREMENT AND PAYMENT

INDEX

PART 1 - GENERAL

1.01 Scope of Work
1.02 Changes in Scope

PART 2 - PRODUCTS

Reserved

PART 3 - EXECUTION

3.01 Item 1. Mobilization/Demobilization
3.02 Item 2. Construction Staking
3.03 Item 3. Job Signs
3.04 Item 4. Field Office
3.05 Item 5. As-Built Drawings
3.06 Item 6. Granular Backfill
3.07 Items 7, 8, 9, 10 and 11. Asphalt Drive, Asphalt Street, State Highway,Stone Surface, and Concrete Surface Replacement
3.08 Items 12, 13, 14, 15, 16, and 17. 10" Sanitary Sewer; 8" Sanitary Sewer; 6" Sanitary Sewer; 4" Sanitary Sewer; 4" Sanitary Lateral, SDR 35; 4" Sanitary Lateral, SDR 26
3.09 Items 18 and 19. Sanitary Manholes - Standard; Sanitary Manholes - Drop
3.10 Item 20 and 21. 4" Cleanouts; 6" Cleanouts
3.11 Items 22, 23, 24, and 25. Wyes 8" x 4"; Wyes 6" x 6"; Wyes 6" x 4"; Wyes 4" x 4"
3.12 Item 26. Pump Station - Individual Service
3.13 Item 27. Septic Tank Installations - Single Tank
3.14 Item 28. Septic Tank Installations - Dual Tank
3.15 Item 29. School Treatment Plant Revisions
3.16 Item 30. Septic Tank Demolition and Removal
3.17 Items 31, 32, and 33. Unstable Soil Excavation; Stone Foundation; Rock Excavation
3.18 Items 34, 35, 36 and 37. 12" Drive Pipe - CMP; 15" Drive Pipe-CMP; 12" Drive Pipe - RCP; 15" Drive Pipe - RCP

SECTION 01900

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 Scope of Work:

A. Bid items to include all foreseeable work associated with the completion of the project.

B. Measurement:

1. Generally, the work actually performed or items actually installed.

2. Conducted by the Contractor and observed by the Owner's Representative.

C. Payment:

1. Include all associated materials and work.

2. Additional payments shall not be made for any "item" of work not in the "Bid", except work considered to be unforeseen and unusual. Engineer's decision of additional payment shall be final.

3. Payments for bid items shall be unchanged except for minor adjustments (± 2%) in design ordered by the Engineer during the work.

1.02 Changes in Scope:

A. Additional payment may be made for unforeseen or unusual work conducted by order of the Engineer, and for major additions to the work.

B. Dewatering shall not be considered unforeseen or unusual work.

C. Major subtractions from the work shall constitute a lessening of the item bid payment.

D. Adjustments in payment shall be made at a negotiated price as per contract conditions.

E. Items of work not specifically ordered by the Engineer shall not be additional pay items.

F. Additional pay items shall be allowed only when work is executed pursuant to the Engineer's prior written instruction. A change order shall be issued in accordance with the General Conditions.

G. Measurement for payment of additional pay items shall be agreed upon daily between the Contractor and Engineer. Payment shall include provision of granular material, disposal of excavated material, and all other needed features of the work performed.

H. Planting of vegetation indicated on the Plans shall be included in the unit and lump sum bids for a particular item of work. The Contractor shall be paid the entire bid amount, less the amount indicated for planting and less specified retainage, until the vegetation has been planted and accepted.

PART 2 - PRODUCTS

Reserved

PART 3 - EXECUTION

3.01 Item 1. Mobilization/Demobilization:

A. Measurement: Unit as acceptably performed.

B. Work Included: Furnish Performance and Payment Bonds and Certificates of Insurance; assemble, set up and mobilize to site personnel, equipment, sanitary facilities, and other facilities and materials required; demobilization and removal of equipment.

C. Payment: Lump Sum Price with Progress Payments made on Schedule of Values provided by Contractor and approved by Engineer.

3.02 Item 2. Construction Staking:

A. Measurement: Unit as acceptably performed.

B. Work Included: All survey staking necessary for the proper installation of the project.

C. Payment: Progress payments will be made based upon the percentage of pipe footage for which staking has been completed.

3.03 Item 3. Job Signs:

A. Measurement: Unit as acceptably performed.

B. Work Included: The preparation and installation of the sign(s) specified.

C. Payment: Lump Sum Price upon completion of installation.

3.04 Item 4. Field Office:

A. Measurement: Unit as acceptably provided.

B. Work Included: Furnish a field office for the Engineer and Owner's use as specified in Section 01010, Paragraph 1.06D.

C. Payment: Progress Payments to consist of 30-percent of the Lump Sum for initially providing the office with the remainder prorated equally over the contract period.

D. Note: If same Contractor is awarded Division I and Division II Contracts, only one field office is required and only one will be eligible for payment.

3.05 Item 5. As-Built Drawings:

A. Measurement: None required.

B. Work Included: The measurement of all completed work and recording on a set of prints the footage of pipe installed and locations for all pipe, fittings and appurtenances installed.

C. Payment: Lump Sum upon completion of this item.

3.06 Item 6. Granular Backfill:

A. Measurement: Cubic yards with quantity for payment computed by the formula W times L times D, divided by twenty-seven (27), where:

W = The width of the trench in feet having a maximum pay width as shown in Par. 3.05 C.10 of Section 02202, also subject to the actual trench width, whichever is less.

L = The actual length of cut at the surface in feet requiring backfill.

D = The vertical distance in feet from the surface (or bottom of subgrade) to the top of the bedding.

In transverse crossings, the angle of repose will be considered in actual pay quantities.

B. Work Included: The removal and disposal of native materials and the placement of Special Sand Backfill in locations specified including compaction as necessary.

C. Payment: Unit Price Bid per cubic yard.

3.07 Items 7, 8, 9, 10 and 11. Asphalt Drive, Asphalt Street, State Highway, Stone Surface, Concrete Surface Replacement, and Sidewalk:

A. Measurement: Number of square yards replaced subject to the pay width limitations shown on the plans.

B. Work Included: The restoration of all stone or paved areas damaged by their activities. The restoration of such surfaces in areas beyond the pay width limitations given on the plans is considered incidental costs.

C. Payment: Unit Price Bid per square yard.

3.08 Items 12, 13, 14, 15, 16, and 17. 10" Sanitary Sewer; 8" Sanitary Sewer; 6" Sanitary Sewer; 4" Sanitary Sewer; 4" Sanitary Lateral, SDR 35; 4" Sanitary Lateral, SDR 26:

A. Measurement: Linear Feet of Pipe, by diameter, by class and type, in place, measured along the centerline of pipe with no deductions for wyes, manholes, or appurtenances.

B. Work Included: Excavation, granular bedding, pipe installation, testing and all other work specified.

C. Payment: Unit Price Bid per linear foot.

3.09 Items 18 and 19. Sanitary Manholes - Standard; Sanitary Manholes-Drop;

A. Measurement: Vertical feet from the manhole outlet invert to the finished top of casting elevation.

B. Work Included: The installation of the manholes including connections to the manhole, adjusting rings as required, and leakage testing.

C. Payment: Unit Price Bid per vertical foot.

3.10 Items 20 and 21. 4" Cleanouts; 6" Cleanouts;

A. Measurement: None Required.

B. Work Included: The installation of cleanouts including all fittings, vertical piping, and covers as shown on the drawings.

C. Payment: Unit Price Bid each for the number of cleanouts completed in each size.

3.11 Items 22, 23, 24, and 25. Wyes 8" x 4"; Wyes 6" x 6"' Wyes 6" x 4"; Wyes 4" x 4":

A. Measurement: None required.

B. Work Included: The installation of wyes as shown on the drawings.

C. Payment: Unit Price Bid each for the number of wyes completed in each size.

3.12 Item 26. Pump Station - Individual Service:

A. Measurement: Structure, in place, with all equipment and power supply as shown.

B. Work Included: Excavation, placing granular subbase; installation of the structure, equipment, controls and power supply; backfilling around the structure; and start-up and operator training by a manufacturer's representative.

C. Payment: Lump Sum Bid: Submit Schedule of Values for Progress Payments.

3.13 Item 27. Septic Tank Installations - Single Tank

A. Measurement: None required.

B. Work Included: As specified.

C. Payment: Unit Price Bid for each item completed.

3.14 Item 28. Septic Tank Installations - Dual Tank

A. Measurement: None required.

B. Work Included: As specified.

C. Payment: Unit Price Bid for each item completed.

3.15 Item 29. School Treatment Plant Revisions

A. Measurement: None required.

B. Work Included: As specified and shown on drawing.

C. Payment: Lump Sum Bid.

3.16 Item 30. Septic Tank Demolition and Removal

A. Measurement: Note required.

B. Work Included: As specified.

C. Unit Price Bid for each item completed.

UNIT PRICES FOR "IF ORDERED" ITEMS:

3.16 Items 31, 32 and 33. Unstable Soil Excavation; Stone Foundation; Rock Excavation:

A. Measurement: Cubic yards computed based upon the depth of unsuitable materials removed from below the pipe bedding elevation and the maximum trench widths in Section 02202.

B. Work Included: The removal of unsuitable materials and their replacement with stabilized materials.

C. Payment: Unit Price Bid per cubic yard.

3.17 Items 34, 35, 36 and 37. 12" Drive Pipe - CMP; 15" Drive Pipe - CMP; 12" Drive Pipe - RCP; 15" Drive Pipe - RCP:

A. Measurement: Linear feet of pipe, by diameter and type, in place measured along the centerline of pipe.

B. Work Included: Excavation, granular bedding, pipe installation and all other work specified.

C. Payment: Unit price bid per linear foot.

* * * END OF SECTION * * *

SECTION 02060

ENVIRONMENTAL PROTECTION PROVISIONS

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SECTION 02060

ENVIRONMENTAL PROTECTION PROVISIONS

PART 1 - GENERAL

1.01 Work Included:

Plan and execute work to incorporate adequate environmental protection measures to minimize or to preclude adverse environmental construction impacts:

A. Air Pollution by Dust

B. Air Pollution by Smoke, Fumes and Sprays

C. Water Pollution by Spillage and Waste

D. Structural Impacts of Erosion on Water Areas

E. Construction Operation in Water Areas

F. Land Despoilment by Destruction of Land Forms and Vegetation

G. Environmental Damage of the Land by Spillage and Waste

H. Noise Pollution, particularly in Residential Areas

I. Improper Use of Pesticides

J. Visual Light

K. Health and Safety Hazards

1.02 Permits:

A. Execute work in compliance with permits provided by Owner.

B. Where required, obtain environmental permits and execute work in compliance with permits.

PART 2 - PRODUCTS

2.01 Equipment:

Equipment shall comply with OSHA Regulations, EPA Regulations, and good construction maintenance practice.

A. Periodically check equipment and machinery for proper tuning to minimize exhaust emissions and noise.

B. Use machinery and equipment incorporating proper muffler design and installation to reduce noise levels.

2.02 Sanitary Facilities:

Furnish chemical sanitary facilities at construction site.

2.03 Temporary Vegetative Plantings (Less than 6 Months):

A. Temporary seedings require fertilizer, lime, seedbed preparation, seed coverage, mulch, and irrigation for quick plant growth.

B. Temporary Herbaceous Species:

March 1 to June 15	Per 1000 Sq. Ft.	Per Acre
(1) Oats	3 lbs.	4 bu.
or		
(2) Perennial Ryegrass	1 lb.	40 lbs.
June 16 to August 15		
(1) Oats and	2 lbs.	2 bu.
Sudangrass	2 lbs.	2 bu.
or		
(2) Perennial Ryegrass	1 lb.	40 lbs.
August 16 to November 1		
(1) Rye	3 lbs.	2 bu.
or		
(2) Wheat	3 lbs.	2 bu.
or		
(3) Perennial Ryegrass	1 lb.	40 lbs.

2.04 Temporary Structures:

A. Temporary ditch checks shall consist of straw or hay bales or coarse aggregate.

B. Temporary inlet filters and filter dikes shall consist of straw or hay bales or filter fabric adequately supported on fence.

C. Temporary dikes shall consist of suitable compacted embankment material.

D. Temporary slope drains shall consist of pipe, coarse aggregate, riprap, rock channel protection, mats, plastic sheets, or other materials. Such materials shall be approved by the Engineer before being incorporated into work. Sediment pits shall be included as part of slope drain construction.

E. Temporary sediment basins and dams shall be constructed by methods described in Excavation and Embankment or Rock Channel Protection, without bedding. Sand or fabric filters may be required.

PART 3 - EXECUTION

3.01 Erosion Control:

A. Limit surface area of erodible earth material exposed by clearing and grubbing surface area of erodible earth material exposed by excavation, borrow, and fill operations and provide immediate permanent or temporary control measures to prevent contamination of adjacent streams or other water courses, ales, ponds, or other areas of water impoundment.

B. Construct temporary ditch checks, filters, benches, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding or other control devices or methods necessary to control erosion and sedimentation.

C. Incorporate permanent erosion control features into project at earliest practicable time. Except where future construction operations will damage slopes, perform permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Establish final grades and application of Liming, Commercial Fertilizer, and Seeding and Mulching.

D. Temporary control measures will be used to correct conditions that develop during construction; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

E. When erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter; otherwise temporary erosion control measures will be required between successive construction stages.

F. Limit area of excavation, borrow and embankment operations in progress commensurate with capability and progress in keeping the finished grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. Mulching, seeding, and other such permanent control measures shall be applied after completion of 8-feet (vertical) of embankment or cut, unless otherwise directed by the Engineer. Should seasonal limitations or embankment make such coordination unrealistic, temporary erosion control measures shall be taken immediately.

G. Mulch, lime, fertilize and temporarily seed each construction area as rough grading is completed, where finish grading and further construction operations will not proceed for one (1) month.

3.02 Dust Control:

Dust control measures using watering equipment shall be used in all areas during construction and in all areas where seeding or other final surface restoration practices are not to be immediately implemented. Water, not oil, will be used for dust control during construction of all facilities.

3.03 Disposal of Debris:

A. All debris (including excavation material in excess of project requirements) shall be completely removed from project site and disposed of.

B. Litter shall be policed daily.

C. Store, maintain, and dispose of materials to preclude harborage or rodents and insects.

3.04 Maintenance of Traffic:

Contractor shall be responsible for control, directions, and safety of vehicular and pedestrian traffic in work areas. Provide all necessary equipment and personnel for this work. Traffic control arrangements shall be subject to Owner's approval.

3.05 Working Hours:

A. Work in Residential and Commercial Areas:

Plan and coordinate work for completion during normal working hours.

B. Work on Sundays and Holidays:

No work will be permitted on Sundays or Federal, legal holidays except to save property or life in case of emergency, unless authorized or directed by Owner's Representative.

C. Night Work:

1. Unless otherwise permitted by Owner, work shall be limited to daylight hours.

2. Work carried on after dark shall be adequately illuminated.

3. Furnish buffers to shield lighting and noise from adjacent residential areas.

3.06 Work Within 100-Year Stream Floodway:

A. Remove all excavated materials.

B. Backfill areas subject to flooding with clean, granular material: Sand, river run pea gravel or equal.

C. Riprap areas subject to erosion.

D. Execute work per Corps of Engineer Permit.

E. Elevation of the 100-year stream floodway is 722.0 ±.

3.07 Open Excavation:

A. Minimize open excavation where practical.

B. Fence open excavation with properly supported snow fencing when work is not in progress.

* * * END OF SECTION * * *

SECTION 02202

EARTHWORK FOR UTILITIES

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SECTION 02202

EARTHWORK FOR UTILITIES

PART 1 - GENERAL

1.01 Description:

A. Scope:

Specifications for the stripping of topsoil and vegetation, excavation, trenching, bedding, filling, backfilling, compaction, and related work in connection with the installation of water mains, gravity sanitary sewers, storm sewers, and force mains are included in this Section.

B. Definitions:

1. Excavation: Removal of earth and rock to form a trench for the installation of a water main, gravity sanitary sewer, storm sewer, or force main.

2. Earth: Unconsolidated material in the crust of the Earth derived by weathering and erosion. Earth includes:

a. materials of both inorganic and organic origin;

b. boulders less than 1/3 cubic yard in volume, gravel, sand, silt, and clay;

c. materials which can be excavated with a backhoe, trenching machine, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers.

3. Rock:

a. Rock is defined as stone or hard shale in original, boulders, over 1/3 cu. yard in volume, masonry or concrete that cannot be broken and removed by normal job equipment (power shovel 1/3 yard capacity, scoops, bulldozers), without the use of explosives or drills.

b. This classification does not include material such as loose rock, concrete or other materials that can be removed by means other than drilling and wedging, but which for reasons of economy in excavating, the Contractor prefers to remove by drilling and wedging.

4. Undercutting: Excavation of rock and unsuitable earth below the bottom of the pipe or conduit to be installed in the trench.

5. Subgrade: Undisturbed bottom of a trench.

6. Bedding: Earth placed in trench to support pipe and conduit.

7. Backfill and Fill: Earth placed in trench from the top of bedding to finished grade, or to subbase of pavement.

8. Topsoil: Earth containing sufficient organic materials to support the growth of grass.

1.02 Submittals:

A. Submittals shall be as specified in the General Conditions.

B. Submit the materials test reports.

1.03 Job Conditions:

A. All information given in the Contract Documents, including drawings relating to borings, materials encountered, and rock elevations, is from surveys performed by other consultants. Such information is furnished only for the information and convenience of the Contractor. The Engineer does not warrant or guarantee that the materials and conditions encountered during construction will be the same as indicated by the boring samples or by information shown on the drawings.

B. Existing storm sewers, sanitary sewers, water mains, gas mains, electric ducts, telephone ducts, steam mains and other underground structures, lines, and their house connections have been shown on the plans according to the best available information. The exact location and protection of these facilities and structures, their support and maintenance in operation during construction (in cooperation with the proper authorities), is the responsibility of the Contractor in the performance of his contract.

PART 2 - PRODUCTS

2.01 Bedding:

A. Clarifications of pipe bedding shall be in accordance with ASTM D23.21 except as modified hereinafter.

B. Class I: Class I bedding shall be angular 6 to 12 mm (1/4 to 1/2 inch) graded stone, coral, slag, cinders, crushed stone or crushed shells.

C. Class II: Class II bedding shall be coarse sands and gravels with maximum partial size of 20 mm (3/4 inch). Class II bedding includes variously graded sands and gravels containing small percentage of fines generally granular and non-cohesive, either wet or dry. Soil types GW (well-graded gravel), SW (well-graded sand), and SP (pea gravel and/or crushed stone mixed with sand) are included in this class.

2.02 Backfill:

A. General: Backfill shall be earth of such gradation and moisture content that the soil will compact to the specified density and remain stable. Unsuitable materials shall not be used.

B. Cover Material: Pipe cover material shall consist of durable particles ranging in size from fine to coarse (No. 200 to 1 inch) in size in a substantially uniform combination. Unwashed bank run sand and crushed bank-run gravel will be considered generally acceptable. Bedding material may be used for cover material.

C. Granular Backfill - Special Backfill: Granular backfill, when indicated on the plans or as ordered by the Engineer, shall be used for backfilling providing it meets the following soils classified by the Unified Soils Classification System ASTM D-2487.

Group Symbols	Typical Names
GW	Well-graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
SW	Well-graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines

D. Gravel Backfill: When the material excavated from the trench is suitable for granular backfill, the Engineer reserves the right to order, in writing, the use of this excavated material in place of the granular backfill specified to be paid for as a separate pay item.

E. Suitable Excavated Materials as Backfill: Excavated material shall be used when earth backfill is specified on the plans or where granular backfill is not specifically specified, provided that such material consists of loam, clay, or other materials which, in the judgement of the Designer, are suitable for backfilling. Unsuitable backfill or frozen backfill material shall not be used. Suitable backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Names
GW	Well-graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-silt mixtures
SW	Well-graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays

F. Unsuitable Materials: Materials which are unsuitable for backfill include stones greater than 8 inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, and the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Names
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
PT	Peat, muck and other highly organic soils

G. Concrete Backfill: Concrete used for backfill around sewers, water mains, or other utility piping shall be Class B concrete.

H. Cellular Concrete: Light weight cellular concrete may be used for filling of abandoned sewers as a grouting mixture for filling voids and as a substitute for backfill concrete in tunnels or casing pipes. The cellular concrete shall be produced by blending preformed foam with cement-sand grout slurry to produce a concrete having a fresh weight per cubic foot of not less than 75 pounds.

PART 3 - EXECUTION

3.01 Existing Utilities, Structures and Property:

A. All poles, fences, sewer, gas, water or other pipes, wires, conduits and manholes, buildings, structures and property along the routes of water mains, force mains, and sewers shall be supported and protected from damage by the Contractor.

B. Movable items such as mail boxes may be temporarily relocated during construction. Place movable items in their original location immediately after backfilling is completed, unless otherwise shown on the drawings. Replace movable items which are damaged during construction.

C. The Contractor shall proceed with caution in the excavation and preparation of trenches so that the exact location of underground utilities and structures, both known and unknown, may be determined. The Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.

D. Whenever, in the opinion of the Engineer, it is necessary to explore and excavate to determine the location of underground structures, the Contractor shall make explorations and excavations for such purpose at no additional cost and would not be eligible for Change Order.

E. Wherever sewer, gas, water, or other pipes or conduits cross the trench, the Contractor shall support said pipes and conduits without damage to them and without interrupting this Contract. The manner of supporting such pipes, etc. shall be subject to the approval of the utility involved.

F. When utility lines that have to be removed or relocated are encountered within the areas of operations, the Contractor shall notify the Engineer in ample time for the necessary measure to be taken to prevent interruption of the service.

G. The Contractor shall so conduct the work that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the work unless he shall have first obtained the property owner's written consent thereto and shall have shown said written consent to the Engineer.

H. All excavated material shall be piled in a manner that will avoid obstructing sidewalks and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural watercourses shall not be obstructed.

3.02 Clearing:

A. Clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site as required to perform work.

B. Do not remove or damage trees that do not interfere with the work. Completely remove trees required to be removed, including stumps and roots. Properly treat damaged trees which can be saved.

C. Debris from the tree removal, including trunk, branches, leaves, roots and stumps, shall not be buried or burned on the job site, but must be completely hauled away and disposed of at the Contractor's expense.

3.03 Stripping and Stockpiling of Topsoil:

A. Strip topsoil and vegetation from the excavated areas. Clean topsoil may be stockpiled for reuse as the upper 6 inches of the areas to be seeded.

B. Do not intermix grass, weeds, roots, root mat, brush and stones larger than 3 inches with stockpiled topsoil. Dispose of root contaminated topsoil.

C. Stockpiled topsoil and fill materials are to be protected from soil erosion by temporary seeding, and are not to be stored within 200 feet of the stream bank/lake shore.

3.04 Pavement and Walk Removal:

A. Remove existing pavement and walks from the excavated areas. Remove excavated asphaltic and concrete materials from the job site as these materials are excavated.

B. The width of pavement removed along the normal trench for the installation of pipe and structures shall not exceed the width of the trench by more than 12 inches on each side of the trench when the amount of pavement removed is less than 75% of the total existing pavement width. Remove all existing pavement when the excavation requires the removal of 75% or more of the total existing pavement width.

C. Remove walks completely when excavation is along the length of a walk and requires the removal of part of the walk. Remove walks to existing joints in the walks when excavation crosses walks. If there are no joints in an existing walk, the width of walk removed shall not exceed the width of the trench by more than 12 inches on each side of the trench.

D. Use methods to remove pavement and walks that will assure the breaking or cutting of pavement and walks along straight lines. The face of the remaining pavement and walk surfaces shall be approximately vertical.

3.05 Excavating:

A. General:

1. After stripping of topsoil and vegetation, perform excavations of every description regardless of material encountered within the grading limits of the project to lines and grades as indicated on the drawings or as otherwise specified.

2. Materials removed below the depths indicated without specific direction of the Engineer shall be replaced at no additional cost to the Owner, to the indicated excavation grade with satisfactory bedding materials placed and compacted.

B. Dewatering:

1. If dewatering becomes necessary, all dewatering flows are to be settled in siltation basins or directed through straw filters before being discharged to stabilized sites such as streams, or lake, or storm sewers, not onto exposed soils, stream banks or any other site where flows could cause erosion.

2. Keep excavations free from water until the water mains, force mains, sewers, structures, and appurtenances to be constructed in the excavations are completed and will safely withstand forces from water. Provide sufficient dewatering equipment and make satisfactory arrangements for the disposal of the water without undue interference with other work, damage to property, or damage to the environment.

3. Operate dewatering equipment ahead of pipe laying and keep the water level below the pipe invert until the pipe is secured by backfill.

C. Trenching:

1. Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.

2. Do not open more than 100 feet of trench in advance of the installed pipe, unless otherwise directed or permitted by the Engineer. Excavate the trench within 6 inches of full depth for a distance of at least 30 feet in advance of the pipe laying, unless otherwise directed or permitted.

3. Contractor shall be responsible for the determination of the angle of repose of the soil in which the trenching is to be done. Excavate all slopes to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting, or where shoring or trench box is to be used.

4. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes which may be adversely affected by weather or moisture content.

5. Flatten the trench sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.

6. Shoring, sheeting, trench box, or other means shall be used to support sides of trenches in hard or compact soil when the trench is more than 5 feet in depth and 8 feet or more in length. Sides of trenches shall include embankments adjacent to trenches. In lieu of shoring, the sides of the trench above the 5-foot level may be sloped to preclude collapse, but shall not be steeper than a 1-foot rise to each 1/2 foot horizontal. Provide a bench of 4 feet minimum at the toe of the sloped portion of the trench wall when the outside diameter of the pipe to be installed is greater than 6 feet.

7. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from the excavation.

8. Excavations shall be inspected by a competent Contractor's representative after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased if necessary.

9. Do not store excavated or other material nearer than 4 feet from the edge of any excavation. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized or allowed adjacent to excavations.

10. The width of trenches in earth for water main pipe, sewers, basin connections, house connections, and other drains up to and including 33 inches in internal diameter shall provide a clearance of not less than 8 inches or more than 10 inches on each side of the pipe.

11. The maximum clear width of trenches in earth for manholes shall be the greatest external width of the structure plus the space necessary for the construction and removal of the forms and construction of masonry work.

12. The design of the water main, force main, and/or sewer pipe and structures is predicated upon the width of trench specified in this Article. The Contractor shall be responsible for the provision and installation, at his own expense, of such remedial measures as may be directed by the Engineer, should the trench width limits specified in this Article are exceeded.

13. Test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible. Establish controls to assure acceptable atmospheric conditions. Provide adequate ventilation and eliminate sources of ignition when flammable gases are present. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line, and basket stretcher, shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.

14. Provide walkways or bridges with guardrails where employees or equipment are required or permitted to cross over excavations.

15. Provide ladders where employees are required to be in trenches 4 feet deep or more. Ladders shall extend from the floor of the trench to at least 3 feet above the top of the excavation. Locate ladders to provide means of exit without more than 25 feet of lateral travel.

16. Provide adequate barriers and physically protect all remotely located excavations. Barricade or cover all wells, pits, shafts, and similar excavations. Backfill temporary wells, pits, shafts, and similar excavations upon completion of exploration and similar operations.

D. Quicksand: Carry on the work with utmost vigor and proceed with the work expeditiously when running sand, quicksand, or other bad or treacherous ground is encountered. Install bedding to support the pipe as directed by the Engineer.

3.06 Sheeting:

A. The Contractor shall be responsible for construction means, methods, techniques, and procedures, and for providing a safe place for the performance of the work by the Contractor, Sub-Contractors, suppliers and their employees, and for access use, work, or occupancy by all authorized persons.

B. The Contractor shall be solely responsible for all obligations prescribed as employer obligations under Chapter XVII of Title 29, Code of Federal Regulations, Part 1926, otherwise known as "Safety and Health Regulations for Construction".

C. Adequate supporting systems, such as sheeting, shoring, piling, cribbing, and bracing shall be furnished and installed by the Contractor as required to protect existing buildings, utilities, and property from damage during the progress of the work.

3.07 Storage and Removal of Excavated Material:

A. Suitable excavated material required for filling and backfilling operations may be stockpiled in on-site locations as approved by the Engineer, until the material is ready to be placed.

B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as trenches are backfilled.

3.08 Temporary Plugs:

Prevent foreign matter from entering pipe while it is being installed. Do not place debris, tools, clothing, or other material in the pipe. Close the open ends of pipe by watertight plugs when pipe laying is not in progress. Remove any earth or other material that enters pipe, lateral pipe, or appurtenances through any open pipe end. Remove earth and other materials at no additional cost to the Owner.

3.09 Backfilling Water Main and Force Main Trenches:

A. Backfilling of water main and force main trenches shall meet the requirements of ANSI/AWWA C600, unless otherwise specified in this Section.

B. Do not backfill trenches and excavations until all utilities have been inspected by the Owner's representative and until all underground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings. Required hydrostatic tests may be applied to the line either before or after the trench is backfilled, subject to the approval of the Engineer.

C. Place and tamp bedding and backfill in a manner which will not damage pipe coating, wrapping, or encasement.

D. Material from the trench subgrade to the centerline of the pipe shall be Class I bedding. Place bedding by hand or approved mechanical methods in layers of 8 inches loose depth. Compact bedding by hand tamping or with a power operated hand vibrating compactor. Deposit bedding in the trench for its full width on each side of the pipe simultaneously.

E. Place pipe cover material from the centerline of the pipe to 12 inches over the pipe. Compact pipe cover material to the density required to allow backfill over the pipe cover material to be compacted to the density specified in this Article.

F. Do not use the following materials for backfill:

1. unsuitable materials;

2. frozen materials;

3. materials which are too wet or too dry to be compacted to the densities specified in this Article.

G. Trenches Requiring Special Backfill When Specified: Where the edge of the trench is 5 feet or less from the edge of the existing or proposed roadway pavement and trenches across roadways, driveways, utility crossing, or in areas to be paved or subjected to traffic, the trench shall be backfilled with Special Backfill. Backfill any trench specifically indicated on the drawings with Special Backfill. Place Special Backfill in 6-inch lifts. Compact each lift of backfill to not less than 95% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling, unless permitted by the Engineer.

H. Trenches in State Highway Right-of-Way: Where excavation occurs within the right-of-way of a state highway, all areas within 12 feet of the pavement edge shall be backfilled with Special Backfill. All areas beyond 12 feet shall be backfilled in the manner specified in the following paragraph.

I. Trenches Not Requiring Special Backfill: Backfill trenches not requiring granular backfill with suitable excavated material. Place and compact backfill to produce an adequate foundation for the applicable paved or unpaved surface treatment. Fill and restore any settlement of the backfill. In paved areas, backfill shall be maintained to subbase elevation. In unpaved areas, backfill shall be mounted above finish grade to allow for settlement. Grade unpaved area to be restored 6 inches below finish grade after settlement of backfill and immediately before restoration of vegetated areas. Place 6 inches of topsoil over area to be restored.

J. Trenches in Traveled Pavements: All cut and trenches in paved streets or other paved areas shall be backfilled within suitable excavated material unless granular backfill is specifically indicated on the plans or ordered by the Engineer to within 12 inches of the street surface. The remainder of the trench is to be filled with crushed stone and compacted in place, prior to opening the street to traffic. The Contractor shall maintain the trenches, adding crushed stone and grading as necessary, until sufficient settlement has taken place and final restoration is made.

3.10 Backfilling Sanitary Sewer and Storm Sewer Trenches:

A. Do not backfill trenches and excavations until all utilities have been inspected by the Owner's representative and until all underground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings.

B. Place and tamp bedding and backfill in a manner which will not damage pipe coating, wrapping, or encasement.

C. Bedding procedures for sanitary sewers and storm sewers shall be as specified in the Section for the applicable pipe material.

D. If bedding does not cover the pipe, place granular backfill from the top of bedding to 12 inches over the pipe. Compact pipe cover material to the density required to allow backfill over the pipe cover material to be compacted to the density specified in this Article.

E. Do not use the following materials for backfill:

1. unsuitable materials;

2. frozen materials;

3. materials which are too wet or too dry to be compacted to the densities specified in this Article.

F. Trenches Requiring Special Backfill When Specified:

See Section 3.09, paragraph G

G. Trenches in State Highway Right-of-Way:

See Section 3.09, aragraph H

H. Trenches Not Requiring Special Backfill:

See Section 3.09, paragraph I

I. Trenches in Traveled Pavements:

See Section 3.09, paragraph J

3.11 Maintaining Traffic:

A. Before closing any thoroughfare, the Contractor shall notify and, if necessary, obtain a permit or permits from the duly constituted public authority having jurisdiction, state, county, or city, which notice shall be given not less than 72 hours in advance of the time when it may be necessary in the process of construction to close such thoroughfare.

B. The Contractor shall conduct his work in such manner as not to unduly or unnecessarily restrict or impede normal traffic through the streets of the community. Insofar as it is practicable, excavated material and spoil banks shall not be located in such manner as to obstruct traffic; and the traveled way of all streets, roads, and alleys shall be kept clear and unobstructed insofar as is possible and shall not be used for the storage of construction materials, equipment, supplies, or excavated earth, except when and where necessary. If required by duly constituted public authority, the Contractor shall, at his own expense, construct bridges or other temporary crossing structures over trenches so as not to unduly restrict traffic. Such structures shall be of adequate strength and proper construction and shall be maintained by the Contractor in such manner as not to constitute an undue traffic hazard. Private driveways shall not be closed except when and where necessary, and then only upon due advance notice to the Engineer and for the shortest practicable period of time consistent with efficient and expeditious construction. The Contractor shall be liable for any damages to persons or property resulting from his work.

3.12 Walks and Passageways:

The Contractor, when required, shall make provisions at cross streets for the free passage of vehicles and foot passengers, either by bridging or otherwise, and shall not obstruct the sidewalks, gutters, or streets, nor prevent in any manner the flow of water in the latter, but shall use all proper and necessary means to permit the free passage of surface water along the gutters. The Contractor shall immediately cart away all offensive matter, exercising such precaution as may be directed by the Engineer. All material excavated must be so disposed of as to inconvenience the public and adjacent tenants as little as possible and to prevent injury to trees, sidewalks, fences, and adjacent property of all kinds. The Contractor may be required to erect suitable barriers to prevent such inconvenience or injury.

3.13 Warning Lights:

The Contractor shall place sufficient warning lights on or near the work and keep them illuminated during periods of reduced visibility (from twilight in the evening until sunrise) and will be held responsible for any damages that any party or the Owner may sustain in consequences of neglecting the necessary precaution in prosecuting this work.

3.14 Rock Removal:

A. If rock is encountered in the excavation, the trench must be excavated to a depth of the main drain elevation shown on profile drawing. It is the intention that there will be at least 6" of granular material between the bottom of the pipe and any rock. Bell holes must be excavated of such width, length and depth as will allow the joints to be properly made up. In the backfilling of trenches, the earth must be firmly tamped over the gravel envelope to grade. Material placed from the top of the gravel to the surface of the ground shall be carefully deposited in layers and compacted as directed by the Designer. Rock removed from the trench shall be disposed of as directed by the Designer and suitable backfill material be substituted therefore.

B. Boulders shall be removed from excavation and stockpiled.

3.15 Rock Excavation:

A. Measurement:

1. Rock shall be stripped for measurement before excavating, and no rock excavated or loosened before measurement will be allowed or paid for as rock.

2. Measurement and payment, shall be by the number of cubic yards required to bring excavation to required surface or grade shown on drawings.

3. Owner may adjust grades should excessive rock be encountered.

B. Rock Excavation Space Allowance:

1. 18" outside wall lines of buildings, or outside of concrete work for which forms are required.

2. 6" below and 6" each side of underground pipes.

3. Outside dimensions of concrete work for which no forms are required.

C. Payment:

1. At agreed unit price per cubic yard.

3.16 Cleanup and Maintenance:

A. Cleanup the job site as backfilling is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure components, and appurtenances. Restore items moved, damaged, or destroyed during construction. Grade area to be restored. Leave backfill mounded over trenches which are not backfilled with Special Backfill. Cleanup and restoration specified in this paragraph shall be completed within 1,000 feet of excavation.

B. Restoration of grass, bushes, trees, and other plants shall be as specified in Section 02482, Landscaping for Utilities.

C. Restoration of pavement and walks shall be specified in Section 02635, Surface Restoration. A temporary driving surface, such as crushed stone, shall be compacted in place in the trench area as backfilling is complete. Cold-mix asphalt patching material may be used as a temporary driving surface at the Contractor's option or when specifically called for in the plans or specifications. Temporary pavement shall not be more than 1,000 feet behind the excavation. When no existing pavement remains after excavation, a temporary compacted aggregate surfacing may be provided instead of the permanent pavement or a temporary cold-mix asphalt pavement. When the pavement is asphaltic concrete, placement of the asphaltic concrete surface course may be delayed until all other heavy construction is completed.

D. Maintain the job site until the work has been completed and accepted. Fill trenches which settle when settlement is visible. Restore items damaged by construction or improper restoration. Keep dust conditions to minimum by the use of water, salt, calcium chloride, oil, or other means.

3.17 Log:

A. The Contractor shall maintain a continuous log showing the following:

1. Size, type, depth, and station-distance of all fittings installed.

2. Size, type, depth, and station of all utilities encountered in any trenching.

B. This log shall be open for inspection at all times by the Designer and shall be turned over to the Designer at the end of construction.

* * * END OF SECTION * * *

SECTION 02222

STRUCTURAL EXCAVATION, BACKFILL AND COMPACTION

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SECTION 02222

STRUCTURAL EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 Submittals:

A. Compaction test results required by Engineer.

1.02 General Description of Work

A. Grading, general excavation, disposal of debris and spoils, preparation of sub-grade and foundation, borrow, embankment, structural and general backfill, restoration and cleanup necessary to complete required structures.

PART 2 - PRODUCTS

2.01 General Fill:

A. Use soil or soil-rock mixture free from organic material and other deleterious substance.

B. Use no rocks or lumps over six inches in greatest dimensions and not more than 15% of the rocks or lumps shall be larger than 2-1/2 inches in greatest dimension.

C. Import fill material which is predominately granular with maximum particle size of two inches and a plasticity index of 12 of less.

2.02 Granular Fill:

A. Use for all interior floors.

B. Use clean aggregate with particle size grade within following limits:

U.S. Standard Sieve Size	% Passing by Weight
1"	100%
3/4"	95% (minimum)
#4	5% (maximum)

2.03 Structural Backfill:

A. Use natural sand or a mixture of sand with gravel or crushed stone.

B. Provide particle size as follows:

U.S. Standard Sieve Size	% Passing by Weight
#4	100%
#200	6%

PART 3 - EXECUTION

3.01 Site Preparation:

A. Remove existing topsoil, vegetation, roots, grass or other perishable material from areas which are to be excavated or filled.

B. Strip materials to full depth of topsoil unless directed otherwise by Engineer.

C. Stockpile topsoil on site where directed.

D. Stripping and stockpiling operations shall be completed before starting excavation operations.

E. Approved topsoil removed from areas will be used for finish grading.

3.02 Rough Grade:

A. Do all rough cutting, filling and grading necessary to bring following areas to planned subgrades:

1. Slabs-On-Grade: To 6" below bottom of such slabs.

2. Outside Lawn Areas: 6" below finish grades. Slope grading uniformly away from buildings.

3. Sidewalks: 6" below finish elevation.

4. Drives or Parking Areas: 8" below finish grades.

B. Cooperate with other subcontractors and/or Owner for installation of sidewalks, paving, finish grading, seeding, sodding or other site work indicated or specified.

C. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given and existing grades.

D. Finish surfaces shall be reasonably smooth, compacted and free from irregular surface changes.

E. Regrade interior and exterior work where shrinkage and settlement has occurred.

3.03 Excavation:

A. Excavate to depths shown and as required for fittings, foundation walls, grade beams, floor slabs, and under floor fills. Excavate subsoil deposits of deleterious material, such as brick, stone, wood, vegetation, silt, etc., where same interferes with new construction.

B. Excavate outside of walls as required to permit placing and removal of forms, inspection of work and installation of dampproofing drain tile, and other below grade work.

C. Excavate to exact size of footings, trenches and other work where forms are not used. Trim and level excavations to proper elevations and clear them of debris and rubbish.

D. Neatly step footings where indicated or required at a slope not exceeding 1:2.

E. If satisfactory soil conditions are not found at depth indicated, cease work and notify Owner's Representative.

F. Backfill unauthorized excavation to foundation levels shown with concrete at no expense to Owner.

3.04 Backfill:

A. Provide minimum of 6" (compacted depth) of granular fill under all interior slabs on grade.

B. Provide minimum of 6" (compacted depth) of granular fill or structural backfill under all sidewalks and exterior slabs on grade.

C. Do not place frozen backfill material. Do not place material on frozen or wet ground or in standing water.

D. Place materials in compacted layers not exceeding 8" under slabs and 18" elsewhere.

E. Place backfill on each side of piers, walls and structures simultaneously to avoid displacement.

F. Use granular fill material against walls to 12" from surface where shown.

G. Protect below grade waterproofing, dampproofing and insulation with single thickness of 1/2" fiberboard, 1/8" asphalt impregnated board or other approved means.

H. Do not operate heavy equipment closer to any wall than a distance equal to height of backfill above top of footings.

3.05 Embankments:

A. Construct all embankment or fill sections with excavated on-site material where possible.

B. Scarify existing grade minimum 6" deep before commencing fill.

C. Provide water as needed to obtain optimum moisture content for compaction.

D. Provide additional off-site material needed to complete embankment.

3.06 Compaction:

A. Backfill adjacent to walls to same density as adjacent fill with small vibratory or hand tamping equipment.

B. Compact backfill and embankment fill within building outlines, drives and parking areas to density of at least 95% of standard proctor density.

3.07 Dewatering:

A. Furnish, install, operate and remove dewatering equipment necessary to drain and keep excavations free of water.

B. Obtain Engineer's approval of proposed method of dewatering.

C. Prevent surface water from flowing into excavation; promptly remove any accumulated water.

3.08 Finish Grading:

A. Place minimum 6" topsoil on all rough graded areas unless shown otherwise.

B. Grade areas disturbed by construction operations.

C. Grade to smooth, uniformly sloping surfaces to elevations indicated.

D. Slope finish ground surfaces from elevations indicated to existing grade with slope not to exceed 2" per foot unless indicated otherwise.

E. Fill depressions and provide for positive drainage away from building area.

3.09 Underground Obstructions:

A. Do not commence excavation prior to site inspection by representative of local utilities.

B. Known underground piping, foundations and other underground obstructions in vicinity of construction are shown on plans in an appropriate way only. The Contractor shall verify actual locations.

C. Protect underground facilities encountered during excavation. Repair without compensation existing facilities damaged during excavation whether or not shown.

D. Contractor must determine exact location of underground utilities to avoid damage and conflicts.

* * * END OF SECTION * * *

SECTION 02224

PIPE BORING AND JACKING

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1.05 Borings and Casing

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3.02 Handling and Delivery

SECTION 02224

PIPE BORING AND JACKING

PART 1 - GENERAL

1.01 Related Requirements Specified Elsewhere:

A. Trenching, Backfilling and Compacting: Section 02221.

B. Drainage: Section 02400

C. Measurement and Payment: Section 01900

1.02 General Description of Work:

A. Provide all labor, materials and equipment and perform all operations necessary for installation of all casing pipe and end plugs where indicated and required to pass under streets, railroad, other utilities, or other obstructions without excavation.

1.03 Quality Assurance:

A. Comply with the latest published editions of the American Society of Testing and Materials (ASTM) Standards:

1. ASTM A139 - Standard mill type wrought steel pipe.

B. Submit manufacturer's certification that materials meet specification requirements.

C. Submit names, locations, and phone numbers of three similar projects where satisfactory performances of comparable work has been performed.

1.04 Permits:

The permits for crossings shall be obtained by the Owner. The Contractor shall give notification to the appropriate authorities prior to the start of the work. Do not start work until all arrangements are completed and permission is given by the appropriate authorities to start the work.

1.05 Borings and Casing:

The Contractor shall be responsible for installing welded steel pipe casings as shown or specified, in accordance with approved jacking and boring methods. The Contractor shall maintain the exact lines and grades, as shown, for the entire length of the steel casing. Before beginning any work, the Contractor shall submit to the Engineer plans and details describing the materials and methods which he proposes to use. Do not proceed with the work until such plans and methods have been reviewed for conformity with the approved permit by the Engineer. The review by the Engineer of any plan or method shall not relieve the Contractor of his responsibility in any way.

PART 2 - PRODUCTS

2.01 General Requirements:

A. Furnish all new steel pipe conforming to ASTM A139, Grade B.

B. Furnish pipe with minimum wall thickness as follows:

1. 18" - 0.250
2. 20" - 0.375
3. 24" - 0.375
4. 30" - 0.375
5. 36" - 0.375
6. 42" - 0.375

C. Coatings and linings not required.

D. The casing pipe and joints shall be constructed to prevent leakage of any matter from the casing or conduit throughout its entire length, except at the ends of the casing where the ends are left open.

E. The ends of the casing shall be suitably protected against the entrance of foreign material which might prevent ready removal of the conduit.

PART 3 - EXECUTION

3.01 Installation:

A. Install by bore and jack methods unless other techniques are approved by Engineer.

B. Excavate bore pits to prevent damage to adjacent structures.

C. Maintain line and grade indicated to within +/-0.20' vertical and +/-0.50' horizontal.

D. Rebore at Contractor's expense if not able to meet tolerances.

E. Install casing and carrier pipe as indicated on plans.

1. Carrier pipe shall be supported by 2x4 wooden blocks nailed to 2x4 skids cut so pipe does not rest on the bells.

F. Backfill bore pits as specified for trench excavation.

G. Fill annular space between casing and carrier pipe with dry blow sand whenever casing size is 24" and larger. As the work of installing the conduit progresses, fill the space between the outer shell of the conduit and the tunnel liner or casing. The Engineer shall have the right to limit the length of conduit placed in any one step before filling the space to ensure that said space is completely filled in a satisfactory manner.

H. Seal ends of casing with at least 1 foot of concrete.

3.02 Handling and Delivery:

A. Do not deliver until all required testing has been performed.

B. Transport and handle pipe in a manner to avoid damage to pipe during delivery and installation.

* * * END OF SECTION * * *

SECTION 02400

DRAINAGE

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3.02 Existing Drains
3.03 Drainage Pipe
3.04 Drainage Ditches

SECTION 02400

DRAINAGE

PART 1 - GENERAL

1.01 Work Included:

A. Drainage work includes all facilities pertaining to drainage of both groundwater and surface water, including existing drainage facilities.

1.02 Related Work Specified Elsewhere:

A. Earthwork for Utilities: Section 02202.

B. Catch Basins, Valve Structures, Manholes and Wet Wells: Section 02430.

C. Paving and Surfacing: Section 02500.

1.03 Description:

A. All work shall be done in accordance to the specifications and conforming to the lines, grades and sections shown on the plans.

1.04 Quality Assurance:

A. Shop Inspection: All materials furnished by the Contractor are subject, at the discretion of the Owner and/or Engineer, to inspection and approval at the manufacturer's plant.

B. Rejection of Defective Material: All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site.

PART 2 - PRODUCTS

2.01 Materials:

A. Corrugated Metal Pipe: Pipe and connections shall conform to the requirements of the current specifications for Corrugated Metal Culvert Pipe, AASHTO M36.

B. Concrete Pipe:

1. Pipe larger than 24 inches in diameter shall be reinforced concrete pipe conforming to ASTM Standard C 76, having a minimum wall thickness of Class B, with the following additional requirements.

a. Circular pipe with elliptical reinforcing shall have a readily visible line at least 12 inches in length painted or otherwise applied on the inside and outside of the pipe at each end so that when the pipe is laid in its proper position, the line shall be at the top of the pipe.

2. Non-Reinforced Pipe: For those pipes less than 24 inches in diameter, the Contractor may choose either extra-strength non-reinforced concrete pipe or extra-strength vitrified clay sewer pipe. The non-reinforced concrete pipe shall conform to ASTM Standard C 14.

C. Vitrified Clay Pipe: Shall conform to ASTM C 700 extra-strength.

D. Perforated Pipe: Shall be perforated PVC or ABS plastic pipe, a minimum of 4 inches in diameter meeting ASTM D 1886-61T or revised standard. Pipe shall be installed as shown on the Drawings with a minimum slope of 1/8 inch per foot. Pipe with round holes shall have holes not greater than 5/16 inches in diameter with a minimum of eight holes per foot of pipe. If slotted pipe is used, slots will have a minimum dimension of 1/8 inch with not more than four slots of any cross section and not less than 20 slots per foot of pipe.

E. Aggregates: Shall be as specified for drainage fill in Section 02200 - Earthwork, and for "Class B Special" pipe bedding in Section 02202 - Earthwork for Utilities.

PART 3 - EXECUTION

3.01 Dewatering:

A. At all times during construction, keep excavations free from standing water. Sumps, if required, shall be located outside of load bearing areas so the bearing surfaces will not be disturbed. Water pumped from the excavation shall be discharged to prevent re-entry into the soil strata being dewatered. Water containing silt or mud shall not be pumped into sewer lines or adjacent streams. The method of dewatering from the excavation shall be approved by the Engineer prior to actual disposal.

B. The dewatering system shall take into consideration the construction procedures, the soil type and the depth of the foundation relative to the groundwater level.

C. Operation of the dewatering system shall be continued until the sides of the structure are carried above the natural ground level and the maximum weight of water displaced by the structure is less than 90% of the uplift resisting capacity consisting of dead weight of the structure and backfill. The Contractor shall submit uplift calculations to the Engineer for approval prior to discontinuing dewatering.

D. Walls shall not be exposed to water pressure before supporting structural work at the next higher level is completed and concrete has properly cured.

E. Provide a standby system for emergency operation in case of failure of the primary power source or mechanical failure of the system.

F. If dewatering becomes necessary, all dewatering flows are to be settled in siltation basins or directed through straw filters before being discharged to stabili zed sites such as streams, or lake, or storm sewers, not onto exposed soils, or stream banks, or any other site where flows could cause erosion.

3.02 Existing Drains:

A. Should any underground drain be encountered, the location which is not shown on the plans, the Contractor shall notify the Engineer at once. The Contractor shall then explore such drainage as directed and, if deemed necessary, take care of it under applicable provisions of these specifications, or as otherwise directed.

B. If existing surface drainage, tile drains, sewers, or other underground drains, or parts thereof, are not part of the Contract or directed to be changed (whether such drainage facilities are shown on the plans or not), the Contractor shall be responsible for and shall protect and preserve any and all such drainage facilities or parts thereof which may be affected by his construction operations. If temporary facilities are provided, before the work is accepted, the Contractor shall have restored such damage or interrupted drainage facilities to the original condition or to an altered state which is at least equal to the original condition.

3.03 Drainage Pipe:

A. Drainage pipe shall be the types, classes, sizes and dimensions required on the plans, furnished and installed at the laces designated on the plans and profiles, or by the Engineer, in accordance with these specifications and with the lines and grades given.

B. Proper facilities shall be provided for lowering the pipe when it is to be placed in a trench. The pipe shall be laid carefully and true to lines and grades in a compacted bedding throughout its length.

C. Pipe which is not in true alignment, or which shows any undue settlement after being laid or is damaged, shall be relaid without extra compensation.

D. Corrugated Metal Pipe: Shall be laid with separate sections joined firmly together with coupling bands, with outside laps of circumferential joints pointing upgrade and with longitudinal laps on the sides.

E. Concrete Pipe: Shall be laid with separate sections joined firmly together with bitumastic material, mortar, or equal. All outside laps of circumferential joints pointing upgrade. Elliptical reinforced pipe shall be laid with the lines at the end of each section at the top of the pipe.

F. Perforated Pipe: Shall be installed with the openings placed downward and all joints protected from the entry of aggregates, as per the manufacturer's instructions. If the slope is not shown in the plans, the minimum slope shall be 1/8 inch per foot.

3.04 Drainage Ditches:

A. Lines, grades, and cross sections of ditches shall be as shown on the plans, otherwise required to establish and obtain proper drainage.

B. Ditches and gutters emptying from cuts in embankments shall be constructed to avoid eroding the embankment.

C. The fill materials, where required, shall be placed in layers not exceeding 6 inches in thickness and compacted by rubber-tired equipment. Sheep's foot rollers shall not be used, except for special circumstances as expressly approved by the Engineer. Compaction shall be performed with the fill material at optimum moisture content and compaction shall produce not less than 90% of the maximum dry density as determined by AASHTO T 99, see Section 02200 - Earthwork.

D. Ditch Excavation: Upon the completion of placing and compacting the fills, the ditch shall be neatly trimmed to the grades and alignments shown on the plans, leaving a smooth, compacted surface.

E. Excess spoil material from the excavation shall be disposed of by the Contractor as provided under Section 02200 - Earthwork.

* * * END OF SECTION * * *

SECTION 02430

CATCH BASINS, VALVE STRUCTURES, MANHOLES AND WET WELLS

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SECTION 02430

CATCH BASINS, VALVE STRUCTURES, MANHOLES AND WET WELLS

PART 1 - GENERAL:

1.01 Work Included:

A. Catch basins, manholes and appurtenances shall be as specified and as shown in the plans, and includes precast concrete units, concrete masonry units or concrete or clay brick or cast-in-place concrete; excepting, however, that brick or masonry manholes will not be permitted for sanitary sewers. Appurtenances include the steps, bedding, the cast iron inlet or frame and lid, and the piping connections.

1.02 Related Work Specified Elsewhere:

A. Earthwork for Utilities: Section 02202

1.03 Description:

A. All work shall be done in accordance to the specifications and conforming to the locations, elevations and details shown in the plans.

1.04 Quality Assurance:

A. Shop Inspection: All materials furnished by the Contractor are subject, at the discretion of the Owner and/or Engineer, to inspection and approval at the manufacturer's plant.

B. Rejection of Defective Material: All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected by the Engineer. The Contractor shall promptly remove all rejected materials from the site.

1.05 Shop Drawings:

Contractor shall submit shop drawings.

PART 2 - PRODUCTS

2.01 Materials:

A. Manholes and Other Structures:

1. Manholes shall be constructed of monolithic concrete or precast manhole sections. Precast manhole sections shall conform to requirements of ASTM Specification C478, latest revision.

2. Materials for manholes, junction chambers, diversion chambers, and miscellaneous concrete structures shall comply with the following:

a. Concrete for precast manhole sections shall be 3000 psi concrete. Monolithic manholes shall use 4000 psi concrete. Ready-mix concrete shall conform to ASTM C94 Alternate 2. Maximum size of aggregate shall be 1-1/2 inches. Slump shall be between 2 and 4 inches.

b. Forms for chamber and structures shall be plywood or other approved material. Steel forms shall be used for the inside face of monolithic concrete manholes.

c. Reinforcing steel shall conform to ASTM A615, Grade 40 deformed bars, or ASTM A616, Grade 40 deformed bars.

d. Mortar Materials:

(1) Sand - ASTM Designation C144, passing a No. 8 sieve.

(2) Cement - ASTM Designation C150, Type 1.

(3) Water - shall be potable.

e. All joints shall be fully sealed and waterproofed. Rubber gaskets for precast concrete manhole sections shall meet the requirements of ASTM C443. The gasket shall be the sole element depended upon to make the joint flexible and watertight.

f. The manufacturer of the precast manholes shall provide core-drilled openings to produce a smooth, uniform, cylindrical hole of the proper size to accommodate a resilient connector meeting the requirements of ASTM C923 for all sewers entering and leaving the manhole. The resilient connectors shall be either Press-Seal Gasket Corp., which provides PSX gasket or Press Wedge II; or similar flexible manhole sleeves furnished by Kor-N-Seal by NPG Systems, Inc; or equal.

g. Precast manhole sections shall be steam cured and shall not be shipped from the point of manufacture for at least five days after having been cast. The exterior surface of each section shall be thoroughly coated with a coal tar epoxy type coating as manufactured by Koppers Company, Bitumastic No. 300-M; Porter Coatings, Tarmastic 100; or equal. Final dry mils thickness shall be a minimum of 12 mils. Monolithic concrete manholes and other concrete structures shall be cured for a minimum of seven days and then coated in the field with a coal tar epoxy type coating as mentioned above.

h. Manhole castings shall be of good quality cast iron and/or ductile iron, conforming to ASTM Designation A48. Castings shall have a total weight of not less than 400 lbs. and shall conform to the design of the manhole casting as shown on the detail sheets. Castings shall have three bolt holes equally spaced around base of frame and shall be securely anchored to cone section with three 3/8 inch bolts and expansion shields.

i. Manhole steps shall be made from a steel reinforcing rod incapsulated in a copolymer polypropylene resin. The manhole steps shall equal or exceed OSHA requirements. Manhole steps manufactured by M.A. Industries, Inc., PS-1-PF, Clay & Bailey Mfg. Co., or equal, are acceptable.

j. Any other special manholes, junction chambers, diversion chambers, and miscellaneous concrete structures shall be constructed as detailed on the drawings.

k. The Contractor may, at his option, furnish and install a combination pre-cast concrete base and first section with pre-cut openings for services. Detailed drawings shall be submitted to the Engineer prior to manufacture.

PART 3 - EXECUTION

3.01 Miscellaneous:

A. Dewatering: Dewatering of the site shall conform to the requirements of trench dewatering.

B. Sub-Base Preparation: Adequate foundation for all manhole structures shall be obtained by removal and replacement of unsuitable material with well graded granular material, or by tightening with coarse angular rock, or by such other means as provided for foundation preparation of the connected sewers, or as required in the special provisions.

C. Bedding for precast base sections shall be a well graded aggregate conforming to the requirements for trench bedding, but not less than 4 inches in thickness and extending to the limits of the excavation. The bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast element.

D. Cast-In-Place Bases: Unless otherwise specified, cast-in-place bases shall be at least 8 inches in thickness and shall extend at least 6 inches radially outside of the outside dimension of the manhole section.

E. Precast manhole sections, when used, shall have the exterior surfaces of each section thoroughly coated with a coal tar epoxy type coating as manufactured by Koppers Company, Bitumastic No. 300-M; Porter Coatings, Tarmastic 100; or equal. Monolithic manholes and other concrete structures shall be coated in the field with a coal tar epoxy type coating. Coating shall be 12 mil minimum dry film thickness. Each joint after being fully mortared shall be coated with a coat tar epoxy type coating upon reaching its final set.

F. Any additional holes cut in the field shall be drilled with a core-drill or in a manner approved by the Engineer.

G. The joint between the casting frame and cone section shall be fully mortared or gasketed and coated with a coal tar epoxy coating upon reaching its final set to become a watertight joint.

3.02 Manholes and Basins:

A. Block or Brick Structures:

1. Masonry units or brick shall be laid up in full unfurrowed mortar joints to provide complete filling of all horizontal and vertical joints. The inside of the structure shall be made to conform to the shape and dimensions specified with reasonably even surfaces and with joints scraped or wiped flush. Ladder rungs shall be as specified for precast manholes except that uniform spacing shall not exceed 16 inches.

2. The outside of all masonry manholes shall be plaster-coated with mortar not less than 1/2 inch thick for the purpose of waterproofing, unless otherwise provided in the special provisions.

B. Precast Manholes:

1. Precast manholes may be constructed with a precast base section or a monolithic base structure as specified or shown on the plans.

2. A precast base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment and making sure that all entering pipes can be inserted on proper grade.

3. All lift holes and all joints between precast elements shall be thoroughly wetted and then be completely filled with mortar, smoothed and painted both inside and out with bitumastic material, to insure watertightness.

4. All joints between elements on sanitary sewer manholes shall be with an approved rubber gasket. Bitumastic material and/or rubber gaskets may be used instead of mortar for structures for storm sewers.

5. The first precast section shall be placed on the cast-in-place base before the base has taken initial set, and shall be carefully adjusted to true grade and alignment with all inlet pipes properly installed so as to form an integral, watertight unit; or the section shall be mortared into a suitable groove provided in the top of the precast base. The first section shall be uniformly supported by the base concrete, and shall not bear directly on any of the pipes.

6. Precast sections shall be placed and aligned to provide vertical sides and vertical alignment of the ladder rungs. The completed manhole shall be rigid and true to dimensions.

C. Monolithic Concrete Structures:

1. Monolithic concrete structures shall be constructed in accordance with the provisions of this Section and the details shown on the plans.

2. Curing: Cast-in-place components shall be moist-cured for a period of not less than seven days except that when high-early-strength cement is used, the curing shall not be less than three days. Pigmented membrane curing compound or other approved method may be applied in lieu of moist curing.

3.03 Excavation:

A. In order to permit the joints to be mortared properly and also permit proper compaction of the backfill material, the excavation shall be made to a diameter of at least 6 inches greater than the diameter of the structure.

3.04 Inlet and Outlet Pipe:

A. The pipe or tile for the inlet and outlet connections shall extend through the wall and beyond the outside surface of the wall a sufficient distance to allow for connections.

B. Flow Channels:

1. For other than one piece bases, the flow channel shall be constructed of sewer pipe set in concrete, or approved equal. Channels shall be semi-circular or U-shaped to the spring line conforming to the inside diameter of the connecting sewer. Where necessary, make gradual changes in size, grade or direction with true curves. No bricks shall be allowed in constructing flow channels.

2. At connections to existing sewers, before the existing pipe is broken out, pour concrete bottom to a depth one half the diameter of the existing sewer. Slope the surface of the concrete along the sides of the pipe to insure drainage into the sewer. After the bottom has cured for at least 24 hours, the top half of the existing pipe shall be broken out to produce a smooth and even edge with concrete fillet.

C. Manhole Drop Connections: Unless otherwise indicated on the Drawings, provide drop inlets into manholes for incoming lines having inverts 2 feet or more above the inverts of the manhole. Encase drop pipe and fittings in concrete extending from the manhole base, as shown in the plans.

3.05 Placing Castings:

A. Castings placed on concrete or masonry surface shall be set in full mortar beds. The mortar shall be mixed in proportion of 1 part cement to 3 parts sand, by volume, based on dry materials. Castings shall be set accurately to the finished elevation so that no adjustment will be necessary.

B. Streets at Grade: Where work is in paved streets or areas which have been brought up to grade, between 8 inches and 20 inches shall be provided between the top of the cone or slab and the underside of the casting ring for adjustment of the casting ring to street grade.

C. Streets or Alleys with No Established Grade: Where work is in the streets or other areas which have not been brought to grade, between 12 inches and 24 inches shall be provided between the top of the cone or slab and the underside of the casting ring for adjustment of the casting ring to street grade.

D. The top of the casting shall be flush with the street surface unless otherwise directed by the Engineer.

E. Manholes Not Within Street or Paved Areas:

1. Unless otherwise directed, in non-cultivated areas, the top of castings shall be at grade.

2. Where work is in cultivated areas, the top of the casting, unless otherwise directed by the Engineer, shall be 12 inches below the established ground surface.

F. Watertight Lids and Frames: For sanitary sewers and watertight structures the frame and lid shall be the watertight type having a rubber gasket and the lid securely fastened with non-corroding bolts. The casting frame shall also be bolted to the concrete structure and set in a mastic sealant as per the manufacturer's instructions.

G. Catch Basins:

1. In grass areas shall have convex grates.

2. In paved areas shall have flat, bicycle safe grates.

3. All catch basin frames and inlet grates shall be products by one manufacturer.

3.06 Leak Testing Sanitary Manholes:

A. All manholes in sanitary sewer lines shall be constructed in such a manner as to preclude all inflow and infiltration. The Contractor is required to conduct exfiltration tests on all manholes, in the presence of the Engineer. The exfiltration test shall consist of plugging all influent and effluent lines, filling the manhole with water to the top of the casting and observing the drop in the water level. A manhole shall have successfully complied with the exfiltration requirements when the water loss is less than 0.2% of the volume of water over a period of 24 hours. The test shall not begin until after the concrete has been fully absorbed with water. The Contractor shall supply all labor, equipment and materials, including water, to satisfactorily complete this test. No compensation will be allowed the Contractor for this test. The Contractor shall include the cost of this test in the manhole price in the Bid Proposal.

B. If the manhole does not pass the leakage test, the Contractor shall correct the cause; if the leak cannot be located, the Contractor shall coat the outside of the entire manhole with an approved waterproof sealant and repeat the test.

3.07 Record of Location:

A. Manhole witnessing shall be from at least two permanent objects identifiable on the plans.

3.08 Cleaning:

A. All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulation at the time of final inspection.

* * * END OF SECTION * * *

SECTION 02450

WALK, ROAD AND PARKING APPURTENANCES

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1.02 Related Work Specified Elsewhere
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PART 2 - PRODUCTS

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PART 3 - EXECUTION

3.01 Marking Pavement

SECTION 02450

WALK, ROAD AND PARKING APPURTENANCES

PART 1 - GENERAL

1.01 Work Included:

A. The Contractor shall furnish and install all appurtenances such as parking wheel blocks and painted pavement markings, as specified and as shown in the plans.

1.02 Related Work Specified Elsewhere:

A. Paving and Surfacing: Section 02500

1.03 Quality Assurance:

A. The Manufacturers of the products specified under this Section shall certify they are in compliance with these specifications and that their product has been prequalified by the State Highway DOT or the local municipality where the work is being performed.

1.04 Regulating Authorities:

A. All work shall comply with the appropriate authorities.

PART 2 - PRODUCTS

2.01 Materials:

A. Comply with the specifications and standards for each specific product involved.

PART 3 - EXECUTION

3.01 Marking Pavement:

A. Pavement marking on bituminous or Portland Cement concrete surfaces shall be made with paint. Bituminous surfaces shall be marked after paving. Concrete surfaces shall be marked after curing.

B. Pavement marking shall be placed as shown in the plans and directed by the Engineer and will include the following types of markings:

1. Two-foot dashed pavement marking line.

2. Four-foot dashed pavement marking line.

3. Solid pavement marking line.

C. All marking shall have a nominal width of 3 inches. Markings shall be either white or yellow. Dashed lines shall be spaced not greater than 50 feet center to center of markings.

D. Markings shall be applied to adhere adequately to the surface. Paint shall be applied at the rate of 15 gallons per mile of solid line. Markings which do not function properly as pavement marking shall be replaced and the application methods revised as directed by the Engineer, and at no additional cost to the Owner.

E. Contractor shall follow applicable portions of Section 621 of the Ohio Department of Transportation Construction and Materials Specifications dated 1/1/1987.

* * * END OF SECTION * * *

SECTION 02482

LANDSCAPING FOR UTILITIES

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3.05 Clean-Up

SECTION 02482

LANDSCAPING FOR UTILITIES

PART 1 - GENERAL

1.01 Description

A. Furnish and install topsoil, fertilizer, seed, mulch, sod, trees, bushes, ornamental plants, fencing, mail boxes, planters and related items necessary to complete work shown or specified.

B. The Contractor shall repair or replace lawn areas, trees and ornamental plants damaged or destroyed during construction of the work included in this Contract, unless otherwise shown on the drawings. The Contractor shall repair or replace fences, mail boxes, planters and other items damaged or destroyed during construction of the work included in this Contract, unless otherwise shown on the drawings.

C. Lawn areas include grassed areas which are cut and maintained on a routine basis. Lawn areas include lawns at homes and businesses and grass shoulders of streets, roads and highways.

D. Replacement of underbrush in fields and woods, along farm fences and roads, and in similar areas is not required, unless otherwise shown on the drawings. However, those disturbed areas shall be seeded.

1.02 Job Conditions

A. Seed between February 15 and June 1 and between August 15 and November 1. Do not sow seed during adverse weather conditions. Do not broadcast seed during high wind. Do not sow seed when the moisture content of the soil is too low or too high for seed germination.

B. Plant trees and ornamental plants during the proper time and under the proper conditions for the particular tree or plant.

PART 2 - PRODUCTS

2.01 Lawn Products

A. Limestone:

Limestone shall be agricultural grade with a minimum total neutralizing power of 90. At least 40% of the limestone shall pass a No. 100 sieve, and at least 90% shall pass a No. 8 sieve.

B. Fertilizer:

Fertilizer shall be 12-12-12 grade.

C. Seed:

1. Seed mix shall be as follows:

Seed Description	Percent by Weight
Kentucky Blue Grass (Poa prateusis)	25%
Kentucky 31 Fescue (Festuca arundinacea var. KY 31)	15%
Perennial Rye (Lolium multiflorm)	60%

2. Seed shall not contain more than 5% inert matter. Seed shall not contain objectional weeds.

D. Mulch:

Mulch shall be straw, grass, hay, pine needles, or wood fiber. Straw shall be threshed straw of cereal grain such as oats, wheat, barley, rye and rice. Mulch shall not contain objectional weed seeds or other material that might be detrimental to the planting being established.

E. Asphalt Adhesive:

Asphalt adhesive shall be emulsified asphalt. Adhesive shall meet the requirements of ASTM D977 for Grade SS-1.

2.02 Fence and Other Products

Replacement fence, mail boxes, planters, and other items shall be new and unused. Fence, mail boxes, planters and other items shall be the same type as the items removed. Fence, mail boxes, planters and other items shall be of equal quality to the items removed when the items removed were new.

PART 3 - EXECUTION

3.01 Grading

Fine grade all non-paved areas disturbed during construction. Areas shall be smooth and uniform. Finish elevations and grades shall be the same as elevations and grades prior to construction, unless otherwise shown on the drawings.

3.02 Seeding

A. Loosen the seed bed, if not loose, to a depth of from 1 to 2 inches below finished grade.

B. Seeds and fertilizers can be sown with standard agricultural drills. Grass seeds may be sown broadcast or with a special seeder attachment on agricultural drills, but shall not be covered with more than 1/2-inch of soil, whether drilled or raked in. If not covered by the drill, all uncovered seed shall, immediately after sowing, be slightly raked or harrowed to cover the seed.

C. Apply fertilizer in the amount of 20 pounds per 1,000 square feet.

D. Sow grass seed at the rate of not less than four pounds per 1,000 square feet.

E. Apply adequate mulching material following seeding and fertilizing.

F. Keep seeded and fertilized areas adequately watered until germination of all seed is completed and uniform grass cover is accomplished.

3.03 Planting Trees and Other Plants

A. Plant trees and other plants in the proper manner for the particular tree or plant being planted.

B. Keep trees and plants properly watered until growth is assured.

3.04 Fencing and Other Restoration

A. Locate fences, mail boxes, planters and other items in the same location that the item had been prior to construction. Erect wire and board fences plumb and on straight lines. Set mail boxes, posts, poles and similar items plumb. Restore planters and similar items to the same shape the items had been prior to construction.

B. Wire fences shall have the proper tension for the type of wire fence restored. Other fences and items shall be properly erected or constructed.

3.05 Clean-Up

Clean-up the job site following landscaping. Remove rubbish, excess materials, temporary structures and equipment. Leave the work in a neat and presentable condition.

* * * END OF SECTION * * *

SECTION 02500

PAVING AND SURFACING

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3.04 Bituminous Pavement Surface - Rigid Base
3.05 Bituminous Plant Mix Pavement or Bituminous Treated Surface Flexible Base
3.06 Driveway, Sidewalk and Curb and Gutter

SECTION 02500

PAVING AND SURFACING

PART 1 - GENERAL

1.01 Description:

A. The Contractor shall furnish all material, equipment, tools and labor necessary to construct and test all paving and surfacing work as specified and as shown in the plans to repair or replace existing paved surfaces such as roads, sidewalks, curb and gutter, driveways and driveway culverts.

1.02 Work Included:

A. Work to be completed under this item includes pavement replacement for roads, sidewalks, curb and gutter, driveway and replacement of driveway culverts. Only pavement replacement as shown on drawings will be a pay item. Curbs, sidewalks, driveways will be replaced by the Contractor but will be considered incidental costs. Replacement of roads outside of designated areas will also be considered incidental. Pavements will be replaced in like kind in accordance with the specifications except as shown on Drawings.

B. Driveway culverts will be replaced in like or better if damaged during construction.

C. Ditch slopes will be restored to provide a functional drainage system.

1.03 Related Work Specified Elsewhere:

A. Earthwork for Utilities: Section 02202

B. Drainage: Section 02400

1.04 Referenced Standards:

A. All classes, types, grades, etc., specified and as shown in the plans refer to the Standards of the Ohio State Highway Department of Transportation (DOT).

B. All work shall conform to the most recent regulations of the Ohio State Highway DOT unless superceded by the local specifications.

1.05 Quality Assurance:

A. The suppliers of each material specified shall submit certifications that the product and/or plant has satisfactorily furnished similar materials for a project by the State Highway DOT, or other recognized public agency, and that the materials proposed to be used will comply with the specifications as shown in the plans.

B. The Contractor doing the paving and surfacing work shall have satisfactorily completed similar work with the State Highway DOT, or other recognized public agency.

PART 2 - PRODUCTS

2.01 Materials:

A. All materials shall comply with the specifications and standards for each specific product involved as specified and shown in the plans.

B. Surfaces designated for pavement replacement shall be replaced in kind with a gravel, bituminous or concrete surface for streets or driveways. The replacing surface in dimension shall be of the same material as previously in place.

C. Driveways shall be replaced for the entire width, even where it is only partially disturbed.

D. Recycled material shall be utilized on a one for one basis in lieu of the specified base requirements.

E. Roto-milled material shall not be used as the top gravel on gravel roads.

2.02 Equipment:

A. Equipment to be used shall be of the type and size that meet all the requirements specified by the Ohio State Highway DOT and Local requirements.

PART 3 - EXECUTION

3.01 Materials:

A. Methods and means used to perform all paving and surfacing work shall comply with the requirements of the Ohio State Highway DOT for the specific products involved.

B. Surfaces may be roto-milled as long as the following constraints are met:

1. Pulverized materials remain in place until required for trench excavation.

2. The stockpiling location is approved by the Engineer.

3. Maximum pulverized particle size shall not exceed 3/4 inch. Should excessive coarse or fine material in the opinion of the Engineer be evident, the pulverized material will not be considered adequate for a gravel base.

C. Prior to repaving, a straight saw cut, parallel and/or perpendicular to the road shall be required at the interface of disturbed and undisturbed pavement. This shall be the case at intersections and at the centerline of all affected roads.

D. Any pavement cutting or breaking for construction of service connections, unless authorized by the Engineer, shall be the responsibility of the Contractor and shall be repaired by the Contractor at no additional cost to the Owner.

E. No pavement replacement shall take place prior to meeting the compaction standards.

3.02 Foundation:

A. Subgrade shall be compacted as specified for no settlement of the foundation materials.

B. Before placing the base, the surface shall be smooth and at the specified grade; with provisions in the slope(s) for surface drainage and for a gradual, smooth transition when abutting existing pavement.

3.03 Portland Cement Concrete Pavement Surface:

A. Where the existing pavement surface is Portland Cement, the pavement replacement shall consist of Portland Cement concrete reinforced as indicated on the plans. Portland Cement concrete shall conform to the applicable provisions of these specifications and shall have a compressive strength of 3,500 pounds per square inch at 28 days. Pavement joints in the replacement surface shall conform to and match the State Highway DOT Standard Specifications for Portland Cement concrete pavement.

3.04 Bituminous Pavement Surface - Rigid Base:

A. Where the existing pavement surface is bituminous concrete and the base consists of a rigid material such as brick, Portland Cement concrete, soil cement, natural cement concrete or a combination of these materials, the base replacement shall consist of Portland Cement concrete base course reinforced as indicated on the plans. Portland Cement concrete shall conform to applicable provisions of these specifications and shall have a compressive strength of 3,500 pounds per square inch at 28 days. The surface replacement shall consist of a bituminous prime coat and a 3-inch minimum thickness bituminous plant mix surface course conforming to the State Highway DOT Standard Specifications.

3.05 Bituminous Plant Mix Pavement or Bituminous Treated Surface Flexible Base:

A. Where the existing pavement is bituminous plant mix material or bituminous surface treatment and the base consist of a flexible material such as gravel or crushed stone, the base replacement shall consist of compacted thickness of gravel or crushed stone conforming to State Highway DOT Standard Specifications or as indicated on the plans.

B. The surface replacement shall consist of a bituminous prime coat and a bituminous plant mix surface course 3 inches in thickness conforming to the State Highway DOT Standard Specifications.

3.06 Driveway, Sidewalk and Curb and Gutter:

A. A straight saw cut, parallel to the road, will be required at the interface of undisturbed and disturbed driveways. A straight saw cut will be required at the interface of undisturbed and disturbed sidewalks.

B. Where necessary to remove and replace driveways, sidewalks and curb and gutter, replacements shall be made as follows:

1. Concrete sidewalks and driveways shall be replaced with concrete having a compressive strength of not less than 3,500 psi at 28 days. Minimum thickness shall be 4 inches for sidewalks and 6 inches for driveways. Surfaces shall have a minimum slope to drain of 1/4 inch per foot.

2. Finishes: After the concrete is placed in the forms, sidewalk and driveways surfaces shall be finished by tamping the concrete with special tools to force the coarse aggregate away from the surface, screening and floating to bring the surface to the required finished level, steel troweling to an even, smooth surface, and brooming with a fiber-bristled brush in a direction transverse to that of the traffic. Sidewalks shall be cross marked at intervals so as to produce approximate squares. The cross marking tool shall cut a groove not less than 3/4 inches deep. Edges of a sidewalk and driveway shall be rounded with an appropriate edging tool.

C. The Contractor shall match the existing curb and gutter type. If removed concrete curb does not have reinforcement bars, two Number 3 bars shall be placed three inches off the bottom of the new gutter.

* * * END OF SECTION * * *

SECTION 02510

STORM SEWERS

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SECTION 02510

STORM SEWERS

PART 1 - GENERAL

1.01 Related Requirements Specified Elsewhere:

A. Earthwork for Utilities: Section 02202

1.02 Submittals:

A. Manufacturer's Literature: Manufacturer's descriptive literature and recommended method of installation.

B. Certificates: Manufacturer's certification that products meet specification requirements.

1.03 Product Delivery, Storage and Handling:

A. Deliver materials on manufacturer's original skids or in original unopened protective packaging.

B. Store materials to prevent physical damage.

C. Protect materials during transportation and installation to avoid physical damage.

1.04 General Description of Work Covered:

A. Furnish and install all pipe, fittings, structures and accessories required for gravity storm sewer lines disturbed or distroyed during construction. This work would be paid for as a part of Sanitary Items 12, 13, 14, 15 and 16 of Section 01900-Measurement and Payment.

1.05 Quality Assurance:

A. Comply with latest published edition of State of Ohio Department of Transportation, Construction and Material Specifications and Standard Details.

PART 2 - PRODUCTS

2.01 General:

A. Furnish equipment, materials and labor for construction or reconstruction of storm drains and pipe culverts.

B. Unless otherwise specified, pipe used for storm drains and pipe culverts shall be non-reinforced concrete, reinforced concrete, or corrugated steel pipe.

2.02 Non-Reinforced Concrete:

A. Material:

Provide non-reinforced concrete pipe and fittings conforming to ASTM specification C-14, Table II (Extra Strength) "Concrete Sewer, Storm Drain and Culvert Pipe", as revised herein.

B Strength:

Crushing strengths of non-reinforced concrete pipe described in Table II of ASTM C-14 shall be increased to following values:

Minimum Strength in Pounds/Lineal Foot

Internal Diameter Inches	Three Edge Bearing Method	Sand Bearing Method
8	2400	3600
10	2400	3600

C. Joints:

1. Plain joints or conforming to ASTM C-443, "Joints for Circular Concrete and Culvert Pipe Using Flexible, Watertight, Rubber Gaskets", as indicated on Drawings.

2. Rubber Gaskets: Circular cross section.

3. Use lubricants and/or adhesives as recommended by pipe manufacturer.

2.03 Reinforced Concrete Pipe:

A. Material:

1. Provide reinforced concrete pipe conforming to requirements of ASTM C-76, "Reinforced Concrete Culvert, Storm Drain and Sewer Pipe".

2. Wall B thickness.

3. ASTM C-76 shall be modified as follows:

a. Replace ASTM C-497, "Testing Concrete Pipe or Tile", with AASHTO T-33.

b. Modify Table V for following additional sizes:

Internal Diameter of Pipe (Inches)	Wall Thickness (Inches)	Circular Reinforcement In Circular Pipe Square Inches	
		Inner Cage	Outer Cage
6	1-3/4	0.07	----
8	1-3/4	0.07	----
10	1-3/4	0.07	----
54	5-1/2	0.86	0.62
60	6	0.95	0.68

4. Reinforced concrete pipe class as shown on construction drawings.

B. Joints:

1. Plain joints or conforming to ASTM C-443, "Joints for Circular Concrete and Culvert Pipe Using Flexible, Watertight, Rubber Gaskets", as indicated on drawings.

2. Compressive joint rubber gaskets.

3. Use lubricants and/or adhesives as recommended by pipe manufacturer.

C. Pipe Marking:

1. Pipe class.

2. Type of wall thickness to be designated as A, B, or C.

3. Date of manufacture.

4. Name or trademark of manufacturer including plant location.

5. Pipe with elliptical steel reinforcement and quadrant steel reinforcement shall have centerline of crown and invert impressed inside or outside pipe at both ends except where cast lift holes are centered over crown of pipe.

6. The centerline of the crown of the pipe without lift holes shall be marked on the inside and outside of the pipe with TB.

7. Mark pipe with quadrant steel with letter Q.

8. Mark pipe with elliptical reinforcement with letter E.

9. Marking shall be eligible and indented on pipe section or painted thereon with waterproof paint.

2.04 Corrugated Metal Pipe:

A. Material:

1. Furnish pipe conforming to AASHTO M-36, and ODOT Construction and Material Specifications, Paragraph 707.

2. Fabricate pipe of Zinc coated iron or steel sheets conforming to ASTM A-444.

3. For bolted pipe seams, use ASTM Designation A-449 bolts, ASTM Designation A-563 Grade C nuts.

B. Fabrication:

1. Corrugations:

a. Fabricate pipe and pipe-arch by resistance spot welded lap construction or helical corrugations and continuous lock or welded seam.

b. Corrugations shall form smooth continuous curves and tangents. Radius of the curvature shall be at least one-half corrugation depth.

c. Corrugations shall be either annular or helical, not less than 50 degrees from longitudinal axis of pipe.

d. Average inside diameter of circular pipe and pipe-arch equivalents shall not vary more than one percent or 1/2-inch, whichever is greater, from nominal diameter when measured on inside crest of corrugations.

e. Corrugation depth shall conform to applicable requirements of Paragraph 13.1 of ASTM Designation A-444.

C. Couplers:

1. Performance Requirements: Preserve pipe alignment and prevent backfill infiltration.

2. Material: Pipe Zinc coated base metal.

3. Minimum Thickness: 0.064 inch.

4. Corrugated bands, bands with projections or sleeve type.

5. Lap equal portion of each pipe connected.

D. Bituminous Protection and Paving:

1. Where indicated on Drawings, furnish pipe with uniform 0.05-inch bituminous coating inside and out as measured on corrugation crests.

2. Where indicated on Drawings, furnish pipe with bituminous material added to inside bottom quarter of circumference to form smooth pavement; minimum thickness, 1/8- inch over corrugation crests.

3. Where indicated on Drawings, furnish pipe coated as required in AASHTO Designation M-190, Type A, and lined on inside to form smooth surface completely filling corrugations to minimum thickness of 1/8-inch above crests.

4. Interior lining shall be applied by centrifugal method and be free from sags and runs.

2.05 Storm Sewer Manholes:

A. Install manholes and catch basins at locations and elevations shown on Construction Drawings.

B. Manholes and catch basins shall be of pre-cast or cast-in-place construction.

C. Construct cast-in-place manholes or catch basins per Section 03300, Cast-In-Place Concrete.

D. Pre-Cast Manhole Bases:

1. Conform to material and test requirements of ASTM C-478, "Pre-Cast Reinforced Concrete Manhole Section".

2. Provide space of 3-inches minimum between floor and pipe flow line for flow channel shaping.

3. Extend base top above sewer pipe crown.

4. Manhole Base Diameter:

a. Pipes less than or equal to 24 inches in diameter: 4-foot diameter manhole base.

b. Pipe equal to 33 inches and not less than 27 inches in diameter: 5 feet diameter manhole base.

c. Pipe equal to 48 inches and not less than 36 inches in diameter: 48-inch diameter T-section manhole base.

d. Pipe equal to 60 inches and not less than 54 inches in diameter: 48-inch diameter T-section manhole base.

5. Pipe Connections:

a. Pipe 33-inch and smaller diameter: Provide pre-cast hole for pipe installation with non-shrink grout.

b. Change in pipe size: For pipe 36-inches or greater, install eccentric reducer on flow line of influent sewer.

c. Change in alignment: For pipe 36-inches or greater, install bend equal in diameter to mainline pipe on influent sewer.

6. Construct T-section manhole bases minimum of 8 inches of Class A concrete with No. 5 reinforcing bars, 8 inches on centers both ways. Provide concrete bases to within one foot of end of T-section parallel with mainline pipe and to width equal to mainline pipe outside diameter.

F. Pre-Cast Manhole Riser (Barrel Section):

1. Pre-cast manhole riser sections: Conform to ASTM C-478.

2. For pipe greater than 48 inches in diameter, provide eccentric reducer from base to 48-inch barrel diameter above base section.

3. Pre-cast riser sections: 48 inches in diameter, a minimum number of sections.

G. Pre-Cast Manhole Cones:

1. Eccentric shape.

2. Minimum Height: 32 inches

3. Converge from 48-inch diameter opening to 24-inch minimum opening.

4. Wall Thickness: 5 inches at 48-inch section, and 8 inches at cone top.

H. Flat Slab Manhole Tops:

Furnish 6-inch flat slab top when manhole is too shallow to permit use of conical top section.

I. Manhole Steps:

1. Aluminum alloy conforming to ASTM Designation B-221, Alloy 6061-T6.

2. Minimum of 3/4-inch square bars with two (2) non-skid grooves.

3. Placed 16 inches apart vertically.

2.06 Pre-Cast Catch Basins:

A. Furnish pre-cast catch basins conforming to ASTM C-478, 5-inch minimum wall thickness.

B. Construct bottom one foot below invert of outlet to serve as trash collector during construction.

C. Upon completion of construction, clean basins.

D. Pour smoothly shaped sloping bottom.

2.07 Poured-In-Place Catch Basins:

A. Construct catch basins with bottoms, sides and tops to accommodate all piping, openings, temporary stubs, embedment and castings.

B. Construct bottom one foot below invert of outlet to serve as trash collector during construction.

C. Upon construction completion, clean basins.

D. Pour smoothly shaped sloping bottom.

E. Set castings in full bed of mortar. Adjust to provide drainage.

2.08 Manhole and Catch Basin Frames, Grates and Covers:

A. Furnish gray cast iron castings conforming to ASTM A-48, Class 30.

B. Castings shall be free from dirt, grease, sand, scale or other foreign substances.

C. Shop coat with approved asphalt paint.

D. Manufacturer's name shall be cast on castings in 1-inch letters, 1/8-inch in relief.

PART 3 - EXECUTION

3.01 General:

A. Provide all labor, equipment and materials and install all pipe, fittings, specials and appurtenances as indicated or specified.

3.02 Pipe Installation:

A. Handling:

1. Handle in a manner to insure installation in sound and undamaged condition.

a. Do not drop or bump.

b. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.

2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.

3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation:

1. Utilize equipment, methods and materials insuring installation to lines and grades as indicated.

   a. Do not lay on blocks unless pipe is to receive total concrete encasement.

   b. Obtain approval from Engineer of method proposed for transfer of line and grade from control to work.

2. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.

3. Insofar as possible, commence laying at downstream end of line and install pipe with bell ends in direction of laying. Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations therefrom.

4. Clean interior of all pipe, fittings and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.

   a. Close open ends of pipe with snug fitting closures.

   b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.

   c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.

5. Inspect pipe prior to installation to determine if any pipe defects are present.

6. Brace or anchor as required to prevent displacement after establishing final position.

7. Perform only when weather and trench conditions are suitable. Do not lay in water.

8. Observe extra precaution when hazardous atmospheres might be encountered.

C. Jointing:

1. General requirements:

a. Locate joint to provide for differential movement at changes in type of pipe embedment, at changes from rock to soil trench bottom, and structures.

(1) Not more than 18 inches from structure wall, or

(2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure.

b. Perform in accordance with manufacturer's recommendations.

c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.

d. Utilize methods and equipment capable of fully homing or making up joints without damage.

e. Check joint opening and deflection for specification limits.

D. Cutting:

1. Cut in neat workmanlike manner without damage to pipe.

2. Cut corrugated metal pipe with Carborundum saw or other approved method.

a. Smooth cut by power grinding to remove burrs and sharp edges.

b. Repair lining as required and approved by Engineer.

E. Closure Pieces:

1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.

2. Observe specifications regarding location of joints, type of joints, and pipe materials and strength classifications.

F. Temporary Plugs:

1. Furnish and install temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.

2. Remove from pipe laid under adjacent contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this contract.

3. Plugs:

a. Use test plugs as manufactured by pipe supplier, or

b. Fabricate by Contractor of substantial construction.

c. Must be watertight against heads up to 20 feet of water.

d. Secure in place in a manner to facilitate removal when required to connect pipe.

3.03 Manhole and Catch Basin Installation:

A. Construct manhole foundation and channel inverts integrally. See Standard Details.

B. Install precast manhole sections after foundation concrete has attained 75% of design strength.

C. Manhole foundation and manhole may be installed simultaneously if manhole section is supported on concrete blocks and foundation concrete placed under and around bottom section.

D. Completely fill joints with preformed plastic gasket.

E. Heat materials in freezing weather and protect work from cold; maintain temperature of work at 40°F. for at least 24 hours after placing.

F. Invert Channels:

1. Form invert channel as indicated.

2. Make changes in direction of flow with smooth curves of as large a radius as size of manhole permits.

3. Make changes in size and grade smoothly and uniformly.

4. Slope floor of manhole adjacent to channels to drain thereto.

5. Finish channel bottom smoothly without roughness, irregularity, or pockets.

G. Pipe Connection:

1. Make watertight.

2. Use rubber gasket.

H. Exterior Pipe Support:

1. Support pipe on concrete cradle from manhole connection to first joint on each side of manhole.

2. Provide pipe joint within 18 inches of manhole wall.

I. Bolt manhole frames to concrete manhole for exposed top manholes.

J. Catch Basins:

1. Use Class A concrete to form catch basin bottoms.

2. Construct catch basin flow channel for minimum flow turbulence.

3. Where catch basins are installed in curb, curb face along catch basin apron shall be vertical and monolithic with apron.

4. Connections to existing drains and sewer system:

a. Connect existing drains which cross new sewer line.

b. Connect no sanitary sewers to new storm sewers.

c. Connections to existing manholes:

(1) Cut hole in existing manhole at required elevation.

(2) Insert new sewer pipe flush with inside of manhole.

(3) Grout new pipe in place.

(4) Reconstruct manhole bottom to suit new connection.

d. Connections to existing sewer:

(1) Build new manhole around existing sewer.

(2) Break out existing sewer inside of manhole and construct bottom to suit new connection.

* * * END OF SECTION * * *

SECTION 02556

PRESSURE SEWER LINES

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SECTION 02556

PRESSURE SEWER LINES

PART 1 - GENERAL:

1.01 Related Requirements Specified Elsewhere:

A. Earthwork for Utilities: Section 02202

1.02 Submittals:

A. Manufacturer's Literature: Manufacturer's descriptive literature and recommended method of installation.

B. Certificates: Manufacturer's certification that products meet specification requirements.

1.03 Product Delivery, Storage and Handling:

A. Deliver materials on manufacturer's original skids or in original unopened protective packaging.

B. Store materials to prevent physical damage.

C. Protect materials during transportation and installation to avoid physical damage.

1.04 General Description of Work Covered:

A. Furnish and install all pipe, fittings, structures and accessories required for water transmission line and/or pressure sewer lines.

1.05 Quality Assurance:

A. Comply with the latest published edition of American Water Works Association (AWWA) Standards:

1. AWWA C110 and C110a - Gray Iron and Ductile-Iron Fittings, 2" through 48" for water and other liquids.

2. AWWA C111 - Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings.

3. AWWA C150 0- Thickness Design of Ductile-Iron Pipe.

4. AWWA C151 - Ductile-Iron Pipe, centrifugally cast in metal mold or sand lined molds, for water or other liquids.

5. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4" through 12" for water.

B. Comply with the latest published editions of the American Society for Testing and Materials (ASTM) Standards:

1. D 2241 - Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).

2. D-3139 - Joints for PVC Pressure Pipes using Flexible Elastomeric Seals.

PART 2 - PRODUCTS

2.01 General Requirements:

A. Pipe furnished may be any one of the materials specified herein for water mains unless shown otherwise on the plans or bid documents.

B. Use ductile-iron pipe for all pressure sewer lines unless shown otherwise on the plans.

C. All pipe shall be marked in accordance with the applicable standard specification under which the pipe is manufactured unless otherwise specified.

2.02 Ductile-Iron Pipe (DIP):

A. Use pipe complying with AWWA C151 except as otherwise specified.

B. Provide thickness class based on AWWA C151 and as follows:

1. 3" to 4" Diameter - Class 51, minimum.

2. 6" to 18" Diameter - Class 50, minimum.

3. 20" to 24" Diameter - Class 51, minimum.

4. Increase thickness class as required by AWWA C151 for depths of cover over 5 feet and/or working pressure in excess of 100 psi.

C. Provide cement mortar lined pipe complying with AWWA C104 and coated with manufacturer's standard coating for all pipe and fittings.

D. Provide mechanical or push-on joints for all buried pipe in accordance with AWWA C111.

E. Provide flange joints for all interior and exterior exposed pipe.

F. Provide mechanical sleeve type couplings where specified or indicated.

G. Provide anchored couplings where indicated and where restraint is required to withstand specified operating or hydrostatic test pressure.

H. Provide fittings:

1. In accordance with AWWA C110 with pressure rating if not less than that specified for adjacent pipe.

2. Compatible with joint type of adjacent pipe.

3. With all specials, taps, plugs, flanges and wall fittings as required.

4. With cement mortar lining in accordance with AWWA C104.

5. Coated with manufacturer's standard coating.

2.03 Polyvinyl Chloride Pipe (PVC):

A. Provide pipe meeting AWWA C900 PVC 1120 or ASTM D2241 Type 1, Grade 1, PVC 1120 Standards.

1. Minimum requirements:

Std.	Size	SDR/ DR	Pressure Class (psi)	Pressure Rating (psi)
C900	4"-12"	25	100	100
D2241	2"-4"	26	95	160
D2241	6"-12"	21	120	200

2. Use pipe meeting minimum requirements unless shown otherwise on plans.

B. Provide push-on joints with bell integrally cast into pipe or with coupling of same material as pipe.

C. Use elastomeric gaskets, as provide in AWWA C900 or ASTM D3139.

D. Provide ductile iron fittings meeting AWWA C110 requirements. Use long radius fittings where possible.

E. Provide fittings with materials and pressure class equal to or greater than that specified for pipe.

F. Provide sleeve type or anchored coupling where indicated or required to join pipe or provide restraint to offset internal or hydrostatic test pressures.

G. Provide pipe marked to indicate the following:

1. Nominal Pipe Size.

2. Material Code Designation.

3. Standard Dimension Ratio.

4. Pressure Rating.

5. Manufacturer's name or trademark.

6. National Sanitation Foundation Seal.

7. Appropriate ASTM designation number.

2.04 Valves:

A. Butterfly Valves:

1. Design: AWWA C504, short body Class 150A.

2. Heavy-duty cast-iron.

3. Shafts: ANSI 304 stainless steel.

4. Discs: NI-Resist Type I with seating edges ground smooth and polished.

5. Seats: Natural rubber for valve class specified.

6. Bearings: Sleeve type, self-lubricated.

7. Operators: Traveling nut type, fully enclosed, open counterclockwise.

B. Check Valves:

1. Design: AWWA C508, suitable for use with potable water.

2. Type: Swing check, level and weight operated, horizontal installation.

3. Rating: 150 psi working pressure.

4. Body: Cast-iron with a bronze seat ring.

5. Disc: Bronze or cast-iron with bronze disc ring.

C. Eccentric Plug:

1. Plug: 100% full opening.

2. Material: Iron body, cast iron plug with rubber covering.

3. Rating: 175 psi working pressure.

4. Stem: NRS

5. Seats: Bronze, adjusted to appropriate pressure and for reverse flows.

6. Operators: Open counterclockwise with 2" square operating nut.

7. Ends: Buried to be mechanical or push-on joint, accessible to be flanged.

PART 3 - EXECUTION

3.01 General:

A. Provide all labor, equipment and materials and install all pipe fittings, specials and appurtenances as indicated or specified.

3.02 Pipe Installation:

A. Handling:

1. Handle in a manner to insure installation in sound and undamaged condition.

a. Do not drop or bump.

b. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.

2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.

3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation:

1. Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.

a. Do not lay on blocks unless pipe is to receive total concrete encasement.

b. Accomplish horizontal and vertical curve alignments of ductile-iron pipe with bends, bevels and open joints.

(1) Limit joint and ductile-iron pipe deflection to conform with AWWA C600.

(2) Use short specials preceding curves as required.

c. Obtain approval of Engineer of method proposed for transfer of line and grade from control to the work.

2. Install pipe of size, material, strength class, and joint type with embedment as shown on plans or specified herein.

3. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.

a. Close open ends of pipe with snug fitting closures.

b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.

c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.

4. Pipe shall be inspected prior to installation to determine if any pipe defects are present.

5. Brace or anchor as required to prevent displacement after establishing final position.

6. Perform only when weather and trench conditions are suitable. Do not lay in water.

7. Observe extra precaution when hazardous atmospheres might be encountered.

8. Sanitary Sewer relation to water mains:

a. Maintain 10 feet horizontal separation whenever possible.

b. When conditions prevent a lateral separation of 10 feet, sewer may be installed closer to a water main if:

(1) Installed in a separate trench.

(2) Installed in same trench with water main located to one side on bench of undisturbed earth with a minimum horizontal separation of 3 feet.

(3) The elevation of the crown of the sewer must be at least 18 inches below the invert of the water main and a minimum horizontal separation distance of 3 feet must be maintained in either (1) or (2) above.

c. When the above conditions cannot be obtained, sewers must be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water tightness.

d. Where the sewer crosses above or less than 18 inches below a water main, one full length of sewer pipe of water main material shall be located so both joints are as far as possible from the water main. The sewer and water pipes must be adequately supported and have watertight joints. A low permeability soil shall be used for backfill material within 10 feet of the point of crossing.

9. Separation of water mains from sewer manholes:

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

b. A minimum horizontal separation of 3' shall be maintained.

10. Construct service lines where shown on plans in accordance with Standard Detail Drawing. Use pipe material specified on plans or in contract documents.

11. Wrap pipe, fittings and tie rods with polyethylene where shown on plans in accordance with AWWA C105.

C. Jointing:

1. General requirements:

a. Local joint to provide for differential movement at changes in type of pipe embedment, at changes from rock soil trench bottom, and structures.

(1) Not more than 18 inches from structure wall, or

(2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure.

b. Perform in accordance with manufacturer's recommendations.

c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.

d. Utilize methods and equipment capable of fully homing or making up joints without damage.

e. Check joint opening and deflection for specification limits.

2. Special provisions for jointing ductile-iron pipe:

a. Conform to AWWA C600.

b. Visually examine while suspended and before lowering into trench.

(1) Paint bell, spigot, or other suspected portions with turpentine and dust with cement to check for cracks invisible to the eye.

(2) Remove turpentine and cement by washing when test is satisfactorily completed.

(3) Reject all defective pipe.

3. Special provisions for jointing and laying PVC pipe:

a. Conform to AWWA C600 and ASTM D2321.

b. Allow pipe to reach trench soil temperature prior to installation in ditch.

D. Cutting:

1. Cut in neat workmanlike manner without damage to pipe.

2. Cut ductile-iron with Carborundum saw or other method approved by Engineer.

a. Smooth cut by power grinding to remove burrs and sharp edges.

b. Repair lining as required and approved by Engineer.

E. Closure pieces:

1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.

2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.

3. May be accomplished with sleeve coupling for water pipe:

a. Of length such that gaskets are not less than 3" from pipe ends.

b. Include spacer ring identical to pipe end such that clear space does not exceed 1/4".

F. Temporary Plugs:

1. Install whenever installed pipe is left unattended.

2. Use water tight plug.

G. Thrust Blocks and Restrained Joints:

1. Provide for all horizontal or vertical turns utilizing fittings.

2. Use on all dead-end and tee fittings.

3. Install as indicated on details.

4. Construct to undisturbed edge of trench for bearing.

5. Provide minimum bearing area in S.F. as follows based on 150 psi test pressure and 2000 psf soil bearing:

Pipe Size	Tee Deadends	11 1/4° Bend	22 1/2° Bend	45° Bend	90° Bend
4"	1.0	0.5	0.8	0.8	1.3
6"	2.2	0.5	0.9	1.6	3.0
8"	3.8	0.8	1.5	2.9	5.3
10"	6.0	1.2	2.3	4.5	8.4
12"	8.5	1.7	3.3	6.5	12.1
14"	11.6	2.3	4.5	8.9	16.4
16"	15.2	3.0	5.9	11.6	21.4

6. Restrained joints shall be installed as per manufacturer's recommendations or as required by Engineer at no additional cost to the Owner.

3.03 Valve and Appurtenance Installation:

A. Valves:

1. Install with stems vertical when installation is horizontal.

2. Tighten all valve glands as work is installed; add additional gland packing, if required; and retighten glands after valves are placed in operation and brought up to operating pressure.

3. Replace any gland packing which is deteriorated or in unsatisfactory condition.

3.04 Acceptance Tests for Pressure Mains:

A. Perform hydrostatic pressure and leakage test.

1. Conform to AWWA C600 procedures, Section 13.

a. As modified herein.

b. Shall apply to all pipe materials specified.

2. Perform after backfilling.

3. Said test shall include all force main in this contract as shown on the drawings. The Contractor shall make arrangements with the Engineer for scheduling the test after the piping has been accepted as being ready for testing. All concrete thrust blocks shall have been in place for a period of at least ten days prior to the test. The test shall be performed on the day mutually agreed upon and in the presence of the Engineer.

4. The Contractor shall furnish all necessary equipment, piping, pumps, fittings, gauges and operating personnel to properly conduct the test. The system will not be acceptable until all leaks have been repaired to the satisfaction of the Engineer.

5. At the option of the Contractor, the force main may be tested in sections approximately 500 feet in length (subject to the approval of the Engineer); and upon satisfactory completion of the leakage test, the trench shall be backfilled as specified.

6. During the filling of the pipe and before the application of the specified test pressure, all air shall be expelled from the pipe line, if necessary, by means of taps at points of highest elevation; and after completion of the test, the taps shall be tightly plugged, unless otherwise specified.

7. When push-on type joints are used, the Contractor shall completely fill the pipe with water and apply sufficient pressure to set the joint gaskets before commencing the leakage test outlined above.

B. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs.

1. Contractor to furnish and install test plugs, including all anchors, braces and other temporary or permanent devices to withstand hydrostatic pressure on plugs, at no additional cost to the Owner.

2. Contractor responsible for any damage to public or private property caused by failure of plugs.

C. Limit fill rate of line to available venting capacity. Fill rate shall be regulated to limit velocity in lines when flowing full to not more than 1 fps.

D. Owner will make water for testing available to contractor at nearest source.

E. Pressure test:

1. Conduct at pressure at least 1.5 times the normal working pressure (not less than 100 psi test pressure).

2. Maintain pressure for a minimum of eight (8) consecutive hours.

3. Test pressure shall not vary by more than +/-5 psi.

F. Leakage test:

1. Conduct concurrently with the pressure test.

2. Maintain pressure for a minimum of eight (8) consecutive hours.

3. Acceptable when leakage does not exceed that determined by the following formula:

$$L = \frac{ND \quad P}{7400}$$

L = Maximum permissible leakage in gallons per hour.
N = Number of pipe joints in segment under test.
D = Nominal internal diameter of pipe being tested in inches.
P = Average actual leakage test pressure, psig.

4. Repeat leakage test as necessary.

   a. After location of leaks and repair or replacements of defective joints, pipe or fittings.

   b. Until satisfactory performance of test.

   c. At no increase in cost to the Owner.

G. Refit and replace all pipe not meeting the leakage or pressure requirements.

H. Repair all visible leaks regardless of the amount of leakage.

I. Owner or Engineer will observe all tests.

* * * END OF SECTION * * *

SECTION 02559

SEPTIC TANK

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1.03 Submittals

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SECTION 02559

SEPTIC TANK

PART 1 - GENERAL

1.01 Description:

A. Site Investigation:

1. At each residence, verify existing disposal facility, building outfall, and lot outfall line.

B. New Septic Tank

1. Install new septic tank and appurtenances.

2. Abandon existing facilities, if required to install new septic tank.

1.02 Related Work Specified Elsewhere:

A. Earthwork for Utilities: Section 02202

B. Sanitary Sewer: Section 02570

1.03 Submittals:

A. Shop Drawings: Submit drawings on septic tanks, piping, covers, and appurtenances.

B. Field Drawings: Upon completion at each residence, furnish 8-1/2" x 11" sketch locating septic tank, gravity pipe and SDG pipe, horizontally and vertically, relative to fixed surface structure, such as building corner, etc.

PART 2 - PRODUCTS

2.01 Description:

Completed septic tank installation shall include:

A. Retention Tank, 1000 gallon or 2000 gallon, effective volume as shown on drawings.

B. Inlet and Outlet PVC Tees for Baffles.

C. Acces Manway

D. Access Port at Outlet and Inlet

E. Watertight Inlet and Discharge Ports

2.02 Septic Tank:

A. Furnish and install a septic tank at a location directed. Septic Tank shall be approved tank by local and state requirements. Tank size as directed by the Engineer.

B. Concrete Tank: Comply with ASTM C913.

C. Wall Penetrations: Where plastic pipe penetrates concrete wall, either:

1. Cast groove integrally in opening for installation of o-ring to provide watertight connection; --or--

2. Cast galvanized steel pipe sleeve in wall for installation of gasket to provide watertight connection.

3. Plastic pipe to concrete will not be permitted for watertight closure.

D. Septic Tank - Polyethylene:

Materials shall comply with the following:

1. Septic tanks shall be made from a high density cross-linked, or linear low density polyethylene material, and shall be rotationally molded.

2. Raw material formulations shall meet or exceed the minimum physical properties described herein.

3. Minimum physical properties:

Property	ASTM	VALUES Cross-Linked High Density PE	Linear-Low Density PE	Units
Density (base resin)	D 1505	0.935	0.935	g/cc
Melt Index	D 1238	N/A	2.0	g/10 min.
ESCR F50, hrs. Condition A; 10% Igepal	D 1693	1000	1000	hrs.
Tensile Strength Ultimate 2"/min.	D 638	2300	2300	PSI
Elongation @ Break 2"/min.	D 638	650	650	%
Vicat Softening Temp.	D 1525	230	230	°F
Brittleness Temp.	D 746	-50	-50	°C
Flexural Modulus	D 790	110,000	110,000	PSI
Izod Impact 73°F	D 256	9	3	ft.-lb./in.

Note: The formulation shall contain sufficient U.V. stabilization material for up to two years above-ground storage.

E. Raw material testing:

1. All raw materials shall be sampled at the minimum frequency of at least one sample for every 10,000 lbs. of material in a 40,000 lb. lot, or every 22,500 lbs. of material in a 180,000 lb. lot. Each sample shall be tested for melt index, flexural modulus and/or density, and Izod impact. The raw material minimum performance requirements outlined in Section 2.02 B.3 shall be met or exceeded.

2. Test results will be recorded by the manufacturer for each sample of raw material tested. The test results from each lot of material used in manufacturing the tanks shall be submitted to the Engineer.

2.03 Cleanouts:

A. Location: Above baffles in influent and effluent pipe. Manway may be used for cleanout.

B. Riser Pipe:

1. Diameter: 18-inches

2. Material: Rigid pipe manufactured of concrete, extra strength Vitreous Clay, ABS Truss Pipe, or Asbestos Cement.

3. Collar: Galvanized Steel band with 3-inch collar perforated for bolting to septic tank cover.

C. Cover: Bell cap with O-ring gasket to provide watertight seal.

2.04 Baffling:

A. Furnish and install baffles at influent and effluent pipe.

1. Tanks: 6-inch x 4-inch tee, ABS, PVC, or equal.

2.05 Waterproofing Materials:

A. Description:

1. Portland cement and chemical additives, mixed with water to form creamy paste.

2. Paste shall form hard, dense, watertight plaster on manhole surface.

3. Mixture, when brushed into precast manhole sections or brick masonry, shall penetrate surface and react chemically with soluble salts to form insoluble crystals, thereby sealing inner structure.

4. Waterproofing materials shall be Drycon manufactured by IPA Systems, Inc.,; Vandex Super as manufactured by Vandex, Inc.; Coma-Kote M by Sika Chemical Corporation; or approved equal.

2.06 Bituminous Sealing Materials:

A. Bituminous Joint Sealer: Mixed asphalt and mineral filler complying with AASHTO M-89, penetration grade 40 to 50.

B. Bituminous Coat: FS TT-C-494, or Mil-C18480, or SSPC-Paint 12, cold-applied solvent-type bituminous mastic coating for application in dry film thickness of 15 mils per coat.

PART 3 - EXECUTION

3.01 Site Work:

A. Locate existing septic tank.

B. Septic tank locations shown on plans are approximate and will be located in field under the direction of Engineer and Owner.

C. Untested house lateral will require the new septic tank location such that it will not impact the existing tank.

D. If new tank impacts existing tank:

1. Excavate tank; expose top of septic tank, inlet, and outlet ports.

2. Pump tank contents: Contractor responsible for disposal at state approved site or as approved by Owner.

3. Contractor shall remove entire tank and shall be responsible for disposal at State approved site or as approved by Owner.

3.02 Septic Tank Installation:

A. Excavation: Overexcavate septic tank pit 6-inches below floor and provide granular cushion. Set tank inlet elevation to provide one percent (1%) slope from building outfall.

B. System Set Up: Ballast to prevent flotation. Install unit true and plumb. Furnish and install adapter fitting to provide watertight connections at inlet and discharge pipe. Seal interior and exterior of tank with Bituminous sealing materials.

C. Testing: Contractor shall fill septic tank to top of riser. If water level has not dropped more than 1/2" in the first 24-hour period, the tank has passed. Should a tank fail the initial test, all joints, including the airtight plugs, of the offending tank shall be checked with an acceptable leak detection device to locate the leak. Should the leaks be due to the airtight plugs, these plugs shall be resealed and the test repeated. Should the leaks be found to be coming from one or more integral parts of the tank, the offending sections can be repaired and retested, but repairs must be approved by the tank manufacturer and the Engineer and must be capable of maintaining long-term watertight integrity for the offending section. Any tank failing the vacuum test more than two times is subject to rejection.

D. Contractor shall make final connection to new lateral or tested and approved existing building lateral.

E. Backfill: Backfill and compact soils in 2-foot lifts to 6-inches above original grade. Support pipes during backfill.

3.03 Continuity of Service:

Maintain continuous service of existing utilities to homes and buildings. If existing leach bed or septic tank overflow drain pipe is destroyed, restore leach bed or drain pipe, or pump septic tank as required until sewer main is ready for connections. Repair damage to surface water drainage courses or pipes, water services, gas services, cablevision, electrical services, or telephone lines.

3.04 Restoration:

A. Maintain site during construction to minimize area disruption. Mound soils over excavation as required for settlement. Mulch site. Dispose of excess materials.

B. Clean up site: Grade site to drain away from tank. Seed site. Restore area to original condition.

* * * END OF SECTION * * *

SECTION 02570

GRAVITY SANITARY SEWERS

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SECTION 02570

GRAVITY SANITARY SEWERS

PART 1 - GENERAL:

1.01 Submittals:

A. Submit manufacturer's descriptive literature and recommended method of installation for products specified in Part 2.

B. Submit manufacturer's certification that products meet specification requirements.

1.02 Product Delivery, Storage and Handling:

A. Deliver materials on manufacturer's original skids or in original unopened protective packaging.

B. Store materials to prevent physical damage.

C. Protect materials during transportation and installation to avoid physical damage.

1.03 General Description of Work Covered:

A. Furnish and install all pipe, fittings, structures and accessories required for sanitary sewer construction as indicated.

1.04 Quality Assurance:

A. Comply with the latest published editions of American Society of Testing and Materials (ASTM) Standards:

1.	ASTM C700	Extra Strength Clay Pipe.
2.	ASTM C12	Installing Vitrified Clay Pipe.
3.	ASTM C425	Compression Joints for Vitrified Clay Pipe and Fittings
4.	ASTM C425	Compression Couplings for Vitrified Clay Plain-End Pipe.
5.	ASTM C478	Concrete Pipe Manholes.
6.	ASTM 3034	PVC Pipe

B. Comply with the latest published edition of American Water Works Association (AWWA) Standards:

1. AWWA C151 Ductile-Iron Pipe

2. AWWA C110 Cast/Ductile-Iron Fittings

3. AWWA C111 Rubber Gasket Joints for Cast/Ductile-Iron Pipe

C. Performance Tests:

The Contractor shall test all gravity sewers constructed under the Contract. The Contractor shall constantly check horizontal and vertical alignment. Testing for vertical deflection in the case of non-rigid pipe and sewer watertightness testing in the case of all gravity sewers and hydrostatic testing of ductile iron pipe shall be as specified in this Section.

D. Line and Grade Requirements:

1. The Contractor shall provide assurance to the Engineer or the Engineer's representative that the sewer is laid accurately to the required line and grade as shown on the drawings. The Contractor shall utilize a laser beam instrument to lay and check the alignment and grade between manholes. Before proceeding with the next section of sewer, the section shall be checked for proper line and grade. Variations from a uniform line and grade as shown on the drawings and described below shall be cause for the line to be rejected.

2. Variance from established line and grade shall not be greater than 1/32 of an inch per inch of pipe diameter and not to exceed 1/2 inch, provided that such variation does not result in a level or reverse sloping invert; provided also that the variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed 1/64 inch per inch of pipe diameter or 1/2 inch maximum.

E. Test Sections:

1. Initial Performance Test:

An initial performance and leakage test will be performed on the first sections of sanitary sewer constructed of approximately 600 feet in length of each size and type sewer material installed. No additional sewer pipe shall be installed until the first section of sewer of each size and type of sewer material has satisfactorily passed the test for line and grade and the leakage test.

2. Subsequent Performance Testing:

After the initial performance test and leakage test and as work progresses, the Engineer may designate additional sections for testing as conditions in his opinion warrant. If a review of the Contractor's workmanship leads the Engineer to question whether or not the tolerances and standards specified are being met, the Engineer reserves the right to select other locations and lengths to be tested. The Engineer shall notify the Contractor of the location where a test is to be required not later than 15 days after the sewer installation has been completed. Unless otherwise authorized, the Contractor shall arrange to commence the test within 15 days after the sewer has been installed or 15 days after receiving notification by the Engineer, whichever date is later.

3. Final Performance Testing for Acceptance:

Before acceptance and final payment for all new sanitary sewers, the Contractor and the Engineer or the Engineer's representative shall check all sewers, even if previously checked, for accurate alignment and grade. Also, all sanitary sewers shall be tested as specified in Articles 3.06 through 3.08 of this Section for watertightness. The program of testing whether by infiltration, exfiltration, or air-testing shall be determined by the Engineer.

1.05 Pipe Marking:

Each length of pipe shall bear the name or trademark of the manufacturer, the location of the plant, and the date of manufacture. Each length shall likewise be marked to designate the class or strength of the pipe. The marking shall be made on the exterior or interior of the pipe barrel near the bell or groove end and shall be plainly visible.

1.06 Length of Open Trench:

Except by permission of the Engineer, not more than 100 feet of trench shall be opened at any one time. Not more than 100 feet of trench may be opened in advance of the completed pipe laying operation, and not more than one street crossing may be obstructed by the same trench at any one time. Trench shall be backfilled immediately after pipe has been installed and alignment verified.

1.07 Start-Up Service:

The manufacturer of the pipe material and fittings shall provide installation advice and bedding, haunching, and backfill instructions to the Contractor's work force when first installing the pipe and fittings. The service of an experienced installation representative shall be provided for a minimum of two days at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 General Requirements:

A. Pipe furnished may be any one of materials specified herein for sanitary sewer construction unless shown otherwise on plans or bid forms.

B. All pipe shall be marked in accordance with applicable standard specification under which pipe is manufactured unless otherwise specified.

2.02 Vitrified Clay Pipe (VCP):

A. Pipe shall be in accordance with ASTM C-700 extra strength.

B. Pipe shall be plain-end with PVC couplings providing water tight joint conforming to ASTM C-245.

C. Joints:

1. Place jointing materials on pipe at plant of manufacturer.

2. Carefully protect joints from injury while handling and storing pipe.

3. Use no pipe with joints deformed, gouged or otherwise impaired.

2.03 Ductile Iron (DI):

A. Joints on ductile iron pipe shall be push-on type conforming to ANSI A21.51 (AWWA C151), latest revision. Fittings shall be cast iron and shall comply with ANSI Specification A21.10, latest revision, with push-on or mechanical joints for 150 psi working pressure.

B. Cast pipe inside and out with coal tar pitch varnish.

C. Use where shown on plans or where required by conflicts with wells and/or water mains.

D. Connection with VCP shall be made with flexible rubber couplings with busing adaptor for identical size transitions (plain-end clay to cast/ductile-iron) as manufactured by Mission Clay Products Company or approved equal.

2.04 Polyvinyl Chloride Plastic pipe (PVC):

A. Comply with ASTM D3034 for pipe using material conforming to ASTM D1784 for pipe and fittings.

B. Joints for PVC Sewer Pipe:

1. Joints on PVC sewer pipe shall be the integral bell type gasketed joint designed so that when assembled the elastomeric gasket inside the bell is compressed radially on the pipe spigot to form a positive seal. The joint shall be so designed to avoid displacement of the gasket when installed in accordance with manufacturer's recommendations. The joint shall comply with the physical requirements of ASTM D3212, and the gasket shall be the only element depended upon to make the joint flexible and watertight.

2. All PVC pipe entering a manhole shall have a manhole waterstop gasket as supplied by the manufacturer firmly clamped around the pipe at the manhole. If flexible entry type manhole system is used, the waterstop gasket is not required.

C. Provide pipe and fittings with minimum SDR-35 dimension ratio.

D. Mark all pipe and fittings.

2.05 Fittings:

A. Fittings such as wyes, tees, and bends shall be made in such a manner as will provide strength and watertightness at least equal to the class of the adjacent main line pipe to which they are jointed and shall conform to all other requirements specified for pipe of corresponding class and internal diameter. Joints shall be of the same type as used on the adjoining pipe.

B. Fabricated branches for wyes and tees shall be securely attached to the wall of the pipe in a watertight manner and shall be flush with the inside surface of the pipe. The branches shall have their axes perpendicular to the longitudinal axis of the pipe. Wye branches shall have their axes approximately 60 degrees for clay pipe and 45 degrees for concrete pipe from the longitudinal axis of the pipe, measured from the bell end. Pipe reinforcement shall not be interrupted beyond a radial distance of 3 inches outside of the fitting.

2.06 Structures and Pipe Accessories:

A. See Specification Section 02430.

PART 3 - EXECUTION

3.01 General:

A. Provide all labor, equipment and materials and install all pipe fittings, specials and appurtenances as indicated or specified.

3.02 Pipe Installation:

A. Handling:

1. Handle in a manner to insure installation in sound and undamaged condition.

   a. Do not drop or bump.

   b. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.

2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.

3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation:

1. All pipe shall be reinspected for soundness and damage due to handling immediately before being lowered into the trench. Any pipe found to be unsound or damaged will be rejected and shall be removed immediately from the site of the work. Utilize equipment, methods and materials insuring installation to lines and grades as indicated.

   a. Do not lay on blocks unless approved by Engineer.
   b. Obtain approval from Engineer of method proposed for transfer of line and grade from control to the work.

2. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.

3. Insofar as possible, commence laying at downstream end of line and install pipe with bell ends in direction of laying. Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations therefrom.

4. Clean interior of all pipe, fittings and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.

   a. Close open ends of pipe with snug fitting closures.

   b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.

   c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.

5. Brace or anchor as required to prevent displacement after establishing final position.

6. Perform only when weather and trench conditions are suitable. Do not lay in water.

7. Observe extra precaution when hazardous atmospheres might be encountered.

8. Sanitary sewer relation to water mains:

   a. Maintain 10 feet horizontal separation whenever possible.

b. When conditions prevent a lateral separation of 10 feet, sewer may be installed closer to a water main if:

(1) Installed in separate trench.

(2) Installed in same trench with water main located to one side on bench of undisturbed earth with minimum horizontal separation 3 feet.

(3) Elevation of crown of sewer must be at least 18-inches below invert of water main and a minimum horizontal separation distance of 3 feet.

c. When above conditions cannot be obtained, sewers must be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water tightness.

d. Vertical separation of sanitary sewers crossing under any water main should be at least 18 inches when measured from of sewer to bottom of water main. If physical conditions prohibit separation, sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Separation distance shall be maximum feasible in all cases. Where sewer crosses above or less than 18 inches below a water main, one full length of sewer pipe of water main material shall be located so both joints are as far as possible from water main. Sewer and water pipes must be adequately supported and have watertight joints. A low permeability soil shall be used for backfill material within 10 feet of point of crossing.

9. Auger or jack steel casing pipe in place where shown on plans.

10. PVC (polyvinyl chloride) gravity sewer pipe and fittings, ASTM Designation D3034 SDR 35, shall be installed in accordance with the directions contained in ASTM Designation D2321. Only materials classified as Class I will be acceptable for bedding, haunching, and initial backfill of the pipe placed and compacted in accordance with ASTM D2321.

11. All PVC pipe entering a manhole shall have manhole waterstop gasket as supplied by the manufacturer firmly clamped around the pipe. If flexible entry type manhole system is used, the waterstop gasket is not required.

12. All PVC pipe shall have a deflection test performed by the Contractor in the presence of the Engineer or his representative.

13. All pipe shall be bedded as described in this specification under Pipe Bedding. Bell holes shall be excavated in advance of pipe laying so the entire pipe barrel will bear uniformly on the prepared subgrade.

14. Each length of pipe shall be mechanically pulled "home" with a winch or come-along against the section previously laid and held in place until the trench and bedding are prepared for the next pipe section. Care shall be taken in laying the pipe so not to damage the bell end of the pipe. Mechanical means consisting of a cable placed inside the pipe with a winch, jack, or come-along shall be considered to pull the pipe home where pushing the pipe will not result in a joint going completely home and staying in place. Pushing the pipe home shall be done by means of a block and push bar. Use of hydraulic excavating equipment as the means of pushing or moving the pipe to grade will not be permitted.

15. The Contractor shall use laser beam equipment to maintain accurate alignment and grade. A qualified operator shall handle the equipment during the course of construction. If bending of the laser beam due to air temperature variations or dust in the air is apparent "within the pipe" units, a fan shall be provided to circulate the air. However, air velocity shall not be so excessive as to cause pulsating or vibrating of the beam. Survey instruments may be used for checking alignment and grade if questions arise about the accuracy of the work.

16. Open excavation shall be satisfactorily protected at all times. At the end of each day's work, the open ends of all pipes shall be protected against the entrance of animals, children, earth, or debris by bulkheads or stoppers. The bulkheads or stoppers shall be perforated to allow passage of water into the installed pipe line to prevent flotation of the pipe line. Any earth or other material that may find entrance into the main sewer or into any lateral sewer through any such open end of unplugged branch must be removed at the Contractor's expense. The cost of all such plugs, and the labor connected therewith, must be included in the regular bid for the sewers.

17. The Contractor shall conduct a leakage test as described in Sewer Tests of the specification on the first section of sewer of each size and type sewer material installed. No additional sewer pipe shall be installed until the first reach of sewer of each size and each type sewer material has satisfactorily passed the leakage test.

C. Jointing:

1. General requirements:

a. Locate joint to provide for differential movement at changes in type of pipe embedment, at changes from rock to soil trench bottom, and structures.

(1) Not more than 18 inches, from structure wall, or

(2) Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing of structure.

b. Perform in accordance with manufacturer's recommendations.

c. Clean and lubricate all joint and gasket surfaces with lubricant recommended.

d. Utilize methods and equipment capable of fully homing or making up joints without damage.

e. Check joint opening and deflection for specification limits.

D. Cutting:

1. Cut in neat workmanlike manner without damage to pipe.

2. Cut cast-iron with Carborundum saw or other approved method.

a. Smooth cut by power grinding to remove burrs and sharp edges.

b. Repair lining as required and approved by Engineer.

E. Closure Pieces:

1. Connect two segments of pipelines or pipeline segment and existing structure with short sections of pipe fabricated for the purpose.

2. Observe specifications regarding location of joints, type of joints, and pipe materials and strength classifications.

F. Temporary Plugs:

1. Furnish and install temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.

2. Remove from pipe laid under adjacent contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this contract.

3.03 Pipe Bedding and Haunching:

A. Each pipe section shall be laid in a firm foundation of bedding material and haunched and backfilled with care.

B. Prior to pipe installation, carefully bring bedding material to grade along the entire length of pipe to be installed. To provide adequate support for the pipe, the following bedding procedures are required.

C. Class I bedding material shall have a minimum thickness beneath the pipe of 6 inches or one-eighth of the outside diameter of the pipe, whichever is greater. For rigid pipe the Class I bedding material shall extend up the sides of the pipe one-sixth of the outside diameter of the pipe.

D. The rigid pipe (such as vitrified clay, concrete, or ductile iron) backfill between the bedding material and a plane 12 inches (300 mm) over the top of the pipe shall be hand-placed granular backfill.

E. For flexible pipe, such as PVC, the placement of embedment material or haunching around the pipe must be done with care. The ability of the pipe to withstand loading in a trench depends on a large part on the method employed in its installation. Class I material shall be carefully hand placed on each side of the pipe up to the spring line. Class I or Class II granular backfill may be used from the spring line to a plane 12 inches over the top of the pipe. Care should be taken so not to compact directly over the pipe.

F. In yielding subsoils, the trench bottom shall be undercut to the depth necessary and backfilled with graded, crushed stone to form a firm foundation. No additional payment shall be made for stabilizing yielding subsoils.

G. Where excavation occurs in rock or hard shale, the trench bottom shall be undercut and a minimum of 6 inches (150 mm) crushed stone bedding placed prior to pipe installation. Additional payment for rock excavation shall be made on "unit cost" projects only, and as prescribed under basis for payment.

3.04 Manhole Installation:

A. Construct manhole foundation and channel inverts integrally. See Standard Details included herein.

B. Install precast manhole sections after foundation concrete has attained 75% of design strength.

C. Manhole foundation and manhole may be installed simultaneously if manhole section is supported on concrete blocks and foundation concrete placed under and around bottom section.

D. Completely fill joints with preformed plastic gasket.

E. Heat materials in freezing weather and protect work from cold; maintain temperature of work at 40° F. for at least 24 hours after placing.

F. Invert Channels:

1. From invert channel as indicated.

2. Make changes in direction of flow with smooth curves of as large a radius as size of manhole permits.

3. Make changes in size and grade smoothly and uniformly.

4. Slope floor of manhole adjacent to channels to drain thereto.

5. Finish channel bottom smoothly without roughness, irregularity, or pockets.

G. Pipe Connection:

1. Make watertight.

2. Use rubber gasket.

H. Exterior Pipe Support:

1. Support vitrified clay pipe on concrete cradle from manhole connection to first joint on each side of manhole as indicated.

2. Provide pipe joint within 18 inches of manhole wall.

I. Bolt manhole frames to concrete manhole for exposed top manholes.

3.05 Service Connections:

A. Install service connection at each dwelling or business place, or as directed by Engineer. The building service shall extend from a "wye" or "tee" fitting in the main sewer line to the property line or easement line, unless otherwise stated on the drawings.

B. Service Wyes: Install wyes, 6" branch diameter unless shown otherwise on plans. See Standard Detail, "Typical Service Connection".

C. Risers: Use in lieu of wyes for service connections where invert of sewer is 15' or more below ground surface or where shown on plans. See Standard Detail, "Typical Riser Service Connection".

D. Make no connections to house sewers or extend service connections beyond this contract without permission of Engineer.

E. Backfill trench only after entire service line and wye connection has been inspected and approved by Engineer. Compact as specified in Section 02202.

F. No payment for service lines will be made until all specified requirements have been met.

G. Fittings for building service connections on a main line sewer 15 inches in diameter or smaller shall be tees or 45-degree wyes and shall be of the same material as the main line sewer, unless otherwise approved by the Engineer.

H. Six-inch lateral pipe shall connect to the main line sewer at the spring line (3 or 9 o'clock position) and shall include the necessary bends and straight pipe sections to reach the property line at the elevations specified. A pipe stopper or a bell cap shall be placed on/in the last bell. This stopper or bell cap should be compatible with the type of infiltration/exfiltration test performed on the sewer.

I. The Contractor shall furnish and use the proper fittings, couplings, and adapters suited to make the transition from clay to clay, clay to concrete, PVC to clay, concrete or ABS which will maintain the structural integrity and the watertightness of the entire sewer system.

J. At the discretion of the Engineer, when and where he feels that improper installation practices are suspected, or questionable bedding materials and methods are employed, or where the installations are severe, the Contractor will have to perform deflection testing on the 6-inch building laterals as specified in Article 3.07.

K. Backfill around fittings and lateral pipe shall be carefully placed and compacted to prevent damage from backfill settlement.

L. The Contractor shall mark the end of each building lateral with a 5/8-inch steel rod 5 feet long placed vertically over the end of the lateral. The rod shall be painted yellow and left sticking above the existing ground not more than 1 inch.

M. The Contractor shall keep accurate horizontal and vertical location measurements of each building service installed. Copies of these measurements shall be furnished to the Engineer as the work progresses. The accuracy of the measurements shall be the Contractor's responsibility.

3.06 Stubs, Connections, Bulkheads and Miscellaneous Item of Work:

A. Where special junction chambers are to be constructed or where existing sewers carrying sanitary sewage are encountered, the Contractor shall provide an maintain temporary connection to prevent a nuisance. All such temporary connections, pumping, and diversion shall be included in the price bid for this work.

B. Where called for on the drawings, shop connections and stubs for future sewer connections shall be provided. The cost of this work shall be included in the price for manholes.

C. New sewer connections to existing manholes shall be neatly made by cutting a hole in the existing structure, concreting the sewer in place, and providing a watertight connection. Such connections shall be included in the bid price for this Contract.

D. The Contractor shall not connect any existing sewers or house services prior to the completion of the exfiltration/exfiltration tests, air tests, and acceptance of the sewer without the written permission of the Engineer.

3.07 Acceptance Tests for Sewer Pipelines:

A. Deflection Testing:

For PVC pipe, the entire length of installed main-line pipe shall be tested for acceptance with an approved go-no-go mandrel under the observation of the Engineer. The testing shall be conducted after the final backfill has been in place for at least 30 days. No pipe shall exceed a deflection of 5%. The deflection test shall be run using a mandrel having a diameter equal to 95% of the inside diameter of the pipe. The test shall be performed without a mechanical pulling device. All pipe exceeding the allowable deflection shall be replaced, repaired, and retested.

B. Infiltration Testing:

1. General:

a. Maximum infiltration for each section of sewer pipe shall not exceed 100 gal/day/inch-mile of pipe diameter.

b. Infiltration, exfiltration or air test may be used to provide compliance with infiltration requirement.

c. Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.

2. Air Test:

a. Furnish all facilities required including:

(1) Necessary piping connections

(2) Test pumping equipment

(3) Pressure gauges or manometers

(4) Bulkheads

(5) All miscellaneous items required

b. Obtain approval from Engineer of equipment and methods proposed for use.

c. Conduct initial test on first section of pipe laid by each crew.

(1) Include initial test on first section of pipe laid by each crew.

(2) Perform before backfilling.

(3) Satisfactorily complete test before crew is permitted to continue pipe installation.

d. Test remaining pipe in sections determined by Contractor and approved by Engineer.

e. The ends of the sewer section being tested shall be sealed and properly blocked. The seal at one end shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice at one end of the section. The air supply line will contain an off-on gas valve and a pressure gauge having a range from 0 to 25 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of the nearest $\pm$ 0.1 psi. The seals at each manhole shall be properly blocked to prevent displacement while the line is under pressure.

f. Plug all pipe outlets with pneumatic plugs having a sealing length equal to or greater than the diameter of the pipe to be tested. The pneumatic plug shall be able to resist internal testing pressures without requiring external bracing.

g. Once the pipe outlet plugs are securely in place, pressurized air is introduced to the system. The air shall be fed through a single control panel with three individual hose connections as follows:

(1) from control panel to pneumatic plugs for inflation in sewer pipe;

(2) from control panel to sealed line for introducing the pressurized air;

(3) from sealed line to control panel. This line will enable continuous monitoring of the air pressure rise in the sealed line.

h. Introduce low pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe.

i. A minimum of two minutes shall be provided for the air pressure to stabilize to conditions within the pipe. (This stabilization period is necessary for variations in temperature to adjust to the interior pipe conditions.) Air may be added slowly to maintain a pressure to 3.5 to 4.0 psig for at least two minutes.

j. Time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of any ground water above pipe shall not be less than time in following table for given diameters.

Pipe Diameter (Inches)	Minutes
6	3.0
8	4.0
10	5.0
12	5.5
15	7.0
18	8.5
21	10.0
24	11.5

In areas where the groundwater is above the top of the pipe, the test pressures shall be increased by 0.433 per foot of groundwater (e.g., if the groundwater is 11-1/2 feet, the 3.5 to 2.5 pressure drop will be increased by 5 psi; the time then will be measured for a pressure drop from 8.5 psi to 7.5 psi).

k. Repeat test as necessary after all leaks and defects have been repaired.

l. Safety Precautions During Air Test:

(1) The air test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

(2) As a safety precaution, pressurizing equipment should include a regulator set at perhaps 10 psi to avoid overpressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

3. Exfiltration Test:

a. Furnish all facilities required to plug pipe sections and fill with water to attain a minimum elevation of water in upstream manhole two feet higher than top of pipe in line being tested, or two feet above existing ground water in trench, whichever is higher elevation.

b. Maintain water level in manhole at start of test period for one hour.

c. Water added to maintain level (water lost) shall not exceed the following amounts:

(1) 8" pipe 1.26 gallon per 100 feet.

(2) 10" pipe 1.58 gallon per 100 feet.

(3) 12" pipe 1.89 gallon per 100 feet.

(4) 15" pipe 2.37 gallon per 100 feet.

(5) 18" pipe 2.84 gallon per 100 feet.

(6) 21" pipe 3.31 gallon per 100 feet.

(7) 24" pipe 3.78 gallon per 100 feet.

Allowable leakage may be increased by 5% for each foot of head above water elevation indicated above.

d. Dewater pipe upon completion of testing.

4. Infiltration Test:

a. May be used in lieu of air test or exfiltration test if contractor can prove that ground water conditions are such that crown of pipe is covered with not less than two feet of water at highest point in section being tested. The test head shall be maintained for not less than 24 hours before a weir measurement is made.

b. The groundwater level at each manhole on the section being tested shall be determined by the Contractor providing a 3/8-inch I.D. pipe through each manhole at an elevation near the invert. Aggregate shall be placed on the outside of the pipe to prevent clogging. The end of the pipe on the inside of the manhole shall contain fittings, together with a vertical transparent pipe to determine the groundwater level. The pipe through the manhole shall be permanently sealed after the tests have been completed.

c. The test shall be conducted by plugging off the upper end of the pipe section being tested and placing a weir or other approved measuring device in the pipe at the lower end of the section. Sufficient time shall be allowed for the water level over the weir to stabilize before reading the flow. The groundwater table shall be checked at the manholes on the section being tested to determine if a minimum to 2 feet of head exists over the top of pipe at the time of the test.

d. Infiltration shall be measured with weir at manhole and shall not exceed amounts stated in paragraph 3, Exfiltration Test.

e. Engineer will require exfiltration or air test if contractor cannot prove to satisfaction of Engineer that ground water conditions are satisfactory.

3.08 Hydrostatic Testing:

A. A hydrostatic test on ductile iron pipe with push-on type joints has two purposes: one is to set the gaskets in place, and the other is to provide a leakage test.

B. Said test shall include all ductile iron sewer pipe with push-on type joints installed by the Contractor in this Contract. The Contractor shall make arrangements with the Engineer for scheduling the test after the sewer pipe has been accepted as being ready for testing. The test shall be performed in the presence of the Engineer on the day mutually agreed upon.

C. Water for testing shall be obtained by the Contractor. The Contractor shall furnish all necessary equipment, piping, pumps, fittings, gauges, and operating personnel to properly conduct the test.

D. Hydrostatic test on ductile iron pipe with push-on type joints installed as gravity sewers and siphons shall be in accordance with the following provisions:

1. The ends of the sewer section being tested shall have test plugs or caps adapted with a tap of adequate diameter to fill and pressurize the system with water.

2. When a section is terminated at a manhole with a plain end (spigot), the pipe must extend into the manhole of sufficient length to accommodate a restraining cap. The benchwall shall be formed in the manhole after the test section has been approved.

3. Water shall be introduced into the section to be tested at the lower end. The upper end shall have an orifice at the top of the plug or cap to expel air when filling the system with water. All air shall be expelled from the pipe.

4. The test plugs or caps shall be capable of withstanding an internal pressure of 175 psi.

5. The system shall be tested in conformance with Section 13 of AWWA Specifications 600, at 50 pounds per square inch over a period of not less than one hour. The system will not be acceptable until all leaks have been repaired.

6. Hydrostatic test may be dangerous if, because of ignorance or carelessness, a line is improperly prepared. It is extremely important that the various plugs be installed in such a way as to prevent blowouts. Inasmuch as a force of 2500 pounds is exerted on an 8-inch plug by an internal pipe pressure of 50 psi, it should be realized that sudden expulsion of a poorly installed plug or cap can be dangerous. As a safety precaution, no one shall be allowed in the manholes when the pipe is pressurized.

3.09 Closed Circuit Television Inspection:

A. The sections of sewers which do not pass the watertightness tests as specified in Article 3.06 shall be inspected by closed circuit television and shall be repaired as directed by the Engineer.

B. The Contractor shall furnish a qualified television technician, a trained supervisor, and sufficient personnel to perform all the work required in the inspection operation.

C. The Contractor shall furnish spare cameras and related equipment to prevent delays due to equipment breakdowns. Cameras shall be equipped with remote-control focusing devices, remote-control devices to adjust the light intensity, and enough cable shall be furnished to inspect 1,000 linear feet of sewer in a continuous operation. One camera shall be small enough to pass through a 6-inch opening.

D. The Contractor shall clean the sewer, where required, one section at a time. After the sewer is cleaned, the television camera shall be attached to end of a rod or line so that it can be pulled through the pipe line. The camera shall trail a line of steel cable which will be attached to a winch of sufficient size to be able to pull back or retrieve the camera whenever necessary.

E. The camera shall transmit a continuous image to the television monitor. This image shall be clear and sharp enough to enable those viewing the monitor to be able to easily see the interior condition of the pipe line being inspected.

F. For each television inspection unit being used, the Contractor shall provide a mobile air-conditioned viewing room large enough to accommodate at least three people for the purpose of viewing the monitor while the inspection is in progress. Minimum size of the monitors shall be 17 inches, measured diagonally across the viewing screen. Electrical power to operate the equipment shall be provided by the Contractor.

G. The Contractor shall furnish all equipment required for making a continuous video tape of the view which appears on the monitor.

H. The Engineer or his representative shall be present at all times during television inspection of the sewers and will indicate to the Contractor whatever data may be required to be logged and prepared for record purposes. The Contractor shall prepare and furnish to the Owner not less than two copies of the complete record, video tape, and report of all inspection work done.

I. The cost of this work (should it become necessary) shall be included as part of the bid, and no additional compensation will be made to the Contractor.

* * * END OF SECTION * * *

SECTION 02611

AGGREGATE ROADWAY

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PART 1 - GENERAL

1.01 Description

PART 2 - PRODUCTS

2.01 Materials

PART 3 - EXECUTION

3.01 Subgrade
3.02 Placement
3.03 Compaction

SECTION 02611

AGGREGATE ROADWAY

PART 1 - GENERAL

1.01 Description:

Place compacted course or courses of crushed aggregate in conformity width, thickness and details specified.

PART 2 - PRODUCTS

2.01 Material - Crushed Roadstone:

Furnish sound, crushed limestone, crushed slag, crushed gravel or slacker aggregate. Shale shall not exceed 5 percent. Where major portion of material in coarse aggregate has shown characteristics of acquiring mudlike condition when tested for soundness, it shall be tested for soundness and the maximum loss shall be 5 percent. If gravel is used, that portion retained on No. 4 sieve shall contain not less than 40 percent fractured pieces. Crushed limestone, crushed slag and crushed gravel shall meet the following grading requirements:

Sieve Size	Total Passing, Percent
2 Inch	100
1 Inch	75-100
No. 4	25-60
No. 40	7-30
No. 200	0-15

Fraction of these materials passing No. 40 sieve shall have plasticity index of not more than six. Graduation and physical characteristics of material shall be such that it will compact to provide stable, structurally sound roadway surface.

PART 3 - EXECUTION

3.01 Subgrade:

Roll and compact subgrade for stabilized crushed aggregate to depth of 6 inches to 100 percent of maximum dry density as determined by AASHTO T 99, Method C.

3.02 Placement:

Spread aggregate over prepared subgrade in uniform lifts not to exceed 6 inches. Blade and shape to specified grade and cross-section. Compact each lift as it is placed.

3.03 Compaction:

Obtain initial compaction of material by use of crawler type tractors, tamping rollers, trench rollers, or suitable pneumatic tire equipment. Use pneumatic tire equipment for final compaction. Compaction shall follow the spreading operation closely to prevent loss of contained moisture and displacement of material.

When surface stability of the crushed aggregate cannot be obtained due to lack of fine, add additional fines to upper portion of course to secure surface stability. maximum fines passing Nol. 200 sieve shall not exceed 15 percent in upper portion.

Water may be applied to aid in compaction and prevent segregation material in manner that will not soften the subgrade. Compact aggregate surface in manner to maintain roadway grade and cross-section.

* * * END OF SECTION * * *

SECTION 02612

ASPHALTIC CONCRETE

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2.02 Fine Aggregate
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2.04 Mineral Filler
2.05 Combined Gradation (Surface Course)
2.06 Mix Design (Surface Course)
2.07 Asphalt Treated Base

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3.02 Tack/Prime Coat
3.03 Placing and Finishing
3.04 Compaction
3.05 Joints
3.06 Surface Smoothness
3.07 Adjust Fixtures
3.08 Limitations of Operations
3.09 Cleanup
3.10 Testing and Acceptance

SECTION 02612

ASPHALTIC CONCRETE

PART 1 - GENERAL

1.01 General Description of Work:

A. Mixing, transporting, placing and finishing a pavement of asphaltic concrete on a prepared subgrade or subbase.

B. Widths, thicknesses and cross-sections shall conform to those shown on the plans and typical sections.

C. Line and grade shall be as shown on the plans and established by the Engineer.

D. All work shall conform with ODOT Specifications.

1.02 Submittals and Quality Assurance:

A. Pre-Placement Testing/Certification:

1. Prior to mixing or placing any asphaltic concrete, furnish evidence from laboratory tests or prior project tests indicating mix design, proposed materials and anticipated densities.

2. Furnish mix design from a laboratory approved by the Engineer. Utilize materials (aggregates, asphaltic cement) which will be incorporated into the project.

B. On-Site Testing:

1. Uncompacted Mix:

a. Asphalt Cement Content: ASTM D2172.

b. Gradation of Aggregates: AASHTO T27.

c. Marshall Stability and Flow: ASTM D1559.

2. Provide on-site testing by an independent testing laboratory approved by Engineer. Cost on on-site testing will be paid by Contractor.

C. Post-Placement Testing:

1. Bulk Density: ASTM D1188.

2. Thickness: Cores taken for density will also be measured for thickness. Cores for quality control testing will be sawn by Contractor at direction of Engineer.

3. Surface Smoothness: Check using 10 foot straight edge. Check both parallel to and at right angles to centerline.

4. Preparation and testing of specimens for quality verification will be done by an independent testing laboratory approved by Engineer.,

5. Pay cost of testing said specimens.

PART 2 - PRODUCTS

2.01 Asphalt Materials:

A. Asphalt Cement: Viscosity Grade AC-10, Penetration Grade 85-100, ASTM D946.

B. Prime or Tack Coat: RC-70 Asphalt Cement, ASTM D597 or RS-1 to RS-2 Emulsified Asphalt, AASHTO M140 or AASHTO M2087.

2.02 Fine Aggregate:

A. Hard durable gains of natural sand, crushed stone or crushed gravel.

B. Maximum limits of deleterious substances are:

1. Shale particles: 2% of portion retained on #16 sieve.

2. Clay and silt particles: 3%

2.03 Course Aggregate:

A. Crushed stone, crushed or uncrushed gravel or mixture thereof.

B. Abrasion loss based on AASHTO T-96:

1. Crushed limestone: Maximum 40%.

2. Crushed or uncrushed gravel: Maximum 35%.

C. Deleterious materials retained on #4 sieve:

1. Clay and silt: Maximum 3%.

2. Shale: Maximum 3%.

3. Mud balls: Maximum 0.5%.

2.04 Mineral Filler:

A. Add as required to attain desired percentage passing No. 200 sieve.

B. Filler material:

1. Pulverized limestone, AASHTO M-17.

2. Portland cement or other inert materials as approved by the Engineer.

2.05 Combined Gradation (Surface Course):

A. Combine fine and coarse aggregates and mineral filler as required to obtain specified gradation.

B. Gradation: See Section 404, ODOT Specifications.

C. Surface mixture must contain minimum 70% crushed particles.

2.06 Mix Design (Surface Course):

A. Percent Asphalt:

1. 6.25% +/-0.5%

2. Base bids on 6.25% asphalt.

B. Stability: 1500+.

C. Flows: 15 maximum.

D. Air Voids: 4% +/-1%.

E. Voids Filled: 80% +/-5%.

2.07 Asphalt Treated Base:

A. Use asphalt cement and aggregate meeting quality specifications for asphaltic concrete surface course.

B. Combined aggregate gradation:

Sieve	% Passing by Weight
1"	100%
3/4"	98-100%
3/8"	65-95%
No. 4	45-75%
No. 8	35-60%
No. 30	18-36%
No. 200	4-8%

C. Mix Design:

1. Percent asphalt:

a. 4.50% +/-0.25%.

b. Base bids on 4.50% asphalt cement.

2. Stability: 1200 minimum.

3. Flow: 15 maximum.

4. Air Voids: 6% +/-2%.

5. Voids Filled: 70% +/-5%.

PART 3 - EXECUTION

3.01 Subgrade (Subbase):

A. Insure subgrade (subbase) is true to line and grade and compacted as specified.

B. Fill and recompact any ruts or depressions.

C. Check cross-section with a template.

3.02 Tack/Prime Coat:

A. Apply uniformly:

1. Rate for asphalt cement: 0.04 to 0.08 gal/SY.

2. Rate for emulsified asphalt: 0.05 to 0.10 gal/SY.

B. Application temperature:

1. Asphalt cement: 120°F to 160°F.

2. Emulsified asphalt: 75°F to 130°F.

C. Apply enough material to penetrate and seal, but not flood surface.

D. Apply to entire surface to include vertical surfaces.

E. Allow to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than 12 hours unless directed otherwise by Engineer.

F. Blot excess asphalt.

G. Maintain surface clean and free from debris, clean and reapply if excess foreign material is introduced to surface.

3.03 Placing and Finishing:

A. Check line and grade. Insure pavement placed will satisfactorily meet the plans and specifications. Fill and compact low spots as necessary.

B. Insure entire surface for each layer to be placed has been thoroughly tacked or primed.

C. Handle and transport mixture in a manner to minimize segregation of fine and coarse aggregate.

D. Maintain temperature of mixture between 250°F and 325°F and during transporting and placing operations.

E. Produce, transport, place and compact material in a continual laydown operation, avoid long delays.

F. Place lifts in layers 4" or less in compacted thickness.

G. Utilize mechanical spreaders to the maximum extend possible.

H. Hand spread irregular areas.

3.04 Compaction:

A. Commence compaction of mixture as soon as temperature permits. provide sufficient rollers to ensure satisfactory compaction before mixture cools.

B. Use mechanical tampers in areas inaccessible to rollers.

C. Use steel-tired finish rollers for final surface compaction.

D. Compact mixture to a minimum of 94% of laboratory mixture density.

3.05 Joints:

A. Longitudinal:

1. Minimum spacing of 3" for successive layers.

2. Adjust screen to obtain complete closure and smooth surface at joints.

B. Transverse:

1. Construct at right angles to centerline.

2. Provide full depth joint with a vertical edge and smooth surface.

3. Minimum spacing of transverse joints shall be 6 feet for successive or parallel layers.

3.06 Surface Smoothness:

A. Finish final surface true to line and grade. Maximum variation: 1/8" in 10'.

B. Insure uniform surface texture.

C. Correct all unsatisfactory surface areas.

3.07 Adjust Fixtures:

A. Raise or lower manhole, intake, valve box and other castings to design grade.

B. Make final adjustments prior to placement of final surface course.

3.08 Limitations of Operations:

A. Place no prime or tack coat or mixture on a damp surface.

B. Place no mixture when surface temperature is 40°F or less.

C. Exclude traffic during prime/tack and placement operations. Allow traffic only after surface has cooled to ambient temperature.

D. Provide necessary signage, flagmen, and/or pilot car as required.

3.09 Cleanup:

A. Remove all debris and excess material to waste sites as designated by the Engineer.

B. Remove all construction equipment.

C. Finish entire project in a workmanlike manner.

3.10 Testing and Acceptance:

A. Preplacement: As previously specified.

B. One Site:

1. Provide sufficient uncompacted mix to run two (2) sets of following tests per sample:

a. Asphalt cement content.

b. Extracted gradation.

c. Marshall stability and flow.

2. Job mix tolerances:

a. Once job mix has been established, daily checks of gradation shall be within following:

Sieve Size(s)	Percent Variation
+/-#4	+/- 7%
#8 to #100	+/- 4%
#200	+/- 2%

b. In no case will tolerances be allowed to expand ranges of gradation specified.

3. Secure one sample set in morning and one in afternoon for a full day's laydown.

C. Post Placement:

1. Cut samples daily from each layer placed.

2. Cut one sample for every 500 tons (or part thereof) of each layer placed. Minimum number of daily samples - two.

3. Identify location and layer of each sample.

4. Samples may be either rectangular or circular. Minimum surface area - 12 square inches.

5. Repair areas from which samples have been cut.

D. Density:

1. Additional samples of pavement may be taken at option of Owner, if:

a. 15% of specimens tested for project fall below specified density; or

b. 50% of one day's specimens tested fall below specified density.

2. Should 15% of the specimens tested fall below specified density, Owner will reduce unit price as follows:

Ratio of Average Density to Specified Laboratory	% Reduction in Unit Price
Greater than 0.90 to 0.94	5%
Greater than 0.75 to 0.90	25%
Greater than 0.50 to 0.75	50%
Greater than or Equal to 0.50	100%

* * * END OF SECTION * * *

SECTION 02614

PORTLAND CEMENT CONCRETE PAVEMENT

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SECTION 02614

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 General Description of Work Covered:

A. Provide mixing, placing, finishing and all related services necessary to construct all concrete pavement work indicated on plans.

B. Furnish widths, thicknesses and cross sections shown on plans and typical section.

C. Follow line and grade shown on plans and established by Engineer.

D. All work shall conform with ODOT Specifications.

1.02 Quality Assurance:

A. Comply with latest published edition of American Concrete Institute (ACI) and American Society of Testing and Materials (ASTM) standards and codes:

1. ASTM A615 - Deformed Billet Steel Bars for Concrete Reinforcement.

2. ASTM C33 - Concrete Aggregates.

3. ASTM C39 - Concrete Strength of Molded Concrete Cylinders.

4. ASTM C94 - Ready-mixed concrete.

5. ASTM C143 - Slump of portland Cement Concrete.

6. ASTM C150 - Portland Cement.

7. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

8. ASTM C260 - Air-Entraining Admixtures.

B. Submit proposed concrete mix proportions to Engineers prior to placing concrete.

C. Furnish evidence from laboratory tests or prior project tests indicating mix proportion and proposed materials will develop required strength.

D. Use testing laboratory approved by Engineer.

PART 2 - PRODUCTS

2.01 Portland Cement:

A. Normal Portland Cement: ASTM C150, Type I.

B. High Early Strength Portland Cement: ASTM C150, Type III.

C. Air-Entrained Portland Cement: ASTM C150, Type 1A.

D. May be either bagged or bulk. Partially set or caked cement will be rejected.

2.02 Water:

A. Clear, fresh, free from injurious amounts of oil, alkaline, acid or organic mater.

B. Water of known potable quality requires no testing. Other sources shall meet requirements of ASSHTO T26.

2.03 Fine Aggregate:

A. Clean, hard, durable particles of natural sand, free from injurious amounts of silt, shale, coal, organic matter or other deleterious substances.

B. Gradation, percent of weight passing:

Sieve Size	Percent Passing
3/8"	100
No. 4	90-100
No. 8	70-100
No. 30	25-55
No. 200	0-1.5

C. Fineness Modulus: 2.3 minimum; 3.1 maximum.

D. Objectionable materials, percent by weight:

Clay Lumps	1.0% Maximum
Coal and/or Shale	2.0% Maximum

2.04 Coarse Aggregate:

A. Clean, hard, durable particles of gravel or crushed stone free from injurious amounts of objectionable materials.

B. Gradation, percent of weight passing:

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	20-55
No. 4	0-10
No. 200	0-1.5

C. Objectionable materials, percent by weight:

Clay Lumps	0.5% Maximum
Coal and Shale	0.5% Maximum
Total of All Shale, Coal and Clay Combined	1.0% Maximum
Unsound Chert Particles retained on 3/8" Sieve	3.0% Maximum

2.05 Admixtures:

A. Air-Entraining Agent:

1. Comply with ASTM C260.

2. Add at mixer, vary amount to produce specified air content.

B. Other Admixtures:

1. Water Reducing: ASTM C494.

2. Cement Disbursing: Pozzolith No. 8.

3. Use only with prior approval by Engineer.

2.06 Reinforcing Steel:

A. Deformed Bars: ASTM A615, Grade 40 or higher.

B. Plain Bars: ASTM A615, Grade 60.

C. Wire Mesh Reinforcement: ASTM A187.

2.07 Curing Materials:

A. Liquid Membrane: White pigmented chlorinated rubber base, ASTM C309, Type II, with 26% solids.

B. Plastic Film: White pigmented, 0.00085" (minimum) thick.

C. Burlap: Jute fabric, clean, free of impurities.

2.08 Joint Materials:

A. Joint Sealer: Hot poured, non-extruding, elastic, ASTM D1190.

B. Performed Expansion Joint Filler:

1. Non-extruding, bituminous fiber, ASTM D1751.

2. Performed polyurethane foam with adhesive lubricant.

2.09 Moisture Barrier:

A. Polyethylene sheet, minimum 8 mil., ASTM E154.

2.10 Proportions and Mix Criteria:

A. Water/Cement Ratio: 0.466 pounds per pound (maximum).

B. Slump: 3" +/-1".

C. Air Content: 6.0% +/-1.0%.

D. Required Flexural Strength:

1. 7-day - 500 psi.

2. 28-day - 650 psi.

Required Compressive Strength:

1. 7-day - 2800 psi.

2. 28-day - 4000 psi.

E. Assumptions for Mix Design:

1. Specific Gravity of Cement: 3.14.

2. Specific Gravity of Aggregate: 2.65.

3. Weight of Water: 62.4 lbs./cubic foot.

4. Air Void: 6%.

F. Submit mix design including proportions of cement, fine aggregate and coarse aggregate and coarse aggregate along with test results one week prior to anticipated placement.

PART 3 - EXECUTION

3.01 Subgrade:

A. Insure subgrade is true to line and grade and compacted as specified.

B. Fill and recompact all ruts or depressions.

C. Check cross section with a template.

D. Place moisture barrier or moisten subgrade prior to placing of concrete. Method to be approved by the Engineer.

E. Place moisture barrier on all line stabilized base.

3.02 Forms:

A. Set accurately to required grade and alignment.

B. Maintain stability while concrete is being placed and finished.

C. Set on firmly compacted subgrade.

D. Clean and oil before concrete is placed.

E. Tamp with mechanical form tamper supplemented with hand tamping for supporting heavy mechanical finishing machines.

F. Deviation in grade and alignment: Not more than 1/4" from line and grade established by Engineer.

3.03 Slip Form Placement:

A. Allow slip form placement of pavement only on approval of Engineer.

B. Submit description of procedure and equipment for slip forming at least two (2) weeks prior to placing concrete.

3.04 A. Slip form stage construction placement of curb and gutter before paving center lanes may be allowed where approved by Engineer.

B. Submit a description of the procedure and equipment to be used at least two (2) weeks prior to placing concrete.

C. Place a keyed and doweled joint on inside edge of gutter.

D. Limit operations to straight sections, returns, etc., will be hand placed with integral curb.

3.05 Mixing:

A. Measuring Devices: Must provide easy, accurate control and checking. Have sufficient weights to check scales throughout ranges used.

B. Units of Measurement:

1. Cement: By weight or bag.

2. Aggregate: By weight.

3. Water: By weight or volume.

4. Admixtures: By weight or volume.

C. Mixer:

1. Mechanical batch type, minimum capacity 1/2 cubic yard.

2. Mixing equipment must be clean, free of injurious materials, old concrete, excess wash water.

3. Equip with an approved timing device and/or revolution counter.

4. Batches shall not exceed the rated capacity of the mixer.

D. Time:

1. Mix until mass is homogenous and uniform in color.

2. Minimum: One minute after all ingredients are in mixer of mixers up to 1 cubic yard capacity; increase 15 seconds for each additional 1/2 cubic yard capacity.

3.06 Transporting:

A. Allow no segregation of materials.

B. Time lapse from addition of water to placement on subgrade:

1. 30 minutes (maximum) for nonagitating trucks.

2. 60 minutes (maximum) for agitating or truck mixers.

C. Add additional cement at the rate of one bag per 5-1/4 gallons when water is added at site. Mix thoroughly.

3.07 Ready-Mixed Concrete:

A. May be used if concrete meets requirements of concrete specifications.

B. Equipment and methods must conform to ASTM C-94.

3.08 Placing and Finishing:

A. Permit no batch trucks or paving equipment on prepared subgrade unless authorized by Engineer based on actual job conditions.

B. Place no concrete until after inspection of subgrade and forms by Engineer.

C. Place concrete continuously so pour unit will be monolithic and will terminate at expansion, contraction or construction joint.

D. Permit not more than 30 minutes between depositing adjacent batches.

E. Prevent segregation during placing.

F. Consolidate with mechanical vibrator. Hand puddle curb section and unusual sections as required.

G. Extend vibrating equipment/devices into slab at least 3/4 depth.

H. Strike off with finish machine capable of striking off surface, screeding and consolidating materials. Machine must have ample weight and power to produce proper finishing.

I. Check crown of screed prior to placement to insure the finish cross section will be compatible with plans.

J. Check surface and curb face with ten-foot straight edge, maximum variance allowed - 1/8".

K. Drag concrete surface longitudinally with double thickness burlap drag, carpet, broom or other approved material to provide uniformly gritty texture.

L. Hand finish where necessary.

3.09 Integral Curb:

A. Construct before slab has initial set. Consolidate curb to insure a bond with slab.

B. Hand finish to cross section as specified.

C. Install curb drop openings for pedestrian ramps and driveways as shown on plans or as directed by Engineer.

D. Use template and curb straps to obtain desired curb cross section.

3.10 Adjust Fixtures:

A. Adjust manhole, inlet, valve box, and other castings to design grade.

B. Use boxouts for fixtures located at edge of slab or across a construction joint. Use a keyed and tied joint for boxouts.

C. Adjust transverse joint spacing for several panels on either side of fixture to permit joint to fall at boxout corner or to be centered on non-boxed out fixture.

3.11 Curing:

A. Use liquid membrane compound on all exposed surfaces and edges.

B. Apply immediately after finish operations and when free water has left surface.

C. Apply at minimum rate of 1 gallon per 200 square feet.

D. If burlap cure is used, maintain in wet condition for 72 hours after placement.

3.12 Joints:

A. Transverse:

1. Extend entirely across pavement at right angles to centerline.

2. Saw (or form) at intervals of 90" or less as soon as possible without ravelling. Time of sawing and spacing can be adjusted by Engineer.

3. Saw additional transverse joints as rapidly as required after placement to prevent random cracking.

B. Longitudinal:

1. Sawed:

a. Saw within 72 hours after concrete is placed.

b. Attach keyway to forms with sufficient support to prevent movement during concrete placement.

c. Support tie bars to ensure proper positioning after concrete placement.

d. Submit proposed method of forming joint for slip form work.

C. Expansion:

1. Plain:

a. Construct as shown on plans.

b. Locations generally not shown but which require expansion joints are all structures and features which project through, into or against slab.

c. Install according to manufacturer's recommendations. Set material securely before placing concrete.

2. Doweled:

a. Construct as shown on plans.

b. Prevent movement or damage during placement of concrete.

3. Sawn:

   a. Saw cut full depth for full width of pavement to provide a sufficient opening for material.

   b. Install according to manufacturer's recommendations at locations shown on plans.

D. Transverse Construction Joints:

1. Install where shown or as specifically permitted by Engineer.

2. Locate all stoppage of concrete placement exceeding 30 minutes and at end of day's work.

3. Provide bulkhead with holes for required dowels.

E. Construction Header:

1. Construct where shown.

2. Header board may be left in place at Contractor's option.

3. Excavate or remove sufficient material to construct header to dimensions shown.

4. Backfill or replace with material equal to or exceeding that removed to fit existing surface. Removal and replacement is incidental to construction of header.

F. Filling Joints:

1. Fill no later than 14 days after sawing.

2. Blow joints clean and dry.

3. Fill immediately after cleaning to 1/8" of surface.

4. Remove excess while material is still pliable.

5. Refill low areas as necessary.

G. Random Cracks:

1. Random cracks developed prior to final inspection must be routed to depth of 2" and sealed as specified for joints.

2. Random cracks judged to have resulted from failure to saw concrete in a timely manner will be subject to penalty of $5.00 per lineal foot of random crack.

3.13 Protection and Form Removal:

A. Protect concrete from all damage prior to acceptance.

B. Prohibit regular traffic for ten (10) days.

C. Permit light construction equipment on new slab after five (5) days unless directed otherwise by Engineer.

D. Leave forms in place a minimum of 24 hours.

E. Exercise care in removing forms to prevent cracking and spalling of concrete. Patch areas of excessive honeycomb as directed by Engineer. Cure areas previously covered by forms, immediately after form removal.

3.14 Limitations Due to Weather:

A. Place no concrete during stormy or inclement weather.

B. Have sufficient burlap or canvas on site to protect fresh concrete in the event of rain.

C. Place day's work header 45 minutes before sunset. Place no concrete when darkness prevents good workmanship. Use artificial light only with specific approval by Engineer.

D. Begin paving operation when temperature is 40°F. and rising.

E. During cold weather, protect as follows:

Predicted Low Temp.	Protection
32° min.	One layer plastic on burlap
25° min.	One layer plastic and one layer burlap or two layers of burlap.
Below 25°	Two layers plastic and/or burlap and 6" of straw.

Covering for temperatures over 25°F. to remain in place 48 hours. For temperatures under 25°F., leave in place for five (5) days, minimum.

3.15 Cleanup and Backfill:

A. Backfill behind curb, along sidewalks and driveways with good material free of lumps and objectionable material.

1. Provide minimum of 4" of topsoil on all exposed disturbed areas.

2. Shape to specified cross section, rake and dress by hand.

3. Leave suitable for seeding.

B. Remove all debris and excess material to waste sites as designated by Engineer.

C. Remove all construction equipment.

D. Finish entire project in acceptable manner.

3.16 Testing and Acceptance:

A. On Site:

1. Gradation by Engineer:

a. Test initial load(s) until slump and air falls within specified limits.

b. Reject stockpiles where samples do not meet specifications.

2. Slump and Air by Engineer:

a. Test initial load(s) until slump and air falls within specified limits.

b. Test intermediate batches to maintain quality.

c. Reject any batch that failed either test.

d. Add no water after testing.

B. Post Placement:

1. Strength:

a. Provide three 6"x12" cylinders or two core tests per 300' of pavement placed where directed by Engineer.

b. Test one cylinder of each set at seven (7) days and one at 28 days. Remaining cylinder as directed by Engineer.

c. Provide additional testing of cured concrete slab if:

1. 15% of specimens tested at 28 days for project fall below specified strength; or

2. 50% of specimens tested for one day's pour fall below specified strength.

d. Cut and test required additional cores within 40 days of pour.

e. Reduce unit bid price should 15% of all specimens tested fall below specified strength.

Ratio of Average Actual Strength to Specified Strength	% Reduction in Unit Price
0.91 to 1.00	5%
0.76 to 0.90	25%
0.51 to 0.75	50%
Less than 0.50	100%

f. Pay all costs of cores taken.

g. Pay all laboratory costs for cylinder and core tests to verify strength.

h. Test cylinders will be cast by Engineer unless directed otherwise.

2. Thickness:

a. Cut cores as directed by Engineer.

b. Pavement 25% deficient in thickness will be removed and replaced at no cost to Owner.

c. Reduce unit bid price where thickness deficiency is less than 25% as follows:

Average Deficiency In Thickness	Percent Reduction In Unit Price
0.00" to 0.10"	0%
0.11" to 0.25"	5%
0.26" to 0.50"	15%
0.51" to 1.00"	25%
Over 1.00"	100%

d. Measure cores used in strength determination for thickness.

e. Cores taken only for this purpose will be paid by Owner if thickness is adequate, if not, such testing will be paid by Contractor.

3. Smoothness and Defects:

a. Grind off all surface variations exceeding 1/8" in 10'. Bush hammering not permitted.

b. Sections must be replaced with depressions exceeding 1/4" in 10'. Replacement shall extend to nearest regular joint at no cost to Owner.

c. Sections with more than one random crack per panel, fractures, spalling or other defects will be replaced at no cost to Owner.

C. Care, handling, storing and delivery of all test specimens to laboratory will be Contractor's responsibility and at his cost.

* * * END OF SECTION * * *

SECTION 02635

SURFACE RESTORATION

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1.02 Related Requirements Specified Elsewhere

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2.03 Flexible Pavement
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PART 3 - EXECUTION

3.01 Road Maintenance
3.02 Preparation
3.03 Concrete Resurfacing
3.04 Seal Coat
3.05 Gravel or Crushed Rock

SECTION 02635

SURFACE RESTORATION

PART 1 - GENERAL

1.01 Description:

A. Replace street, alley, driveway and/or sidewalk surfaces damaged during construction with like materials as existed on the respective surfaces unless specified or shown otherwise on the Plans.

B. All work shall conform with ODOT Specifications.

1.02 Related Requirements Specified Elsewhere:

A. Earthwork for Utilities: Section 02202

PART 2 - PRODUCTS

2.01 Road Gravel:

A. Sieve Analysis:

Sieve Size	% Passing
3/4"	100
#4	55-75
#8	20-35
#200	15

B. Maximum percent shale particles in fraction retained on #4 sieve - 10%.

C. Maximum percent mud balls - 10%.

2.02 Crushed Rock:

A. Sieve Analysis:

Sieve Analysis	% Passing
3/4"	100
#4	50-75
#8	20-35

B. Maximum percent wear by ASSHTO T-96, Grading B-45%.

C. Maximum percent loss by freeze and thaw text on fraction retained on #4 sieve - 10%.

D. Maximum shale content - 5%.

2.03 Flexible Pavement:

A. Conform to Section 400, ODOT "Construction and Material Specifications" as tabulated on "Pavement Restoration Schedules".

B. Quality Assurance: Furnish batch analysis and certification of conformance.

2.04 Rigid Pavement:

A. Conform to Section 450, ODOT "Construction and Material Specifications" as tabulated on "Pavement Restoration Schedules".

B. Quality Assurance: Furnish batch analysis and certification of conformance.

PART 3 - EXECUTION

3.01 Road Maintenance:

A. Place and compact six (6) inches of crushed rock or road gravel on roadway cuts to edge of berm or three (3) feet outside pavement, whichever is greater.

B. Maintain roadway during construction. Blade, place, and compact road gravel at regular intervals so as to provide even road grade through construction period. Remove excess or loose materials from right-of-way.

3.02 Preparation:

A. Compact, grade and prepare all surface areas requiring restoration.

B. Saw-cut exposed broken edges of concrete or asphaltic concrete.

3.03 Concrete Resurfacing:

A. Remove temporary surfacing as required.

B. Place and consolidate pavement section to thickness shown on schedules. Minimum depth of concrete as follows:

1.	Streets and Alleys:	Original surface thickness plus one (1) inch
2.	Private Drives:	6-inches
3.	Sidewalks	4-inches

C. Finish surface and cut joints to match existing joint pattern.

D. Protect portland cement concrete for five (5) days.

E. Cure concrete.

F. Place no concrete on frozen base, free water, ice, or when air temperature is 40°F. or less.

3.04 Seal Coat:

A. Seal coat areas designated on the plans.

B. Shape and roll surface to uniform acceptable cross-section.

C. Apply bituminous material uniformally at a rate of 0.25 gallons per square yard for each seal coat.

D. Spread cover aggregate at a rate of 25 lbs. per square yard for each seal coat.

E. Roll with steel or pneumatic tired roller.

F. Apply two (2) seal coats to areas receiving seal coat work.

G. Do not apply seal coat on wet base or when air temperature is below 55°f.

3.05 Gravel or Crushed Rock:

A. Spread 4-inches of designated material on prepared surface.

B. Blade, shape and compact to firm, well-drained surface.

* * * END OF SECTION * * *

SECTION 02800

PLANTING

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2.03 Mulch
2.04 Tree Stakes
2.05 Grass Seeding
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3.05 Planting Ground Cover
3.06 Sowing Turf Grass
3.07 Staking
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3.09 Staking

SECTION 02800

PLANTING

PART 1 - GENERAL

1.01 Description:

A. Work Included:

1. Furnish and plant vegetation as indicated on planting schedule.

2. Relocate plants as indicated on Drawings.

3. Where not otherwise specified or indicated on Drawings for planting or sodding, restore all damaged areas and exposed earth areas with uniform cover of grass by seeding, sprigging, sodding, or other method approved by Owner's Representative.

1.02 Quality Assurance:

A. Qualification of Workmen: Execute work under supervision of experienced, knowledgeable planting foreman.

B. Standards:

1. Disease and Insect Control: Comply with specifications of Federal, State and County laws.

2. Quality and Size: Conform with "Horticultural Standards" for number one grade nurserymen.

3. All plants shall be true to name.

4. Tagging:

a. One of each bundle or lot shall be tagged with name and size of plant in accordance with standard practice of American Association of Nurserymen.

b. Botanical names shall take precedence over common names.

1.03 Submittals:

A. General: Comply with the provisions of Section 01300.

B. Materials Lists: Submit list of materials proposed to be furnished and installed, demonstrating conformance with specification.

C. Certificates: Deliver all certificates to Owner's Representative.

1.04 Product Handling:

A. Delivery and Storage: Deliver items to job site in original containers with labels intact and legible. Remove from site plants not to name, and materials which do not comply with specification. Protect plant materials before, during and after installation.

B. Replacements: In event of damage, make repairs and replacements.

PART 2 - PRODUCTS

2.01 Fertilizer:

A. Provide commercial balanced 11-8-4 fertilizer. Seeding shall be 12-12-12.

B. Deliver to site in bags labeled with manufacturer's guaranteed analysis.

C. Protect fertilizer from elements during storage.

2.02 Soil Amendment:

Provide Redwood sawdust fortified with organic nitrogen, or a commercial soil amendment such as "Tillo", "Silver Spade", or equal.

2.03 Mulch:

Provide standard size ground bard chips 1/4 inch to one inch in size, being mill-run chips of Douglas Fir bard, "Silverbark" distributed by Weyerheauser Company, or equal.

2.04 Tree Stakes:

Provide tree stakes, rough-sawn, two inches by two inches by eight feet long.

2.05 Grass Seed:

A. General:

1. Grass seed shall be free from noxious weeds, grade A recent crop, recleaned, and treated with appropriate fungicide at time of mixing.

2. Deliver to site in sealed containers with dealer's guaranteed analysis.

B. Proportions by Weight:

Kentucky Blue Grass	65%
Red Fescue	15%
Annual Rye	20%

2.06 Plant Materials:

Provide plant materials as indicated on Plant Schedule.

2.07 Other Materials:

All other materials, not specifically described but required for a complete and proper installation, shall be as selected by the Contractor subject to the approval of Owner's Representative.

PART 3 - EXECUTION

3.01 Inspection:

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

3.02 Spreading of Topsoil:

A. Finish Grading: Conform to Section 02220.

B. Fine Grading: Upon completion of finish grading, perform all fine grading required in planting areas, using topsoil obtained from the site.

C. Raised Planter Beds:

1. Backfill with a mixture consisting of two parts topsoil and one part specified soil amendment, by volume.

2. Place the backfill mixture in layers not exceeding eight inches in uncompacted thickness.

3. Compact each layer by thorough saturation with water to prevent future settlement.

3.03 Removal of Plants for Relocation:

A. Refer to Section 02110, Clearing and Grubbing.

B. Plants to be relocated shall be packaged, maintained and replant in conformance with requirements of specifications for Commercial Nursery Stock.

3.04 Planting Trees and Shrubs:

A. General:

1. Plant nursery stock upon delivery to site and approval by Owner's Representative.

2. Where site conditions will not permit, heel-in all bare root and balled material with damp soil to protect from sun and wind.

3. Regularly water all nursery stock in container.

4. Place stock in cool area protected from sun and drying winds.

B. Excavation:

1. At all holes more than twelve inches deep, probe by hand to determine if mechanical auger will hit in-place utilities.

2. Provide planting holes:

a. For shrubs in one gallon containers, a hole twelve inches in diameter and twelve inches deep.

b. For shrubs and trees in five gallon containers, a hole 20 inches in diameter and 18 inches deep.

c. For trees in 15 gallon containers, a hole 30 inches in diameter and 30 inches deep.

C. Planting:

1. Fill holes with backfill mixture consisting of three parts soil taken from the hole and one part soil amendment, by volume.

2. Fill to proper height to receive pant, and thoroughly tamp before setting plant.

3. Set pant in upright position in center of hole, and compact the backfill mixture around the ball or roots.

4. Thoroughly water each plant when the hole is 2/3 full.

5. After watering, tamp soil in place until the surface of backfill is level with surrounding area and crown of plant is at finished grade of the surrounding area.

6. Build up temporary watering basin around base of each tree and shrub, except no basins in turf areas or in raised planter areas.

3.05 Planting Ground Cover:

A. Preparation: Rake existing soil smooth and free from all soil lumps, rocks, sticks, and other deleterious materials.

B. Planting:

1. Space the ground cover plants evenly as indicated on Drawings, staggering spaces around trees and shrubs and in open areas.

2. Plant only in soil that is moist but friable, never wet or soggy.

3. In the case of planting in open on hot days shorten time between planting and watering.

C. Mulch Planting Area:

1. Straw mulch 50 lbs. per 1000 square feet.

2. Jute netting on slopes 1:2 or greater.

3.06 Sowing Turf Grass:

A. Preparation: Grade all seed beds, thoroughly removing all ridges and depressions, and making all areas into smooth, continuous, firm planes that ensure proper drainage. Remove all soil lumps, rocks, sticks, and other deleterious material.

B. Sowing:

1. Sow at rate of 3.02 pounds per 1,000 square feet.

2. Promptly after seeding, wet seed bed thoroughly.

3. Keep areas moist throughout germination period.

C. Fertilizing: Apply fertilizer at rate of 12 pounds per 1,000 square feet, raking lightly into the soil.

D. Mulch Planting Area:

1. Straw Mulch - 50 lbs. per 1,000 square feet.

2. Jute Netting on slopes 1/2 or greater.

E. Protect turf areas by erecting temporary fences, barricades, signs and other protection as needed to prevent trampling.

3.07 Staking:

A. Stake trees, one stake per tree minimum with two tree ties per stake.

B. Drive stakes into ground at two feet minimum.

3.08 Inspection:

In addition to normal progress inspections, schedule and conduct formal inspections, giving Owner's Representative at least 24 hours prior notice of readiness for inspection:

1. Inspect plants in containers prior to planting.

2. Inspect plant locations, to clarify compliance with Drawings.

3. Final inspection at the end of the maintenance period.

3.09 Maintenance:

A. General: Maintain planting, starting with planting oeprations and continuing for thirty (30) days after all planting is complete and approved by Owner's Representative.

SECTION 02821

SEEDING

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2.03 Mulch
2.04 Water

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3.02 Preparation
3.03 Application
3.04 Protection
3.05 Lawn Establishment
3.06 Cleanup

SECTION 02821

SEEDING

PART 1 - GENERAL

1.01 Quality Assurance:

A. Source Quality Control: Provide producer's tests for purity and germination of seed, dated within nine months of sowing.

B. Submit seed and fertilizer -- bag labels as evidence of materials supplied.

1.02 Job Conditions:

A. Existing Conditions: Perform seeding only after preceding work affecting ground surface is completed.

B. Environmental Requirements:

1. Plant seed on unfrozen soil within 5% to 10% moisture content.

2. Do not seed when wind exceeds 15 mph.

3. Seed between calendar dates: April 1 to May 15 and August 15 to October 1.

C. Protection: Restrict foot and vehicular traffic from seeded areas after planting to end of the established period.

1.03 Scope: Prepare seed bed and apply seed on all disturbed areas outside of pavement.

PART 2 - PRODUCTS

2.01 Seed:

A.

Species	Percent by Weight
Kentucky Blue Grass	65%
Red Fescue	15%
Annual Rye	20%

B. Use clean, dry, new crop seed.

2.02 Fertilizer:

A. Commercial inorganic pre-mixed.

B. Available nutrients by weight: 12%-12%-12%.

2.03 Mulch:

A. Clean straw, or

B. Wood cellulose fiber.

C. Jute netting.

2.04 Water:

A. Free of matter harmful to plant growth.

PART 3 - EXECUTION

3.01 Inspection:

A. Check that preceding work affecting ground surface is completed.

B. Verify that soil is unfrozen and within allowable range of moisture content.

C. Begin work only when conditions are satisfactory.

3.02 Preparation:

A. Fine grade area using hand raking, harrowing or other method to form seed bed.

B. Till fertilizer into top 2 inches of soil at rate of 12 lbs./1000 square feet.

C. Water dry topsoil as required at least 48 hours prior to seeding to obtain a loose friable seed bed.

3.03 Application:

A. Broadcast half of seed with mechanical seeder.

B. Broadcast remaining half of seed at right angles to first seeding pattern, using same broadcast method.

C. Apply seed at 3.02 lbs./1000 square feet.

D. Cover seed to depth of 1/4" by raking, harrowing or cultipacking.

E. Roll seeded area with roller weighing maximum of 150 lbs./ft. of width.

F. Spread mulch uniformly at 50 lbs./1000 square feet.

G. Place jute netting over seeded area with slopes 1 to 2 and steeper.

H. Anchor mulching fabric with stakes 4 feet o.c. and at edges.

I. Water seeded areas if rainfall is not imminent.

J. Apply additional annual rye at rate of 0.75 lbs./1000 square feet on slopes in excess of 20%.

3.04 Protection:

A. Immediately after seeding, erect barricades and warning signs to protect seeded areas from traffic until grass is established.

3.05 Lawn Maintenance:

A. Watering:

1. Keep soil moist during seed germination period.

2. Supplement rainfall if necessary during germination.

B. Reseed and mulch spots larger than 1 square foot not having uniform stand of grass.

C. Repair and reseed eroded areas.

D. Establishment period to extend sixty (60) days.

3.06 Cleanup:

A. Remove trash and excess materials from project site.

B. Maintain paved areas in clean condition.

C. Remove barriers and signs from project site at termination of establishment period.

* * * END OF SECTION * * *

SECTION 11353

PUMP SYSTEM PIPING

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2.02 Support and Thrust Blocking

PART 3 - EXECUTION

3.01 Cleaning
3.02 Hydrostatic Testing
3.03 Preparation for Shipment

SECTION 11353

PUMP SYSTEM PIPING

PART 1 - GENERAL

1.01 Scope:

Pump system shall be piped and pressure tested by manufacturer prior to shipment. Piping shall conform to applicable codes. Refer to Division 15.

1.02 Related Requirements Specified Elsewhere:

A. General Conditions: Division 1

B. General Provisions: Section 01110

C. Pumping System Equipment:

1. Pump Station Electrical: Section 11354

PART 2 - PRODUCTS

2.01 Piping Schedule:

A. Service: Pumped Waste (Inside Pump Station).

B. Lift Station:

a. Operating Pressure: 100 psig

b. Temperature: 100 degrees F.

C. Pipe:

4" thru 12"	Ductile Iron, Class 50, flanged ends ANSI/AWWA-C115/A21.15, ANSI/AWWA-C151/21.51

D. Joints: Flanged ANSI/AWWA-C115/A21.15

E. Fittings:

4" thru 12"	Cast iron, flanged ends. ANSI/AWWA-C110/A21.10

F. Flanges: 250# Ductile Iron, ANSI/AWWA - C115/A21.15.

G. Gaskets: Ring Type.

H. Bolts and Nuts: Machine bolts with hex nuts, regular series, Grade B.

I. Valves:

1. Eccentric Plug Valve:

4-inch	Specifically designed for sewage applications with 100% port opening (equal to pipe). Iron body and plug, Buna-N rubber coating on plug to minimize wear and corrosion, replaceable bronze seats. Seat rings shall seal at required pressures and with reverse pressures where required. Flanged ends ANSI B16.1. Fixed hand-wheel operator.
6" thru 12"	Specifically designed for sewage applications with 100% port opening (equal to pipe). Iron body and plug, Buna-N rubber coating on plug to minimize wear and corrosion, replaceable bronze seats. Seat rings shall seal at required pressures and with reverse pressures where required. Flanged ends ANSI B16.1. Fixed hand-wheel operator.

3. Check Valve - 4" x 8":

a. Cast iron body.

b. Fitted with external lever and spring.

c. Bronze body ring threaded into valve port.

d. Valve clapper shall be cast iron, bronze face, and shall swing completely clear of waterway when valve is full open.

e. Hinge pin shall be of 18-8 stainless steel construction and shall be utilized with bronze bushings and O-ring seals.

f. Valves shall be equipped with removable cover plate to permit entry of for complete removal of internal components without removing valve from line.

g. Valve Rating: 175 psi water working pressure, 350 psi hydrostatic test pressure.

2.02 Support and Thrust Blocking:

Support pipes to isolate piping loads from pumps. See details on Drawings.

PART 3 - EXECUTION

3.01 Cleaning:

Flush internals of pipe, valves, strainers, etc., with water of sufficient velocity and quantity that will dislodge sediment or dirt that has accidentally entered the system.

3.02 Hydrostatic Test:

A. Test Procedure:

1. After flushing, fill system with water, venting off entrapped air at high points of system.

2. Apply hydrostatic pressure to 1-1/2 times the operating pressure or 150 psig.

3. Hold test pressure for 30 minutes. Inspect to determine there is not a visible leak or significant pressure variation..

4. If hydrostatic test is satisfactory, drain pipe.

B. Repair of Leaks:

1. Retightenign flanged bolts and/or replacing gasket.

2. After repairs, system shall be retested.

3.03 Preparation for Shipment:

A. Package unti to protect piping from damage during shipment or installation.

B. Provide closures and supports for piping ports.

C. Support pipe extensions beyond pump chamber.

* * * END OF SECTION * * *

SECTION 11362

INDIVIDUAL SERVICE PUMP

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2.03 Motor
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2.06 Slide Coupling

PART 3 - EXECUTION

3.01 Installation
3.02 Start-Up
3.03 Site Restoration

SECTION 11362

INDIVIDUAL SERVICE PUMP

PART 1 - GENERAL

1.01 Description:

In locations where septic tanks do not drain by gravity to SDG Main, furnish and install Septic Tank Effluent Pump-Slide Coupling Package System, complete with all required equipment factory installed or field assembled. Principle items of equipment include centrifugal submersible effluent pump, mercury level controls, slide coupling, starter control panel, fiberglass reinforced polyester basin with cover, junction box, gate valve, check valve, piping, fittings, and slide rails.

1.02 Related Requirements Specified Elsewhere:

A. Earthwork for Utilities: Section 02220

B. Water and Pressure Sewer Lines: Section 02556

C. Sanitary Sewer: Section 02570

1.03 Quality Assurance:

A. Furnish pump station package factory assembled. Each package unit shall be by same manufacturer.

B. Equipment shall comply with applicable codes.

1.04 Submittals:

Submit schedule of package units indicating pump sizes and basin dimensions with Shop Drawings.

1.05 Product Handling:

A. Store package in dry heated area under cover until installation.

B. Maintain equipment upon installation until collection system is placed into service by Owner.

PART 2 - PRODUCTS

2.01 Operating Conditions:

Individual service pumps shall have the following characteristics:

A. Design Capacity: Ten gallons per minute (10 gpm).

B. Discharge: Two and one half inch (2-1/2") force main.

C. STEP pump head and H.P. requirements:

T.D.H.	Max. H.P.	Min. RPH	Voltage
15'	1/3	1750	115

D. Spherical solid handling capability: 2-inch nominal.

2.02 Pumping Unit:

A. Pump Construction:

1. Pump Body, Motor Housing and Intermediate Coupling: High quality cast iron.

2. Finished Coat: Air dry enamel.

3. Exposed Hardware: Corrosion-resistant stainless steel.

4. Vertical Pump Discharge: 2-1/2" NPT

B. Seal:

1. Double tandem mechanical type.

2. Upper seal shall run in oil-filled chamber.

3. Lower seal shall run in pumped fluid.

4. Fabrication: Ceramic and carbon faces and stainless steel metal parts.

C. Impeller:

1. Enclosed single vane molded of polypropylene.

2. Threaded stainless steel drive insert and stainless steel wear sleeve.

2.03 Motor:

A. Submersible motor constructed with open windings to operate in clean dielectric oil for cooling windings and lubricating bearings.

B. Motor windings shall be Class B insulation.

C. Thrust bearing shall be of ball type; upper radial bearing shall be sleeve type with permanent lubrication.

D. Motor shaft shall be stainless steel construction.

E. Single phase motors shall be of permanent split capacitor design with overload protection in motor.

F. No motor starting switch shall be located within motor.

2.04 Electrical Installation:

A. Level Controls:

1. Three sealed mercury switches constructed in solid polyurethane shell, complete with ten (10) feet of conductor cord.

2. One switch shall start pump and second one shall turn off pump.

3. Level controls shall be clamped to piping as shown on drawing.

B. Starter Control Panel:

1. Enclosure - NEMA 3 for outside mounting.

2. Starter: 115/230 volt, single phase start control, line circuit breakers, horsepower rated motor contactor, control fuses, terminal blocks for level controls, hand-off-auto selector switch and amber run light.

3. Tamperproof, fully gasketed door, with two padlockable door latches.

C. Appurtenances:

1. Moisture Sensor.

2. Alarm:

a. Audio-visual high water alarm, panel mounted.

b. Mounted in separate NEMA 3 enclosures.

c. Alarm shall be activated by mercury level control.

3. Running Time Meter.

D. Electrical Power Cord: Furnish electrical power cord, three conductors, No. 12, Type SOG, 100-feet or as required to complete electrical installation.

2.05 Basin:

A. FRP Construction:

1. Custom molded of fiberglass reinforced polyester resin, nominal wall thickness of 3/16 inches.

2. Basin Dimensions:

a. Diameter: 48 inches
b. Depth: 48 inches

3. Gravity Connection: 4-inch plastic pipe adapter securely fastened to tank with stainless steel bolts and nuts, and leaktight, located 30-inches above basin floor.

B. Contractor's Option: Precast concrete pipe wet well, conforming to A.S.T.M. C76, Class I.

C. Basin Cover:

1. Cast iron or ABS, 18-inch effective opening x 1/4-inch minimum plate.

2. Sandblast cast iron cover. Coat interior and exterior with tar base corrosion-resistent epoxy paint.

2.06 Slide Coupling:

Fit basin with a hydraulic sealed slide coupling arrangement without draining or entering the basin wet well to permit installation and removal of pump unit.

PART 3 - EXECUTION

3.01 Installation:

A. Excavation: Over excavate basin pit 6-inches below basin floor and provide granular cushion.

B. System Set Up: Ballast basin to prevent flotation. Install unit true and plumb. Furnish and install adapter fittings to provide watertight connections at inlet and discharge pipe. Complete piping to 25-feet outside basin.

C. Backfill: Backfill and compact soils in 2-foot lifts to 6-inches above original grade. Support pipes during backfill.

D. Electrical Work: Complete electrical installation by connection to closest residence serviced. Ground electrical equipment. All work shall conform to National Electric Code. Where electrical service run exceeds 100-feet, verify line size for pump amperage and voltage drop.

3.02 Start-Up:

A. Pressure test all piping and fittings.

B. Dry test and wet test pump units.

C. Place STEP system into service. Equipment warranty will commence upon thirty (30) days successful operation.

3.03 Site Restoration:

A. Maintain site during construction to minimize area disruption. Mound soils over excavation as required for settlement and mulch site. Dispose of excess materials.

B. Clean up, grade and seed site. Restore area to original condition or better.

*** * * END OF SECTION * * ***