DELAWARE COUNTY REGIONAL SEWER DISTRICT

CONSTRUCTION
and
MATERIALS SPECIFICATIONS

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CHAPTER I - GENERAL PROVISIONS

101 Scope

These specifications shall govern all construction performed and materials used in conjunction with constructing, installing, maintaining, and operating wastewater systems which will be privately owned and operated or publicly owned, operated, and maintained by the Delaware County Regional Sewer District (District), including service lines and components that convey wastewater to the District's systems, except when these specifications are superseded by more stringent requirements or specifications of another governing agency or government having jurisdiction of the work being performed.

102 Plans and Specifications

The location and nature of the work shall be shown in a set of construction drawings which shall be submitted and approved by the District. These specifications and the construction drawings prepared for the work are intended to be complete. Anything called for in the specifications and not shown on the construction drawings or shown on the construction drawings and not called for in the specifications must be furnished by the Contractor as though appearing in both the construction drawings and specifications. If there is an apparent conflict or a conflict in fact between sections of the specifications or the specifications and the construction drawings as approved by the District, the most stringent information and interpretation shall prevail, subject to the discretion of the Sanitary Engineer.

103 Reference Specifications and Drawings

When the American Society for Testing Material (ASTM Specifications), State of Ohio Department of Transportation Construction and Material Specifications (ODOT CMS), Ohio Environmental Protection Agency (OEPA), and/or other specifications and standard drawings are referred to, such references shall be to the latest edition in effect on the date the construction drawings are approved (signed) by the District, unless otherwise noted. When such references are made, said specifications and drawings shall become a part of these specifications.

104 Developer / Landowner to Meet Contractor Responsibilities

When a Developer/Landowner wishes to develop land by installing or causing the installation of sewer systems, which are intended to be privately owned and operated or publicly owned, operated, and maintained by the District, the Developer/Landowner shall be responsible to the District for all things listed in the specifications as Contractor responsibilities.

105 Definitions

Whenever the words defined in this paragraph, or pronouns used in their stead, occur in these specifications, they shall have the meaning herein given:

105.01 Abbreviations: Whenever the following abbreviations are used in these specifications or on the construction drawings, they are to be construed as meaning the following:

Abbreviation Table	
Organization	**Abbreviation**
American Association of State Highway and Transportation Officials	AASHTO
American Concrete Institute	ACI
American National Standards Institute	ANSI
American Society for Testing and Materials	ASTM
American Public Water Association	APWA
American Water Works Association	AWWA
Code of Federal Register	CFR
Delaware County Engineer's Office	DCEO
Delaware County Regional Sewer District	District
Ohio Department of Commerce	ODOC
State of Ohio, Department of Transportation, Construction and Material Specifications	ODOT CMS
Ohio Environmental Protection Agency	OEPA
United States Environmental Protection Agency	EPA
United States Army Corps of Engineers	USACE
Water Environment Federation	WEF

105.02 Contract: An agreement between the Contractor and the Owner for the purpose of completing the project.

105.03 Contractor: The party entering into a contract, or authorized representatives legally empowered to act on that party's behalf, and to perform construction of the improvements.

105.04 Subdivider's Agreement: A contract executed between the District and Owner/Developer that outlines the guidelines to be followed for construction of wastewater infrastructure.

105.05 District: As formed under the Ohio Revised Code, Chapter 6117, the Delaware County Regional Sewer District.

105.06 Field Inspector: A person authorized by the District to observe the project during its construction for general compliance with the construction drawings and these specifications.

105.07 Rules and Regulations: Established guidelines to regulate sanitary sewers within the jurisdiction of the Delaware County Regional Sewer District.

105.08 Sanitary Engineer: The Sanitary Engineer or a duly authorized representative of the District, to act as the contact between the District and the Contractor, to administer the contract at the direction of the District.

105.09 Specifications: The latest edition of these Construction and Material Specifications in effect on the date the construction drawings are approved (signed) by the District, the specifications included with the construction

drawings, and any other requirements referenced in the specifications or construction drawings.

105.10 Subcontractor: All persons, partnerships or corporations having contracts awarded them by the Contractor or other Subcontractors, to do or perform any part of the work.

105.11 Improvements: All of the work to be executed and finished by one or more Contractors in accordance with these specifications and the construction drawings as approved by the District. Improvements are synonymous with "The Work" or "The Project".

106 Samples and Shop Drawings

Material samples, if required, a list of suppliers, and such shop drawings, sketches, specifications, and descriptions required to establish compliance with these specifications shall be submitted to the Sanitary Engineer and approved prior to ordering, installing or using any equipment or material. Submission should be made at least 14 days prior to the date that approval is required. Construction cannot commence prior to approval of samples and shop drawings.

107 Quality of Materials

Wherever particular brands or makes of material, devices, or equipment are shown or specified, such items shall be regarded as standard. Any other brand or make of material, device, or equipment which, in the opinion of the Sanitary Engineer, is the equivalent to that specified in quality, workmanship, economy of operation, and suitability for the purpose intended, shall be accepted. Acceptances of such items shall not be construed to remove the Contractor's responsibility to provide a complete, usable facility as specified herein and shown on the construction drawings.

108 Project Control

108.01 Authority of the Sanitary Engineer: The Sanitary Engineer shall observe the progress and quality of the improvements during construction and determine if the Contractor's work is in general conformity with the construction documents. Based on onsite observations, the Sanitary Engineer shall endeavor to guard the District against apparent defects and deficiencies in the permanent work constructed by the Contractor, but does not guarantee the performance of the Contractor. The Sanitary Engineer is not responsible for construction means, methods, techniques, sequences, procedures, time of performance, programs, or for any safety precautions needed for the construction work. The Sanitary Engineer is not responsible for the Contractor's failure to execute the work in accordance with these specifications or the construction drawings. In making the construction observations as described herein:

a) The Sanitary Engineer shall receive and make recommendations on all questions of fact which may arise, including the quantity, quality, or suitability of materials and equipment furnished, the work performance, and the rate of progress of the work.

b) The Sanitary Engineer may correct any apparent or actual errors or omissions when such corrections are necessary for the proper fulfillment of the intention of the specifications and construction drawings.
c) Failure of the Sanitary Engineer to observe or recommend rejection of any defective, unauthorized, or non-conforming work or materials, shall not in any way prevent later rejection when such defective, unauthorized or non-conforming work or materials are discovered, nor obligate the District to final acceptance.
d) The Sanitary Engineer may suspend work wholly or in part due to the failure of the Contractor to correct conditions unsafe for workers or the general public, for failure to carry out provisions of the contract, and/or to carry out orders.
e) The Sanitary Engineer may suspend work for such periods as deemed necessary due to adverse weather conditions, conditions considered adverse to the performance of the work, or for any other condition or reason deemed to be in the public's best interest.

108.02 Control of Work and Materials: All work and materials shall be subject to review by the Sanitary Engineer. The Sanitary Engineer or representatives shall be provided access to all parts of the work and shall be provided such information and assistance by the Contractor as is required to complete his review. The Sanitary Engineer shall call the attention of the Contractor to any observed failure of the work or materials to conform to the specifications or construction drawings. Should the Contractor fail to comply with these specifications or construction drawings, fail to provide certificates and/or proof of the suitability of materials or fail to prosecute the work in a diligent and good workmanlike manner, the Sanitary Engineer may recommend to the District that the Contractor's operation be suspended on any or all portions of the project until such unauthorized, non-reviewed, or defective work or materials are corrected.

108.03 Testing of Equipment and Materials: The taking of samples, testing of soils and concrete, and all other tests required by these specifications or because of the lack of certificates or proof of suitability of any materials shall be performed at no expense to the District and all costs shall be borne by the Contractor. All equipment and materials that have passed the prescribed tests may be incorporated in the work, provided that said equipment and materials meet all other requirements of the specifications and the construction drawings.

108.04 Watertight Structures: All structures to be used for holding water shall be made watertight and shall be tested by filling with water before they will be accepted. Tests of concrete waterbearing basins shall be made before backfill is placed, however, where special reasons make this impractical the Sanitary Engineer may permit backfilling to proceed before the test is made. Permission to backfill shall not relieve the Contractor of any responsibility for watertightness of the structures and if upon making the test the need to remove backfill arises, it shall be done by and at the expense of the Contractor.

108.05 Plans and Work Drawings: The Contractor shall keep a complete set of construction drawings and shop drawings on the project site at all times for the use of those legitimately interested.

108.06 Construction Layout Stakes: Stakes showing the lines and grades necessary for the completion of the project will be provided by a licensed surveyor. The establishing of horizontal and vertical controls for the applicable items of work and the final measuring are the basic items to be provided. Cut-sheets in a format acceptable to the Sanitary Engineer shall be provided for all sewer line installations.

108.07 Authority and Duties of the Field Inspector: Inspectors employed by the District or their designated agents will be authorized to inspect all work done and materials furnished. Such inspection extends to all or any part of the work and to the preparation, fabrication or manufacture of the materials to be used. The Inspector is not authorized to alter or waive the provisions of the contract. The Inspector is authorized to call the attention of the Contractor to any failure of the work or materials to conform to the specifications and construction drawings. The Inspector is authorized to reject materials which do not meet specification requirements or suspend the portion of the work involved until any question at issue can be referred to and decided by the Sanitary Engineer. The Inspector is not authorized to issue instructions contrary to the specifications and construction drawings or to act for the Contractor.

108.08 Inspection Notice and Fees:

a) The Contractor shall give at least 48 hours notice, excluding weekends and holidays, to the District for any inspection to be conducted. The Contractor shall furthermore insure that no work shall be covered or obscured prior to inspection and acceptance by the District Inspectors. The Sanitary Engineer, the Sanitary Engineer's authorized designee, or the Inspector may order work to be uncovered or exposed, and the District shall have no liability for the costs or expenses incurred as a result of work being uncovered or exposed.
b) The Developer of a subdivision shall, prior to the start of construction, pay the amount set forth in the Subdivider's Agreement to cover the cost of inspecting the improvements. As the project progresses, if additional inspection money is required, it will be requested by the District.

109 Maintenance Guarantee

All material and equipment placed and installed under these specifications shall be guaranteed by the Contractor against defects of material, workmanship, and design for a period of at least 5 years after the completion of the work and acceptance by the District. Failure of the Contractor to rectify damage, improper design, faulty workmanship and materials as supplied by him and shown by test to be deficient within 5 years' operation, shall entitle the District to proceed against the Contractor for the cost of making good the obligation.

110 Service of Manufacturer's Representative

When required by the construction drawings or specifications, the services of competent and experienced manufacturer's representatives shall be furnished to supervise the initial installation of material and equipment as well as to provide start-up and operational instructions to the District personnel. Where the supervision by a manufacturer's representative is not called for, the Contractor is not relieved of his responsibility to properly construct or install material in accordance with the terms of these specifications or to provide start-up and operational instructions.

111 Notices

Notice shall mean written notice. Written notice shall be deemed to have been duly served when delivered in person to the person, firm, officer, agent or representative, or when delivered at the last known business address of such person, firm or corporation, or when enclosed in a postage prepaid wrapper or envelope addressed to such person, firm, or corporation at his, their, or its last known business address and sent by registered mail with return receipt requested.

112 Sanitary Regulations

Suitable on-site sanitary conveniences for the use of all persons employed on the project, properly screened from public observation, shall be provided and maintained by the Contractor. The Contractor shall obey and enforce such other sanitary regulations and orders and shall take such precautions against infectious diseases as may be deemed necessary by the District.

113 Access to Abutting Properties

The Contractor shall provide and maintain temporary access to all properties where access is interrupted by his construction operations.

114 Inclement Weather Conditions

All work which will be adversely affected by climatic conditions such as rain, wind, frost or temperature, or in the event that the site conditions are not acceptable for installation (mud, cold, etc.), shall be suspended at the discretion of the District. Whenever work proceeds under such conditions, the Contractor shall provide approved facilities for protecting all the materials and the finished work. This shall include heating of materials if required for proper installation. No materials shall be installed during climatic conditions that do not meet said manufacturer’s recommendations.

115 Timbering Order Left in Place

In case any timbering, sheathing or bracing used in shoring trenches or other excavations is ordered left in place by the Sanitary Engineer, it shall be cut off as directed.

116 Utility Costs

The Contractor shall pay for the installation and use of all utilities such as water, gas, and electric service during construction and until final acceptance of the project by the District.

117 Compliance with Laws

The Contractor shall include, in all contracts for work on the project, provisions requiring the Contractor or Subcontractor to:

117.01 Comply with all applicable laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss.

117.02 Erect and maintain, as required by existing conditions and progress of the project, all necessary safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Owners and Users of adjacent utilities.

117.03 Guard all machinery and equipment.

117.04 Guard or eliminate all hazards in accordance with the safety provisions of applicable state and federal laws, orders, findings, and regulations.

117.05 Exercise the utmost care and provide supervision from properly qualified personnel when using or storing explosives, paint, or other hazardous materials or equipment.

118 Protection of Finished Work

The Contractor shall be held responsible for any and all materials or work and shall be required to make good, at his own cost, any injury or damage which said materials or work may sustain from any source or cause whatever, before final acceptance thereof. This includes the Contractor’s responsibility to mark utilities at the work site in order to protect the Contractor’s materials or work.

119 Contractor Not Released by Subcontractors

No Subcontractors shall under any circumstances relieve the Contractor of his liabilities and obligations to fulfill the requirements of these specifications.

120 Field Office

All contracts that are let and administered by the District, when required in the project specifications and/or construction drawings, shall have provided and maintained a field office of at least 150 square feet, located conveniently to the work in which a separate desk, chair, file cabinet, telephone, light, and heat shall be provided for the exclusive use of the Sanitary Engineer. The office may be part of the Contractor's office; however, the Sanitary Engineer’s office shall be separated by doors and partitions to provide a soundproof barrier between the two offices and the offices shall have separate entrances from the outside. On projects by private developers, an office may be provided but is not required.

121 Safety and Health Provisions

The Contractor is bound by all provisions of the Federal Occupational Safety and Health Act of 1970 (OSHA), and all other applicable federal, state, and local laws, regulations, findings, and orders relating to safety and health conditions on the work site.

Construction methods shall be consistent with the Occupational Safety and Health Administration (OSHA) amended Construction Standards for Excavations, 29 CFR Part 1926, sub-part P, effective March 5, 1990 and amendments thereto.

122 Substitutions

Whenever a material, article, or piece of equipment is identified on the Plans by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality, and function may be considered.

The Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the agreement by reference to brand name or catalogue number, and if, in the opinion of the Sanitary Engineer, such material, article, or piece of equipment is of equal substance and function to that specified, the Sanitary Engineer may approve its substitution and use by the Contractor.

123 Deeds and Easements

It is the responsibility of the Owner/Developer to acquire all necessary deeds and easements (both temporary and permanent) and present a copy of the recorded deed or easement to the Sanitary Engineer prior to the start of construction.

124 Sanitary Sewer Main Access Road

Sanitary Sewer Main Access Roads shall be required in circumstances where District maintenance vehicles will be unable to park close enough to a proposed or existing manhole (onsite or offsite) to provide proper maintenance. Generally, access roads may be comprised of ten (10) inches of ODOT Item 410, Type C constructed over geotextile fabric; however, varying soil or site conditions may necessitate a paved access road. All access roads shall have a minimum width of twelve (12) feet and shall include a turn-around area at their termination. In some circumstances, a permanent culvert may need to be installed to allow for such access. All permits required for the installation of any culverts are the responsibility of the Owner/Developer. The Owner/Developer shall also provide any sewer access easements necessary through the site to allow District to perform maintenance activities.

125 Pre-Construction Meeting

The following list must be provided to the Sanitary Engineer or Construction Coordinator prior to scheduling:

1) Ohio EPA approval.
2) Signed Sub-dividers' agreement.
3) Three (3) copies of plans two (2) days prior to the meeting and cut sheets (shop drawings) two (2) days prior to starting work.
4) All development fees must be paid in full before scheduling.
5) Any and all permits and approved Stormwater Pollution Prevention Plan required to start construction.
6) Any and all offsite easements necessary to complete the work.
7) Construction bond and other financial surety.

Meetings will be scheduled with the Sanitary Engineer and/or Construction Coordinator. A representative from the Owner/Developer, Design Engineer, and Contractor will be required to attend meetings unless directed by the Sanitary Engineer or Construction Coordinator.

126 Protection of Trees

Special care shall be taken to avoid damages to trees and their root system. Machine excavation shall not be used when, in the opinion of the Sanitary Engineer, it would endanger tree roots. The operation of all equipment shall be conducted in a manner which will not injure trees, trunks, branches, or their roots. Removal of trees must be approved by the Sanitary Engineer.

127 Final Acceptance/Project Closeout

Upon completion of construction and testing of improvements, owner shall request final inspection and approval from the District. The District shall conduct television inspection and visual inspection and submit list of corrective items to owner for remedy (may include cleaning of sewers as required) upon completion of the inspections. The Delaware County Board of Commissioners shall, upon certification in writing from the Delaware County Sanitary Engineer that all construction is complete according to the plans and specifications, by Resolution, accept the improvements and accept and assume operations and maintenance of the improvements.

The owner shall within thirty (30) days following completion of construction of the improvements, and prior to final acceptance, furnish to the District as required:

1) "As built" drawings of the Improvements which plans shall become the property of the County and shall remain in the office of the Delaware County Sanitary Engineer and Delaware County Engineer and/or the City of Powell. The drawings shall be on reproducible Mylar (full size), two paper copies (one full size & one 11”x17”), and a Compact Diskette with the plans in .DWG format & .PDF format.
2) An Excel spreadsheet, from the current template as provided by the Delaware County Sanitary Engineer’s website, shall accompany the plan submittal showing the locations of the manholes in Ohio State Plane North Coordinates NAD 1983 (NAVD 1988 datum) and other miscellaneous project data.
3) An itemized statement showing the cost of the improvements.
4) An Affidavit or waiver of lien from all contractors associated with the project that all material and labor costs have been paid. The owner shall indemnify and hold harmless the County from expenses or claims for labor or materials incident to the construction of the Improvements.
5) Documentation showing the required sanitary easements.
6) Equipment, spare parts, operation & maintenance manuals, and additional warranties.

CHAPTER II - CONSTRUCTION MATERIALS

201 General

All material furnished by the Contractor shall conform to the minimum requirements of the latest edition of any referenced specifications in effect on the date the construction drawings are approved (signed) by the District.

201.01 When requested by the District, the manufacturer, producer or supplier shall furnish a sworn statement that the inspections of all the specified materials have been made and that the results comply with the requirements of these specifications, or shall furnish certified copies of these tests results. No material shall be used until approved by the District.

202 Samples

The Contractor may be required to furnish samples of any or all materials and equipment he proposes to use which are subject to these specifications. Approval of any samples shall not be taken to change or modify any specification requirement. After a material or equipment has been approved, no change in brand or make shall be permitted without prior approval. Failure of any material or equipment to pass the specified tests will be sufficient cause for refusal to consider any further samples of the same brand of that material or equipment for use under these specifications. The District may take test samples from the various materials or equipment delivered to the site of the work by the Contractor whether previously approved for construction or not. Any material or equipment which fails to meet the requirements of these specifications shall be subject to removal and replacement by the Contractor with material or equipment meeting the requirements of these specifications.

203 Aggregate

Aggregate shall conform to the following items:

203.01 Aggregate for concrete shall meet the requirements of ODOT CMS Item 703.02.

203.02 Fine Aggregate for mortar shall meet the requirements of ODOT CMS Item 703.03.

203.03 Stone Aggregate shall conform in all respects to the specific kind described under ODOT CMS Item 703.

204 Brick and Masonry Units

All units shall conform to the requirements of ODOT CMS Item 704.

205 Cement and Concrete

205.01 Concrete shall conform to ODOT CMS Items 499.02 and 499.03.

205.02 Cement for mortar shall be as specified under the appropriate requirement for ODOT CMS Item 701.

205.03 Concrete incidentals shall conform to ODOT CMS Item 705.

205.04 Reinforcing steel shall be deformed bars conforming to ODOT CMS Items 709.01, 709.03 or 709.05. Bar mats and wire fabric shall conform to ODOT CMS Items 709.09, 709.10, or 709.12. The bar size number is specified on the construction drawings or on the standard drawings. The Contractor shall adhere to the methods of caring for, placing, bending, splicing, supporting, and protectively coating reinforcing steel as required by ODOT CMS Item 509.

206 Fence

All fabric, posts, wire fasteners, and incidental materials shall conform to ODOT CMS Item 710.

207 Iron, Steel, Metals, and Incidental Materials

207.01 All iron casting, structural steel, miscellaneous metals, and incidental materials shall meet the requirements of ODOT CMS Item 711.

207.02 Manhole steps shall be made of reinforced polypropylene plastic conforming to ODOT CMS Item 711.31. The steps shall be spaced as shown on the standard drawings or the construction drawings and cast or driven into walls of pre-cast risers and concave sections or mortared with a non-shrinking grout.

208 Sewer Pipe

All pipe, fittings, appurtenances, and fittings shall be no longer than one (1) year from date of manufacture prior to use.

208.01 Polyvinyl Chloride (PVC):

a) Pipe:

1) For sizes up to and including 15 inches in diameter, PVC pipe shall conform to ASTM D 3034 SDR 35, with a cell classification of 12454 as defined by ASTM D 1784, and joints meeting ASTM D 3212 and gaskets meeting ASTM F 477. For depths greater than 20 feet, SDR 26 shall be used.
2) For sizes 18 inches in diameter and larger, the PVC pipe shall conform to ASTM F 679 (PS 46), with a cell classification of 12454 as defined by ASTM D 1784, and joints meeting ASTM D 3212 and gaskets meeting ASTM F 477. For depths greater than 20 feet, PS 115 (SDR 26) shall be used as shown on the drawings.
3) For depths greater than 28 feet, C-900 or C-905 pipe with a cell classification of 12454, as defined by ASTM D 1784, and joints

meeting ASTM D-3139 and gaskets meeting ASTM F 477 shall be used as shown on the drawings.

b) Fittings:

1) Contractor shall provide factory certification of fitting classification and SDR rating.
2) For sizes up to 15 inches in diameter, PVC pipe fittings shall conform to SDR 35 gasketed heavy wall sewer fittings meeting ASTM D 3034 and ASTM F 1336, with a cell classification of 12454. For depths greater than 20 feet SDR 26 fittings are required.
3) For sizes 10 inches and smaller, a one-piece molded fitting is required.
4) For sizes 18 inches in diameter and larger, PVC pipe fittings shall conform to SDR 35 gasketed heavy wall sewer fittings meeting ASTM F 679 and ASTM F 1336, with a cell classification of 12454. For depths greater than 20 feet SDR 26 fittings are required.

208.02 Ductile Iron Pipe: All ductile iron pipe shall conform to AWWA C151, with joints conforming to AWWA C111, with Protecto 401 epoxy ceramic coating.

208.03 Polypropylene Pipe: For sizes 18 inches in diameter and larger, pipe and fittings shall conform to ASTM 2764, with joints meeting ASTM D 3212. Pipe diameters from 18" to 30" dual-wall shall have smooth interior and exterior annular corrugations. Pipe diameters from 30" to 60" triple-wall shall have smooth interiors and exterior annular corrugations. Pipe shall be joined with a gasketed integral bell and spigot joint meeting the requirements of ASTM F2764. Pipe shall be watertight according to the requirements of ASTM D3212. Spigot shall have two (2) gaskets meeting the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable protective wrap. For depths greater than 20 feet, the Contractor shall provide applicable AASHTO LRFD Section 12 design calculations confirming the engineering design. Use of HDPE pipe shall be approved by the Sanitary Engineer.

208.04 Adaptors for connecting pipes of dissimilar material and size and for connecting broken or cut sewer pipe shall be equivalent to those supplied by Fernco, Inc. Main line adaptors shall be rigid style and services may be flexible style. Each application shall be approved by the District on a case-by-case basis.

209 Manholes, Catch Basins, Inlets, and Junction Chambers

All materials used in the construction or fabrication of manholes, catch basins, inlets, junction chambers, and other miscellaneous structures pertinent to sewer construction shall conform to ODOT CMS Item 604.02. All manholes and junction chambers for sanitary sewers shall be precast in accordance with ODOT CMS Item 706.13 unless otherwise approved by the District. All manhole, vault, and chamber joints shall be sealed with Conseal CS-202 or equivalent. The Sanitary Engineer may require an inside coating of cementitious or epoxy lining on manholes that contain a force main discharge connection or are downstream of a force main connected manhole. The cementitious or epoxy product shall be a coating system as required by the District. All lids for manholes

located in either the floodway or 100-year Flood Plain Zone shall have a watertight bolt down lid, Neenah R-1916-C.

210 Sewer Pressure Pipe

210.01 Ductile iron pipe shall be Class 53 and conform to AWWA C151 with a minimum working pressure of 350 psi with joints conforming to AWWA C111. Protecto® 401 ceramic epoxy lining of ductile iron pipe and fittings may also be required by the Sanitary Engineer.

210.02 PVC SDR 21 ASTM D 2241, ASTM 1483 with a cell classification of 12454 and joints in accordance with ASTM D 3139 and gaskets in accordance with ASTM F 477.

210.03 PVC AWWA C 900 DR18, AWWA C909 CL 235, with a cell classification as defined in ASTM D1784 of 12454.

210.04 High Density Polyethylene (HDPE) AWWA C901 or C906 ASTM PE 4710 DR11.

210.05 Fittings shall be ductile iron conforming to either ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. Fittings shall have a standard asphaltic coating on the exterior. Tapping sleeves shall be per Section 216.05 of these specifications.

210.06 Metallic detectable underground 12-gauge wire shall be installed below and within six (6) inches of all sewer force mains. Wire shall be green as specified by the APWA color code. At all valves, line beginnings and ends, wire shall be clamped to a three (3) foot piece of rebar with a brass clamp. The rebar shall be set vertically next to the valve or the structure and stand two (2) inches above ground. Wire shall be brought to the ground surface every 500 feet or at all air release valves. Locations shall be marked in the field with a valve box marked “Sewer”.

210.07 Metallic detectable underground marking tape shall be installed above all sanitary sewer forcemains. Tape shall be green as specified by the APWA color code and shall be a minimum of 3 inches in width. The tape shall bear the words “CAUTION…FORCE MAIN” permanently printed on the tape. Tape shall be installed 18 inches to 24 inches below grade.

211 Underdrains

Underdrains shall conform to the following specifications:

211.01 Perforated Concrete Pipe, ODOT CMS Item 706.06.

211.02 Concrete Drain Tile, ODOT CMS Item 706.07.

211.03 Vitrified Clay Pipe, ODOT CMS Item 706.08.

211.04 Clay Drain Tile, ODOT CMS Item 706.09.

211.05 Perforated Polyvinyl Chloride Pipe, ODOT CMS Item 707.41.

211.06 Heavy Duty Corrugated Polyethylene Slotted Drain, ASTM F 465.

212 Steel Casing Pipe

Casing pipe shall be steel pipe meeting ASTM specifications, 35,000 psi yield strength and 60,000 psi tensile strength, or approved equivalent, to serve as a casing for sewer and shall be installed within the limits and at the location shown on the construction drawings. Steel casing pipe shall have a minimum wall thickness as indicated on the Standard Construction Drawings, unless otherwise approved by the Sanitary Engineer. Casing spacers shall be Advanced Products & Systems, Model SSI Stainless Steel, used in positioning the carrier pipe within the casing pipe. Casing spacers must achieve a tight fit between the carrier pipe and the casing. Grout meeting ODOT Item 613 or clean sand meeting ODOT Item 703.03 shall be used to fill the annular space.

213 Valves

213.01 Gate valves shall have a non-rising stem, left hand open (counter-clockwise) with double O-ring stem seals. Valves shall have end joints conforming to AWWA C111. Valves shall pass a seat test at a pressure of 250 psi without leakage. The valve shell shall pass a shell test with the valve in the open position at a pressure of 400 psi without leakage through metal, flanged joints or stem seals. Additionally, the valves shall conform to one of the following:

a) AWWA C509 having a sealing mechanism that provides zero leakage at the water working pressure against line flow from either direction. No exposed metal seams, edges, screws, etc. shall be within the waterway in the closed position (all surfaces shall be rubber covered). The rubber covered gate shall not be wedged in a pocket nor slide across the seating surface to obtain tight closure. All internal and external ferrous surfaces, including the interior of the gate, bolt holes, and flange faces, shall be coated prior to assembly of the valve with epoxy having a minimum thickness of eight (8) mils. There shall be an O-ring seal above the storm collar, and an O-ring seal below the stem collar with the area between the O-ring seals filled with lubricant. There shall be anti-friction washers at the stem collar.

213.02 For valves two (2) inches and smaller, use Mueller A-2362 or approved equal. All valves 2 inch and smaller shall meet the same material specification requirements from 213.01.

213.03 Plug Valves shall be as follows:

a) Valve Construction
   1) Non-lubricated eccentric plug type with resilient plug faces and stainless steel or nickel alloy seat.
   2) Body and Plug Material: Cast iron, ASTM A 126-66, Class B.
   3) Bushing Material: Teflon-lined fiberglass or stainless steel, permanently lubricated upper and lower units.
   4) Stem Seals: Adjustable vee or dual O-ring; Buna-N.

5) Plug Facing: Buna-A or Hycar.

b) Manual Operators: Provide enclosed worm gear actuators on all chain-wheel and hand-wheel operated valves. Provide position indicator.

c) Manufacturer: Dezurik, Val-matic, or approved equal.

213.04 Air release valves shall be automatic sewage air release valves with 2" inlet and back flushing accessories. Valve and assembly shall be Vent-O-Mat Model 050RGX052, Serial Number 15239.

CHAPTER III - GENERAL CONSTRUCTION REQUIREMENTS

301 Description

This section describes the general work required for furnishing and installing underground conduits and the associated equipment, material, and labor necessary to provide complete and usable public and/or private sanitary sewers.

301.01 PVC pipe (Sect. 208.01) and polypropylene pipe (Sect. 208.03) shall be installed in accordance with ASTM D2321 "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications".

302 Trench Excavation

Trenches shall be excavated to a width sufficient to allow for proper jointing and placing of the conduit. To a point 24 inches above the top of the conduit, the trench walls shall be vertical and shall not exceed the dimensions shown on the construction drawings or the standard drawings. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers or the public, or obstruct sidewalks, driveways, roadways or other structures.

302.01 Unsuitable Material: The foundation for the conduit bed shall be firm for its full length. Where unsuitable material is encountered, it shall be removed to the depth directed by the District and for a width on each side equal to the diameter or span of the conduit and replaced with Type A or Type B backfill as defined in Section 305. Rock or boulders encountered at the conduit bed shall be removed at least six (6) inches below the bottom of the conduit and replaced with granular bedding.

302.02 The Contractor shall be responsible for undercutting of unsuitable material to a point 24 inches below the original grade for all District constructed and financed projects. Additional excavation beyond 24 inches, provided it is not due to the fault or neglect of the Contractor, shall be measured by the Sanitary Engineer, or their designee, and paid for as a change in work on all District constructed and financed projects. The Contractor is responsible for all undercutting on all development projects.

302.03 Conduit in Embankment: When a conduit is to be placed within an embankment or the top of the conduit is above the existing ground, the embankment shall be constructed to a point at least five (5) feet above the top of the conduit, in accordance with the requirements of ODOT CMS Item 203, before trenching for the conduit.

302.04 Excess Excavation: Unless otherwise stated on the construction drawings, the Contractor shall dispose of all excess excavation at his own expense. The

material shall be disposed of in a manner that meets all local, state, and federal regulations.

302.05 Blasting Procedures: When it is necessary to resort to blasting with explosives, the Contractor shall use the highest degree of care and adequate protective measures so as not to endanger life, completed portions of the project, and all other property, both public and private. Before conducting any blasting operations, the Contractor shall furnish the District, in writing, a schedule of intended blasting operations and shall give the District prior written notification of any changes in such schedule. Contractor is required to provide notification to the County, Township, and local authorities (Fire Dept, etc.) one (1) week prior to blasting. Local residents shall also be notified by mail. The responsibility of the Contractor with respect to the use of explosives in blasting includes compliance with all laws, rules, and regulations of local, state, and federal agencies, and the insurer which governs the storage, use, manufacturing, sale, handling, transportation, and other dispositions of explosives. The Contractor's operations shall be conducted with every precaution by trained, reliable personnel under satisfactory, experienced supervision. No blast shall be fired until all persons in the vicinity have had notice and reached positions out of danger. An on-site siren or air horn shall be sounded ten (10) minutes prior to daily blasting activities. The Contractor shall be responsible for any and all damages resulting from the use of explosives. All firing shall be done by electric means only, and the Contractor shall make suitable provisions to prevent the scattering of broken rock, earth, stones or other material during blasting operations.

a) All blasting operations shall be covered by public liability and property damage insurance with copies of such insurance certificates furnished to the District.
b) Except in the case of continuous tunnel operations, all blasting shall be limited to specified daylight hours.
c) Blasting in close proximity, as identified by the Sanitary Engineer, to District infrastructure requires pre- and post-blasting CCTV and internal investigation.

302.06 Pavement Removal: Removal of pavement and road surfaces shall be part of the trench excavation. The amount removed shall depend on the width of trench required for installation of the pipe and the dimensions of the area into which valves, manholes, or other structures will be installed. The dimensions of pavement removed shall not exceed the dimensions of the opening required for installation of pipe, valves, manholes or other structures by more than 4 feet in any direction, unless otherwise stipulated in the specifications. Methods such as sawing or drilling shall be used to ensure the removal of pavement along straight lines. All appropriate permits of local jurisdiction shall be secured by the Contractor prior to any pavement removal.

303 Removal of Water

The Contractor shall, at all times during construction, provide proper and satisfactory means and devices for the removal of all water entering the excavations and shall remove all such water as fast as it may collect in such a manner as shall not interfere with the prosecution of the work or the proper placing of masonry or other work. Discharges from

the trench dewatering system shall be directed away from the trench in order not to affect the trench stability and shall be filtered through appropriate siltation devices meeting local or state codes prior to entering drainage ways or streams. The Contractor shall not dispose of ground and/or surface water into newly constructed or existing water lines or sanitary sewers unless specifically approved by the District. The Contractor shall, at the end of each day, place a watertight plug or cap at the end of the last joint to prevent water and/or materials from entering the system. The plug or cap shall not be removed until the excavation is dewatered.

The Contractor shall submit a dewatering plan to the District prior to construction. The Contractor is responsible for all local, state, and federal withdrawal permits, reporting, and maintenance associated with the removal and discharge of said water. The Contractor will be required to clean all conduits that were utilized to convey and promote removal of water to the satisfaction of the District.

304 Bedding

All conduits shall be laid on bedding as described in these specifications and shown on the Standard Construction Drawings. Unless otherwise shown, bedding shall be Class B. Bedding material shall be used to backfill around the pipe as indicated in SCD Sa.S-2. The bedding classifications are as follows:

304.01 Class A bedding shall be granular material as shown on ODOT CMS Table 703.01-1, No. 57 "washed" stone aggregate, extending from a point six (6) inches below the bottom of the conduit to the springline of the conduit for rigid pipe or to a point twelve (12) inches above the top of the conduit for flexible pipe.

304.02 Class B Bedding shall be natural undisturbed soil free from stones larger than two (2) inches, topsoil, vegetation, debris, rubbish, peat or frozen material and shaped to fit the pipe with recesses shaped to receive the bell.

304.03 When the trench is excavated below the proposed grade the excess depth shall be filled with Class A or B Bedding material.

305 Backfill / Trench Dams

All trenches and excavations shall be backfilled as specified herein as soon after the sewers, force mains, or other structures are completed and the particular type of construction and the circumstances will permit.

305.01 The type of backfill shall be:

a) Type A: Granular material as specified in ODOT CMS Item 304 or 703.17, Aggregate Materials for 304 shall be required. For the top six (6) feet of the trench, backfill shall be ODOT CMS Item 304, from the pipe bedding to the level six (6) feet below the top of the trench, backfill shall consist of #4 stone meeting the requirements of ODOT CMS 703, Table 703.01.

b) Type B: Natural soil free from stones larger than two (2) inches across their greatest dimensions, topsoil, vegetation, debris, rubbish or frozen material.

305.02 Unless the type of backfill is specified herein or on the construction drawings as either Type A backfill, Type B backfill, or unless otherwise specified, it shall be understood to mean that Type A backfill is be used, whether actually specified on the construction drawings or not.

305.03 The backfill within the road right-of-way or for lines that are outside the right-of-way but to a depth of seven (7) feet from the edge of pavement and a 1-to-1 influence line shall be Type A.

305.04 When concrete bedding or encasement is used, the trench or excavation shall not be backfilled for at least 24 hours after placing the concrete, except that the conduit may be covered to a depth not to exceed twelve (12) inches to afford protection. The method employed in depositing the backfill shall be such as to prevent damage to the concrete cradle, sewer or other structures.

305.05 All backfilling operations and placement of the backfill material shall be conducted so as to protect the conduit, its appurtenances, and structures from damages. Equipment which will cause the trench loads to exceed the pipe strength, shall be kept at least five (5) feet away from the trench.

305.06 When Type A Backfill is called for, the material shall be placed in one (1) foot lifts and compacted using mechanical tampers so as to obtain 98 percent of its maximum, laboratory dry density. Approval of water prior to its use shall be obtained from the Sanitary Engineer. When Type B Backfill is called for, the backfill shall be carefully selected, carefully placed, and compacted per ODOT CMS Item 203, with the exception that Type B Backfill shall be compacted to 95% of its maximum dry density. Compaction tests shall be provided by the Contractor as requested by the District to verify backfill compaction complies with the District's requirements. The Contractor shall bear all costs for this work.

305.07 Regardless of the backfill method used or testing results obtained, the Contractor shall be responsible to correct any settlement or deterioration of the backfill and restore the area.

305.08 Concrete structures built in place shall not be backfilled until permitted by the Sanitary Engineer.

305.09 All Type A backfill shall be compacted by mechanical vibratory equipment.

305.10 Trench dams shall be required when specified in the construction plans or directed by the Sanitary Engineer. Trench dams shall consist of predominately clay soil or a mixture of predominately clay soil and bentonite. Trench dams are to be constructed on all sanitary sewer gravity main lines at intervals not to exceed 400 feet and shall be located approximately 25 feet upstream of manholes, lift stations, and other structures. Trench dams shall also be located the same distance downstream of storm ditch crossings or underground water sources or as directed by the District. Trench dams shall not be installed at

wyes, risers, laterals, utility crossings, pavement crossings or granular backfill areas. The minimum length of an individual trench dam shall be five (5) feet. The width shall extend fully from the excavated trench wall to the opposite excavated trench wall. The height of trench dams shall extend from the excavated trench bottom to within two (2) feet of the existing ground surface.

Trench bottoms within the proposed trench dam area may be excavated by machine to the proposed pipe springline. The area shall then be carefully excavated by hand or similar means so as to accommodate and properly support the pipe without the use of bedding aggregate and properly support the pipe with a predominately clay material.

The area above the installed pipe shall be backfilled with clay and/or bentonite materials. The placement and compaction of the backfill shall be in accordance with ODOT CMS Item 203. The method of installation shall also conform to the pipe manufacturer's published recommendations.

Deviations from any of the above listed requirements shall not be allowed without a written request from the Contractor and consequent written approval by the District. The cost for this work shall be included in the price bid for other various related items.

Trench dams may also be provided, at the option of the homeowner or Developer, immediately upstream of the main line sewer on all service connections at the time of the construction of the service connection.

306 Concrete Backing

Wherever called for or shown on the construction drawings, the Contractor shall provide and place Class QC4 per ODOT CMS Item 499 concrete backing in accordance with the Standard Construction Drawings.

Concrete backing shall be required for laterals at 45^{O} or higher angles on the wye and riser. For force main tees and bends, a mega-Lug restrained joint shall be required in additional to concrete backing.

307 Concrete Encasement

Wherever called for on the construction drawings, the Contractor shall provide and place ODOT CMS Item 499 Class QC4 concrete encasement as shown on the Standard Construction Drawings. If encasement is required, concrete shall completely surround the pipe and shall have a minimum thickness of $^{1}/_{6}$ of the inside diameter of the pipe or six (6) inches, whichever is greater. Class QC4 concrete shall be used with an ultimate compressive strength of no less than 4000 psi at 28 days.

308 Jurisdictional Water and Wetland Crossings and Erosion and Sediment Control

Sewers crossing jurisdictional streams and other open channels shall be designed to cross the streams as close to perpendicular as possible. The number of crossings shall be minimized to the extent possible.

Watercourse protection shall be installed over the top of the backfilled trench for all

stream crossings.

Any conditions required by the USACE, Ohio EPA, or other agencies having jurisdiction over the jurisdictional waters and/or wetlands shall be adhered to.

If a project crosses a jurisdictional water body or if the equipment necessary to install the project must cross a jurisdictional water body or if other features on the site are subject to erosion from the proposed construction activities, then sediment controls shall be shown on the Plans.

a) Temporary or permanent erosion and sediment controls must be installed prior to disturbance.
b) All runoff, whether onsite or offsite, shall be contained by erosion control measures.
c) All stock piles shall be protected from sediment generation. If stockpiles are placed on a future site of a development, the general locations shall be shown on the Plans to ensure there is not a conflict with any sanitary manholes.

All sediment basin calculations shall account for disturbed areas for the sanitary sewer in addition to the disturbed areas for the site grading.

The Sanitary Engineer may require additional erosion and sediment controls at any time that, in his or her opinion, the controls installed on the site are not adequately protecting the surrounding areas from erosion.

River Crossings and Flowing Streams

Description: The Contractor shall furnish all labor, materials, and equipment necessary to install the river crossings as shown on the plans as described herein.

General: It is the intent of the plans and specifications to install river crossings in such a manner as to protect the sewer from erosion and to restore, as much as practicable, the river banks and bottom to their original condition.

Sewer Protection: The sewer will be protected from erosion either by concrete encasement around the pipe or by a concrete slab level with the top of the rock above the pipe.

River Bank Restoration: The river banks will be restored by back filling the sewer pipe trench with mechanically compacted earth to the original surface. The river banks will be graded, fertilized and seeded, or protected from erosion immediately following the completion of the crossing. Riprap shall be utilized for bank protection on outside curves in streams and rivers, where directed by the Sanitary Engineer.

River Bottom Restoration: The river bottom trench above the concrete will be backfilled with excavated bottom material.

Construction Procedure: If the river/stream requires a permit to cross, the Contractor shall use the procedure outlined in the approved permit. If a permit is not required, one of the following methods will be used:

Option #1: Boring or tunneling.

Option #2: The Contractor shall construct an earth embankment from the riverbank to a point beyond the centerline of the river. The slopes of the earth embankment shall be protected from erosion by covering them with 6 mil polyethylene sheeting. The sheeting shall extend from the river bottoms to an elevation of 2 feet above the water level. The sewer pipe shall then be installed in a trench excavated through the embankment. The embankment and material and any excess trench excavation shall be removed to an offsite disposal area. The same procedure shall be used to install the remainder of the river crossing.

Option #3: The Contractor shall construct a cofferdam of sandbags or inflatable bags, from the riverbank to a point beyond the centerline of the river. The sewer pipe shall then be installed in a trench within the cofferdam. Any excess trench excavation shall be removed to an offsite disposal area. The cofferdam shall then be removed. The same procedure shall be used to install the remainder of the river crossing.

The crown of all sewers crossing the streams shall be sufficient depth below the natural bottom of the stream bed. The minimum cover over the crown of the pipe shall meet one of the following requirements:

308.01 One (1) foot if the sewer is located in rock or the sewer is constructed in accordance with any method as prescribed in Section 307.

308.02 Four (4) feet if the sewer is located in materials other than rock.

The crossing shall be free from change in grade and the sewer should be designed to cross the stream as nearly perpendicular to the stream flow as possible.

309 Tunneling and Jacking

This work shall include the furnishing of all labor, equipment, and material necessary to install tunnels, boring, and jacking as shown on the plans. Work includes all clearing and grubbing; removal and restoration of fences, sidewalks, pavements, and other property; excavation; grouting and pumping sand or other granular material inside and outside the tunnel or bore as described herein; providing all liner plates, steel pipe or conduit, grout, sand or granular material; providing and removing all dewatering and pumping systems; all shoring, cribbing, and sheathing, testing, and other work associated and required to provide a complete, usable tunnel.

309.01 Other Requirements and Permits: All work within the right-of-way of private companies and public agencies shall conform to the requirements and regulations of the respective companies or agencies. The Contractor shall obtain permits for any railroad, local, state or federal highway crossing, shall coordinate scheduling of construction of such crossings with railroads and highway departments, and shall pay any charges established therefore for work accomplished by those companies or agencies. Special construction requirements defined by railroads or highway departments shall be adhered to by the Contractor. A copy of the permit or approval from the respective companies or agencies shall be furnished to the District prior to starting work in the right-of-way.

309.02 Tunneling: Casing Pipe shall conform to Section 212. In excavating the tunnel, care shall be exercised to trim the surface of the excavated section to a

true line and grade with the excavation conforming to the outside of the tunnel plates as nearly as possible. In the installation of tunnel or shaft liner, the length of unsupported tunnel or shaft shall be no greater than 1½ times the laying length of a liner plate or pipe. Liners shall be placed promptly as excavation permits. Upon the completion of any ring of liner plates, bolts shall be retightened in the two (2) rings previously completed. Should the top half of the tunnel excavation be supported by cutting shield, excavation shall not advance beyond this support. The vertical face of the excavation shall be supported as necessary, to prevent sloughing and interruptions to the tunneling operations.

309.03 Borings: Installation of steel conduit by the boring method shall be done using an auger type boring machine or a machine of such a design as to meet the individual requirements of the railroad, local, state or federal highway system being crossed. The Contractor shall provide an approach pit, completely sheathed and of sufficient size to accommodate the lengths of conduit and the operation of the boring equipment. The operation of the boring equipment shall be subject to continuous checking by the Contractor to insure proper alignment of the encasement pipe.

309.04 Jacking: The Contractor shall provide an approach pit for the jacking operation, excavated so that the jacking face is a minimum of three (3) feet above the conduit. This open face will be shored securely to prevent displacement of the embankment. The pit shall include a backstop of sufficient size to take the thrust of the jack. Care shall be exercised in placing the guide rails to ensure that the conduit will be accurately constructed to line and grade. The entire approach pit shall be sheeted. Hydraulic or mechanical jacks may be used in this operation. The number and capacity of the jacks shall be adequate to complete the operation. A jacking head shall be used to transfer the pressure from the jacks and the jacking frame to the pipe. If an auger is used, the pipe shall be jacked simultaneously with the augering. The construction work shall be checked by the Contractor at frequent intervals to insure proper line and grade of the installation.

309.05 Casing pipe shall be installed per the manufacturer's recommendations or as shown on the Standard Construction Drawings, with the more stringent of the two applied. Casing pipe spacers shall be made of stainless steel and shall achieve a tight fit between the casing pipe and carrier pipe, with no void spaces between the spacer runner and carrier pipe.

309.06 Grouting: Any space existing outside the casing pipe shall be grouted at low pressure through grout holes provided in a sufficient quantity in the liner. These holes shall be installed in suitable locations so that grouting can be done effectively. Grout shall meet the requirements of ODOT CMS Item 613 or clean sand meeting the requirements of ODOT CMS Item 703.03. The pressure grouting shall preferably begin at the lowest middle hole of each grout section, the grout holes above being open, and proceed upward progressively and simultaneously on both sides of the tunnel. Grouting shall be done as near the end of the line as practicable and, if deemed necessary, grout stops shall be placed behind the sections at or near the end of the erected lining to permit grouting to or near the end.

309.07 Brick and Mortar Bulkheads: Brick and mortar bulkheads shall be required at each casing pipe terminus. Brick materials shall conform to ODOT CMS Item 602, Brick Masonry. Mortar materials shall conform to ODOT CMS Items 701.07 for masonry cement and 703.03 for mortar sand.

309.08 Fill Material: After the sewer has been installed inside a tunnel, the space remaining between the sewer and the tunnel liner shall be filled with grout having a sand-cement ratio of 5:1 containing a minimum of 4.5 bags of cement per cubic yard.

310 Directional Boring

Sanitary sewer mains, and/or force mains may be installed under pavement or ground surfaces through directional drilling practices in lieu of open-cut excavation. The limits of the directional boring shall be as shown on the construction drawings. Substitution of open-cut excavation for directional boring shall be approved by the District prior to performance.

310.01 Materials: The pipe shall be HDPE (AWWA C-906) PE 3408 resin as specified in ASTM D 3550 for sanitary sewer mains and/or force mains. The HDPE pipe shall be ductile iron pipe size and have a minimum rating of SDR 11 unless the manufacturer's recommendations require a thicker wall. The internal diameter of the HDPE main shall be equal to or greater than that of the open-cut excavation material in which connection or transition is made. The sanitary sewer main and forcemain shall have a green identification band.

310.02 Fittings: The fittings used to transition between the open-cut excavation material and the directional boring material shall be as recommended by the manufacturer or as a minimum as follows: HDPE (AWWA C-906) shall be restrained a minimum of three (3) joints on both sides of the bore when installed by directional drill method.

310.03 Qualifications: The directional drilling contractor shall have actively engaged in the installation of pipe using guided boring for a minimum of three (3) years, with at least three (3) projects in similar ground conditions and with similar size and length. The field supervisory personnel employed by the directional drilling contractor shall have at least five (5) years' experience in the performance of work. Written proof of qualifications should be submitted and approved by the Sanitary Engineer prior to construction.

310.04 Tracer Wire: Two (2) insulated 8-gauge, stranded copper wires shall be installed with the pipe for locating purposes. At each end of a bored section, wire shall be clamped with a brass connector to a piece of ½" rebar. Wire shall be pulled back through the bored hole with the pipe and tested for continuity. The top of the rebar shall be installed flush with the ground at each end of the bore. Tracer wire shall be brought to the ground surface every 500 feet as indicated in Section 210.

310.05 Testing: The finished main shall be tested in accordance with Sections 408 and/or 409 of these specifications. Mains not holding the specified pressure for the test duration shall be removed from the hole, repaired or replaced and installed and tested again.

310.06 Pilot Hole: The Contractor shall follow the pipeline alignment as shown on the drawings. If adjustments are required, the Contractor shall notify the Sanitary Engineer for approval prior to making the adjustments. In the event of difficulties at any time during boring operations requiring the complete withdrawal from the tunnel, the Contractor shall be allowed to withdraw and abandon the tunnel and begin a second attempt at a location approved by the Sanitary Engineer.

310.07 Installation: After the pilot hole is completed, the Contractor shall enlarge the hole, if needed, by pre-reaming, and install a swivel to the reamer and commence pullback operations. Reaming diameter shall not exceed 1½ times the diameter of the product pipe being installed. The product pipe being pulled into the tunnel shall be protected and supported so that it moves freely and is not damaged by debris on the ground during installation. Pullback forces shall not exceed the allowable pulling forces for the pipe material. The Contractor shall supply documentation from the pipe manufacturer verifying allowable pulling force. The thickness of the pipe shall be increased, at no additional costs, if pullback forces are anticipated to exceed the allowable pulling force on the specified pipe.

310.08 Drilling Fluid: Drilling fluid shall be a mixture of water and bentonite clay or other District approved mixture. The fluid shall be inert. Disposal of excess drilling fluid and spoils will be the responsibility of the Contractor who shall comply with all relevant regulations and permit agreements. Excess drilling fluid and spoils shall be disposed at an approved location. The Contractor is responsible for transporting all excess drilling fluid and spoils to the disposal site and paying any disposal costs. Excess drilling fluid and spoils shall be transported in a manner that prevents accidental spillage onto roadways. Excess drilling fluid and spoils shall not be discharged into sanitary or storm systems, ditches or waterways. Drilling fluid returns (caused by fracturing of formations) at locations other than the entry and exit points shall be minimized. The Contractor shall immediately clean up any drilling fluid that surfaces through fracturing.

310.09 Acceptable Deflection and Grade: Force mains shall have no deflection which exceeds the manufacturer's recommendation for the approved and installed material. Sanitary sewer lines shall be within 0.1 foot of desired grade at either end and have a "Belly" of no more than 0.1 foot. This shall be measured by filling the pipe with water, letting it drain, and televising the line. Installations that do not meet these acceptable tolerances will be considered insufficient and re-installation will be required.

310.10 As-Builts: An as-built survey of the plan and profile for the installed main shall be submitted at 25 foot intervals. These elevations at the prescribed intervals shall be taken during installation of the pilot hole.

310.11 Service Lateral Directional Boring: Laterals installed under existing pavements may be directionally bored as approved by the Sanitary Engineer. Pipe must be HDPE meeting the requirements of Section 210.04 or Modified PVC Yelomine® pipe meeting the requirements of ASTM D-2241 with a minimum cell classification of 12454 as per ASTM D 1784.

311 Miscellaneous Work

All items of work called for on the construction drawings or in these specifications for which no specific method of payment is provided shall be performed by the Contractor and the cost of same shall be included in the price bid for the various related items.

312 Field Tile

All field tile and storm sewer broken during excavation shall be replaced with material equal to or better than its original condition unless otherwise authorized by the Sanitary Engineer.

313 Temporary Pavement Replacement

Temporary pavement replacement shall be provided for permanent pavement damaged or removed by the Contractor in the performance of the work to limits shown on the construction drawings or ordered by the Sanitary Engineer. Temporary pavement shall be installed as soon as the trench has been backfilled. The Sanitary Engineer may require that all materials and equipment incidental to providing the temporary pavement be on the job site prior to removing the existing pavement. Unless otherwise approved by the Sanitary Engineer, the temporary pavement shall be as shown on the construction drawings. Temporary pavement shall be maintained by the Contractor until permanent pavement is installed.

314 Permanent Pavement Replacement

The pavement shall be replaced by first removing the temporary pavement down to the clean granular material and removing the existing pavement for at least twelve (12) inches beyond the trench limits on each side. The pavement to be removed shall be neatly sawed, not more than 72 hours prior to the placing of permanent pavement materials. The permanent pavement materials and workmanship shall be at least equivalent to the existing pavement being replaced, as determined by the Sanitary Engineer. After removal of the temporary pavement and sawing of the existing pavement edges and prior to the placing of the permanent pavement, Tack Coat, ODOT CMS Item 407, shall be applied to the exposed existing pavement edges, and Prime Coat, ODOT CMS Item 408, shall be applied to the base material and Seal Coat, ODOT CMS Item 409, shall be applied to the surface of the final asphalt coat at the sawcut.

315 Traffic Control

The Contractor shall submit a plan and schedule for detouring traffic ten (10) days prior to the closing of any road. Any temporary closing of a road does not relieve the Contractor of the responsibility to provide access to the property by emergency vehicles and the Owners.

Where it is anticipated that work will close a road, the Contractor shall inform the agency in control of the right-of-way, the local law enforcement agency, the local Fire Department, the Sanitary Engineer, the County Sheriff's Department, the School District, and the District as to the extent, nature, and time of the closing. The Contractor shall post pre-closing notification signs along the road(s) to be closed one week in advance and shall have a notice printed in a local newspaper three (3) days prior to the closing, stating

the extent, nature and time of the closing. Adequate lights, signs, flagmen, and barricades shall be used as required in *Ohio Manual of Uniform Traffic Control Devices* (OMUTCD) and ODOT CMS Item 614 to safeguard the traveling public at all times. No road shall be closed until the schedule is approved by the District and the agency in control of the right-of-way. No existing traffic flow shall be altered until the Contractor submits in writing a request for approval of the alteration of traffic. The request shall be directed to the District and the agency in control of the right-of-way. Approval shall be considered only when received in writing.

316 Safety of Construction

Contractors shall comply with the latest Occupational Safety and Health Act requirements.

317 Clean Up and Restoration of Surfaces

All surfaces, including grass or lawn, pavement, sidewalk, curbing, and other surfaces, disturbed or destroyed during and resulting from the construction shall be replaced by the Contractor as specified herein.

317.01 Top Soil Placement and Grading:

a) General: All topsoil will be removed during the earthwork operation and stored for later use in location(s) indicated on the drawings.

b) The topsoil will be hauled from the stockpiles and placed on the completed cuts or fills in accordance with the plans. The final grading will then be carried out to the elevations as shown on the plans. Topsoil shall be placed in accordance with ODOT Item 659.11, except as noted in Para. 317.03 b).

c) Topsoil: Topsoil shall conform to ODOT Item 653.

d) Fertilizer: Fertilizer shall contain the specified percentages of total nitrogen, available phosphoric acid, and water soluble potash. The weight, name of plant nutrients, and guaranteed percentages shall be marked on the sealed fertilizer containers.
   1) 12-12-12: This fertilizer shall be used with Seed Mixes 1, 2, and 3.
   2) 5-10-10: This fertilizer shall be used with Seed Mix 4.

e) Inoculant: Seed Mix 4 (Crownvetch) shall be treated with inoculant culture of nitrogen fixing bacteria not more than one year old.

317.02 Restoration: The Contractor shall provide temporary seeding and mulching using Seed Mix 3 as shown in the Stormwater Pollution Prevention Plan. Within seven (7) days of clearing and grubbing, stabilize all inactive areas cleared and grubbed that are scheduled to remain idle for more than 21 days with temporary seeding and mulching. If an area is within 50 feet of any water body, provide temporary seeding and mulching within two (2) days following clearing and grubbing if scheduled to remain idle for more than 21 days. When surface soil is replaced, any settlement below the original ground surface occurring within the guarantee period shall be refilled with surface soil equivalent to the original material.

317.03 Seeding: The work shall be performed as required and in accordance with the following specifications, except as modified herein:

a) Seed Mix:
   1) Seed Mix 1 shall be used in all commercial and residential lawn areas.
   2) Seed Mix 2 shall be used along ditches within County rights-of-way and on vacant lands with no development.
   3) Seed Mix 3 shall be used for temporary seeding.
   4) Seed Mix 4 (Crownvetch) shall only be used as directed by the Sanitary Engineer for slopes greater than 3:1 and on shale or rock slopes.

b) Preparation of Seed Bed:
   1) Topsoil: Topsoil that is available as part of the excavated material shall be removed, stockpiled, and used to backfill the areas to be seeded. Before placing topsoil or seed, remove foreign materials of three (3) inches or greater in any dimension. Remove stones one (1) inch or greater in any dimension from all seeded areas in front of residences, commercial properties, between curbs and sidewalks, or as shown in the plans.
   2) Non-Topsoil: If there is a deficiency of topsoil as part of the excavated materials, the Contractor shall provide topsoil from another source at no cost to the District.
   3) Seed Mix 1: When Seed Mix 1 is required, the seedbed shall be four (4) inches of topsoil. Refer to Para. 317.01 for topsoil requirements.
   4) Seed Mix 2: When Seed Mixes 2, 3, or 4 are required, the seedbed shall be a minimum of two (2) inches of topsoil. Refer to Para. 317.01 for topsoil requirements.

Seed Mix Table			
Seed Mix	**Composition**	**Minimum Germination**	**Minimum Purity**
Seed Mix 1 (Lawn Mix)	40% Kentucky Bluegrass (Poa pratensis)	75%	85%
	40% Creeping Red Fescue (Festuca rubra)	85%	98%
	20% Annual Ryegrass (Lolium multiflorum)	85%	95%
Seed Mix 2 (Right-of-Way Mix)	40% Kentucky Bluegrass (Poa pratensis)	75%	85%
	40% Creeping Red Fescue (Festuca rubra)	85%	98%
	20% Annual Ryegrass (Lolium multiflorum)	85%	95%
Seed Mix 3 (Temporary Seeding)	20% Kentucky Bluegrass (Poa pratensis)	75%	85%
	80% Annual Ryegrass (Lolium multiflorum)	85%	95%
Seed Mix 4 (Crownvetch, slopes 3:1 and on shale or rock slopes, as directed)	30% Crownvetch (Coronilla varia)	70%*	99%
	30% Kentucky 31 Fescue (Festuca arundinacea var. Ky.31	85%	95%
	30% (Pennlawn) Red Fescue (Festuca rubra)	85%	98%
	10% Annual Ryegrass (Lolium multiflorum)	85%	95%

*Germination includes a total of quick germination plus hard seeds

c) Mulch:
   1) Straw: Straw mulch shall be baled wheat or oat straw free of weed seed, sticks or other foreign material.
   2) Wood Cellulose Fiber: Wood cellulose fiber mulch shall be dyed green and shall not inhibit the growth or germination of the seed.

d) Asphalt Emulsion: Emulsion shall conform to American Association of State Highway and Transportation Officials (AASHTO) M140 or AASHTO M208.

e) Dry Seeding: When a seed mix is sown dry, the materials shall be applied as follows:
   1) Fertilizing: Fertilizer shall be applied uniformly to all areas to be seeded. The fertilizer shall be disked, harrowed or raked into the seedbed to a depth of two (2) inches. The Contractor shall provide a smooth seedbed prior to seeding.
      1.1) Seed Mix 1: Apply fertilizer at a rate of ten (10) pounds per 1,000 square feet.
      1.2) Seed Mix 2, 3, and 4: Apply fertilizer at a rate of five (5) pounds per 1,000 square feet.

2) Seeding: The seed shall be mixed thoroughly and sown thoroughly over the prepared areas. After sowing, the area shall be raked, dragged or otherwise treated to cover the seed with soil to a depth of ¼ inch.

2.1) Seed Mix 1: Shall be sown at a rate of ten (10) pounds per 1,000 square feet. Use broadcast seeding methods between August 15 and October 30. Use hydraulic seeding methods between March 1 and October 30.

2.2) Seed Mixes 2 and 3: Shall be sown at a rate of five (5) pounds per 1,000 square feet. For Seed Mix 2, use broadcast seeding methods between August 15 and October 30. Use hydraulic seeding methods between March 1 and October 30. For Seed Mix 3, use between March 1 and October 30, or as directed by the Sanitary Engineer.

2.3) Seed Mix 4 (Crownvetch): This seed mix shall be sown at a rate of two (2) pounds per 1,000 square feet. Prior to sowing, it shall be inoculated in accordance with manufacturer's directions. This seed mix shall not be sown during the months of September or October.

3) Water: The Contractor shall water the seeded areas daily. The seeded areas shall be kept moist for a minimum of two (2) weeks after seeding and mulching.

4) Mulching: Straw mulching material shall be placed evenly over all seeded areas within 48 hours of seeding at a rate of two (2) tons per acre between March 15 and October 15 and at a rate of three (3) tons per acre between October 16 and March 14. Straw mulching material shall be secured with asphalt emulsion applied at a rate of 60 gallons per ton of mulch or by other approved methods. Mulching which is displaced shall be replaced and the area reseeded. Other work damaged as a result of mulch displacement shall be repaired.

f) Hydraulic Seeding: When seed is applied hydraulically, a combined slurry of fertilizer, inoculant when required, seed, and wood cellulose fiber mulch shall be applied in one operation. The inoculant for Seed Mix 4 (Crownvetch) shall be increased to five (5) times the manufacturer's recommended rate for dry seeding. Wood cellulose fiber shall be mixed at a rate of 46 pounds per 1,000 square feet. Fertilizer and seed shall be mixed at the rate specified for dry seeding.

g) Sodding: All areas requiring sod will be done in accordance with ODOT CMS Item 660.

h) Planting Trees and Shrubs shall be done in accordance with ODOT CMS Item 661.

i) Mowing: Begin to mow seeded or sodded areas within two (2) weeks of application. Continue mowing on a weekly basis to maintain a maximum height of five (5) inches until notified otherwise by the Sanitary Engineer.

j) Maintenance: Seeded areas shall be maintained by the Contractor. Any settled or eroded areas shall be filled, graded, and reseeded. Seeding

and/or sodding will not be accepted and paid for by District until it is fully and uniformly established and is alive, healthy, and weed free as determined by the Sanitary Engineer.

317.04 Pavement: All pavement damaged or removed during construction shall be replaced per the Standard Construction Drawings and requirements of these specifications.

317.05 Sidewalks: All sidewalks damaged or removed during construction shall be replaced per the Standard Construction Drawings to the width of the existing sidewalk.

317.06 Curbs: All curbs damages or removed during construction shall be replaced per the Standard Construction Drawings or the same as existing as directed by the Sanitary Engineer.

317.08 Other Surface: Any surface damaged or removed during construction shall be replaced in kind.

318 Connection to Existing Sewers

Contractor shall install mechanical plugs in the upstream and downstream inverts of the connection manhole. Plugs shall be inspected routinely by the Contractor to ensure that stormwater from the construction site is not entering the public sewer system. Plugs shall also be inspected after each rain event.

CHAPTER IV - SANITARY SEWER

401 Description

This section describes the work required to install sanitary sewers, including the pipe, manholes, and structures. The work includes all clearing and grubbing; removal and restoration of fences, sidewalks, pavements, and other property; trenching; bedding and backfill; construction; providing and removing all dewatering and pumping systems; all shoring, cribbing, and sheathing; testing; and any other work associated with installing complete, usable conduits, including tees, wyes, manholes, and structures. The requirements stated in this chapter are in addition to those stated in Chapters I, II, and III, whether or not a section of any chapter is specifically referenced herein.

402 Materials

The sanitary sewer line and associated materials and equipment shall be as shown on the construction drawings and specified in Chapter II of these Specifications.

403 Trench Excavation

The trench shall be excavated in accordance with Section 302 of these Specifications.

404 Bedding

The bedding shall be placed in accordance with Section 304 of these Specifications.

405 Laying Conduit

Except where otherwise directed by the Sanitary Engineer, the conduit shall be laid starting at the lowest point with the bell or groove end laid upgrade. The bottom segment of the conduit shall be in contact with the shaped bedding throughout its full length. All conduit shall be laid with ends abutting and true to line and grade. Line and grade for sanitary sewer conduit shall be established by the Contractor using a laser beam or other approved method. Any method used shall provide a means to periodically check the accuracy of the method being used. Conduit shall be laid at grades that are greater than or equal to the minimum grades established by *Recommended Standards for Wastewater Facilities*, current edition, unless approved by the Sanitary Engineer.

405.01 The method of joining conduit sections shall be such that the ends are fully entered and sealed. The inner surfaces shall be reasonably flush and even, with all possible care being used when joining the conduit to ensure that the conduit ends are clean. Gaskets shall be installed in accordance with the manufacturer's recommendations. All connections with structures shall be made watertight, using an approved flexible watertight joint. Grout shall not be used to make the structure watertight. Structures not made watertight using flexible watertight joints shall be re-excavated, replaced or repaired as necessary to make watertight. All exposed surfaces shall be smooth and flush with the adjacent walls.

405.02 Concrete blocking, supports, and buttresses shall be provided at all tees, bends, valves, and at any other location shown on the construction drawings

or as directed by the Sanitary Engineer. These concrete structures shall be ODOT CMS Item 499 Class QC4 concrete per Section 205 and shall be built to the lines, grades, and dimensions shown on the Standard Construction Drawings.

405.03 During any construction where the outside temperature is below 40 degrees Fahrenheit all rubber gaskets and lubricants shall be kept in an area heated to at least 40 degrees Fahrenheit until needed. No gasket or lubricant shall be out of the heated area more than 5 minutes before being placed in the bell or on the spigot of the pipe. The Contractor shall lubricate all joints according to the manufacturer's recommendations.

a) Inclement Weather Conditions: All work which will be adversely affected by climatic conditions such as rain, wind, frost or temperature shall be suspended at the discretion of the District. Whenever work proceeds under such conditions, the Contractor shall provide approved facilities for protecting all the materials and the finished work. This shall include heating of materials if required for proper installation. No materials shall be installed during climatic conditions that do not meet said manufacturer's recommendation.

405.04 The Contractor shall furnish and install, prior to testing, all fittings, air release valves, wyes, and service taps in the number, sizes, and locations shown on the construction drawings, or at locations selected by the Sanitary Engineer. All appurtenances are to be furnished and installed by the Contractor.

405.05 The Contractor, in connection with the laying of the sewer line, shall furnish and install all valves as shown or as directed by the Sanitary Engineer. Valves will be provided with mechanical joint ends, unless otherwise shown or approved by the Sanitary Engineer. The Contractor shall furnish and lay any special casting necessary to make the valve installation as shown on the construction drawings.

405.06 The Contractor shall furnish and lay all closure pieces, special bends, and fittings necessary for construction of the pipe along the route shown by the construction drawings.

406 Backfill / Trench Dams

All trenches and excavations shall be backfilled and trench dams provided in accordance with Section 305 of these specifications.

407 Manholes and Special Structures

407.01 General Construction Methods: Construction for the item specified shall conform to the Standard Construction Drawings and be placed at the locations and elevations shown or ordered except that the height of any unit may be changed to meet finished grade.

Adequate precautions shall be taken to prevent concrete or mortar from freezing. Brick, concrete block, etc., having a temperature of 40 degrees Fahrenheit or less shall not be set with mortar until heated for a period

sufficient to insure a temperature of 50 degrees Fahrenheit to 80 degrees Fahrenheit, throughout the entire mass of the material.

Iron frames, taps, and covers shall be of the type and set as called for on the construction drawings or standard drawings. Special care shall be exercised to prevent the entrance of earth or debris into the pipe lines connecting with the manhole or special structure. All such earth or debris resulting from the construction operations shall be removed.

407.02 Manholes: Manholes shall be pre-cast, meeting ASTM C478. The joints between sections shall conform to ASTM C443. The pre-cast bottoms and sections shall be provided with lifting lugs and reinforced for handling. Manhole sections shall be assembled with Conseal, or approved equal, at all section joints, in addition to the sealed O-ring joint. Bottoms shall be set so as to have a uniform bearing on at least six (6) inches of granular material as shown on ODOT CMS Table No. 703-1, No. 67 aggregate. The invert channel shall be the true shape of the lower half of the sewer conduit. The sewer shall be connected to the manhole with a flexible watertight joint of approved manufacture using a rubber sleeve with stainless steel banding or a rubber gasket that seals through compression or expansion, conforming to ASTM C923. The annular space between the outside wall of the pipe and the wall opening of the manhole shall be filled to the springline of the pipe with trowelable Easy Stick or approved equivalent. Grout on the interior of the manhole is not permitted to make the manhole structure watertight. Repairs shall only be made per Section 409.02.

407.03 Special Structures: Concrete structures poured in place or constructed of brick or masonry units shall be constructed in accordance with ODOT CMS Item 602. Doghouse manholes, per Standard Construction Drawing Sa.S-4, shall only be installed on existing concrete sewer pipe.

407.04 Excavation: The excavation shall be such that ample room for construction is provided and shall include the removal of any obstruction which is necessary to provide ample room.

407.05 Backfill: The backfilling shall follow the completion of the work as closely as the type of construction will permit. The backfill material for all manholes and structures shall be Type A material to an elevation a minimum of twelve (12) inches above the top of the pipe, unless otherwise shown on the construction drawings.

407.06 Manhole Casting, Cover, and Grade Ring: All manhole castings and covers shall be of the machined type with vent holes and the pick hole shall not penetrate completely through the ring. The manhole castings shall be sealed to the concrete cone section with an elastometric material approved by the Sanitary Engineer. Care shall be taken to assure that no gaps in the elastometric material develop during the installation process. Materials and installation shall be in accordance with the standard construction drawings.

407.07 Cementitious or Epoxy Coating: See Section 209.

408 Force Main Testing

A hydrostatic test as required in applicable sections of AWWA C600 for ductile iron pipe, or AWWA C605 for PVC pipe, shall be applied to the whole or to individually isolated sections of the force main either before or after the trench is backfilled. The pressure during the test shall be maintained at 150 psi or 1½ times the working pressure, whichever is greater, in any section being tested. The duration of each pressure test shall be at least two (2) hours. The Contractor shall supply, and the District shall verify, gauges for the test. Furthermore, the Contractor shall furnish all materials, make all taps required, and furnish a pump, piping, all other equipment and all assistance necessary for conducting the tests. Before applying the specified pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made by the Contractor at points of highest elevation or as required. Taps shall be of the sizes as shown on the construction drawings or as directed by the Sanitary Engineer.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. No pipe installation will be accepted until this leakage is less than the values presented in the following table as provided in the AWWA Specifications for 10.5 gallons per day per mile per inch of nominal diameter pipe for 1,000 feet of pipe:

Allowable Leakage at 150 psi	
Pipe Size (Inches)	**Leakage in gallons per hour**
4	0.33
6	0.50
8	0.66
10	0.83
12	0.99
15	1.24
18	1.49
21	1.74
24	1.99
27	2.24

Any testing performed against existing valves shall be at the Contractor's risk and in strict compliance with the requirements of the Sanitary Engineer. If unable to achieve the required test the Contractor shall disconnect from the existing valve, plug the line, and retest until satisfactory results are obtained. Any damage caused to existing facilities shall be repaired at the Contractor's expense.

409 Sewer and Manhole Testing

The Contractor shall furnish all labor, equipment, and materials which are required to test the sections of the sanitary sewer conduit and manholes for watertightness. The Contractor shall perform the air/vacuum test. All tests shall be conducted in the presence of a District representative. The tests for leakage shall include all portions of the sanitary sewer system, including manholes and service lines that are installed by the Contractor.

The sewer shall be tested in sections, each section extending between two (2) consecutive manholes or from the end of the sewer to the nearest manhole. No test shall be performed until the sewer line has been backfilled and no later than 90 days after completion of the finished grade when not below pavement and after the completion of rough subgrade when any portion or segment of the pipe is below pavement.

409.01 Air Test: The test shall be conducted in accordance with ASTM 1417. The inlet end of the upstream and downstream manhole shall be closed with an airtight bulkhead. The sewer will then be put under pressure to 3.5 psig. The minimum time requirements for the 0.5 psig pressure drop from 3.5 psig to 3.0 psig shall not be less than the following:

Minimum Specified Time Required for 0.5 PSIG Pressure Drop											
Pipe Size (in.)	Min. Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:54	57	20.942L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:47	50	27.352L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09
54	25:31	44	34.618L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38
60	28:30	40	42.738L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32

The minimum time requirements for the 1.0 psig pressure drop from 3.5 psig to 2.5 psig shall not be less than the following:

Minimum Specified Time Required for 1.0 PSIG Pressure Drop											
Pipe Size (in.)	Min. Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	3:46	597	.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46
42	39:48	57	41.833L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07
48	45:34	50	54.705L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
54	51:02	44	69.236L	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16
60	65:40	40	85.476L	142:28	213:41	284:55	356:09	427:23	498:37	569:50	641:04

An air pressure correction is required when the prevailing ground water is above the sewer line being tested. Under this condition, the air test pressure must be increased 0.5 psi for each foot the ground water level is above the invert of the pipe.

409.02 Vacuum Test: All manholes shall be vacuum tested in accordance with the following specifications. The test head shall be placed at the top of the manhole casting and the manhole vacuum tested after the internal or external seal has been installed.

A vacuum of ten (10) inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop one (1) inch.

The manhole shall pass if the time for the vacuum reading to drop from ten (10) inches of mercury to nine (9) inches of mercury meets or exceeds the values indicated in the following table:

Minimum Test Times for Various Manhole Diameters									
Depth (Feet)	**Diameter (Inches)**								
	30	33	36	42	48	54	60	66	72
	Time (Seconds)								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	34	41	46	51	57
16	22	24	28	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	58	65	72	81
22	31	33	38	46	55	64	72	79	89
24	33	36	42	51	59	70	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

If the manhole fails the initial test, necessary repairs shall be made by using an injectable grout approved by the District. The manhole shall then be retested until a satisfactory test is obtained.

409.03 Deflection Test: When PVC or polypropylene pipe is used a deflection test shall be performed. Pipe deflection shall not exceed 5 percent if tested after 30 days, or 7.5 percent if tested after 90 days from the trench being backfilled to finish grade. The method of testing shall be subject to the approval of the Sanitary Engineer. If rigid balls or mandrels are used to test the pipe deflection, no mechanical pulling devices shall be used. Any lines which fail the test must be repaired and retested by the Contractor at no cost to the District. The test shall be performed under the direction of a licensed Professional Engineer as required by the Ohio EPA. A District representative must be on site during the deflection test. The Contractor may perform vibration on the pipe one time prior to repairing the pipe. Closed-circuit televising (CCTV) must be performed prior to and after vibration is performed.

410 Wye Poles

The Contractor shall furnish and place, as directed, approved wye poles made of 4-inch by 4-inch hardwood lumber at all wye locations, ends of extended services or at the end of each riser where risers are required. The wye poles shall extend above the ground at least three (3) feet and have a minimum bury of four (4) feet. Wye poles shall then be painted green.

411 Risers

Risers, if called for on the construction drawings, shall be placed at the mainline sewer to the lengths specified.

412 Service Connections and Lines

412.01 There are three (3) methods for connecting existing buildings to District sewers:

1) Connect to a wye branch on the mainline sewer during construction.
2) Install a cut-in wye branch to the mainline sewer.
3) Install a sewer lateral to connect to an existing sewer manhole.

412.02 Service or house connections shall not be connected to the lateral or main line sewers until full approval of said lateral or main line sewer has been received.

412.03 The sewer service lines shall be PVC or ductile iron pipe, as specified in Section 208 of these specifications, with watertight joints and proper fittings, except 90-degree bends, for all changes in alignment or grade. Only adapters approved by the District shall be used to change from one pipe material to another in any sewer line. Sewer service lines shall be no less than six (6) inches in diameter and shall be laid at a minimum slope of ¼ inch per linear foot. The District may, by special permission in each case, authorize the building sewer to be laid at a minimum slope of ⅛ inch per linear foot if it is determined to be necessary. All sewer service lines shall be laid no farther than ten (10) feet from the building foundation. The interior of each length of pipe shall be made perfectly clean and free from offsets, fins, and projections before the next length is connected thereto. The District may require that the watertightness of the sewer service line be demonstrated by the testing procedures established in Section 409.

412.04 Existing sewer service lines may be used in connection with new buildings or alterations to existing buildings only when it can be demonstrated that such sewers conform in all respects to the requirements contained herein for new building sewer services. The District may make an exception as to the size of old building sewers provided they are not less than four (4) inches in internal diameter, and otherwise meet the requirements of this section. Sewer service lines constructed parallel to any exterior wall, cellar, basement or cistern shall be at least three (3) feet away. Sewer service lines shall have at least two (2) feet of earth or stone cover unless otherwise approved by the District.

412.05 All excavation for sewer service lines shall be by open cut from the surface unless otherwise specified. The sides of the trench shall be vertical, using such sheathing and bracing as necessary to accomplish this result. The pipe shall be bedded and backfilled in accordance with the Standard Construction Drawings. In the event the trench is excavated below the required grade of the pipe; the excess space shall be filled with the stone specified for the Class B Bedding in accordance with Section 304 as necessary to provide a uniform and adequate bearing surface. The width of the trench at the top of pipe shall not exceed two (2) feet plus the outside diameter of the pipe nor shall the width be less than one (1) foot plus the outside diameter of the pipe. When unstable, soft or spongy conditions are encountered at the trench bottom, such material shall be removed and replaced with clean, crushed stone sufficient to stabilize the trench bottom to support the pipe to a true line and grade. Water, gas, telephone, electric or cable lines shall not be laid in the same trench as the building sewer service line.

Contractor can request permission to directional bore services within the right-of-way. Directional bores shall be performed only with HDPE or PVC Yelomine® pipe in this case.

412.06 The building sewer shall be bedded to an elevation at least twelve (12) inches over the top of the pipe using Class B bedding in accordance with Section 304. The balance of the backfill shall be made in accordance with the requirements of Type B Backfill, Section 305.

412.07 Connection to existing wye-branches shall be made carefully to avoid damage to the bell of the branch or to the lateral sewer. Such damage as may occur shall be repaired as directed by the District. Connections to a sewer at a point where no wye-branch has been provided shall be made using a cut-in wye branch where the mainline is ten (10) inches or larger.

412.08 The permit holder shall repair or restore any drains or service lines damaged or disturbed during the construction of the sewer service line.

412.09 Surface water which collects in basement or foundation excavations shall not be discharged at any time into the sewer service line.

413 Storm Water Connections

No downspouts, surface inlets, foundation drains or any other source of ground or surface water shall be connected either directly or indirectly to or discharged into any part of the sanitary sewer system.

414 Valves

Valves larger than two (2) inches shall conform to Section 213.01. Valves two (2) inches and smaller shall conform to Section 213.02.

414.01 Extension Stems: If the top of the operating nut is more than 36 inches below the finished grade an extension stem shall be provided to place the operating wrench nut between 24 inches and 36 inches of the finished grade. Cost of extension items shall be included in the unit price bid for the various valve types and sizes.

414.02 Valve Boxes: Unless otherwise noted on the construction drawings or directed by the Sanitary Engineer, all valves larger than two (2) inches and locations of tracer wire grounds shall be provided with Standard Valve Boxes. Covers for the boxes shall be marked “SEWER”. All boxes shall be provided with the necessary extensions to bring the top of the box to the finished grade. All valve boxes shall be installed such that they are centered vertically over the valve operating nut and such that the box provides maximum cover of the operating housing. Boxes that are to be installed in areas subject to vehicular travel shall be the Traffic Type Valve Boxes. All valve boxes shall be as shown on the Standard Construction Drawings.

414.03 Valve Supports: Concrete piers or supports shall be provided under all valves per Section 405.02.

414.04 Operation: All valves which affect the flow of sewage through active lines are to be operated by District personnel only.

415 Tools and Spare Parts

Each project which installs sanitary sewers as part of a development shall provide one set of the following items plus one additional set for every ten (10) manholes installed on the main line sewers.

Additional Parts and Tools	
Item*	**Quantity**
Riser Rings (3-2" rings and 2-4" rings)	5
Manhole Lifting Hook	1
Complete Manhole Casting (Frame and Lid)	1

* Items shall be delivered to a location specified by the District.

416 Inspection Manhole (Commercial)

Inspection manholes will be required on all non-residential sewer service laterals. Inspection manholes are required to be a minimum of 48 inches in diameter and preferred to be a maximum of four (4) feet deep and located after the grease trap, if applicable. The location must be such that the District shall have access to the structure at all times for testing and monitoring purposes. The locations shall be approved by the Sanitary Engineer.

CHAPTER V - SUBMERSIBLE PUMP STATIONS

501 General

This specification provides a guideline for a developer designed and constructed pump station. The Sanitary Engineer reserves the right to make additions to these requirements based on site conditions and the upstream pump station tributary area. The developer shall comply with the requirements of the Ohio EPA and "Recommended Standards for Wastewater Facilities" (10 States Standards) during the design of this pump station. The developer should also refer to District Standard Drawing Sa.S-36, Pump Station Details, Sheets 1 through 11 which also apply to this pump station.

Pump Stations with pumps less than 30 horsepower (Hp) and less than 500 gallons per minute (GPM) shall be designed with submersible pumps in accordance with the standard drawings for pump stations. Pumps in excess of 30 Hp shall be designed in accordance with the requirements of the Sanitary Engineer. All work and equipment must be approved by the Sanitary Engineer prior to performing the proposed work.

502 Design

The design engineer shall be responsible for submitting the following information to the Sanitary Engineer for review:

502.01 A site and grading plan showing erosion and sediment control.
502.02 A pump station plan and cross sections, including the wet well and utility building.
502.03 An odor control equipment plan.
502.04 An electrical site plan.
502.05 Electrical one line and control block diagrams.
502.06 Power and control panel plans.
502.07 The results of geotechnical investigations (soil borings and laboratory testing of soil samples) at the wet well location.
502.08 Buoyancy calculations. The contractor shall be responsible for anti-floatation methods needed during construction until backfill is properly placed.
502.09 Pump sizing calculations showing head loss, force main sizing including force main velocities, system curve for design flow and ultimate peak flow, system curve versus pump curves for design flow and ultimate peak flow.
502.10 Product data for all proposed equipment. Data shall include physical dimensions, features, components, ratings, and performance.
502.11 Shop drawings detailing dimensions, components, location, identification of field connections, arrangement of components and operational characteristics.

503 Site Layout

The site layout of the pump station will be in general accordance with the pump station Standard Drawings. However, site-specific layouts will be required for review and approval by the Sanitary Engineer. Pump station structures and electrical and mechanical equipment shall be protected from physical damage by the 100-year flood and should remain fully operational and accessible during the 25-year flood. At least 1 (one) foot of freeboard above the 100-year flood elevation will be provided at all pump station building entrances and hatches. The following items provide the minimum requirements based on a generic site layout.

504 Driveway

504.01 Driveways will be designed so that vehicles are not required to back onto public or private streets or roadways. Driveways shall be designed to allow service truck with equipment (i.e. portable generator) sufficient room to completely pull off the street/roadway while opening the site gate to gain entrance.

504.02 The driveway shall be sloped to facilitate drainage away from the pump station.

504.03 Concrete sidewalk shall be provided from the access drive to the entry of the pump station building and odor control chemical tank as shown on the standard pump station drawings.

504.04 The disturbed areas between the concrete sidewalks and around the pump station building shall be graded to drain away from the building and landscaped as directed by the Sanitary Engineer. Four inch-perforated drainage tiles shall be provided in areas that are not free draining as an outlet away from the pump station.

505 Pump General Requirements

505.01 Pumps shall be FLYGT "N" series submersible pumps.

505.02 Provide Flygt Experion energy saving premium efficient motors.

505.03 Pump speed shall not exceed 1750 revolutions per minute.

505.04 Pump suction and discharge openings shall be at least 4-inch diameter.

505.05 Provide a Type 304 stainless-steel guide rail and lift chain/cable system.

505.06 Provide a quick-disconnect sealing flange and discharge elbow with integral baseplate. The mating surface shall be a machined metal-to-metal design providing a watertight contact.

506 Pump Detailed Specifications

506.01 Pumps shall be of the centrifugal, non-clog, solids handling, submersible, wastewater type. Pumps shall be non-overloading throughout the entire range of operation without employing the service factor, which shall be not less than 1.15. The pump curve shall be submitted to the Sanitary Engineer for approval and shall state pumping head, capacity, pump efficiency, solids handling capacity, and reflect motor service factor.

506.02 The pump volute type casing shall have a 125 lb flange that is faced. Contractor shall provide appropriate increaser to transition from the pump discharge flange to the discharge piping as shown on the Drawings. The pump discharge shall conform to ANSI standards and be manufactured of heavy-duty gray cast iron, ASTM A-48, Class 35. The casing shall be of sufficient strength and thickness to withstand all stresses imposed by the intended service at full operating load. The pumps shall be mated to a 90° cast iron inlet elbow with mounting pedestal. The mounting base shall be provided by the manufacturer and shall be suitable for withstanding the pump weight and forces generated via the pump. The inlet elbow intake shall be situated in parallel with the pump discharge outlet.

506.03 The casing shall be accurately machined and bored for register fits with the suction and casing covers. All exposed nuts or bolts shall be ANSI type stainless steel construction.

506.04 Impellers shall be hard iron, ASTM A-532 Alloy IIIA (25% chrome) or as recommended by the manufacturer for the specific application. Impellers shall have a maximum of two vanes, have a non-clog design and have pump-out vanes to prevent materials from collecting in the mechanical seal area. Impellers shall be

dynamically balanced. Impellers shall be slip fit to a tapered shaft and key driven or with a bolt, washer and key.

506.05 Motors shall be of the Premium Efficiency type, with rated efficiencies at full load. The premium efficiency motor rotor shall have end rings and rotor bars constructed of cast aluminum. Motors shall have stator, rotor, and bearings mounted in a sealed submersible housing. The stator windings shall be inverter-duty rated with Class H insulation, 180°C rated (356°F) a minimum 1.15 service factor. Motors shall be air filled NEMA B design. Intrinsically safe winding thermal sensors shall provide further protection. Stator shall be securely held in place yet easily removable in the field.

506.06 Pumps shall be equipped with low resistance, bi-metal heat sensors mounted directly on the stator windings and sized to open at 155°C and automatically reset at 30-35°C differential. The sensors shall be connected in series with the motor starter coil so that the starter is equipped with 3 leg overload heaters and protects all normal overloads.

506.07 Bearings shall include an upper radial bearing and a lower thrust bearing. Bearings shall be heavy-duty single row ball bearings that are permanently lubricated. The upper radial and lower thrust bearings shall have a minimum B-10 life of 50,000 hours at the best efficiency point.

506.08 The shaft shall be machined from series 300- or 400-stainless steel and be of a large diameter with minimum overhang.

506.09 An intrinsically safe leakage sensor shall be provided to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When activated, the FLS will send an alarm both local and/or remote. USE OF VOLTAGE SENSITIVE SOLID STATE SENSORS AND TRIP TEMPERATURE ABOVE 125°C (260°F) SHALL NOT BE ALLOWED. The pump and motor shall be designed to operate partially or completely submerged in the liquid being pumped.

506.10 Electrical power cords shall be Flygt SUBCAB water resistant 600V, 60°C, UL and CSA approved and applied dependent on amp draw for size. A service-proven, manufacturer-guaranteed method, acceptable to the Engineer, shall protect pumps from leakage at the cord entry point. Cord lengths shall be as required and as shown on the Drawings.

506.11 Pumps shall be painted after assembly with a single standard coat of zinc chromate base enamel. Finish paint shall be the manufacturer's standard for the application.

506.12 The pump volute shall be supported by the inlet elbow base.

506.13 Testing shall include the following:

a) Visually inspect pump to assure that it is in accordance with the specification, as to voltage, phase, and hertz.

507 Mechanical Seals

507.01 Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion and abrasion resistant tungsten-carbide seal ring.

507.02 Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

507.03 The following seal types shall not be considered acceptable or equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

507.04 Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load.

507.05 Where a seal cavity is present in the seal chamber, the area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

507.06 Seal lubricant shall be FDA approved, nontoxic.

508 Wet Well

508.01 The Wet Well shall be constructed of poured-in-place reinforced concrete or pre-cast concrete sections in the diameter required on the individual plans but in no case less than ten (10) feet. Precast concrete shall be per ASTM C478. Watertight rubber gaskets shall be per ASTM C443.

508.02 Only circular wet wells will be permitted.

508.03 The floor shall have a 1:1 slope to the hopper bottom.

508.04 FLYGT Safe Hatch (with stainless steel lockable hasps) aluminum access door shall be used on any opening on the wet well as deemed applicable by the Sanitary Engineer.

508.05 A minimum four (4) inch diameter vent with down-turned elbows and a stainless-steel or plastic mesh insect screen, emergency pump out connection, and temporary level control ports shall be provided as shown on the pump station standard drawings.

508.06 The wet well will be sized to provide enough storage to have no more than 10 pump starts per hour under peak design conditions. The fill time should not exceed 30 minutes (adjust float levels for initial flows and confirm starts/hour does not exceed manufacturer recommendations).

508.07 Provide a FLYGT Multitrode Level Monitoring System. Provide one backup high level alarm and pump start float. Install level sensors such that they are not affected by the influent sewer or pump suction. Under a high alarm condition, the pump run time will be controlled by an adjustable analog timer manufactured by Allen Bradley or approved equal.

508.08 Use of non-conductive grating is required by the Electric Code.

509 Sewage Grinder

509.01 An electric powered, immersible motor, sewage grinder sized for the peak influent sewer flow as manufactured by JWC Environmental shall be provided. Submit sizing information and shop drawings to the Sanitary Engineer for review.

509.02 The installation of the grinder shall include a stainless-steel frame and retrieval system mounted on the interior wall of the wet well at the invert of the influent line. This shall include a lifting bracket.

509.03 All controls and the power supply will be installed complete as part of the grinder installation.

509.04 Grinder electric supply will be mounted as provided by JWC Environmental inside the pump station building.

509.05 Electrical conduit lines shall be provided from the supply/power unit to the grinder. Any conduits that are underground shall be enclosed.

509.06 Electrical cables that are not placed in conduit shall be fully supported and braced on 1- foot centers.

510 Valves

510.01 All eccentric plug valves shall be McWane (Clow) Eccentric Plug valves, F-5412 or approved equal.

510.02 Flanged, horizontal swing check valves shall be McWane (Clow) F-5382 or approved equal. Valves shall be equipped with outside stem lever and weight. Valves shall meet or exceed the requirements of AWWA Standard C508.

510.03 Flanged, grooved, or mechanical joint pipe, fittings, couplings, and valves are acceptable.

510.04 Grooved fittings and couplings and valves may be utilized in lieu of welded, threaded, or flanged joints as shown on the Drawings. Gasket selection and intended use shall be verified as suitable for the intended service as published in the manufacturer's latest literature. Installation shall be in accordance with the coupling manufacturer's latest published instructions.

510.03 Grooved joint couplings shall consist of two or more ductile iron housings to ASTM A536, FlushSeal pressure responsive gasket to ASTM D2000, and zinc-electroplated steel bolts and nuts to ASTM A449. Basis of Design: Victaulic Style 31.

511 Piping

511.01 All PVC piping and appurtenances shall be Schedule 80, unless otherwise noted.

511.02 All ductile iron piping as shown on the plans shall be Thickness Class 52.

511.03 All underground piping shall be installed below the building footer.

511.04 All above ground piping shall be painted. Primer – Sherwin Williams Copoxy Shop Primer 3.0-5.0 dry mils. Finish coat – Sherwin Williams Macropoxy 646 4-6 dry mils.

511.05 All underground piping outside of the building and wet well shall be joined using mechanical joint sleeves with "MEGALUG".

511.06 All piping, valves, and appurtenances inside the wet well and building shall be flanged or grooved Victaulic® joints. Grooved end pipe shall be Class 53 (min), with ends that comply with ANSI / AWWA C606.

511.07 Grooved joint couplings shall consist of two or more ductile iron housings to ASTM A536, FlushSeal pressure responsive gasket to ASTM D2000, and zinc-electroplated steel bolts and nuts to ASTM A449. Basis of Design: Victaulic Style 31.

512 Junction Box

512.01 A NEMA 4X stainless steel electrical junction box shall be placed adjacent to the wet well for disconnecting the pump and grinder, as shown on the standard pump station drawings.

512.02 Specific location of junction box is subject to approval by the Sanitary Engineer.

512.03 The bottom of the junction box will be no less than 3.5 feet from the final grade and be at a top height of no more than 5.5 feet from final grade.

512.04 Duplex junction boxes shall have dimensions of no less than 24" x 24" x 8".

512.05 Triplex junction box sizing shall be submitted to the Sanitary Engineer for approval prior to construction.

512.06 Separate conduits for pump electrical leads, level control sensors, and floats shall be required. One spare ¾" conduit shall be supplied with a pull string for future use.

512.07 Gas seals and sealing wyes shall be provided for all conduit coming from the wet well to the junction box. Explosion proof sealer compound and packing/wadding made by Appleton shall be used.

512.08 Junction box shall have lockable quick release latching mechanisms.

512.09 Provide appropriate terminal as required by/for power and control wiring.

513 Fasteners

513.01 All nuts, bolts, hasps, washers, anchors, and other miscellaneous metals shall be Type 316 stainless steel.

513.02 Aluminum in contact with concrete shall be covered in bitumastic material.

514 Building

514.01 The 2-room structure will house all the electronic/electrical components for the control of the pumps, monitoring system, and sewage grinder on one side, and all piping, valves, appurtenances, etc. on the other side.

514.02 Developers desiring a pump station to match architectural styles of the development shall submit pump station building plans to the Sanitary Engineer for approval.

514.03 The building shall be a minimum of 8'W x 18'L x 10'H, insulated with R-19 insulation rating for the sidewalls and attic areas.

514.04 The building exterior finish shall either be composed of split face block or shall match local architecture (as directed by the Sanitary Engineer). Masonry work shall conform to the latest edition of the "National Concrete Masonry Association". All block shall be treated with Hydrozo Enviroseal® Double 7, by Hydrozo Coatings Company per the manufacturer's specifications.

514.05 Hollow load-bearing concrete masonry units shall meet the requirements of ASTM C90.

514.06 Mortar shall be Type S in accordance with ASTM C-270 and have a minimum compressive strength of 1,800 psi in 28 days. Grout shall have a minimum compressive strength of 2,500 psi in 28 days.

514.07 Ceilings shall be 5/8-inch plywood, PS1 rated, exterior exposure, grade C-C plywood sheathing. Panels shall be secured with 8c nails, at 6 inches on center along boundaries, continuous at panel joints, and at all other edges, and at 12 inches on center in the field. Ceiling shall be painted white with two coats of Sherwin-Williams Rejuvenate™ exterior latex paint.

514.08 The building shall meet the most recent local building codes.

514.09 Provide complete 5 kW heater system with blower, automatic reset linear thermal cut-out, temperature element, and thermostat control accessible at floor level. Complete installation shall include mounting brackets and steel disconnect switch per manufacturer's specifications. Provide heater manufactured by QMark series/model MUH35C.

514.10 Ventilation will be provided for the attic area and the main room of the building. Attic ventilation shall be by convection and whereas building ventilation shall be by providing two closable (weather-tight) shuttered louvers with screens.

514.11 A thermostatically controlled fan and louver system shall be provided for both fresh air inlets for the building.

514.12 A 9-inch floor drain shall be installed in the valve area to direct water into the wet well. Floor drain shall be Zurn Z550 with a stainless-steel grate installed flush with the finish floor elevation. A P-trap/check valve shall be installed in the drain line to prevent gases from entering the building. The P-trap/check valve shall be accessible for repair/replacement. Provide a 2" Duckbill check valve inside wet well on the end of the drain line.

514.13 Polyeurethane caulking shall be applied around the entire perimeter of the finish floor and ceiling, and along all ceiling panel joints. Caulking material shall be SIKA IA or approved equal. Contractor shall submit caulk samples to the Sanitary Engineer for approval.

514.14 Interior walls shall be painted white with two coats of Sherwin-Williams Loxon XP® masonry coating.

514.15 Doors shall be Steelcraft LW18, 18-gauge, galvannealed, prime coated, with Steelcraft F16, 16-gauge, galvannealed, welded frames. Furnish and install LCN 4040XP Series closers. Provide locks with Sargent LA keyways.

514.16 Roofing material shall be Certainteed Landmark™ TL shingles, Max Def Moire Black in color, with all associated accessories, or shall match local architecture, as directed by the Sanitary Engineer.

514.17 Provide below slab water vapor retarder meeting the requirements of ASTM E96 for underslab.

514.18 Grounding and bonding:

a). Codes and Standards: Perform all work to furnish and install grounding in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein:

I. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and National Electrical Code (NEC) as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment. Use of conduit system for ground conductor shall not be allowed.

II. Underwriters' Laboratories, Inc. (UL) Compliance: Comply with applicable requirements of UL Standards Nos. 467, "Grounding and Bonding Equipment", and 869 "Reference Standard for Service Equipment", pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors". Provide grounding and bonding products which are UL listed and labeled for their intended usage.

III. Institute of Electrical and Electronic Engineers (IEEE) Compliance: Comply with applicable requirements and recommended installation practices of IEEE Standards 80, 81, 141 and 142 pertaining to grounding and bonding of systems, circuits and equipment.

b). Ground Rods: Locate a minimum of one rod length from each other and at least the same distance from any other grounding electrode. Interconnect all ground rods with bare conductors buried at least 24 inches below grade. Connect bare cable ground conductors to ground rods by means of exothermic welds. Make these connections without damaging the copper coating or exposing the steel. Drive rods until tops are 2 feet-6 inches below finished floor or final grade except as noted otherwise.

514.19 Building shall be equipped with lightning protection consisting of at least one (1) gently-tapered aluminum air terminal. The completed installation shall meet the "Installation Requirements for Lightning Protection Systems, UL96A" of the Underwriter's Laboratories, current edition. Air terminal(s) shall be a maximum of 24 inches from the roof edge. Spacing between terminals, if more than one is installed, shall not exceed 20 feet. The complete system shall include aluminum or copper clad lightning conductors and the conductors shall maintain a horizontal or downward path. All bends in the conductor(s) shall have a radius bend of 8 inches or greater, and shall have an angle bend of 90^{O} or greater. Grounding rod(s) shall be constructed of copper, copper clad, or steel and be installed per the manufacturer's specifications.

515 Odor Control

515.01 An odor control chemical system shall be designed and provided by Evoqua, or approved equal. The system shall be installed per the approved drawings and Standard Construction Drawing Sa.S-36.

515.02 The odor control chemical shall meet the following specifications:

a) Material shall be free of any objectionable odor-producing compounds.
b) Concentration: minimum of 3.5 lbs. of nitrate oxygen per gallon – wt/wt.
c) Appearance: clear solution free from particulate matter.
d) Stability: temperature range -4 degrees F to 120 degrees F.
e). pH: The material shall not be less than 4.0 S.U. nor greater than 10.0 S.U.
f) Certificate of Analysis: A certificate of Analysis detailing the composition of the specific nitrate solution shall accompany each delivery.
g) Samples: t the County's request, a minimum 1,000 mL sample shall be provided with each delivery.

The material required under this specification shall be used to remove hydrogen sulfide, thereby preventing odor and corrosion within wastewater collection and treatment systems. The material shall utilize and enhance naturally occurring biochemical treatment processes to accomplish hydrogen sulfide removal. The material shall be a liquid-phase product. It shall be delivered, stored, and fed into the wastewater via standard liquid-phase chemical handling procedures.

515.03 The odor control system shall contain the following components:

a) One (1) storage tank – 2, 000-gallon minimum capacity
b) A spill/storage tank failure containment system constructed of 3000 psi minimum, cast-in-place or precast concrete.
c) The drainage from containment system shall be directed to wet well
d) A NEMA 4X Stainless Steel Control Panel
e) All piping, valves, fittings, gauges, and electronics necessary for complete operation.
f) A 1,000 ml in-line graduated cylinder for pump calibration
g) A stainless steel pipe support stand.
h) 2" PVC fill lines with ball valves and quick connect couplings.
i) All miscellaneous piping, fittings, filters, etc. needed to complete the system.

515.04 Odor control chemical tank shall include two (2) variable frequency drive, Gorman-Rupp Bellows chemical feed pumps with adjustable feed rate.

515.05 Odor control chemical tank shall include a leveling device connected to the station's SCADA system that monitors tank level.

515.06 The contractor shall furnish the concrete pad and containment with all in-slab piping and conduit. All electrical connections and wiring shall be done by the contractor.

515.07 The contractor shall furnish and install all necessary slab openings, sleeves, and sealant.

515.08 The contractor shall furnish and install all hangers, supports, and blocking for piping.

515.09 All hardware required for installation shall be stainless steel, furnished and installed by the contractor.

515.10 Floor drain in odor control chemical tank containment area shall be Zurn Z550 with ball type back water valve and drum trap Zurn Z-1099, or approved equal with 6-inch outlet and 9-inch strainer. Floor grate shall be installed flush with finish floor.

516 Pressure Gauges

A liquid filled pressure gauge shall be provided on the force main at the location shown on Standard Construction Drawing Sa.S-36. The pressure gauge shall be liquid filled and have a range that covers the operating range of the system. The pressure gauge type and manufacturer shall be submitted for approval by the Sanitary Engineer. The common force main discharge line shall have a pressure gauge capable of outputting a 4-20 mA signal to be monitored by the Multi-Smart SCADA System. This gauge shall be a Cerabar M PMP51 Model #PMP51-4MMFO/101.

517 Magnetic Flowmeter

Magnetic flowmeters shall be provided on the force main at the location shown on Standard Construction Drawing Sa.S-36. Flowmeters shall be pulsed direct current induction meters with the following specifications:

a) System accuracy, 2.0 percent of rate from 0 to 10 percent of range, 0.4 percent of rate from 10 to 100 percent of range.
b) System repeatability, 0.5 percent of rate in 10 to 100 percent flow range.
c) Drift, complete zero stability.
d) Ambient temperature range of -20 to 150 degrees Fahrenheit.
e) Minimum fluid conductivity limit of 5 microsiemens per centimeter or higher.
f) Process fluid temperature of 190 degrees F maximum.
g) Range adjust, continuously adjustable from 1 to 31 feet per second (fps).
h) Signal output, 4-20 milliamperes direct current (mAdc) isolated into 0-800 ohms, isolated. Filed selectable active or passive scaled pulse output, relay output assigned to various functions.
i) Power requirements, 120 V alternating current (Vac) + 10 percent, 60 Hz, 30 W maximum.

Provide magnetic flowmeter manufactured by Siemens, Model 5100W with integral 5000 transmitter.

518 Air Release

An air release as manufactured by Vent-O-Mat, Model 050RGX1021 shall be provided at the location shown on the Standard Drawings.

519 Electrical

519.01 Provide components that comply with NFPA 70 and that are listed and labelled by UL where applicable.

519.02 A 110-volt GFCI duplex outlet and lighting for the work area shall also be included.

519.03 Tamlite® W2LED Series exterior lights with photocell and switch inside the building shall be installed to provide light to the wet well area. Two LED lights capable of producing sufficient light as approved by the Engineer shall be provided overlooking the wet well and the access drive. Lighting placement shall be in accordance with the standard drawings.

519.04 All electrical components within the Motor Control Center shall be manufactured by Allen Bradley.

519.05 Lighting Panel: Provide a 3 phase-4 wire 208Y/120-volt lighting panel. Provide in NEMA 1 enclosure with 150-Ampere main circuit breaker and branch circuit breakers as shown on drawings. Panel shall be sized to allow up to 12 single pole branch circuit breakers. Provide ground fault interrupt circuits as required by NEC. All components shall be manufactured by Square D Inc.

519.06 Service Entrance Disconnect Switch: Provide 600 Volt, 200 Ampere, 4-wire, heavy duty fused disconnect switch rated for service entrance use. Switch shall be load break and HP rated for the application. The enclosure shall be NEMA 1 rated with a pad-lockable handle. Provide with Class J fuse rated sized at 150 amperes.

519.07 Transfer Switch: Provide 600 Volt, 200 Ampere, 3 pole.

519.08 Power Panel: Provide 3-phase 4-wire power panel with 150-ampere main circuit breaker rated for 480Y/277 Volts. Provide in NEMA 1 enclosure with branch circuit breakers as shown on drawing. Panel shall be sized to allow up to 6-3 pole branch circuit breakers. Provide ground fault interrupt circuits as required by NEC.

519.09 Distribution Transformer: Provide 3-phase, 30 KVA, NEMA 1 dry type transformer with 480-volt primary and 208Y/120-volt secondary. Provide mounting bracket to keep transformer off floor.

519.10 Site Lighting: Provide lighting contactor with Hand/Off/Auto selector switch control in building to control lighting mounted on outside of building as shown on standard drawing.

519.11 Provide photocell mounted on building and connect to auto circuit to control outside lighting.

519.12 Building Lighting: Provide ceiling mounted luminaires in Control Room and Valve Room as shown on standard drawings. Luminaires shall be LED and shall have at least 1200 initial delivered lumens, a luminous efficacy of at least 71 lumens/W, a color temperature of 4000K, at least 80 CRI, an estimated life of at least 50,000 hours, and shall include a minimum 1-year warranty on the entire luminaire including the driver.

519.13 Building Exhaust Fan: Provide fan with integral control as shown on Standard Drawings. Fan shall be controlled by the lighted switch outside of the building.

519.14 Wiring and Schematics

a) Wire all power and devices to the Control Panels as detailed on the approved drawings.

b) Clearly identify and mark all conduits entering/leaving the Control Panels as of their destination.

c) Keep field wiring neat and bundled inside the Control Panels. All field wiring shall be contained in wire way provided within the Control Panels.

d) Keep conduit filings from entering panels when installing conduit.
e) Provide 3/4" plywood mounting board on wall of electrical room where panels are mounted.
f) Provide panel schematics and panel layout drawings for each control panel supplied. Items on the schematic shall be labeled to match the labels used on the panel layout and bill of material.
g) Provide wiring inside panels that is neatly bundled with wire ties and/or run inside plastic wire troughs. Terminate all device wiring on terminal blocks with no more than two (2) wires per screw. Provide 20% additional spare terminal blocks in each panel.
h) Provide terminals for incoming power and neutral connections.
i) Provide one wired terminal for every two field devices powered from the same wire. Provide one wired terminal for every two field devices sharing a common neutral.
j) Provide separate terminals for DC voltage / analog signal wiring.
k) Provide spare terminals for signal cable shield terminations.
l) Provide isolated space inside panel for intrinsically safe wiring as required by NEC and manufacture's recommendations.
m) Label all terminals and wires with individual and unique wire numbers. Provide industrial type wire markers, such as Brady "Wrap Around" type wire labels.
n) Provide labels with numbers that are printed, NOT “hand written", on each wire label. Provide Nameplates with individual designations for all control relays, breakers, fuses, and all other miscellaneous equipment mounted inside panels.
o) Provide sufficient wiring so that all doors may be fully opened for panel access without having to disconnect any wiring, terminal blocks, etc. Design interior of panels so that all devices, wiring, terminal blocks, etc. are easily accessible for maintenance and testing.
p) Provide UL listed type MTW wire with 600 V insulation, minimum size AWG #18 copper for DC voltage / analog signal panel wiring, unless otherwise noted on the Standard Drawings. Keep all DC voltage / analog signal wiring separate from 120 VAC wiring.
q) Provide UL listed type MTW wire with 600 V insulation, minimum size AWG #16 copper for 120 VAC panel wiring.
r) Color code all 120 VAC panel wiring in the to identify it separately from analog signal and communications wiring, and keep 120 VAC wiring in separate wiring troughs from all other wiring. Panels are arranged such that all wiring from the terminal blocks to the field is separated from that wiring within the panel. Maintain this segregation.
s) Contractor shall utilize sweeps only (no elbows) for conduit directional changes.
t) Connect all service line wires to main line wires using Duratrace™ Part #3WB-01 (blue), Copperhead® LSC12-Blue, or Pro-Trace® #73901 weatherproof underground wire connectors.

519.15 Control Panels

a) Provide a new Pump Control Panel, Sewage Grinder Control Panel and SCADA panel constructed of new and un-deteriorated parts and components. Panels are to be installed in the building.
b) Provide panels that are factory wired and tested prior to shipment so that field installation will consist only of setting panels in place and making final field connections.
c) Provide and install all switches, pilot lights, and other panel devices as specified herein or as noted on the approved drawings.

d) Provide all plug-in control relays in Control Panels as noted on the approved drawings.
e) Provide original and three spare fuses for each type and size fuse in the panel.
f) Mount sub-panel as indicated on the approved drawings.
g) Pump monitoring equipment shall be manufactured by Multitrode, Inc
h) Provide a NEMA 12 enclosure that is UL, CSA, and IEC approved and sized as required. Provide enclosure complete with full size sub panel. Pump supplier shall provide enclosure. Provide enclosure that is fabricated from 14-gauge steel with the following features:
    I. Continuously welded and ground smooth seams.
    II. Oil-resistant continuously gasketed doors.
    III. 3-point latching mechanism operated by an oil-tight key locking handle.
    IV. Heavy gauge continuous hinges.
    V. Removable print pocket mounted on door.
    VI. Collar studs for mounting sub panel.
    VII. Ground stud welded on door.
    VIII. Finish to be white epoxy polyester coated inside and ASNI 61 high solids re-coatable gray finish outside.
    IX. Sub panel to be full size of enclosure and constructed of 10 to 12-gauge steel with white epoxy polyester coated finish.

519.16 Circuit Breaker:

a) Provide molded case circuit breakers with inverse time and instantaneous tripping characteristics size per NEC requirements.
b) All circuit breakers shall have ground fault protection where indicated or as required by NEC.
c) Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make/quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy, and arc extinction shall be accomplished by means of arc chutes.
d) A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

519.17 Circuit Breaker Handle: Provide Allen Bradley Non-Rotary Circuit Breaker Operating Mechanism. Breakers shall be accessible (through the door type) without opening the main door.

519.18 Smart Motor Controller: Provide Allen Bradley Bulletin 150 Smart Motor Controller - SMC Dialog Plus. Provide SMC Dialog Plus units that are properly sized for the load they are controlling.

a) Control Power Transformer: Provide a control power transformer that is size properly supply 120VAC control power for the Pump Control Panel and its associated equipment. Provide a transformer that is 480 VAC single phase primary, 120 VAC single phase secondary.
b) Current Transformer: Current transformers shall be provided to monitor 3 phases of each pump. Current transformers shall have the capability to allow the Multi-Smart/SCADA System to monitor pump drain. Current Transformers shall be manufactured by Allen Bradley.

519.19 Pump Selector Switch: Provide Allen Bradley Model 800T (NEMA 4/13) 3 positions maintained contact non-illuminated selector switches with contacts rated for 125 VAC operations. Provide switches complete with contacts as required and legend plates engraved as shown on the contract drawings.

519.20 Back up float system in operation pilot light: Provide Red Allen Bradley Model 800T pilot lights rated for 125 VAC. Provide complete unit with engraved legend plates as shown on the contract drawings.

519.21 Control Relays: Provide 120 VAC control relays with DPDT contracts rated for 5 amps (minimum) at 120 VAC. Provide relays as required, complete with mounting sockets.

519.22 Pump Control Panel Interior Light: Provide Hoffman low profile 120 VAC fluorescent light, or approved equal. Provide light complete with integrally mounted manual switch and properly sized bulb.

519.23 Backup Float System: A one-float back-up level control system shall be included to act as an emergency back-up level control system if the main system or level probe should fail. The backup system will operate when the pump selector switches are in Auto Mode. Indication shall be provided on the control panel when the backup float system is in operation and a signal shall be sent to the telemetry system. The back-up level control system will include one encapsulated mercury float switch, Flygt ENM 10, suitable for suspending directly into wet will and an analog Allen Bradley Timer. Furnish the float with required length of 16/2 SJO cord. Float shall be "UL" approved and suitable for operating intrinsically safe relays. Provide flat, stainless steel mounting brackets for suspending float with cord grips included. When the backup float is reached, the first pump will turn on and the second pump will turn on 10 seconds later. Both pumps will run for an adjustable time period then shut off.

519.24 Control Panel Operations: All control panel components shall be integrated to form a complete and functioning system.

a) Interconnection schematics shall be submitted with shop drawings that detail how each component is wired and grounded.
b) All programmable settings shall be submitted with shop drawings that detail how the system will function.

519.25 Level Sensing:

c) A Multi-Stage Level Sensing Device designed to detect liquid level at specified intervals in tanks or sumps and interface with an electronic controller for pump control and liquid level display. The level sensing equipment shall be Multitrode 3 M level sensing probe with 1 foot increments.
d) Probe Cable: The flexible cable used for the level sensing probe shall be comprised of PVC/PVC multi-conductor construction with a common oversheath that is water and oil resistant. The multi-conductor cable shall be identified with numbering and text along the entire length of the outer sheath at required intervals. Individual conductors of the multi-conductor cable shall be numbered for easy identification, as well as connection to the pump controls.
e) Cables: Cables shall be secured to the top of probe bodies by synthetic rubber compression fittings for strain relief. Flexible cables shall be rated to physically support the combined weight of the level sensing probe and any suspended cable connected to the probe.
f) Mounting and Installation: Mounting connections shall be stainless steel. The mounting assembly for probes shall include a device available to maintenance personnel to clean the level sensing probe at desired maintenance intervals.

519.26 SCADA: The SCADA system shall be Multitrode Outpost Control and Monitoring software connected to the County's wireless network with an MDS iNET 900 MHz spread spectrum radio. District staff shall conduct a radio/telemetry study to determine antenna type and installation height. Contractor shall furnish and install all equipment necessary for the SCADA system, including radio, antennas, etc.

Multi-Smart/SCADA shall monitor the following additional I/Os:

a) Power failure
b) Sewage Grinder unit running
c) Sewage grinder failure
d) Odor control chemical alarm

519.27 A High Tide high level backup SCADA alarm shall be included.

a) Model No. is HTT-900
b) Communication: cellular
c) Input Power: 100-240V / 50-60Hz
d) 12 Discrete inputs
e) Enclosure: 8in x 10 in, Nema 4X FRP or Dinrail kit
f) Operating Temperature: -25C to 70C
g) Built-in power fail monitor and battery backup.
h) Backup Battery: 12V 1-2 days
i) High level backup alarm.

519.28 Backup Generator:

a). General: Provide all labor, tools, equipment, and materials necessary for a complete and functional engine-generator system in accordance with the plans and as specified herein for the engine-generator set, batteries, battery charger, to include automatic transfer switch, exhaust system, weatherproof housing, sub-base fuel tank.

b). Codes: Perform all work in compliance with all applicable federal, state, and local codes and regulatory requirements, the National Electrical Code (NEC), National Fire Protection Association (NFPA), Underwriters' Laboratories, Inc. (UL), American National Standards Institute (ANSI), National Electrical Manufacturers Association (NEMA), Institute of Electrical and Electronic Engineers (IEEE).

c). Submittals: Product data, shop drawing, wiring diagrams. Show all components and features specified. Show all connections to feeders, load, and accessory equipment. Differentiate between factory installed and field installed wiring and components.

I. Quality Control Submittals
   a. Submit warranty documents.
   b. Submit manufacturer's current installation recommendations.
   c. Submit factory test report prior to shipment.
   d. Submit certified copies of the field test report.
   e. Submit Operation and Maintenance Manuals

II. Include instructions on storage, installation, start up, operation and maintenance.

III. Submit a complete parts list and a recommended spare parts list.

d). Generator Details

I. Manufacturer: Kohler.

II. Sizes, Ratings, and Quantities
   a. Output power: to be sized according to pump and voltage requirements.
   b. Output voltage: 480Y/277 volt, 3-phase, 4-wire, 60 Hertz at rated speed.
   c. Maximum voltage dip: 20 percent root mean square (RMS) voltage dip as measured during the fourth complete cycle following the application of the load.
   d. Steady state frequency regulation: ±0.5 percent.
   e. Maximum frequency dip. 10 percent.
   f. Altitude rating: 850 feet above sea level.

g. Temperature: 105 deg F maximum and -20 deg F minimum.
h. Rated for continuous standby operation.
i. Single step load pickup: Meet NFPA 110 requirements.

e). Engine and Accessories
I. Manufacturer: John Deere.
II. Liquid cooled.
III. Four stroke cycle.
IV. Full compression, diesel for use with No. 2 diesel fuel.
V. Replaceable cylinder liners.
VI. Valves shall not require adjustment while in service.

f). Base
I. Mount the engine-generator set on a structural steel base.
II. Base shall maintain proper alignment between components during shipment, installation, and operation.
III. Vibration Isolators
a. Provide vibration isolators to prevent transmission of vibrations from the generator to the foundation and surrounding structures.
b. Isolators shall provide a minimum of 90 percent isolation.

g). Remote Annunciator
I. Battery powered.
II. Meeting Level 1 requirements of NFPA 110.
III. Provide the following alarms and controls:
a. Audible alarm and silence button.
b. Lamp test button.
c. Over-crank alarm light.
d. Low coolant temperature alarm light.
e. High coolant temperature pre-alarm light.
f. High coolant temperature shutdown light.
g. Low oil pressure pre-alarm light.
h. Low oil pressure shutdown light.
i. Over-speed light.
j. Low fuel light.
k. Control switch not in auto light.

h). Batteries
I. Lead-acid.
II. Ampere-hour rating equal to or greater than the manufacturer's recommendations.
III. Capacity for a minimum of three cranking cycles in the ambient temperatures specified.
IV. Unit mounted rack for battery mounting.
V. Battery cables of adequate size to prevent voltage drop problems during cranking cycle.
VI. Engine block heater.
VII. Provide a battery charger.

i). Sub-base Mounted Fuel Tank
I. Leak Detection
a. Provide an inter-tank leak detector with alarm contact
b. Provide control panel for local and remote annunciation of leak.
II. Provide fuel level gauge with adjustable low level alarm contacts.

j). Weatherproof Housing
I. General: Completely enclosed weatherproof/sound attenuated housing to protect the generator from adverse weather conditions and reduced the

sound. The sound enclosed housing shall provide average of 75 dB sound level at 23 feet and shall meet state and local regulations to restrict the level sound near the residential area.

II. Constructed of reinforced sheet steel, primed and painted.
III. Lockable, removable side panels.
IV. Lockable door over the generator control panel.
V. Generator silencer mounted inside housing.

k). Disconnect Switch – Provide circuit breaker at the generator.

APPENDIX A – TESTING REPORTS AND LOGS

DELAWARE COUNTY Ohio

DELAWARE COUNTY REGIONAL SEWER DISTRICT

AIR TEST REPORT

	MH TO MH	Pipe Diameter (in)	Length of Test (ft)	Start Pressure (psig)	End Pressure (psig)	Test Duration (min:sec)	Pass	Fail	Check if Retest	Comments
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

Date: _____ Project: _____

Total Inspection Time (Hrs): _____ Contractor: _____

Inspector: _____ Contractor's Representative: _____

(NAME) (SIGNATURE) (NAME) (SIGNATURE)

DELAWARE COUNTY Ohio

DELAWARE COUNTY REGIONAL SEWER DISTRICT

VACUUM TEST REPORT

	MH No.	MH Diameter (in)	MH Depth (ft)	Start Pressure (in Hg)	End Pressure (in Hg)	Test Duration (seconds)	Pass	Fail	Check if Retest	Comments
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

Date: _____ Project: _____

Total Inspection Time (Hrs): _____ Contractor: _____

Inspector: _____ Contractor's Representative: _____

(NAME) (SIGNATURE) (NAME) (SIGNATURE)

DELAWARE COUNTY Ohio

DELAWARE COUNTY REGIONAL SEWER DISTRICT

MANDREL TEST REPORT

	MH TO MH	Pipe Material	Pipe Diameter (in)	Mandrel Type	Mandrel Diameter (in)	Length of Test (ft)	Pass	Fail	Check if Retest	Comments
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

Date: _____ Project: _____

Total Inspection Time (Hrs): _____ Contractor: _____

Inspector: _____ Contractor's Representative: _____

(NAME) (SIGNATURE) (NAME) (SIGNATURE)

DELAWARE COUNTY REGIONAL SEWER DISTRICT

HYDROSTATIC TEST REPORT

	Pipe Diameter (in)	Pipe Material	Location of Test	Length of Test (ft)	Test Pressure (psi)	Leakage (gal/hr)	Pass	Fail	Check if Retest	Comments
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

Date: _____ Project: _____

Total Inspection Time (Hrs): _____ Contractor: _____

Inspector: _____ Contractor's Representative: _____

(NAME) (SIGNATURE) (NAME) (SIGNATURE)