TOWN OF THOMPSON'S STATION
WILLIAMSON COUNTY, TENNESSEE

SPECIFICATIONS COVERING THE DESIGN AND INSTALLATION OF SEWER COLLECTION SYSTEMS

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WPN 26.0349

APPROVED

THE DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED BY THE

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION

DIVISION OF WATER RESOURCES

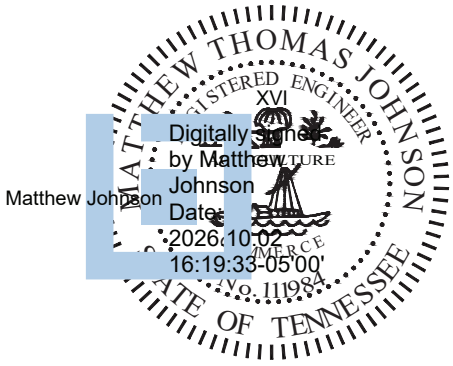
AND IS HEREBY APPRIOVED FOR CONSTRUCTION BY THE COMMISSIONER

Michael J Bascom

10/21/ 2026

THIS APPROVAL SHALL NOT BE CONSTRUED AS CREATING A PRESUMPTION OF CORRECT OPERATION OR AS WARRANTING BY THE COMMISSIONER THAT THE APPROVED FACILITIES WILL REACH THE DESIGNED GOALS.

APPROVAL EXPIRES FIVE YEARS FROM ABOVE DATE



Section 21: Package Sewer Lift Station, Grinder

Detail 1: Precast Concrete Manhole

Detail 2: Sanitary Manhole Joint

Detail 3: Sanitary Manhole Frame & Cover

Detail 4: Resilient Pipe Connector to Manhole

Detail 5: Sewer Pipe Bedding & Haunching

Detail 6: Service Repair

Detail 7: Cleanout

Detail 8: Concrete Cap

Detail 9: Concrete Encasement

Detail 10: Utility Casing Pipe

Detail 11: Watertight Manhole Cover

Detail 12: Pipe Separation

Detail 13: Grease Interceptor

Detail 14: Temporary Silt Fence

Detail 15: Sewer Lift Station

SECTION 1
GENERAL GUIDELINES

PART 1. GENERAL

1.1 The purpose of these guidelines is to provide a guide to the Developers and their engineers and contractors in order to achieve an acceptable installation for furnishing of wastewater service to developments. The words "Town of Thompson's Station," "Town" and "Wastewater Operators" are to be used interchangeably. Approvals by the Town may be delegated to Town staff, Town engineering consultants, or other representatives of the Town. The Town will determine which of its staff and consultants are required to review submitted documents and perform inspections. Summarized below are requirements and conditions that apply to the granting of utility service by the Town of Thompson's Station.

1.1.1 Prior to the design of any utility line extension or expansion, the design engineer should first confer with the Town of Thompson's Station Staff in regard to growth potential and density that may be expected in the general area of the extension being planned. A conference with the Town Administrator and/or Wastewater Operator should follow to discuss system standards and requirements, as well as any problems related to the mains being extended.

1.1.1.1 Construction of utility lines, including individual service connections, may not begin prior to approval by the Town of Thompson's Station.

1.1.2 No connection to an existing utility shall be made until all lines have been completely tested and the tie-in is approved by the Town's Consulting Engineer.

1.1.3 Testing will not be completed until paving is completed.

1.1.4 The Town of Thompson's Station will not accept utility lines that were not approved in accordance with the Town Code and constructed in accordance with these specifications.

1.1.5 The Town of Thompson's Station requires performance and maintenance bonds for sewer infrastructure as specified in the Town's Subdivision Regulations.

1.1.6 All utility lines and services to property line or right-of-way only constructed utilizing these specifications become the property of the Town of Thompson's Station upon acceptance by the Town. Utility lines and services to property line or right-of-way only will not be accepted by the Town unless and until they are in strict conformance with these specifications.

1.1.7 Easements required across private property or in roads are to be acquired by the Developer in the name of the Town. Easements shall have a minimum width of 20 feet unless justification is submitted and approved for another width. Wider easements may be required for sewer lines over 12 feet deep. Each pipeline shall be the only utility located within a specific easement, unless approved by the Town.

1.1.8 All applicable Federal and State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the construction throughout.

1.1.9 Sizes and locations of all water and sewer lines and appurtenances, and all construction shall be in accordance with the plans approved by the Town.

1.1.10 Permits for pavement cuts or crossing of public roads, including any special backfill and pavement repair as required by the agency having jurisdiction, are the responsibility of the Developer. A bond is required from the Developer to cover all costs of repair and maintenance for a period of one (1) year from the date of acceptance of the project by the Town for all work performed in existing rights-of-way of all roads.

1.1.11 Prior to the commencement of construction project, the Developer shall submit complete design documents to the Town for approval. The submittal shall include all required permit applications, design reports, specifications, and construction drawings prepared under the supervision of a licensed Professional Engineer. Construction activities shall not begin until all required regulatory reviews have been completed and written approval has been received from the Town, TDEC and any applicable local utility. Any revisions to the approved design must be submitted for review and approved prior to implementation in the field.

1.1.12 The Developer shall provide sealed engineering plans, specifications, and hydraulic calculations demonstrating that the proposed system is designed in accordance with applicable Town standards, TDEC regulations, and accepted engineering practices. Construction shall not proceed until the Town and TDEC have received and accepted the required engineering documentation.

1.1.13 If construction has not started within one (1) year from the date of approval, utility plans shall be resubmitted to renew approval. Renewal is not guaranteed.

1.1.14 The Developer's name, project cost, and estimated working time for each project shall be submitted to the Town.

1.1.15 Laboratory test reports shall be provided on all pipes to assure that it meets the requirements of the Town's specifications.

1.1.16 Shop drawings for utility materials shall be submitted to the Town of Thompson’s Station for review after being thoroughly checked by the Developer and stamped with their approval.

1.1.17 The Town reserves the right to relocate water and sewer lines on the construction plans to facilitate maintenance.

1.1.18 All utility construction shall be in accordance with specifications of the Town of Thompson’s Station.

1.1.19 Unless authorized by the Town, all grading work shall be completed, and all roads constructed to subgrade and lot corners are to be marked prior to the installation of utility lines. A survey or CAD drawing of the proposed grade shall be required of the developer.

1.1.20 The Developer shall be responsible for locating and verifying the elevations of existing utilities prior to construction.

1.1.21 The Developer shall provide a set of construction cut sheets prior to the preconstruction meeting and the cut sheets shall include the stations of all proposed service connections.

PART 2. EASEMENTS

2.1 Sewer installations require easements in accordance with the Town's Subdivision Regulations.

2.2 All easements shall be platted in accordance with the Town's Subdivision Regulations.

2.3 Multiple pipelines are not allowed in the same easement unless approved by the Town.

PART 3. PRE-CONSTRUCTION MEETING

3.1 Before beginning any construction, the Developer shall contact the Town and execute a contract with them paying all wastewater capacity fees as required.

3.2 After this contract is executed and before beginning any construction, the Developer or his Engineer shall schedule a pre-construction conference to be held between the Contractor, Developer, Developer's Engineer, and the Town and their Consulting Engineer. At this meeting, the Developer will be informed of the Town's policies and any special requirements.

PART 4. FLOW BASIS

4.1 Per capita flow: Sewer systems serving residential development should be designed on the basis of an average daily per capita flow of wastewater of not less than 350 gallons per day per Equivalent Dwelling Unit (EDU) when no water use information is available. For developments tied into the Regional or Heritage Commons systems an average daily per capita flow of wastewater of not less than 250 gallons per day per EDU may be used. The Developer may submit information and calculations that request use of other rates per EDU for the Town's review and approval. This amount of flow is assumed to cover nominal infiltration, but an additional allowance should be made where conditions are unfavorable.

4.2 Sewer systems serving commercial developments shall have wastewater flow rates and quality calculated based upon TDEC and established engineering design standards. Calculations shall be submitted to and reviewed and accepted by the Town.

PART 5. FINAL ACCEPTANCE

5.1 Upon completion of the sewer project, the Developer shall request final inspection and acceptance by the Town. The acceptance package shall include, at a minimum, record drawings (as-builts), testing and inspection documentation, certification of construction by the project engineer, and any other documentation required by the utility or TDEC. All deficiencies identified during inspection shall be corrected prior to acceptance. The sewer system shall not be placed into permanent service, nor shall ownership or maintenance responsibilities be transferred to the Town, until final acceptance has been granted in writing by the Town and all applicable regulatory requirements have been satisfied..

END OF SECTION

SECTION 2
SPECIAL PROJECT PROCEDURES

PART 1. GENERAL

1.1 SMOKING AND FIRE PRECAUTIONS

1.1.1 No smoking, fire or use of any fire- or explosion-producing tools or equipment will be permitted on the properties of oil companies or other companies prohibiting same on their premises or at any locations where such may endanger said premises or the current operations thereon.

1.2 MANUFACTURERS' QUALIFICATIONS

1.2.1 The manufacturers of all materials and equipment used must be reputable and regularly engaged in the manufacture of the particular material or equipment for the use and service to which it will be subjected.

1.3 DEVELOPER SHALL PAY FOR ALL LABORATORY INSPECTION SERVICES

1.3.1 All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Developer and approved by the Town. The Developer shall pay for all laboratory inspection services as a part of the Contract. Submit all material test reports to the Town or its engineer in triplicate.

1.4 COMPLIANCE WITH STATE AND LOCAL LAWS

1.4.1 Comply with all applicable requirements of state and local laws and ordinances to the extent that such requirements do not conflict with federal laws or regulations.

1.5 MARKERS

1.5.1 Preserve all Corps of Engineers, USGS, TVA, State of Tennessee, and private markers; do not remove or disturb any such markers without prior approval from the Town. Any removal and replacement of such markers shall be by the Developer.

1.6 PAVEMENT REPAIR AND/OR REPLACEMENT

1.6.1 Whenever pipe trenches are cut across or along existing pavement or shoulders, backfill same day and restore traffic over the cuts as quickly as possible by constructing a temporary twelve-inch (12") surface of Class A, Grade D crushed stone. Add material and otherwise maintain such surface until the permanent pavement is restored or until the entire project is accepted.

1.7 APPROVED CHEMICALS

1.7.1 All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification,

must show approval of either EPA or USDA. The use of all such chemicals and the disposal of residues shall be in strict conformance with all applicable instructions and regulations.

1.8 DEPARTMENT OF TRANSPORTATION PERMITS

1.8.1 The Town will assist in securing any permits and provide bond as required by the Tennessee Department of Transportation for the installation of permanent facilities on State highway rights-of-way. The costs for such bonds and/or permits, if applicable, shall be paid by the Developer. All such work shall be coordinated with and be subject to the approval of the Tennessee Department of Transportation, in addition to the approval of the Town.

1.8.2 The Developer will secure any permits as required by the local highway department for the installation of water lines within the rights-of-way of county roads. The Developer shall be responsible for complying with the requirements of the local highway department, and all such work shall be coordinated with and be subject to the approval of the local highway department, in addition to the approval of the Town.

1.9 INSTALLATION, TESTING, AND GUARANTEE

1.9.1 The completely installed system shall be guaranteed against any and all defects of manufacture, materials, workmanship, or installation for a period of one year from the date of acceptance.

1.10 DRAWINGS OF RECORD

1.10.1 The Developer shall provide and keep up-to-date a complete record set of blueline prints, which shall be corrected daily to show every change, and the approved shop drawings. The Developer shall keep this set of prints at the job site and use it only as a record set. This shall not be construed as authorization for the Developer to make changes to the approved layout without definite instructions in each case.

1.10.2 Prior to Final Acceptance, the Developer shall submit as-built plans / as-built drawings of the improvements installed as part of the Project, including but not limited to: the potable water system, the sanitary sewer system, the drainage/detention/stormwater management system, landscaping, irrigations system, photometric plan, and streets including curbs and gutters and sidewalks, signed and sealed by a Design Professional, confirming that the installed improvements are in compliance with Town Regulations and the approved Final Project Documents.

1.11 UTILITIES

1.11.1 The Developer shall contact the owner of all underground utilities before beginning construction in the area. Carefully protect from damage all utilities in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility in order to complete the work properly, do so in compliance with the rules and regulations of the particular utility involved. Any such work shall be considered

incidental to the construction of the project, and no additional payment will be allowed therefor.

1.12 INSURANCE

1.12.1 The Developer shall procure, maintain, and furnish an Owner's protective policy in accordance with the town’s Land Development Ordinance, Section VIII.

END OF SECTION

SECTION 3
REFERENCE STANDARDS

PART 1. GENERAL

1.1 REQUIREMENTS INCLUDED

1.1.1 Quality Assurance.

1.1.2 Schedule of References

1.1.3 Acronyms and Abbreviations used in Contract Documents.

1.1.4 Source of Reference Standards.

1.2 QUALITY ASSURANCE

1.2.1 For products or workmanship specified by association, trades, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

1.2.2 Conform to reference standard by date of issue current on date of Contract Documents except when a specific publication date is specified.

1.2.3 Should specified reference standards conflict with Contract Documents request clarification from the Engineer before proceeding.

1.2.4 The contractual relationship of the parties to the contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.2.5 When required by individual Specifications section, obtain copy of standard. Maintain copy at jobsite during submittals, planning, and progress of the specific work, until Substantial Completion.

1.3 SCHEDULE OF REFERENCES

AA Aluminum Association
1400 Crystal Drive, Suite 430
Arlington, VA 22202

AASHTO American Association of State Highway and Transportation Officials
555 12th Street, N.W.
Washington, DC 20004

ACA American Cement Association
200 Massachusetts Ave NW, Suite 200
Washington, DC 20001

ACI	American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331
AGC	Associated General Contractors of America 2300 Wilson Blvd Arlington, VA 22201
AI	Asphalt Institute 2696 Research Park Dr Lexington, KY 40511
AISC	American Institute of Steel Construction 130 E Randolph St, Suite 2000 Chicago, IL 60601
AISI	American Iron and Steel Institute 25 Massachusetts Avenue NW, Suite 800 Washington, DC 20001
ANSI	American National Standards Institute 1180 Avenue of the Americas New York, NY 10036
APA	American Plywood Association 7011 S 19th St Tacoma, WA 98466
AREMA	American Railway Engineering and Maintenance-of-Way Association 4700 Eisenhower Ave, Suite A10 Alexandria, VA 22304
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 180 Technology Parkway NW Peachtree Corners, GA 30092
ASME	American Society of Mechanical Engineers 2 Park Avenue New York, NY 10016
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive, PO Box C700 West Conshohocken, PA 19428

AWPA	American Wood-Preservers Association 2430 US Highway 27, Suite 330-223 Clermont, FL 34714
AWS	American Welding Society 8669 NW 36th St, #130 Miami, FL 33166
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
BIA	Brick Institute of America 12007 Sunrise Valley Drive, Suite 430 Reston, VA 20191
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Rd, Suite B 215 Columbia, MD 21046
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173
DHI	Door and Hardware Institute 2001 K Street NW Washington, DC 20006
EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council 1420 King Street Alexandria, VA 22314
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FGIA	Fenestration and Glazing Industry Alliance 12707 Eckles Rd Plymouth, MI 48170
FHWA	Federal Highway Administration 404 BNA Drive, Building 200, Suite 508 Nashville, TN 372127

FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) 1800 F Street NW Washington, DC 20405
GA	Gypsum Association 962 Wayne Ave, Suite 620 Silver Spring, MD 20910
IEEE	Institute of Electrical and Electronics Engineers 445 Hoes Lane Piscataway, NJ 0885
IMI	International Masonry Institute 17101 Science Drive Bowie, MD 20715
MBMA	Metal Building Manufacturer's Association 1300 Summer Avenue Cleveland, OH 44115
MIL	Military Specification Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Rd, Bldg C, Suite 312 Glen Ellyn, IL 60137
NASSCO	National Association of Sewer Service Companies 5285 Westview Dr, Suite 202 Frederick, MD 21703
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877
NEMA	National Electrical Manufacturers Association 1812 N Moore St, Suite 2200 Arlington, VA 22209

NTMA	National Terrazzo and Mosiac Association 209 N Crockett St Fredericksburg, TX 78624
PCI	Precast/Prestressed Concrete Institute 8770 W Bryn Mawr Ave, Suite 1150 Chicago, IL 60631
PS	Product Standard U. S. Department of Commerce 1401 Constitution Ave NW Washington, DC 20230
SDI	Steel Deck Institute PO Box 70, Florence, SC 29503
SFIA	Steel Framing Industry Association 513 W Broad St, Suite 210 Falls Church, VA 22046
SFPA	Southern Forest Products Association 6660 Riverside Drive, Suite 212 Metairie, LA 70003
SJI	Steel Joist Institute 101 Kuker St Florence, SC 29501
SMACNA	Sheet Metal and Air Conditioning Contractors National Association 4201 Lafayette Center Drive Chantilly, VA 20151
SSPC	Steel Structures Painting Council 40 24th Street Pittsburgh, PA 15222
SWANA	Solid Waste Association of North America 8484 Georgia Avenue, Suite 230 Silver Spring, MD 20910
TAS	Technical Aid Series Construction Specifications Institute 5034A Thoroughbred Lane Brentwood, TN 37027

TCA	Tile Council of America, Inc. 100 Clemson Research Blvd Anderson, SC 29625
TDOT	Tennessee Department of Transportation James K. Polk Building 505 Deadrick Street Nashville, TN 37243
TOSHA	Tennessee Department of Labor Occupation Safety and Health 220 French Landing Drive Nashville, TN 37423
UL	Underwriters Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 4
QUALITY CONTROL

PART 1. GENERAL

1.1 REQUIREMENTS INCLUDED

1.1.1 General Quality Control.

1.1.1.1 Workmanship.

1.1.1.2 Manufacturers' Instructions.

1.1.1.3 Manufacturers' Certificates.

1.1.1.4 Mockups.

1.1.1.5 Manufacturers' Field Services.

1.1.1.6 Testing Laboratory Services.

1.2 RELATED REQUIREMENTS

1.2.1 General Conditions: Inspection and testing required by governing authorities.

1.2.2 Section 3 - Reference Standards: Applicability of specified reference standards.

1.3 QUALITY CONTROL, GENERAL

1.3.1 Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.4 WORKMANSHIP

1.4.1 Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

1.4.2 Perform work by utilizing only persons qualified to produce workmanship of specified quality.

1.4.3 When necessary, secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.5 MANUFACTURERS' INSTRUCTIONS

1.5.1 Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Town before proceeding.

1.6 MANUFACTURERS' CERTIFICATES

1.6.1 When required by individual Specification Sections, submit manufacturers' certificate, in duplicate, that products meet or exceed specified requirements.

1.7 MOCKUPS

1.7.1 When required by individual Specifications Section, erect complete, full-scale mockup of assembly at Project site.

1.8 MANUFACTURER'S FIELD SERVICES

1.8.1 When specified in respective Specification Sections, require supplier or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship; start-up of equipment; test, adjust, and balance of equipment, as applicable; and, to make appropriate recommendations.

1.8.2 Representative shall submit written report to Town listing observations and recommendations.

1.9 TESTING LABORATORY SERVICES

1.9.1 Developer shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services required by individual Specification Sections.

1.9.2 Services will be performed in accordance with requirements of governing authorities or agencies and with specified standards.

1.9.3 Employment of Testing Laboratory shall in no way relieve Developer of obligations to perform work in accordance with requirements of Contract Documents.

1.9.4 Developer shall cooperate with Testing Laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.

1.9.4.1 Notify Town and Testing Laboratory at least 48 hours prior to expected time for operations requiring testing services.

1.9.4.2 Make arrangements with Testing Laboratory and pay for additional samples and tests for Developers' convenience.

1.9.5 Reports will be submitted to Town in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards and with Contract Documents.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 5
EROSION CONTROL

PART 1. GENERAL

1.1 This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period. During flood seasons, protect the sites by sandbagging, the pumping of water, and any other means appropriate to restrain flooding of plant and equipment. During dry weather, sprinkle the sites with water or use other means as necessary to provide dust control. In case of abnormally cold weather, any construction such as excavation work may be delayed until warmer weather or covered to prevent freezing.

1.2 All work shall be in accordance with the Town of Thompson's Station's stormwater policies and in accordance with the TDEC's Erosion and Sediment Control Handbook, latest edition. Prior to any excavation activities commencing, the developer, developer's engineer, and/or Developer shall apply for and receive an approved permit from the Town of Thompson's Station for such excavation activities. The application for permit will be reviewed by the Program Director and an approved permit shall be obtained prior to excavation activities. All erosion and sediment runoff control measures shall be installed in accordance with the approved permit and shall be maintained throughout the project cycle and until adequate and approved vegetative cover has been established.

PART 2. PRODUCTS

2.1 Temporarily stabilize areas from which topsoil has been removed and topsoil stockpiles by seeding fast growing annuals such as rye and annual ryegrass that provide quick protection. These annual grasses are to be seed certified by the State Department of Agriculture and can be worked into the soil when the site is prepared for final seeding of more permanent species. Use commercial lime and fertilizer on exposed areas subject to erosion.

PART 3. EXECUTION

3.1 Conduct construction so as to provide the site with maximum protection from erosion at all times.

3.2 Conduct excavation activities to provide erosion and sediment control as follows:

3.2.1 Do not start clearing and excavation until a firm construction schedule is submitted to and approved by the Town of Thompson's Station. Continuously coordinate the schedule with the clearing and excavation activity.

3.2.2 In streets and other paved areas, remove excavated material from the site as construction progresses to prevent any erosion of this material.

3.2.3 In other areas, place the excavated material so as not to block any drainage area. Replace this excavated material in the trench immediately after repairs have been completed and are approved by the Town of Thompson's Station.

3.2.4 Retain natural vegetation whenever feasible. Install sediment control measures where needed and maintain throughout the project.

3.2.5 Restore and cover exposed areas subject to erosion as quickly as possible by means of seeding and mulching. Use diversion ditches or other methods as appropriate to prevent storm water from running over the exposed area until seeding is established as specified.

3.2.6 Take particular care along streams and drainage ditches so that fallen trees, debris, and excavated material will not adversely affect the stream flow. Exercise care to minimize the destruction of stream banks. Wherever the stream banks are affected by construction, reduce the slope of the stream banks to provide a suitable condition for vegetation protection. Minimize land exposure in terms of area and time.

3.2.7 Cover exposed excavated areas with mulch or vegetation.

3.2.8 Mechanically retard the rate of runoff water.

3.2.9 Trap the sediment contained in the runoff water utilizing approved sediment control measures.

3.2.9.1 Divert water from erosive areas.

3.2.9.2 Take care during the pouring of concrete, hauling of materials, etc., to keep vehicles from creating a severe erosion problem. Proper scheduling of operations and prompt repair of ruts created during this operation is necessary from this source.

3.2.9.3 Control dust by sprinkling or other means as necessary to keep it to a minimum.

3.2.9.4 Pave or otherwise stabilize roadways and driveways as soon as feasible.

3.2.9.5 Regrade and reseed surfaces eroded or otherwise damaged during any and all construction operations as necessary.

END OF SECTION

SECTION 6
STORAGE AND PROTECTION

PART 1. GENERAL

NOT USED.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

3.1 STORAGE, GENERAL

3.1.1 Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.

3.1.2 Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

3.2 EXTERIOR STORAGE

3.2.1 Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.

3.2.2 Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.

3.2.3 Provide surface drainage to prevent erosion and ponding of water.

3.3 MAINTENANCE OF STORAGE

3.3.1 Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.

END OF SECTION

SECTION 7
UNCLASSIFIED EXCAVATION FOR UTILITIES

PART 1. GENERAL

1.1 The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work; the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping of trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the Town, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

3.1 PREPARATION OF THE SITE

3.1.1 Before starting construction, remove from the work site all vegetation growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the drawings and/or the Town specifically indicate are to be removed. Dispose of this refuse material in a manner acceptable to the Town.

3.1.2 In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the drawings, specifically listed in the specifications, marked on the site, or identified by the Town. In no case damage or remove such growth without written permission from the Town.

3.1.3 If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth, grub the excavated area, and remove all large roots to a depth of not less than 2 feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the Town. Fill all holes or cavities created during this work that extend below the subgrade elevation with suitable material, and compact to the same density as the surrounding material.

3.1.4 Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the Town.

Take special precautions to protect and preserve such growth throughout all stages of the construction.

3.1.5 Preparation of the site shall be considered an integral part of the excavation and one for which no separate payment shall be allowed.

3.2 UNSUITABLE MATERIALS

3.2.1 Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1-inch to 2-inch lifts of crushed stone up to the level of the lines, grades, and/or cross sections shown on the drawings. The top 6 inches of this refill shall be No. 67 (TDOT) crushed stone for bedding.

3.3 ROCKS AND BOULDERS

3.3.1 Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be considered as unclassified excavation, and no separate payment will be made, therefore.

3.3.2 Should rock be encountered in the excavation, remove it by blasting or otherwise.

3.3.2.1 Blasting operations shall be conducted in accordance with all existing ordinances and regulations. All structures shall be protected from the effects of the blast. The blasting shall be done by licensed experienced workers. Dispose of excavated rock in accordance with applicable federal, state, county, and local regulations and in accordance with this Section.

3.3.2.2 If, in the sole opinion of the Town or Engineer, the Developer persistently uses excessive blasting charges or blasts in an unsafe or improper manner, the Town will direct the Developer to employ an independent, qualified blasting consultant, approved by the Engineer, to supervise the preparation for each blast and approve the quantity of each charge.

3.3.2.3 The Developer will notify the Engineer before any charge is set and prior to blasting. Following review by the Engineer regarding the proximity (normally within 300 linear feet) of permanent structures to the blasting site, the Engineer may direct the Developer to employ an independent qualified specialty subcontractor, approved by the Engineer, to monitor the blasting by use of seismograph, identify areas where light charges must be used, conduct pre event and post event inspections of all structures, including photographs or videos, and maintain a detailed written log.

3.3.2.4 Any damage caused as a result of blasting operations shall be promptly repaired by the Developer.

3.3.3 Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the bottom of pipe up to 30 inches in diameter and not less than 12 inches below the bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with No. 67 (TDOT) crushed stone or other approved material, tamp to the proper grade, and make ready for construction. For monolithic concrete sewers and for structures, excavate rock to the outside bottom of the structure or sewer.

3.4 DISPOSAL OF MATERIALS

3.4.1 Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the Town shall be used for these purposes. Any materials not to be used for these purposes shall be considered waste materials and disposed of by the Developer as specified below.

3.4.2 Waste materials may be deposited in spoil areas at locations approved by the Town. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 8, Seeding.

3.4.3 Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat and workman like condition, as described below.

3.4.4 The disposal of waste materials shall be considered an integral part of the excavation work and one for which no separate payment shall be allowed.

3.5 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

3.5.1 Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, collars, concrete saddles, and pipe protection) that are called for by the drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

3.5.2 The Developer may, if he chooses, use a motor powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utility service connections.

3.5.3 Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the Town, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the

Town on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed but shall not be more than the distance determined by the following formula: 4/3d + 15 inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the Town, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to non-vertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15 inches may be cause for the Town to require that stronger pipe and/or a higher class of bedding.

3.5.4 Pipe bedding shall be as specified in Section 11, 3.1.12 for gravity sewers and Section 12, 3.1.9 for force mains.

3.5.5 Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.

3.5.6 Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2-foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures. Should the Developer excavate below the elevations shown or specified, he shall fill the void with either concrete or granular material approved by the Town.

3.5.7 Do not excavate pipe trenches more than 200 feet ahead of the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the Town deems necessary to maintain vehicular or pedestrian traffic.

3.5.8 In all cases where materials are deposited along open trenches, place them so that in the event of rain no damage will result to the work and/or to adjacent property.

3.5.9 Excavation for other structures may be performed with non-vertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2-foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the drawings.

3.6 SHEETING, SHORING, AND BRACING

3.6.1 Take special care to avoid damage wherever excavation is being done. Sufficiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.

3.6.2 Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5 feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5 feet deep when examination of the ground indicates hazardous ground movement may be expected. Guard the walls and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.

3.6.3 Comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. The sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the Town. However, such approval does not relieve the Developer of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing.

3.6.4 Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the Town.

3.6.5 Do not leave sheeting, shoring, or bracing materials in place unless this is called for by the drawings, ordered by the Town, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.

3.6.6 Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.

3.6.7 The Developer may use a trench box, which is a prefabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

3.7 THE DEWATERING OF EXCAVATION

3.7.1 Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the Town. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.

3.8 BORROW EXCAVATION

3.8.1 Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the Town. All state and local regulations concerning borrow pits, drainage and erosion control shall be strictly followed.

3.8.2 Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth, and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the Town.

3.8.3 Properly clear and grub borrow pits and remove all objectionable matter from the borrow pit material before placing it in the backfill.

3.8.4 The taking of materials from borrow pits for use in the construction of backfill, fills, or embankments shall be considered an incidental part of the work; no separate payment shall be made for this.

3.9 BACKFILLING

3.9.1 Begin backfilling after the line construction is completed and then inspected and approved by the Town. Backfill materials shall be in accordance with these specifications.

3.9.2 Backfill material above the pipe envelopes shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or objectionable materials. Place this backfill simultaneously on either side of the trench in even layers that before compaction are no more than 6 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. Compaction of backfill material layers shall be at 90 percent by standard proctor test. Where adjacent to and within paved areas the top 12-inches of the trench at subgrade shall consist of crusher-run stone compacted at 95 percent by

standard proctor test. Compaction testing shall be at intervals directed by the site inspector.

3.9.3 From 1 foot above the pipe upward, the backfill material may contain broken stones that make up approximately 3/4 of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids completely. The maximum dimension of individual stones in such backfill shall not exceed 4 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

3.9.4 If earth material for backfill is, in the opinion of the Town, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the Town considers too wet or otherwise unsuitable.

3.9.5 Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials.

3.9.6 Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Town. On heavily traveled roadways, cold mix or leveling course binder 2 inches thick shall be installed and maintained until permanent pavement is installed.

3.9.7 Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

3.9.8 Wherever pipes have diameters of 15 inches or less, do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.

3.9.9 Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the Town.

3.9.10 Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the Town's requiring that the Developer's other

activities be suspended until backfilling and clean-up operations catch up with pipe laying.

3.9.11 Compaction Requirements: Unless specified otherwise elsewhere, under buildings and 2 times the depth of pipe beyond, and under roads and 2 times the depth beyond the shoulder, compact to 95 percent maximum density in accordance with ASTM D698. In all other locations, compact to 90 percent maximum density.

3.10 MAINTENANCE

3.10.1 Seed and maintain in good condition all excavated areas, trenches, fills, embankments, and channels until final acceptance by the Town.

3.10.2 Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the Town. Continue such maintenance until final acceptance of the project, or until the Town issues a written release.

3.11 SLOPES

3.11.1 Neatly trim all open cut slopes, and finish conforming either to the slope lines shown on the drawings or the directions of the Town. Leave the finished surfaces of bottom and sides in reasonably smooth and uniform planes like those normally obtainable with hand tools, though the Developer will not be required to use hand methods if he is able to obtain the required degree of evenness with mechanical equipment. Conduct grading operations so that material is not removed or loosened beyond the required slope.

END OF SECTION

SECTION 8
SEEDING

PART 1. GENERAL

1.1 This work shall be performed in all disturbed areas not receiving such site improvements as buildings, roads, walks, sod, planting, etc., and shall include, but not necessarily be limited to, all seed bed preparation; the supplying and placing of soil additives, seed, and mulch wherever required by the drawings or directed by the Town; and maintenance.

1.2 Unless otherwise approved in writing by the Town, seeding operations shall be limited to the following planting periods:

1.2.1 Spring - March 1 through May 30

1.2.2 Fall - August 15 through October 31

1.3 Refer to other sections for items affecting seeding. Coordinate this work with that specified by other sections for timely execution.

PART 2. PRODUCTS

2.1 GRASS SEED: Kentucky 31 Fescue (Festuca elatior) and/or annual rye meeting the requirements of the State Department of Agriculture and furnished in new bags or bags that are sound and not mended; no "below standard" seed will be accepted.

2.2 FERTILIZER: commercially manufactured; Grade 10-10-10; furnished in standard containers that are clearly marked with the name, weight, and guaranteed analysis of the contents and that ensure proper protection in transportation and handling; and in compliance with all local, state, and federal fertilizer laws.

2.3 AGRICULTURAL LIMESTONE: containing a minimum of 85 percent calcium carbonate and magnesium carbonate combined, 85 percent of which passes a No. 10 mesh sieve.

2.4 MULCH: stalks of rye, oats, wheat, or other approved grain crops properly cured prior to bailing, air dried, and reasonably free of noxious weeds and weed seeds or other material detrimental to plant growth.

2.5 MULCH BINDER: Mulch on slopes exceeding 3 (horizontal) to 1 (vertical) shall be held in place by the use of a mulch binder, as approved by the Town/Engineer. The mulch binder shall be non-toxic to plant and animal life.

PART 3. EXECUTION

3.1 Perform all seeding and related work as a continuous operation. Sow seed as soon as the seed bed has been prepared and perform subsequent work in a continuous manner.

3.2 Before beginning seeding operations in any area, complete the placing of topsoil and final grading, and have the work approved by the Town.

3.3 Scarify, disk, harrow, rake, or otherwise work each area to be seeded until the soil has been loosened and pulverized to a depth of not less than 2 inches. Perform this work only when the soil is in a tillable and workable condition.

3.4 Apply fertilizer and agricultural limestone uniformly over the seed bed, and lightly harrow, rake, or otherwise incorporate them into the soil for a depth of approximately 1 inch at the following rates:

3.4.1 Fertilizer: 15 pounds per 1,000 square feet

3.4.2 Agricultural Limestone: 40 pounds per 1,000 square feet

3.5 Sow seed uniformly with a rotary seeder, wheelbarrow seeder, hydraulic equipment or by other satisfactory means.

3.6 The seeding rate shall be 5 pounds per 1,000 square feet for Kentucky 31 Fescue (Festuca elatior).

3.7 When seeding during March 1 through April 1 and October 1 through November 20, add an additional 3 pounds per 1,000 square feet of annual rye grass.

3.8 Perform no seeding during windy weather or when the ground surface is frozen, wet, or otherwise untillable.

3.9 Spread mulch material evenly over the seeded areas immediately following the seeding operation.

3.9.1 Mulch Rate: 2 bales (100 pound minimum) per 1,000 square feet

3.10 The mulch rate may be varied by the Town, depending on the texture and condition of the mulch material and the characteristics of the area seeded. Cover all portions of the seeded areas with a uniform layer of mulch so that approximately 25 percent of the ground is visible.

3.11 No equipment, material storage, construction traffic, etc., will be permitted on newly seeded ground.

3.12 Developer shall be responsible for watering seeded areas until a sufficient stand of grass has been developed, as determined by the Town.

3.13 Dispose of all surplus materials as directed by the Town.

PART 4. INSPECTIONS

4.1 The Town shall inspect the seeding within 60 days after planting and determine if it is acceptable.

PART 5. GUARANTEE

5.1 Secure an acceptable growth of grass in all areas designated for seeding.

5.2 An area is considered acceptable if it is represented by a minimum of 100 seedlings per square foot of the permanent species of grass representative of the seed mixture. If an acceptable growth is not obtained on the first planting, reseeding and remulching will be required.

5.3 If the planting is less than 50 percent successful, rework the ground, refertilize, reseed, and remulch.

END OF SECTION

SECTION 9
PAVEMENT REPAIR

PART 1. GENERAL

1.1 The work specified by this section shall consist of repairing or replacing all damaged pavement, whether public or private. Dirt shoulders, roads, streets, drives, and walks are to be restored to their original condition as an incidental part of the installation of utilities. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall, and repave the entire area as specified below and as shown on the drawings or on the standard drawings.

1.2 Both these specifications and the drawings make reference to the current edition of the standard specifications of the Tennessee Department of Transportation (TDOT). Even though the weather limitations, construction methods, and materials specifications contained in the TDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the TDOT specifications shall not be considered applicable.

1.3 WARRANTY: The Developer shall provide Town with a two-year unconditional maintenance free warranty on the asphaltic concrete pavement. The warranty time shall begin on the date of final acceptance of the pavement by the Town. The warranty shall be executed by the paving contractor and co-signed by the Developer.

PART 2. PRODUCTS

2.1 MINERAL AGGREGATE BASE: Class A, Grading D crushed stone (TDOT specifications, Section 303, subsection 903.05)

2.2 BITUMINOUS PRIME COATS: Cutback asphalt, Grade RC-250, or emulsified asphalt, Grade AE-P (Section 402, Subsections 904.02 and 904.03)

2.3 CRUSHED STONE CHIPS: Size 7 or Size 8 (Subsection 903.14)

2.4 DOUBLE BITUMINOUS SURFACE: For both courses, either cutback asphalt, Grade RC-800 or RC-3000, or emulsified asphalt, Grade RS-2 (Subsections 904.01 and 904.03)

2.5 ASPHALTIC CONCRETE BINDER: Grading B or C, as directed by the Town (Section 307)

2.6 BITUMINOUS TACK COAT: Grade AE-3 (Section 403, Subsection 904.03)

2.7 ASPHALTIC CONCRETE SURFACE: Grading E (Section 411)

2.8 QUICK DRY TRAFFIC MARKING PAINT (WHITE AND YELLOW): Section 716

PART 3. EXECUTION

3.1 SUBGRADE

3.1.1 Before any base material is installed, compact the subgrade of the area to be paved to 95 percent of optimum density as determined by ASTM D698 (Standard Proctor).

3.1.2 The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection of 1 inch or more. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.

3.2 BASE

3.2.1 Install a mineral aggregate base of the type specified above in accordance with Section 303 of the TDOT specifications. The maximum compacted thickness of any one layer shall be 6 inches and the total thickness of the base shall be that indicated by the standard drawings or as shown on the plans.

3.2.2 When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course or as shown on the standard drawings. Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

3.2.3 Where flowable fill is required it shall conform to TDOT Specifications Section 204.06 Backfill material. Typical 28 day compressive strength shall be 100 to 500 psi depending on particular location as determined by the Engineer or his representative.

3.3 SEAL COAT SURFACE

3.3.1 Uniformly apply a bituminous prime coat of either emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard. Immediately after application, uniformly cover the entire area with Size 7 crushed stone chips at a rate of 12 pounds per square yard.

3.4 DOUBLE BITUMINOUS SURFACE

3.4.1 Apply the first course at a rate of 0.38 to 0.42 gallon per square yard with either emulsified asphalt, Grade RS-2, or cutback asphalt, Grade RC-800 or RC-3000, and then immediately cover with Size 6 crushed stone chips at a rate of 33 to 37 pounds per square yard. After this is rolled, apply the second course at a rate of 0.30 to 0.35 gallon per square yard, and at once uniformly cover with Size 7 chips at a rate of 20 to 25 pounds per square yard. Then roll the entire area.

3.4.2 After the application of the cove aggregate, lightly broom or otherwise maintain the surface for a period of 4 days, or as directed by the Town. Maintenance of the surface shall include the distribution of cover aggregate over the surface to absorb any free bitumen and cover any areas deficient in aggregate. Sweep excess material from the

entire surface with rotary brooms. Sweep the surface at the time determined by the Town.

3.5 ASPHALTIC CONCRETE BINDER

3.5.1 Apply a bituminous prime coat of emulsified asphalt, Grade AE-P, or cutback asphalt, Grade RC-250, at a rate of 0.38 to 0.42 gallon per square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs and gutters, walls, walks, trees, etc; if such splashing does occur, remove it immediately. After the prime coat has been properly cured, apply an asphaltic concrete binder to the thickness shown on the standard drawings or the plans.

3.5.2 Carefully place the material to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

3.5.3 If milling of the street is required, the thickness of the binder course as specified by the Engineer shall be maintained after milling.

3.6 ASPHALTIC CONCRETE SURFACE

3.6.1 If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under PRODUCTS at a rate of 0.05 to 0.10 gallon per square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the prime or tack coat has been properly cured, apply the asphaltic concrete to the thickness shown of the drawings or standard drawings.

3.6.2 Apply the surface course as described above for the binder course.

3.7 SMOOTHNESS

3.7.1 The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

3.8 SAMPLING AND TESTING

3.8.1 Submit to the Town test reports made by an independent testing laboratory on the crushed stone aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain his approval of these reports before starting paving operations.

3.8.2 Tests shall be made of the completed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of the deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests.

3.8.3 When making surface tests, furnish one man to mark all surface defects for corrections.

END OF SECTION

SECTION 10
MANHOLES

PART 1. GENERAL

1.1 Manholes shall be precast or monolithic concrete with eccentric cones unless otherwise approved by the Town. All manholes shall contain Xypex add mixture to be batch mixed with the concrete prior to casting of the manhole. In special instances, upon requesting and obtaining prior approval of the Town of Thompson's Station, Xypex may be applied to the manhole after it has been cast but prior to leaving the manufacturer's site.

1.2 Refer to other sections for items affecting manholes. Coordinate this work with that specified by other sections for timely execution.

1.3 Location: Manholes shall be installed at the upper end of each collection sewer line, at all changes in grade, at points of changes in size, and at all pipe intersections

1.4 Drop Manholes: A drop pipe shall be provided for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert should be u-shaped to prevent deposition of solids.

1.5 Diameter: The minimum diameter of manholes shall be 48 inches. The entrance tube shall be at least 24 inches in diameter.

1.6 Shop drawings are required for castings, plastic gaskets, and precast manholes specified in this section.

PART 2. PRODUCTS

2.1 CONCRETE MASONRY: Reinforced or plain, meeting the applicable requirements of Section 14, Concrete for Utility Lines.

2.2 CASTING ADJUSTMENT: Adjustment of casting to match finish grade may be made by concrete grade rings or Expanded Polypropylene rings. Expanded Polypropylene rings shall be Cretex Pro-Ring or equal.

2.3 MORTAR: Composed of one (1) part Portland cement and two (2) parts sand (volumetric measure) thoroughly mixed in a tight box, with water added gradually and mixed continually until mortar has attained the proper consistency for use in brick masonry; prepared only in such quantities as needed for immediate use; mortar mixed for more than 30 minutes, retempered, or previously set will not be allowed.

2.4 GRAY IRON CASTINGS: Cast iron conforming to the requirements of Class 30, ASTM A48; made accurately to the required dimensions; sound, smooth, clean, and free from blisters and other defects; not plugged or otherwise treated to remedy defects; machined so that covers rest securely in the frames with no rocking and are in contact with frame flanges for the entire perimeter of the contact surfaces; thoroughly cleaned subsequent to machining and, before rusting begins, painted with a bituminous coating so as to present a smooth finish;

tough and tenacious when cold, but not tacky and with no tendency to scale; and with the actual weight in pounds stenciled or printed by the manufacturer on each casting in white paint.

2.5 PLASTIC GASKET FOR PRECAST MANHOLES: Preformed plastic gasket shall meet or exceed all requirements of FS SS-S-00210, "Sealing Compound, Preformed Plastic for Pipe Joints," Type I, rope form. The sealing compound shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes, or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded rope form of suitable cross section and in such sizes as to seal the joint space when the pipes are laid. Use two (2) complete ropes at each joint. The sealing compound shall be protected by a suitable removable two (2) piece wrapper, which shall be designed so that half may be removed longitudinally without disturbing the other half in order to facilitate application of the sealing compound. The flexible plastic gasket shall also meet the requirements of the following table:

Composition	Test Method	Minimum	Maximum
Bitumen (Petroleum Plastic Content)	ASTM D4	50	70
Ash Inert Mineral Matter	AASHO T111	30	50
Volatile Matter	ASTM D6	--	2.0

Property	Test Method	Minimum	Maximum
Specific Gravity at 77 degrees F	ASTM D71	1.20	1.30
Ductility at 77 degrees F (cm)	ASTM D113	5.0	---
Softening Point	ASTM D36	320° F	---
Penetration at 77 degrees F (150 gms) 5 sec.	ASTM D217	50	120

2.6 LADDER BARS: An aluminum alloy weighing 2.2 pounds or 1/2-inch steel reinforced rod encapsulated in polypropylene plastic.

2.7 MATERIAL TESTING: All precast reinforced concrete manhole risers and tops specified herein shall be tested and inspected by a commercial testing laboratory approved by the Town prior to delivery to the site, and all materials that fail to conform to these specifications shall be rejected. After delivery to the site, any materials that have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site. Supply certified copies in duplicate of the inspection and acceptance reports of the testing laboratory to the Town before using the materials. The commercial testing laboratory shall be engaged and paid for by the Developer. Submit a certificate from the manufacturer of the castings indicating that they meet all applicable requirements of these specifications.

PART 3. EXECUTION

3.1 Dewater sufficiently to maintain the ground water level at or below the bottom of the manhole foundation prior to and during placement of the foundation. All manhole installations require the subgrade soil to be compacted to a minimum of 95 percent standard proctor density and a minimum of 12 inches of TDOT #67 compacted base stone.

3.2 Obtain an adequate foundation for all manhole structures by removing and replacing unsuitable material with well graded granular material, by tightening with coarse rock, or by such other means as provided for foundation preparation of the connected sewers or as directed by the Town. Wherever water is encountered at the site, place all cast-in-place bases or monolithic structures on a one-piece waterproof membrane to prevent any movement of water into the fresh concrete.

3.3 When the foundation subgrade has been prepared and is approved by the Town, carefully construct the concrete foundation for monolithic manholes to the line and grade required by the drawings. Construct the manholes after the concrete foundation has been allowed to set for a period of not less than 24 hours.

3.4 For precast manholes, carefully block the base section above the prepared surface so that it is fully and uniformly supported in true alignment; make sure that all entering pipe can be inserted at proper grade. Then place the concrete foundation and invert under and upon this base section as shown in the standard drawings. A base section with monolithic foundation (bottom) may be used when approved by the Town.

3.5 Thoroughly wet and then completely fill all lift holes and joints, inside and outside, with non-shrink grout to ensure water tightness.

3.6 Construct monolithic concrete manholes and bases of 4,000 psi concrete in accordance with the provisions of this section and applicable provisions of Section 16, Concrete for Utility Lines. The ladder bars shall be cast in place.

3.7 Carefully set the cast iron frame for the cover at the required elevation, and properly bond it to the masonry with cement grout and mastic seal. The required elevation is defined as the top of casting elevation on the approved construction plans. Whenever manholes are constructed in paved areas, tilt the top surface of the frame and cover so as to conform to the exact slope, crown, and grade of the existing adjacent pavement.

3.8 Manhole inverts shall be constructed of concrete or Portland cement mortared masonry fill and may, at the Developer's option, be covered with cement mortar to the approximate cross section of the sewers connected to them. Make any necessary changes in cross sections gradually from side to side of the manhole; make changes in direction of flow of the sewers to a true curve of as large a radius as is permitted by the size of the manhole.

3.9 All rigid unreinforced pipe entering or leaving the manhole shall be provided with flexible joints within 12 inches of the manhole structure; or encase the full joint in concrete. Place such pipe on firmly compacted bedding, particularly in the area of the manhole excavation, which is normally deeper than excavation for sewer trenches. Take special care to see that the

openings through which pipes enter the structures are completely and firmly rammed full of shrink proof mortar or otherwise constructed to ensure watertightness.

3.10 A flexible pipe to manhole connector shall be used to provide a watertight joint between the gravity sewer line and manhole. This connector shall be Kor-N-Seal I Connector or an approved equal.

3.11 Where the difference in the invert elevation of two or more lines intersecting in one manhole is 24 inches or more, construct a drop manhole. Drop manholes shall be similar in construction to standard manholes except that a drop connection of pipe and fittings of the proper sizes and materials shall be constructed outside the manhole and supported by 3,000 psi concrete as indicated by the standard drawings.

3.12 Place backfill by hand around the manhole and to a distance of at least one (1) pipe length into each trench; and tamp with selected material up to an elevation of 12 inches above the crown of all entering pipes. Continue backfilling in accordance with the requirements for trench backfilling.

3.13 Each manhole shall be vacuum tested. No standing water shall be allowed in the manhole excavation which may affect the accuracy of the test. All lifting holes and exterior joints shall be filled and pointed with an approved non-shrink mortar. All pipes and other openings into the manhole shall be suitably plugged in such a manner as to prevent displacement of the plugs while the vacuum is drawn. Installation and operation of the vacuum equipment and indicating devices shall be in accordance with equipment specification and instructions provided by the manufacturer. A vacuum of 10 inches shall be drawn. The time for the vacuum to drop to 9.0 inches for one minute shall be recorded. Acceptance for 4-foot-diameter manholes shall be defined as when the time to drop 1 inch meets 60 minutes.

For manholes 5 feet in diameter, add an additional 15 seconds. For manholes 6 feet in diameter, add an additional 30 seconds. If the manhole fails the test, necessary repairs shall be made and the vacuum test repeated until the manhole passes the test. If the manhole joint mastic on gasket is displaced during the vacuum test, the manhole shall be disassembled, the seal replaced, and the manhole re-tested.

END OF SECTION

SECTION 11
SANITARY SEWERS (GRAVITY)

PART 1. GENERAL

1.1 Pipe material shall be PVC unless otherwise shown on the drawings. Ductile iron pipe shall be used only when approved by the Town or as allowed by this Specification.

1.2 Shop drawings are required for all products specified in this section.

1.3 Refer to other sections for items affecting gravity sewers. Coordinate this work with that specified by other sections for timely execution.

PART 2. PRODUCTS

2.1 PIPE

2.1.1 No sewer collection line shall be less than 8 inches in diameter.

2.1.2 Polyvinyl Chloride (PVC): to meet and/or exceed the requirements of ASTM D3034, SDR 35; suitable for use as a gravity sewer conduit with provisions for contraction and expansion at each joint; with a rubber ring and standard length 12.5 feet plus or minus 1 inch; designed to pass all tests at 73 degrees F (plus or minus 3 degrees F); 6 inches long sections of pipe to be subjected to impact from a free falling type (20 pounds, Type A) in accordance with ASTM D2444 with no evident splitting or shattering (denting not considered a failure); and with a minimum envelope of 4 inches of granular material around the pipe, but with all other bedding and backfilling requirements remaining the same as for other pipe material.

2.1.3 For mains 15 inches or smaller with greater than 12 feet of cover, SDR26 PVC. Regardless of depth, pipe material for mains larger than 24 inches shall be approved by the Town. No lines shall be deeper than 15 feet without Town approval.

2.1.4 Ductile Iron: with push-on joints conforming to ASTM A746, minimum Class 250 thickness unless otherwise shown on the drawings. Mains 16 inches through 24 inches in diameter shall be Ductile Iron.

2.1.5 Lateral Branches: to be tees of the same material as the main sewer and have a 4-inch inside diameter for residential and 6-inch diameter for commercial unless otherwise specified or noted; able to withstand all test pressures involved without leakage.

2.1.6 For PVC and ductile iron pipe, furnish a certificate from the pipe manufacturer indicating that the pipe meets all applicable requirements of these specifications.

2.2 JOINTS AND JOINTING MATERIALS

2.2.1 All rubber end rings shall be extruded or molded and cured such that any cross section will be dense, homogenous and free of parasites, blisters, pitting, and other imperfections. The basic rubber material, EPDM, shall meet ASTM C443 with the

exception of 40-60 duro hardness. The resilient interlocked end seals shall be duro A-40-70, plus or minus 2.

2.2.2 Polyvinyl Chloride (PVC) Pipe Joints: Joints for sewer plastic pipe shall meet all requirements of ASTM D3212 standard specifications. Joint design shall be tested and certified to result in no leakage under prescribed laboratory test conditions of joint alignment, load conditions, pressure and vacuum, and deflection. Pipe and fittings shall have integral bell with elastomeric seal joint.

2.2.3 Ductile Iron Pipe Joints: Gasket type joints for bell and spigot ductile iron pipe designed to meet the infiltration requirements of these specifications; jointing to comply with the applicable provisions of ANSI A21.11.

2.3 COMPRESSION COUPLINGS

2.3.1 When dissimilar pipe materials are joined, use compression couplings that are resistant to the corrosive action of soils and sewage and that will provide a permanent watertight joint. The compression couplings shall be of natural or synthetic rubber or rubber-like material and shall comply with the requirements and test methods specified in Table 2 of ASTM C425. The coupling shall meet the leak requirements specified in ASTM C425, and the bands for attaching the couplings to the dissimilar pipes shall be of stainless steel meeting ASTM A167 or A240. Each coupling shall bear the manufacturer's identifying mark and an indication of its size.

PART 3. EXECUTION

3.1 PIPE LAYING

3.1.1 Lay no pipe except in the presence of an inspector representing the Town unless authorized.

3.1.2 Sewers shall be designed with straight alignment between manholes

3.1.3 Depth: In general, sewers should be deep enough to drain basements and to prevent freezing. Where practical, a minimum depth of 5 feet should be maintained unless approved otherwise by Thompson’s Station

3.1.4 Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting as provided in Section 7, Unclassified Excavation for Utilities.

3.1.5 Wherever necessary to provide satisfactory bearing surface, place concrete cradles as shown on the drawings or as directed by the Town. Cradles shall be of concrete and conform to the dimensions shown on the drawings.

3.1.6 Slope: Slope determination to achieve minimum velocity shall be calculated according to the most recent addition of the TDEC’s Design Criteria for Sewage Works Chapter 2 – Collection Systems. No pipes shall be installed with a slope greater than 20 percent.

3.1.7 High Velocity Protection: Ductile iron pipe shall be used when slopes are greater than:

SEWER SIZE INCHES	SLOPE (FT/100 FT)
8	18
10	13
12	9

3.1.8 Lasers must be used after the type and procedures are approved by the Town. When lasers are used, set reference points for both line and grade at each manhole. Where grades are 0.6 percent or less, check the elevation of the beam each 100 feet with an offset point or Engineer's level.

3.1.9 Do not allow water to run or stand in the trench while pipe laying is in progress or before the trench has been backfilled. Do not at any time open up more trench than the available pumping facilities are able to dewater.

3.1.10 Correct trench bottoms found to be unsuitable for foundations after pipe laying operations have started, bringing them to exact line and grade with compacted stone as necessary and as approved by the Town.

3.1.11 Carefully inspect each piece of pipe and special fitting before it is placed, and lay no defective pipe in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade. When pipe laying is not in progress, keep the ends of the pipe tightly closed with an approved temporary plug.

3.1.12 Bell holes shall be large enough to allow ample room for the pipe joints to be properly made. Cut out bell holes no more than two (2) joints ahead of the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel rests on a solid foundation for its entire length. Lay each pipe joint so as to form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.

3.1.13 Pipe Bedding: All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made because of the width and depth of trench. Backfill material from 1 foot above the pipe should not exceed 4 inches in diameter at its greatest dimension. Ductile iron pipe shall be required when: 1) sewer installation occurs in areas of non-virgin soil (i.e., areas of "fill"), 2) the final grading cover is less than 2 1/2 feet, and 3) in roadways where cover is less than 4 feet. Piers shall be provided for when necessary for support. An impermeable barrier of compacted clay or concrete encasement shall be used at the transition from fill to virgin soil to prevent piping of water through the crushed stone bedding.

For structural reasons, ductile iron pipe, concrete encasement, or relocation shall be required when culverts or other conduits are laid such that the top of the sewer is less than 18 inches below the bottom of the culvert or conduit. Special care shall be used in placing bedding in the haunching region.

3.1.13.1 Unpaved areas: Each sewer pipe section shall be laid on six (6) inch bed of size no. 57 or size no. 67 crushed stone and shall be backfilled to 12" above the pipe top using size no. 57 or size no. 67 compacted crushed stone.

3.1.13.2 Paved Areas: Each sewer pipe section shall be completely encapsulated with 6 inches of bedding material on the bottom and both sides. The entire depth of the trench shall also be backfilled with bedding materials compacted in 6-inch lifts. Bedding materials shall be size no. 57 or size no. 67 crushed stone.

3.1.14 Where sanitary sewers are installed in new fill, a compaction letter sealed by a Geotechnical Engineer registered in the State of Tennessee shall be submitted to the Town prior to accepting the installation. An acceptable compaction letter shall state that the field density testing indicates the fill has been compacted to at least 95 percent of the maximum dry density, according to the Standard Proctor. If a compaction letter is not available, special protection such as replacement with ductile iron pipe with joint restraint or encasement with flowable fill shall be utilized as approved by the Town.

3.1.15 Before constructing or placing any joints, demonstrate to the Town by completing at least one sample joint, that the methods to be used conform to the specifications and will provide a watertight joint and further that the workmen to be involved in this phase of work are thoroughly familiar and experienced with the type of joint proposed.

3.1.16 No other type of joint may be used unless authorized in writing by the Town.

3.1.17 When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An acceptable approximate method for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

3.1.18 Install tee branches in sewer lines to serve properly each lot facing or abutting on the street or alley in which sewer is being laid and at such other locations as may be designated by the Town. If tee branches are not to be used immediately, close them with approved stoppers that are held in place to prevent infiltration and withstand all test requirements. All service line end caps shall be marked by a green metal fence post as to allow the builder to determine the exact location of the service lateral.

3.1.19 For all tees that are plugged and laid in rock, blast a minimum of 6 linear feet of ditch line in the direction and to the approximate grade of the future lateral as directed by the Town, but do not excavate the material. Furnish the Town with a record of the exact location of each tee installed.

3.1.20 If the work consists of constructing a new sewer to replace an existing one, connect existing service lines to the new line.

3.1.21 New service laterals shall conform to the standard drawings.

3.1.22 The Developer shall provide an above-ground green metal fence post marker or 2-inch PVC pipe painted green, at the property line to indicate the termination of new service laterals.

3.1.23 As the work progresses, thoroughly clean the interior of the pipe in place. After each line of pipe has been laid, carefully inspect it, and remove all earth, trash, rags, and other foreign matter from its interior.

3.1.24 The pipe shall meet the test requirements for water tightness; immediately repair any leak or defect discovered at any time after completion of the work. Any pipe that has been disturbed after joints were formed shall be taken up, the joints cleaned and remade, and the pipe relaid. Carefully protect all pipe in place from damage until backfilling operations are completed.

3.1.25 Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by the Town.

3.1.26 Water Supply Interconnections: There shall be no physical connection between a potable water supply line and a sewer or appurtenance thereto which would permit the passage of any wastewater or polluted water into the potable supply.

3.1.27 Water Main Horizontal Separation: Whenever possible, sewers should be laid at least 10 feet horizontally edge to edge from any existing or proposed water pipe. Should local conditions prevent a lateral separation of 10 feet to the water main, a separation of less than 10 feet may be approved if the sewer is laid in a separate trench and if the elevation of the top of the sewer pipe is at least 18 inches below the bottom of the water pipe.

3.1.28 Utility Vertical Separation: Whenever a sewer must cross under a water main or storm drain, the sewer shall be laid at such elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide the separation or reconstructed with ductile iron pipe for a minimum distance of 10 feet on each side of the sewer. At least one full length of water main should be centered over the sewer so that both joints shall be as far from the sewer as possible.

3.1.29 When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and the sewer shall be installed inside a steel casing pipe extending 10 feet beyond the crossing in both directions.

3.1.30 Perform boring by means of auguring to the size, line, and grade shown on the drawings. Jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide a watertight joint.

3.1.31 Make connections to all existing sewer lines as shown on the drawings or as directed by the Town. Make connections either by removing a section of the sewer from the

existing line and inserting a wye or tee branch of the proper size or by constructing a manhole, junction box, regulator chamber, or other structure as shown on the drawings.

3.1.32 Make connections to existing manholes or inlets by methods of machine coring and installation of a Kor-N-Seal boot connector. After the boot connector has been properly installed in the existing structure, insert a length of sewer pipe into the boot connector and tighten the band strap of the boot connector. Fill around the void area between the pipe and existing structure located on the inside of the existing structure with non-shrink grout to a neat finish. Shape or reshape the existing inverts or bottom of the manhole/structure as necessary to fit the invert of the sewer pipe and allow unobstructed flow through the existing structure.

3.1.33 Joint dissimilar pipe by using suitable compression couplings. If compression couplings are not available, make jointing with a special fabricated coupling approved by the Town.

3.1.34 Provide concrete protection or concrete cap as shown on the drawings for pipe sewers that, when completed, have less than 2.5 feet of covering in non-traffic areas and four (4) feet of cover in traffic areas. If such protection is not shown on the drawings, place it in accordance with the typical section shown.

3.1.35 Carefully protect from damage all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electrical lines, and other utilities or structures in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility or structure in order to complete the work properly, do so in compliance with the provisions set forth in other section of these specifications. Any such work shall be considered incidental to the construction of pipe sewers, and no additional payment will be allowed, therefore.

3.1.36 Water service connections will be repaired or replaced by the Developer.

3.1.37 Service or house connections to existing sewers that are damaged or removed shall be repaired or replaced by the Developer.

3.1.38 Where required, the Developer shall provide a concrete check dam in the trench for the gravity sewer lines. The check dam shall be constructed in accordance with the detail included in the Standard Drawings. Check dams shall be provided on each creek bank, swale etc. as to prevent ground water from traveling along the trench and to prevent surface water from entering the trench at creek crossings. The Town may request addition of check dams anywhere on gravity lines or force mains where groundwater conditions require.

3.1.39 All surface water crossings shall be in accordance with the requirements of the General Permit for an Aquatic Resource Alteration Permit.

3.1.39.1Above Water Crossings-The pipe shall be:

Adequately supported.

Protected from damage and freezing.

Accessible for repairs and replacement.

3.1.39.2 When Crossing Water Courses which are Greater than 15 Feet in width the pipe shall be push-on restrained joint ductile iron with locking gaskets. Pipe shall be American Fastite, US Pipe TR Flex, or equal.

3.2 TESTING OF GRAVITY SEWERS

3.2.1. Visual Tests

3.2.1.1 Upon completion of the construction or earlier if the Town deems advisable, the Town will make a visual inspection of the sewer and construction site. Immediately repair all leaks and defects found by such inspection.

3.2.1.2 Sewers shall be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that, after flooding, the flood water drains off so that no remaining puddle of water is deeper than 1/2 inch on pipe 36 inches internal diameter or smaller and 3/4 inch on pipe larger than 36 inches internal diameter. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or relaid by the Developer.

3.2.1.3 The Developer will be held strictly responsible that all parts of the work bear the load of the backfill. If cracks 1/100 inch in width develop in the pipe within one year from the date of final acceptance of the work, the Developer will be required to replace all such cracked pipe. To this end, the Developer is advised to purchase pipe under a guarantee from the manufacturer, guaranteeing proper service of sewer pipe under conditions established by the drawings, specifications, and local conditioning at the site of the work.

3.2.2 Leakage Tests: Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

3.2.2.1 Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C969. Make calculations in accordance with the Appendix to ASTM C969.

3.2.2.1 Low pressure air tests: Perform low pressure air testing as follows:

i) Furnish all equipment, facilities, and personnel necessary to conduct the test. The test shall be observed by a representative of the Owner.

ii) Perform the first series of air tests after 2,000 linear feet (LF) but before 4,000 LF of sewer has been laid. The purpose of this first series of tests is to assure both the Contractor and the Owner that the materials and method of installation meet the intent of these specifications. Conduct the remainder of the tests after approximately each 10,000 LF has been laid.

iii) Plug all tees and ends of sewer services with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

iv) Prior to testing, check the pipe to see that it is clean. If not, clean it by passing a full-gauge squeegee through the pipe. It shall be the Contractor's responsibility to have the pipe cleaned.

v) Ductile Iron pipelines: Test in accordance with ASTM C924. Allowable pressure drop shall be as given in ASTM C924. Make calculations in accordance with the Appendix to ASTM C924.

vi) PVC plastic pipelines. Test in accordance with UBPPA Uni-B-6. Allowable pressure drop shall be as given in UBPPA Uni-B-6. Make calculations in accordance with the Appendix to UBPPA Uni-B-6.

3.2.3.4 Repairs: Regardless of the outcome of any tests, repair any noticeable leak.

3.3 VISUAL INSPECTION OF MISCELLANEOUS MATERIALS

3.3.1 All material used on this project will be visually inspected by the Town at the site for conformance to the required specifications. When reasonable doubt exists that said material meets the specifications, the Town may require certified mill tests, samples, and/or tests by an independent laboratory or other suitable form of verification that the material meets the required specifications.

3.4 Deflection Testing: Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of the pipe. Determine

whether the allowable deflection has been exceeded by the use of a pull-through device or a deflection measuring device.

3.4.1 Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

3.4.1.1 A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

3.4.1.2 Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 40 degrees F, and shall have a surface Brinell hardness of not less than 150.

3.4.1.3 Center bored and through-bolted with a 1/4-inch minimum diameter steel shaft having a yield strength of not less than 70,000 psi, with eyes or loops at each end for attaching pulling cables.

3.4.1.4 Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

3.4.2. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.

3.4.3. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

3.4.4. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

3.5 CLEANUP

3.5.1 After completing each section of the sewer line, remove all debris, construction materials, and equipment from the site of the work, grade and smooth over the surface

on both sides of the line, and leave the entire area in a clean, neat, and serviceable condition.

3.6 VIDEO INSPECTION

3.6.1 New gravity sewer lines shall be required to be inspected using CATV video inspection equipment should the sewer line not pass the standard air testing, mandrel test or visual inspections. The Town of Thompson's Station will require the Developer to perform this type of inspection to determine if debris or defects exist within the sewer line. This video inspection shall be performed after all utilities have been installed, roadways paved and all other infrastructure installed and completed. This inspection shall serve to verify that sewer lines, manholes and service laterals are clean and free of debris and defects. Any defects discovered during the video inspection shall be corrected in accordance with these standard specifications by the developer and/or his contractor.

END OF SECTION

SECTION 12
SEWAGE FORCE MAIN

PART 1. GENERAL

1.1 Furnish all material, equipment, tools, and labor in connection with the sewage force main, complete and in accordance with the drawings and these specifications.

1.2 It shall be the Developer's responsibility to ensure that all necessary materials are not found to be defective in manufacture. Materials damaged in handling after being delivered by the manufacturer shall be replaced by the Developer. If installed material is found to be defective before the final acceptance of the work or during the warranty period, the material shall be fully replaced.

1.3 The Developer shall be responsible for safely storing materials needed for the work that have been accepted by him until they have been incorporated into the completed project. Keep the interiors of all pipes, fittings, and other accessories free from dirt and foreign matter at all times.

1.4 Refer to other sections for work related to that specified by this section. Coordinate this work with that required by other sections for timely execution.

1.5 Minimum force main size shall be 4 inches in diameter.

1.6 Air Release Valve: An automatic air release valve shall be placed at high points in the force main to prevent air-locking.

1.7 Termination: Force mains shall terminate in the invert of a manhole.

1.8 Pipe Diameter: Force mains are to be designed to achieve scouring velocity as demonstrated in the Developer’s or engineer’s submittals to the Town. Minimum velocity shall be at least 2 feet per second, with velocities of 3.5 feet per second preferred for small diameter forcemains.

1.9 A maximum Hazen and Williams "C" factor used should not be greater than 130 regardless of that actually determined for the pipe.

PART 2. PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS (TOWN APPROVAL REQUIRED)

2.1.1 Ductile iron pipe shall be made of good quality ductile cast iron that meets the requirements of ASTM E8-61T. The pipe shall be centrifugally cast in metal or sand-lined molds. It shall be made and tested in accordance with ASTM A536 and be subjected to and able to withstand a hydrostatic pressure of 500 psi.

2.1.2 The pipe shall be plain end ductile iron pipe with a push-on single gasket joint and shall conform to ANSI A21.51/AWWA C151. The design thickness shall be Class 50 for pipe as defined by ASTM A21.50/AWWA C150.

2.1.3 The length of each individual piece of ductile iron pipe shipped must be plainly marked on that piece of pipe.

2.1.4 The push-on single gasket joints shall be UL approved and able to withstand an operating pressure of 200 psi.

2.1.5 The bell of each pipe shall have a tapered annular opening and a cast or machined retaining groove for the gasket. The gasket groove shall have a flared design so that maximum deflection will be provided. The plain spigot end of the pipe shall be beveled in order to simplify its entry into and centering within the bell and the compression of the gasket.

2.1.6 The gasket shall be of high quality vulcanized rubber made in the form of a solid ring to exact dimensions. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket itself shall be such that the joint is liquid tight for all pressures from a vacuum to the maximum internal liquid pressure of 350 psi.

2.1.7 Enough lubricant shall be furnished with each order to provide a thin coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell, and have no harmful effect on the rubber gasket. It shall have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather and that will enable it to adhere to either wet or dry pipe.

2.1.8 Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings unless otherwise shown on the drawings. All fittings shall conform to ANSI A21. 10/AWWA C110. Restrained joint fittings and pipe shall be subject to Town approval.

2.1.9 Pipe and fittings shall be lined with Protecto 401, Permox CTF, or Engineer-approved equal. The outside coating shall be manufacturer's standard asphaltic coating.

2.2 PVC PIPE

2.2.1 All forcemains shall be constructed of PVC, unless approved by Town. All plastic pipe shall be made from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by ASTM D1784.

2.2.2 Pipe shall have gasket belled ends for push on type jointing and shall conform to AWWA C900, ductile iron pipe equivalent outside diameters. The pipe shall have a minimum Dimension Ratio (DR) of 18 and shall be capable of withstanding a working pressure of 235 psi. Pipe shall be supplied in minimum lengths of 20 feet. Each length of pipe furnished shall bear identification markings in conformance with AWWA Standard C900.

2.2.3 The Developer's methods of storing and handling the pipe shall be approved by the Town. All pipe shall be supported within 5 feet of each end; in between the end supports, there shall be additional supports at least every 15 feet. The pipe shall be

stored away from heat or direct sunlight. The practice of stringing pipes out along the proposed force main routes will not be allowed.

2.2.4 Certain information shall be applied to each piece of pipe. At the least, this shall consist of:

2.2.4.1 Nominal size

2.2.4.2 Type of material

2.2.4.3 DR

2.2.4.4 Manufacturer

2.2.4.5 Pressure Rating

2.2.5 Pipe that fails to comply with the requirements set forth in these specifications shall be rejected.

2.2.6 The pipe shall have push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed. Gaskets shall be made of vulcanized natural or synthetic rubber; no reclaimed rubber will be allowed. The gaskets shall be of the manufacturer's standard design dimensions and of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal.

2.2.7 The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75 degrees F.

2.2.8 Enough lubricant shall be furnished with each order to provide a coat on the spigot end of each pipe. This lubricant shall be nontoxic, impart no taste or smell, have no harmful effect on the gasket or pipe material, and support no bacterial growth. The lubricant containers shall be labeled with the manufacturer's name.

2.2.9 Joints shall be manufactured in accordance with ASTM D3139 except that the thickness of the bell shall be, as a minimum, equal to that of the barrel. Joints shall be either integral bell and ring joints with rubber compression gaskets as manufactured by the Clow Corporation, Johns-Manville, or Vulcan Plastic Corporation; twin gasket couplings as manufactured by the Certain-Teed Products Corporation; or equal. However, the pipe and bell must be made by the same manufacturer.

2.2.10 Standard and special fittings shall be ductile iron. Use standard mechanical joint fittings. All fittings shall conform to the specifications of ANSI A21. 10/AWWA C110. Restrained joint fittings and pipe shall be subject to Town approval.

2.2.11 Fittings Pipe and fittings shall be lined with Protecto 401, Permox CTF, or Engineer-approved equal. The outside coating shall be manufacturer's standard asphaltic coating.

2.2.12 Fitting laying lengths shall conform to ANSI A21. 10/AWWA C110.

2.2.13 Fittings shall be in accordance with the standard mechanical joint fittings manufactured by the U.S. Pipe and Foundry Company, American Cast Iron Pipe Company, Clow Corporation, or equal.

2.3 VALVES

2.3.1 Plug Valves:

2.3.1.1 Non-lubricated type eccentric valves shall be rated for 175 psig service at 140 degrees F. Valves shall have drip-tight shutoff with pressure from either direction and cast iron bodies. Exposed service valves shall have flanged ends in accordance with ASME B16.1 flanged or AWWA C606 grooved end connections.

2.3.1.2 Plug shall be all metal, matching body with round or rectangular port with no less than 80 percent of connecting pipe area and coated with Buna-N, welded nickel seats, self-lubricating stainless steel stem bearings, and stem seal multiple V-rings or U-cups with O-rings of nitrile rubber, with grit seals on both upper and lower bearings. For buried service, provide completely sealed operator filled with heavy lubricant and 2-inch nut. Size operator for 1.5 times the maximum shutoff pressure differential for direct and reverse pressure, whichever is higher.

2.3.1.3 Manufacturers and Products:

i) DeZurik, Style PEC

ii) Valmatic, Style 5800R

iii) Pratt, Ballcentric

2.3.2 Air Release Valves: shall be mounted on common header and all high points along force mains. Air/Vacuum release valves shall be rated for raw sewage, have a minimum 2" inlet, and be provided with flush ports. Valves shall be sized for intended system hydraulics. Air release valves shall be mounted on isolation valves. The air release valve drain pipe shall be a minimum of 1-inch PVC Sch. 40 Drain pipe shall be solidly fastened and shall discharge into gravel bottom of the valve vault. Liquid shall not accumulate within the drain pipe. Air/Vacuum release valves shall have a

PVC or stainless steel 316 body. Approved manufacturer is DeZurik/APCO 401 or Vent-O-Mat Series RGX.

PART 3. EXECUTION

3.1 INSTALLATION OF FORCE MAIN

3.1.1 Lay the force main to and keep it at the lines and grades required by the drawings. All fittings shall be at the required locations, and spigots well centered in the bells. Where the grades are 0.2 percent or less, either use batterboards or a laser to maintain the required slopes.

3.1.2 Unless otherwise indicated by the drawings, all force mains shall have at least 36 inches of cover. The pipe shall slope continuously between high and low points and have a minimum of 60-inch cover at the high points. No departure from this policy shall be made except at the order of the Town, or unless shown otherwise on the drawings.

3.1.3 Provide and use tools and facilities that are satisfactory to the Town and that will allow the work to be done in a safe and convenient manner. Use a derrick, ropes, or other suitable equipment to lower all pipe and fittings into the trench one piece at a time. Carefully lower each piece so that neither it nor any protective coating or lining it may have will be damaged. Under no circumstances, drop or dump force main materials into the trench.

3.1.4 Lower no pipes and fittings into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. After the pipe has been lowered, remove all unnecessary materials from it. Before any pipe is laid, brush and wipe clean the outside of its spigot end and the inside of its bell and ensure that the pipe is dry and oil-free.

3.1.5 Take every precaution to keep foreign material from getting into the pipe while it is being placed in the trench. If the crew laying the pipe cannot put it into the trench and in place without allowing earth to get inside it, then place a heavy, tightly woven canvas bag of suitable size over each end of the pipe and leave it there until it is time to connect that pipe to the one adjacent to it.

3.1.6 Place no debris, tools, clothing, or other materials in the pipe during laying operations.

3.1.7 After a length of pipe has been placed in the trench, center the spigot end in the bell of the adjacent pipe, and then insert to the depth specified by the manufacturer and bring to the correct line and grade. Secure the pipe in place by tamping an approved backfill material around it.

3.1.8 Bell holes shall be big enough so that there is ample room for the pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.

3.1.9 Pipe Bedding: All force mains shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be made because of the width and depth of trench. Backfill material from 1 foot above the pipe should not exceed 4 inches in diameter at its greatest dimension.

For structural reasons, ductile iron pipe, concrete encasement, or relocation shall be required when culverts or other conduits are laid such that the top of the sewer is less than 18 inches below the bottom of the culvert or conduit. Special care shall be used in placing bedding in the haunching region.

3.1.9.1 Unpaved areas: Each pipe section shall be laid on six (6) inch bed of size no. 57 or size no. 67 crushed stone and shall be backfilled to 12" above the pipe top using size no. 57 or size no. 67 compacted crushed stone.

3.1.9.2 Paved Areas: Each pipe section shall be completely encapsulated with 6 inches of bedding material on the bottom and both sides. The entire depth of the trench shall also be backfilled with bedding materials compacted in 6-inch lifts. Bedding materials shall be size no. 57 or size no. 67 crushed stone.

3.1.10 Where force mains are installed in new fill, a compaction letter sealed by a Geotechnical Engineer registered in the State of Tennessee shall be submitted to the Town prior to accepting the installation. An acceptable compaction letter shall state that the field density testing indicates the fill has been compacted to at least 95 percent of the maximum dry density, according to the Standard Proctor. If a compaction letter is not available, special protection such as replacement with ductile iron pipe with joint restraint or encasement with flowable fill shall be utilized as approved by the Town.

3.1.11 Whenever pipe laying is not in progress, close the open ends of pipe in the trench with a watertight plug or by other means approved by the Town. Caulk the joints of any pipe in the trench that cannot be completed until a later time with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, this seal shall remain in place until the trench has been pumped completely dry.

3.1.12 The cutting of pipe so that fittings or closure pieces can be inserted shall be done in a neat and workmanlike manner and without any damage to the pipe. Follow the manufacturer's recommendations concerning how to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipe's axis.

3.1.13 The flame cutting of pipe by means of an oxyacetylene torch will not be allowed.

3.1.14 Unless otherwise directed by the Town, lay pipe with the bell ends facing in the direction of laying.

3.1.15 Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed that necessary for the joint to be satisfactorily made, nor that recommended by the pipe manufacturer and shall be approved by the Town.

3.1.16 Lay no pipe in water or when it is the Town's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, this shall be considered incidental to the project, and no separate payment will be made for its use.

3.1.17 Install thrust blocks wherever the force main changes direction (e.g., at tees and bends), at dead ends, or at any other point where the manufacturer recommends and/or the Town indicates that they are to be used.

3.1.18 Make all joints, whether standard mechanical or push-on joints, in conformance with the recommendations of the joint manufacturer as approved by the Town.

3.1.19 When PVC pipe is installed, a minimum size 14-gauge copper wire shall be installed along the pipe. The ends of the wire shall terminate in a valve box or other acceptable location whereby detection equipment may be attached.

3.1.20 All pipe shall have detection tape installed. Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sewer, Green, “Caution Sewer Line Buried Below”. Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be a minimum of 2 inches when buried less than 10 inches below the surface. Tape width shall be a minimum of 3 inches when buried greater than 10 inches and less than 20 inches.

3.2 HYDROSTATIC TESTS

3.2.1 Pressure Test

3.2.1.1 After pipe has been laid and backfilled as specified above, subject all newly laid pipe or any valved section thereof to a pressure of 150 psi, or 1.5 times the working pressure, whichever is greater. All connections (if applicable) are to be laid prior to testing the main and tested as part of the test of the main. No more than 2,500 linear feet of pipe shall be tested at one time.

3.2.1.2 The duration of each pressure test shall be at least one (1) hour.

3.2.1.3 Slowly fill each valved section of pipe with water and apply the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) with a

pump connected to the pipe in a manner satisfactory to the Town. Furnish the water, pump, pipe, connections, gauges, and all necessary apparatus.

3.2.1.4 Before applying the specified test pressure, expel all air from the pipe. If air/vacuum assemblies are not available at high places, make the necessary taps at the points of highest elevation before testing, and insert plugs after the test has been completed.

3.2.1.5 Carefully examine all exposed pipes, fittings, and valves, during the test. Remove any cracked or defective pipes, fittings, and/or valves, discovered in consequence of this pressure test, and replace with sound material in the manner specified. Repeat the test until the results are satisfactory to the Town.

3.2.2 Leakage Test

3.2.2.1 Conduct the leakage test after the pressure test has been satisfactorily completed. Furnish the water, pump, pipe, connections, gauges, measuring devices, and all other necessary apparatus as well as all necessary assistance to conduct the test.

3.2.2.2 The duration of each leakage test shall be two (2) hours; during the test, subject the main to a pressure of 150 psi.

3.2.2.3 Leakage is defined as the amount of water which must be supplied to the newly laid pipe or any valved section in order to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

3.2.2.4 No pipe installation will be accepted until the leakage is less than the number of gallons per two (2) hour period listed below:

Pipe Sizes	Gallons per 1,000 Feet of Pipe
2" - 2-1'4"	0.2
3"	0.5
4"	0.6
6"	0.9
8"	1.2
10"	1.5
12"	1.9
14"	2.2
16"	2.6
18"	2.9
20"	3.2
24"	3.8

3.2.2.5 Should any test of pipe laid disclose leakage greater than that specified, the Developer shall locate and repair the defective joints until the leakage is within the specified allowance.

3.3 CLEANUP

3.3.1 After completing each section of force main, remove all debris and all construction materials and equipment from the work site. Then grade and smooth over the surface on both sides of the main. The entire area shall be clean and left in a condition satisfactory to the Town. Seed and mulch as required elsewhere in these specifications.

END OF SECTION

SECTION 13
BORING AND CASING FOR SANITARY SEWERS

PART 1. GENERAL

1.1 The work to be performed hereunder shall consist of the installation of casing pipe and carrier pipe for wastewater lines as shown on the drawings or as called for in these specifications. For the open cut casing pipes, it shall include the excavation of the trench, placing proper bedding material, furnishing and installing the casing pipe, furnishing and installing the carrier pipe, backfilling, and disposing of the excess excavated materials. For the boring and jacking of casing pipes, it shall include the excavation of a boring pit, auger boring between the point as specified on the drawings, furnishing and installing of the carrier pipe, and disposing of the excavated materials in the manner herein provided.

1.2 WORK INCLUDED

1.2.1 The Contractor shall furnish and install bored or jacked steel casing, complete and in place, all in accordance with the requirements of the Contract Documents. Carrier pipe installation within the steel casing shall be in accordance with the requirements contained within this Section.

1.2.2 In the performance of the work, the Contractor shall comply with the lawful requirements of the affected railway companies, public agencies, and owners of public utilities or other facilities respecting the safeguarding of traffic and improvements which might be endangered by the boring and jacking operations. Approach trenches in public streets will not be permitted to remain open for extended periods of time.

1.2.3 If the Contractor is not ready to place the pipe in the casing at the time of completion of boring and jacking operations, the ends shall be bulkheaded, and the approach trenches in public streets shall be backfilled, temporary surfacing placed thereon, and the affected portion of the street reopened to traffic.

1.2.4 The Contractor shall be responsible for maintaining the specified line and grade, and for preventing settlement of overlying structures, or other damage due to the boring and jacking operations.

1.3 DEFINITIONS

1.3.1 Boring – the method of excavating soil to create a conduit between two points without disturbing the surface between the sending and receiving pits. Methods included herein, but are not limited to, are auger boring, tunnel boring, and micro tunneling.

1.4 SUBMITTALS

1.4.1 The Contractor, prior to beginning any trench or structure excavation 5 feet deep or over, shall submit to the Town a detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against

the hazard of caving ground during the excavation of such trenches or structure excavation. Such design shall be signed and sealed by a professional engineer.

1.4.2 Submittals:

1.4.2.1 Casing installation schedules which include schedules of excavation, pipeline installation and backfill operations.

1.4.2.2 Material list including diameter, thickness, and class of steel casing.

1.4.2.3 Detailed locations and sizes of all boring or jacking and receiving pits.

1.4.2.4 The method of transporting the pipe in the casing and the method of "tugging" the pipe into the joints.

1.4.2.5 Details of concrete support blocks and bracing to prevent the carrier pipe from shifting or floating.

1.4.2.6 All permits associated with the boring or jacking operations.

1.4.3 Certifications: The Contractor shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section. Provide certification of physical and chemical properties of all steel.

1.5 QUALITY ASSURANCE

1.5.1 All boring or jacking operations shall be done by a qualified Contractor with at least 5 years' experience involving work of a similar nature.

1.5.2 The Contractor shall give the Town a minimum of 3 days advance notices of the start of an excavation or boring operation.

1.5.3 All work shall be performed in the presence of the Town's representative and the Owner.

1.5.4 Welding Requirements: All welding procedures used to fabricate steel casings shall be prequalified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or special welds for pipe cylinders, casing joint welds, reinforcing plates and grout coupling connections.

1.5.5 All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the type of materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing work on the casing or pipeline. Machines and electrodes similar to those used in the work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders.

PART 2. PRODUCTS

2.1 CASING PIPE

2.1.1 The casing pipe shall be of steel meeting the latest approved American Railway Engineering Association "Specifications" for Pipelines for Carrying Flammable and Nonflammable Substances." The steel casing pipe shall have minimum yield strength of 35,000 PSI and shall have the minimum wall thickness shown in the following table:

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE
FOR E72 LOADING

Carrier Pipe Diameter	Casing Pipe Diameter (min.)	Nominal Thickness
4 inches	10 inches	0.250 inches
6 inches	12 inches	0.250 inches
8 inches	16 inches	0.312 inches
10 inches	20 inches	0.312 inches
12 inches	22 inches	0.312 inches
14 inches	24 inches	0.344 inches
16 inches	26 inches	0.375 inches
18 inches	28 inches	0.406 inches

2.1.2 When the casing pipe is installed without benefit of a protective coating, the wall thickness shown above shall be increased to the nearest standard size, which is a minimum of 0.063 inches greater than the thickness shown.

2.2 CARRIER PIPE

2.2.1 The carrier pipe shall be PVC, SDR 21, unless otherwise noted on the drawings.

2.3 GROUT

2.3.1 Grout: Grout shall consist of one part Portland cement, three parts sand and the minimum amount of water necessary to obtain the desired consistency and all grout mixtures shall contain 2 percent of bentonite by weight of the cement. Portland cement, water and sand shall conform to the applicable requirements of the specification Section 14 except that sand to be used shall be of such fineness that 100 percent will pass a Standard No. 8 sieve and at least 45 percent, by weight, will pass a Standard No. 40 sieve. Bentonite shall be a commercial-processed powdered bentonite, Wyoming type, such as Black Hills or equal.

2.3.2 Grout Connections: The Contractor shall provide grout connections on the interior of the steel casing pipe as specified. Longitudinal spacing between the grout connections may be decreased to provide more frequent grouting, but in no case shall the spacings shown or specified be exceeded.

2.3.3 Annular Sand: Sand for the annular space between the carrier pipe and the steel casing shall be clean with 100 percent passing a Standard No. 30 sieve.

2.4 CASING SPACERS:

2.4.1 Unless otherwise shown, spacers shall be placed 1-2 feet on either side of the bell joint and one every 6-8 feet apart thereafter for a total of three casing spacers per joint of pipe.

2.5 CASING END SEALS

2.5.1 End seals shall be Link-Seal modular pipe seals.

2.5.2 The Wrap-Around or Pull-On end seal shall be manufactured of 1/8" thick neoprene rubber. Provide minimum 2" wide T-304 stainless steel banding with 100% non-magnetic worm gear mechanism.

PART 3. EXECUTION

3.1 GENERAL

3.1.1 Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor. Any subsurface investigation by the Bidder or Contractor must be approved by the appropriate authority having jurisdiction over the site. Rock and/or water, if encountered, shall not entitle the Contractor to additional compensation.

3.1.2 Casing construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from casing operations and shall repair and restore damaged property to its original or better condition at no cost to the Owner.

3.1.3 Face Protection: The face of the excavation shall be protected from the collapse of the soil into the casing.

3.1.4 Bore Pit Design: Design of the bore pit and required bearing to resist installation forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor, at no additional cost to the Owner. Due to restrictive right of way and construction easements, casing lengths less than the nominal 20 foot length may be necessary.

3.2 HIGHWAY CROSSINGS

3.2.1 The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right of way.

3.2.2 Work along or across the highway department rights of way shall be subject to inspection by such highway department r.

3.2.3 All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.

3.2.4 No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.

3.2.5 In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right of way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.

3.2.6 The Contractor shall be responsible for providing the Owner sufficient information to obtain a blasting permit, if required, in a timely manner.

3.3 GROUNDWATER CONTROL

3.3.1 The Contractor shall control the groundwater throughout the construction of the casing.

3.3.2 Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.

3.3.3 When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum.

3.4 SAFETY

3.4.1 Provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

3.4.2 Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.

3.4.3 Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL 596), as amended, applicable regulations of the Federal Government, OSHA

29CFR 1926 and applicable criteria of ANSI A10.16 81, “Safety Requirements for Construction of Tunnel Shafts and Caissons”.

3.5 SURFACE SETTLEMENT MONITORING

3.5.1 The Contractor shall place settlement markers outside of pavement area, along the centerline of the casing at 20 foot intervals and offset 10 feet each way from the centerline of the tunnel. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement and at 10 and 25 feet in each direction from the centerline of the casing. Tie settlement markers to bench marks and indices sufficiently removed as not to be affected by the casing operations.

3.5.2 Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Engineer. In the event settlement or heave on any marker exceeds 1 inch, the Contractor shall immediately cease work and using a method approved by the Engineer and the authority having jurisdiction over the project site, take immediate action to restore surface elevations to that existing prior to start of casing operations.

3.5.3 Take readings and permanently record surface elevations prior to start of dewatering operations and/or shaft excavation. The following schedule shall be used for obtaining and recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the Engineer's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.

3.5.4 The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.

3.5.5 Promptly report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action.

3.6 BORING

3.6.1 The boring shall be accomplished by means of auguring to the size, line and grade shown on the drawings.

3.7 INSTALLATION OF OPEN CUT CASING PIPE

3.7.1 For open cut of casing pipes, install the steel casing pipe into the open cut as the trench excavation proceeds. Weld sections of casing pipe together to provide watertight joints, and replace the coatings in areas where damaged by welding.

3.8 INSTALLATION OF CASING PIPE

3.8.1 Jacking Head: A steel jacking head shall be fitted to the lead section of the casing in such a manner that it extends around the entire outer surface of the steel casing and projects at least 18 inches beyond the driving end of the casing. The jacking head shall not protrude more than 0.5 inches outside of the outer casing surface. The head shall be

securely anchored to prevent any wobble or alignment variation during the boring or jacking operations. To minimize voids outside the casing, excavation shall be carried out entirely within the jacking head and not in advance of the head. Excavated materials shall be removed from the casing as the boring or jacking operation progresses and no accumulation of excavated materials within the casing shall be permitted.

3.8.2 Jacking Pit: The excavations for the boring or jacking operations shall be adequately shored to safeguard existing substructures and surface improvements and to ensure against ground movement in the vicinity of the jack supports. Heavy guide timber, structural steel, or concrete cradles of sufficient length shall be provided to assure accurate control of boring or jacking alignment. The Contractor shall provide adequate space within the excavation to permit the insertion of the lengths of casing to be bored or jacked. Timbers and structural steel sections shall be anchored to ensure action of the jacks in line with the axis of the casing. A bearing block, consisting of a timber or structural steel framework, shall be constructed between the jacks and the end of the casing to provide uniform end bearing over the perimeter of the casing and distribute the jacking pressure evenly.

3.8.3 Control of Alignment and Grade: The Contractor shall control the application of the jacking pressure and excavation of materials ahead of the casing as it advances to prevent the casing from becoming earthbound or deviating from the required line and grade. The Contractor shall restrict the excavation of the materials to the least clearance necessary to prevent binding in order to avoid loss of ground and consequential settlement or possible damage to overlying structures. Allowable grade deviations in horizontal and vertical alignments shall be no greater than 0.2 feet per 100 feet in any direction over the length of the jacking or boring to a maximum deviation of 0.5 feet.

3.8.4 Exterior Grouting: Immediately after completion of the boring or jacking operations, the Contractor shall inject grout through the grout connections in such a manner as to completely fill all voids outside the casing pipe resulting from the boring or jacking operations. Grout pressure shall be controlled so as to avoid deformation of the steel casing and avoid movement of the surrounding ground. After completion of the grouting operations, the Contractor shall close the grout connections with cast-iron threaded plugs.

3.8.5 Installation: The installation of the casing shall be in accordance with the Contract Documents and subject to the approval of the agency having jurisdiction over the area containing the boring or jacking operations.

3.8.6 Should appreciable loss of ground occur during the jacking operation, the voids shall be backpacked promptly to the extent practical with soil cement consisting of a slightly moistened mixture of one part cement to five parts granular material. Where the soil is not suitable for this purpose, the Contractor shall import, at the Contractor's expense, suitable material. The soil cement shall be thoroughly mixed and rammed into place as soon as possible after the loss of ground.

3.9 INSTALLATION OF CARRIER PIPE

3.9.1 The carrier pipe shall be furnished by the Developer. Upon acceptance of the casing, install the carrier pipe in the casing by jacking it through the casing. If necessary to achieve proper line and grade on the carrier pipe, strap wood or other suitable blocking to the carrier pipe to offset any minor variations in the alignment of the casing.

3.9.2 Joints: All joints of the carrier pipe within the casing shall be joined in accordance with the specification Sections for the type of pipe material installed.

3.9.3 Application of Coatings: Application of coatings to the exterior of the carrier pipe shall be performed in accordance with the requirements of the specification Sections for the type of pipe materials installed and as provided for in these Specifications.

3.9.4 Testing of the Carrier Pipe: Hydrostatic testing of the carrier pipe shall be completed prior to the filling of the annular space between the casing and carrier pipe with sand. Hydrostatic testing shall be performed in accordance with the appropriate specification Section.

3.9.5 Sand Backfill for Annular Space in Jacked Casing: For gravity sewers, the Contractor shall provide sand backfill for the annular space after the sewer is placed at the appropriate grade and elevations. The Contractor shall furnish the necessary sand, equipment, hoses, valves, and fittings for the operation. Sand shall be conveyed by air through a hose and deposited by air pressure in its final position. The sand shall be free of lumps to flow unimpeded and to completely fill all voids. In general, sand backfill will be considered completed when no more sand can be forced into the annular space. The Contractor shall protect and preserve the interior surfaces of the steel casing from damage.

3.9.6 Closing of Pits: After jacking equipment and excavated materials from the boring or jacking operations have been removed from the jacking pit, the Contractor shall prepare the bottom of the jacking pit as a pipe foundation. The Contractor shall remove all loose and disturbed materials below pipe grade to undisturbed earth and recompact the material in accordance with the Section 7.

3.10 LAYOUT OF WORK

3.10.1 The Developer will provide the detailed layout required to keep the excavation and pipe installation on grade.

PART 4. GUARANTEE OF WORK

4.1 Guarantee a usable completed casing between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the casing shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the drawings and on the bottom by an elevation no lower than the existing inlet pipe invert.

4.2 The allowable tolerance at the upstream end point of the casing shall be such that the invert of the carrier pipe may be positioned at the elevation shown on the drawings.

END OF SECTION

SECTION 14
CONCRETE FOR UTILITY LINES

PART 1. GENERAL

1.1 This item shall include furnishing and installing concrete blocking, cradles, anchors, caps, pipe protection, and/or encasement at the locations shown on the drawings and/or directed by the Town.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

3.1 Concrete work shall conform to ACI 301-72 (as revised), as modified by the supplemental requirements below:

3.1.1 Strength: The strength of concrete shall be 3,000 psi unless otherwise shown on the drawings.

3.1.2 Durability: All concrete exposed to weather shall be air entrained.

3.1.3 Slump: Concrete shall be proportional and produced to have a slump of 3 inches with a 1 inch tolerance.

3.1.4 Admixtures: Air entrainment, mandatory for concrete exposed to weather, may be used. A water reducing admixture (retarding, normal, or accelerating, depending on placing temperature), may be used if approved by the Thompson's Station.

3.1.5 Reinforcing Steel: Yield strength of reinforcing steel shall be 60,000 psi.

END OF SECTION

SECTION 15
SEWER LIFT STATION

PART 1. GENERAL

1.1 SUMMARY

1.1.1 This Specification details the requirements for small residential and commercial wastewater pump stations and valve vaults. Small stations are defined as having a peak hour flow (PHF) capacity of less than 1,000 gpm.

1.1.2 This is not intended to be an all-inclusive specification for the construction of a submersible type station and associated valve vault. Project specific conditions may make it necessary to modify the requirements of this section.

1.1.3 All pump stations shall include a minimum of two pumps (duplex arrangement) sized to convey the peak hourly flow (PHF) with one pump out of service.

1.1.4 All sanitary sewer lift stations shall be submersible type.

1.1.5 All lift stations shall operate automatically based on the water level in the wet well. Level control device and float switch shall be fully accessible without the need for personnel entering the wet well.

1.1.6 Pump station shall be provided with a generator as specified below.

1.2 GENERAL

1.2.1 All pumps, regardless of station design, shall be electric, centrifugal non-clogging units capable of passing incompressible 3-inch spheres, and shall have no less than 4-inch diameter suction and discharge openings. Semi chopper or vortex pumps may be accepted on case-by-case basis.

1.2.2 The lift station shall consist of submersible centrifugal sewage pumps, stainless steel 316 guide rail system, wet well access, discharge seal and elbow, control panel, starters, liquid level control system, SCADA monitoring system, and all hardware necessary to provide a complete working system. Every integral component of the guide system shall be stainless steel 316, which includes the following but not limited to: guide rails, brackets, fittings, bolts, nuts, fasteners, adapters, attachments, etc. Flanged discharges are not allowed.

1.2.3 Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors. In addition, a minimum of 5-hp motor is required, unless prior arrangements have been made and approved by the Town. Submit pump head capacity and system curves to the Town, along with the lift station plans. Base the curves on the total of static head, friction losses through force mains, headers and pump risers. Pump duty point for nominal design flow shall be within 75% and 115% range of pump's flow at Best Efficiency Point (B.E.P).

1.2.4 The proposed elevation of all critical components shall be shown in the Drawings including, but not limited to, pump intake line inverts, control and alarm levels, top of the wet well, influent line invert(s).

1.2.5 All electrical equipment/panels and controls shall be above ground.

1.2.6 Scaled engineering drawings and calculations shall be submitted to the Town for review and approval. After completion of project, as-built drawings shall be provided to the Town prior to final acceptance of station.

1.2.6.1 Calculations shall include flow projections for area served initially and future build-out, if applicable.

1.2.6.2 Calculations should use a peak multiplier of at least 2.5.

1.2.6.3 Include hydraulic calculations that show pump and system curve, pump cycle times, and pipe headloss.

1.2.6.4 Calculation package and/or Engineering Report submitted to TDEC for approval shall also be submitted to the Town.

1.2.7 Lift station design shall comply with Town's standard drawings and include all features and appurtenances shown.

1.3 PUMPS

1.3.1 Impellers shall consist of cast stainless steel or hard iron. Mechanical Seals shall consist of Tungsten Carbide. Silicon Carbide seals will be evaluated and approved on case-by-case basis.

1.3.2 The motor shall be submersible and conform to the requirements of NEMA MG 1. The motors shall be 3-phase, 60-Hz, 277/480 V, squirrel cage, induction type, NEMA Design B Type, Class H motor insulation, high efficiency design, housed in a completely watertight and air-filled chamber, with a minimum 1.15 service factor. The motor shall be sized to avoid overload when operating at any point along the characteristic curve of the pump.

1.3.3 Pump duty point shall be within 75% to 115% range of pump's flow at Best Efficiency Point (BEP) for one and two pumps in operation as to achieve the maximum efficiency possible, and no substitutions will be accepted after approval of the Lift Station construction plans. Designer shall consider different combinations of pumps, impellers and pipe sizes including discharge and force main piping in order to achieve the pump operating criteria and maximum efficiency.

1.3.4 Approved pump manufacturer is Flygt.

1.3.5 Sealing of the pump unit to the discharge connection shall be a machined metal to metal watertight, hydraulically sealed contact.

1.3.6 Pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.

1.3.7 All cables shall be continuous (no splices allowed) and intended for wastewater service applications.

1.4 STATION PIPING

1.4.1 Pipe reducers, if required installed at discharge base of submersible pumps shall be eccentric type. Reducers installed at discharge header shall be concentric reducer.

1.4.2 The piping design shall consider surge effects and provide protection where necessary. Surge relief shall be contained in the system.

1.4.3 Floor drains from valve vaults to wet wells shall be designed to prevent gas from entering the valve vault, using a check valve and "P" trap.

1.4.4 Provide 316 stainless steel pipe supports for pipes in wet well. Pipe supports in the valve vault shall be stainless steel or concrete.

1.4.5 Lift station piping shall be ductile iron or stainless steel and shall have flanged connections to allow for removal of pumps and valves without interruption of the lift station operations. Wall penetrations shall be Link Seal or approved equal.

1.4.6 If elevation change is required outside of the valve vault, use forty-five (45) degree ductile iron elbows to achieve the correct elevation.

1.5 WET WELL

1.5.1 Pump station wet well shall be precast reinforced concrete and shall conform to ASTM C478.

1.5.2 Dimensions: Minimum 72” in diameter; larger as necessary to accommodate submersible pumping equipment, piping, supports, emergency storage volume (1 hour of average flow) and to support pump cycle times. Depth of wet wells shall consider, but not be limited to all the following: emergency storage volume and adequate submergence of submersible pumps.

1.5.3 Sufficient depth shall be provided to accommodate cycle time and motor submergence.

1.5.4 In determining the cycle time, only the volume below the pipe invert and above the top of pump or manufacturer’s minimum submergence (whichever is greater) shall be considered.

1.5.5 Pumping levels shall be set to provide a minimum capacity between operational water levels sufficient to allow a minimum of ten minutes in one pumping cycle. The minimum time between successive starts of the same pump shall be ten minutes.

1.5.6 The effective volume (from pump off elevation to the invert of the gravity pipe) shall be based on a fill time of 30 minutes at Average Daily Flow (ADF). The high liquid level in the wet well (storage capacity) shall not exceed the invert elevation of the lowest inflow pipe.

1.5.7 Pump-off water levels shall provide adequate submergence to preclude pump inlet cavitation. Design maximum water levels shall not exceed the invert elevation of the influent pipe.

1.5.8 The wet well floor shall have a minimum slope of 1:1 to the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the pump inlet.

1.5.9 Interior ladders shall not be permitted.

1.5.10 Only one inlet connection shall be permitted to a wet well. A kingpin manhole shall be installed within 20 feet of the wet well.

1.5.11 For buoyancy calculations, the soil ring weight (from the outer face of the bottom slab to the outer edge of the wet well) shall be 100 percent of the total weight of the soil ring. The net density of the soil shall be used for calculating weight, i.e., soil density less the water density (62.4 pounds per cubic foot). A minimum safety factor of 1.1 shall be achieved.

1.5.12 Wet well shall be coated with bitumastic coal tar epoxy. Commercial Product's epoxy will not be allowed.

1.5.13 Preformed butyl rubber gaskets shall be used at all joints between manhole sections.

1.5.14 The wet well shall have at least one double-leaf hatch as specified in this Section.

1.5.15 A davit crane shall be mounted at the wet well for the purpose of retrieving the pumps from the wet well. Davit crane shall be provided with an electric winch with stainless steel cable. Provide hook and saddle grab for lifting pumps via chain. All components must be rated for the pump weight with a factor of safety of 1.2. Davit crane shall be manufactured by Thern.

1.6 VALVE VAULT

1.6.1 Valve vaults shall be precast reinforced concrete and shall conform to ASTM C478.

1.6.2 A separate valve vault shall be installed downstream of the wet well vault. It shall be sized to accommodate valves and routine maintenance without removing the valve from vault.

1.6.3 Plug Valves: Install a plug valve on the downstream side of each check valve. Valves shall meet the following requirements:

1.6.3.1 Non-lubricated type eccentric valves shall be rated for 175 psig service at 140 degrees F. Valves shall have drip-tight shutoff with pressure from either direction and cast iron bodies. Exposed service valves shall have flanged ends in accordance with ASME B16.1 flanged or AWWA C606 grooved end connections.

1.6.3.2 Plug shall be all metal, matching body with round or rectangular port with no less than 80 percent of connecting pipe area and coated with Buna-N, welded nickel seats, self-lubricating stainless steel stem bearings, and stem seal multiple V-rings or U-cups with O-rings of nitrile rubber, with grit seals on both upper and lower bearings. Valves to 6 inches shall be provided with lever operator. Larger valves shall be equipped with totally enclosed, geared, manual operator with handwheel. Size operator for 1.5 times the maximum shutoff pressure differential for direct and reverse pressure, whichever is higher. For buried service, provide completely sealed operator filled with heavy lubricant and 2-inch nut.

1.6.3.3 Manufacturers and Products:

i) DeZurik, Style PEC

ii) Valmatic, Style 5800R

iii) Pratt, Ballcentric

1.6.4 Check Valves: A flanged, non-slamming check valve shall be installed on the discharge side of each pump. Check valves shall be swing type with an external lever and minimum pressure rating of 250 psi. Approved check valve manufacturers and models are APCO CVS-6000/6000A and Valmatic 7800/7900.

1.6.5 Butterfly valves, tilting disc check valves, or other valves utilizing a tilting disc in the flow line are not allowed.

1.6.6 Air/Vacuum Release Valves: shall be mounted on common header and all high points along force mains. Air/Vacuum release valves shall be rated for raw sewage, have a minimum 2-inch inlet, and be provided with flush ports. Valves shall be sized for intended system hydraulics. Air release valves shall be mounted on isolation valves. The air release valve drain pipe shall be a minimum of 1-inch PVC Sch. 40 Drain pipe shall be installed in a manner that doesn't represent a tripping hazard and shall be solidly fastened; unless embedded in concrete slab, and shall discharge into wet well. Liquid shall not accumulate within the drain pipe. Air/Vacuum release valves shall have a PVC or stainless steel 316 body. Approved manufacturer is DeZurik/APCO 401 or Vent-O-Mat Series RGX.

1.6.7 Surge Relief Valves: When required, surge relief valve size shall be selected based on Firm Pumping Capacity flow. It shall be rated for raw sewage service, and it shall have isolation valve on the inlet side. Opening setting shall not exceed 5 psi above normal operating pressure of the system at header when firm pumping capacity flow is being discharged. Surge relief pipe shall be routed back to either wet well or manhole next to wet well. When the analysis shows dangerous surge pressure at firm pumping capacity, a surge relief valve will be included in the design in addition to the soft starters.

1.6.8 Install a discharge pressure gauge rated for corrosive service that meets the following specifications: 4.5-inch Dial, Grade 1A, ASME B40.100, ±1% full scale accuracy, liquid filled, type 316 stainless steel bourdon tube, glass safety lens, full blowout protection, weatherproof, hermetic seal and with a standard ¼ inch NPT. Pressure gauge shall be provided with a glycerin filled diaphragm seal and isolation ball valve. Vacuum gauges shall meet the same specifications of the pressure gauges.

1.6.9 Bypass Connection: Each valve vault shall include a bypass connection with a male cam-lock fitting and cap. The bypass connection shall be isolated by a plug valve, as specified above.

1.7 ACCESS FRAMES AND DOORS

1.7.1 Access frames shall be manufactured by USF Fabricators, Halliday Products, Bilco or Approved Equal.

1.7.2 The wet well shall be furnished with access frame and doors along with an integrated fall protection system. Equipment furnished shall include the necessary aluminum access frames with spring loaded double doors, stainless steel upper guide holder, and level sensor cable holder. Doors shall be aluminum diamond plate.

1.7.3 Wet well access doors shall be sized according to the pump manufacturer's recommendations. As a minimum, doors shall be sized to allow pumps to pass through the hatch opening with a one-inch clearance between the back of the pump volute and the door. The front hatch frame shall have a minimum eight-inch clearance from the front of the pump volute. Double doors shall be used wherever possible.

1.7.4 The valve vault shall be furnished with spring loaded double access doors which covers entire vault opening. The difference between the interior vault dimensions (length and width) and hatch dimensions shall not be greater than 12 inches. Equipment furnished shall include the necessary aluminum access frames, and spring loaded double doors. Doors shall be aluminum diamond plate.

1.7.5 Wet well hatch hinges shall not be mounted on the same side as the guide rails and float/control ball rack.

1.76 The access frame and door(s) shall have stainless steel hardware.

1.7.7 Access doors that are not exposed to vehicular traffic shall have a load rating of 300 pounds per square foot (psf). Access doors exposed to vehicular traffic shall have a H-20 traffic load rating. The support beam for load rating shall be mounted on the door.

1.7.7.1 Angle Frame Covers (300 psf rating)

i) The single leaf and double leaf access frames and covers shall have a 1/4-inch-thick one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor. Door panels shall be 1/4-inch-aluminum diamond plate, reinforced to withstand a live load of 300 lbs. psf, uniform load. Doors shall open to 90 degrees and automatically lock with T-316 stainless steel hold open arms with aluminum release handles. Doors shall close flush with the frame. Hinges and all fastening hardware shall be T-316 stainless steel. Unit shall lock with a non-corrosive locking bar and have a non-corrosive handle. Unit shall carry a lifetime guarantee against defects in material and/or workmanship.

1.7.7.2 H-20 Rated Angle Frame Covers

i) The single leaf and double leaf access frames and covers shall have a 1/4-inch-thick, one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor. The inside of the frame shall have a door-support ledge on two sides. Both frame and ledge must be supported by a full bed of Class A concrete. The door panels shall be 1/4-inch-aluminum diamond plate, reinforced to withstand a live load of the H-20, uniform live load. Doors shall open to 90 degrees and automatically lock with a T-316 stainless steel hold open arm with release handles. For ease of operation, doors shall incorporate enclosed stainless steel compression spring assists. Doors shall close flush with the frame. Hinges and all fastening hardware shall be T-316 stainless steel. Unit shall lock with a T-316 stainless steel slam lock with removable keys and have a non-corrosive handle. Unit shall carry a lifetime guarantee against defects in material and/or workmanship.

1.7.8 The protective fall protection panel shall be installed with a 3-inch aluminum “I” bar grating with Safety Orange powder-coated finish. Grating shall be hinged with tamper proof stainless steel bolts and shall be supplied with a positive latch to maintain unit in an upright position. Grating shall have a 6 inch viewing area on each lateral unhinged side for visual observation and limited maintenance. A padlock hasp for owner-supplied padlock shall be provided.

1.8 ELECTRICAL EQUIPMENT

1.8.1 Electrical service shall be 277/480-volt, 3-phase, and 4-wire, unless otherwise approved or the power company indicates this is unacceptable. Minimum service

size shall be 200 amps. Request for smaller electrical service shall be reviewed and considered for approval on a case-by-case basis. All enclosures shall be stainless steel 304, rated NEMA 4X with lever type door closures. Pump control enclosure shall be double door type as to locate all 480V/230V equipment on the right side and all 120V equipment on the left side. Single-phase systems are not allowed.

1.8.7.1 If 3-phase power is unavailable, then a phase converter (PC) shall be provided for each pump station that will convert single phase incoming power into three phase power to operate the pump station. The phase converter shall be sized and provided by the pump manufacturer, and the pump manufacturer shall take full responsibility for coordinating sizing and installation of the PC. The PC shall be a static three phase converter, designed to operate multiple motors to their full load rating, plus normal overload. Unit shall be Ronk Type K-Duo Add-A-Phase Power Converter, sized for the selected pumps.

1.8.2 Conductors for power shall be stranded copper, rated for 75 ºC, with insulation suitable for dry and wet locations. Sizing shall be done according to NEC requirements. Power conductors shall be continuous. Field splices are not allowed.

1.8.3 Wire size for controls shall be minimum #14 AWG copper stranded rated for 90 ºC. Wire size for SCADA controls shall be minimum #16 AWG copper stranded rated for 90 ºC.

1.8.4 Install a din rail-mounted transient voltage surge protector and lightning arrestor inside the control panel.

1.8.5 Due to the potential presence of hydrogen sulfide and other corrosive gases, greases, oils, and other constituents frequently present in sewage, all mounting hardware shall be Type 304 Stainless Steel. Seal-offs shall be installed in conduit leading into the pump control panel and junction boxes. All enclosures shall be Type 304 Stainless Steel and disconnects shall be FRP-NEMA 4X. All enclosures and disconnects shall be lockable with a padlock.

1.8.6 Main electrical disconnect shall be housed in a separate NEMA 4X, stainless steel enclosure and shall be equal to Square D, Class 3110, 600-volt class, heavy duty, service rated safety switch, with all copper current carrying parts, Model H36_DS. Provide with fusing class size based on the characteristics of the motor loads served and the available fault current. Main electrical disconnect shall be time delay fuse or time delay circuit breaker. Provide a surge arrestor in a separate NEMA 4X, SS304 enclosure mounted in the service pole mounting rack. Approved Manufacturers: Square D, Siemens, General Electric, and Cutler-Hammer.

1.8.7 Electrical equipment shall comply with the latest version of the NFPA National Electrical Code (NEC) requirements for Class 1, Group C and D, Division 1 locations. Additionally, equipment located in wet wells shall be suitable for use under corrosive environments. Each flexible cable shall be provided with a

watertight seal and separate strain relief. High water float switch shall be normally open and nonmercury type.

1.8.8 Free-standing electrical service and transfer switch shall be housed in heavy-duty electrical weatherproof, NEMA 4X, stainless steel 304 enclosures securely mounted onto the rack a minimum of 24 inches above the ground. Provide 120-volt, 20-amp duplex, GFI receptacle in an "in-use" weatherproof box with clear cover. Light switches shall also be installed in a weatherproof box with an "in-use" clear weatherproof cover.

1.8.9 All electrical equipment shall be protected from the 100-year flood event and be protected from potential flooding from the wet well. If the electrical equipment is raised 4 feet or more to be above the 100-year flood event, then a platform shall be constructed with rails and adequate working clearance in front of the electrical equipment, with permanent ladder or steps for access. As a minimum, control panels shall be mounted on a 4-inch-tall concrete housekeeping pad. All electrical equipment and connections in wet wells and valve vault shall be rated for Class 1 Division 1 explosion proof.

1.8.10 Transfer switches, motor controls, dry type transformers, load centers, SCADA monitoring system and connectors for portable generators, and wiring gutters shall be mounted on a single rack. Mounting rack shall be constructed of type 304 stainless steel strut, 1-1/2-inch minimum, mounted on a minimum 4-inch-diameter and ½-inch-thick hot dip galvanized structural steel tube. Approved manufacturers: UNISTRUT, Kindorf, and B-Line. Touch up with cold galvanizing compound any scratches where coatings are applied. Close all exposed tube ends with proper size PVC plug caps. Do not use the electrical service pole for supports.

1.8.11 Provide terminal blocks and panel wiring for future remote start and stop contacts.

1.8.12 All underground electrical conduits shall be grey, rigid nonmetallic conduit (RNC). Field manufactured bends are not permitted. Only factory fabricated conduit bends are allowed. Buried conduit shall have a cover depth of 18 to 24 inches beneath the finished surface. Conduit shall comply with minimum NEC bend radius and not burned or kinked.

1.8.13 All exposed conduit shall be rigid aluminum. To avoid tripping hazards, conduits must be buried and/or embedded in concrete slabs.

1.8.14 Provide general illumination of 1.0 foot-candle (average) on the lift station equipment areas. Use LED fixtures for general illumination.

1.8.15 Install all conduit runs in initial construction sized to meet ultimate electrical and instrumentation needs.

1.8.16 Design electrical supply, control and alarm circuits to allow for disconnection outside the wet well. Terminals and connectors shall be protected from corrosion by location outside the wet well in a NEMA 4X stainless steel enclosure.

1.8.17 Locate the motor control center outside the wet well, readily accessible and protected by conduit seals, to meet the requirements of the NFPA National Electrical Code to prevent the atmosphere of the wet well to enter the control center. The seal shall be so located that the motor may be electrically disconnected without disturbing the seal.

1.8.18 Pump motor cables shall meet the requirements of the National Electrical Code for flexible cords in wastewater pumping stations. Power cord terminal fittings shall be corrosion-resistant and constructed in a manner to prevent entry of moisture into the cable and shall be provided with strain relief appurtenances.

1.8.19 Ground in accordance with NEC Code.

1.8.20 All electric conduits shall be sized in a manner that electric conductors shall not overfill the conduits. The conductor filling percentage for all conduits shall not exceed 40 percent. For motors with insulated jacketed power cables provided by pump manufacturer as an integral part of the pumping unit, the diameter of the electric conduit for such power cable shall have a diameter 1.58 times greater than the outer diameter of the power cable. When the calculated diameter for the conduit lies between two standard conduit sizes select the next larger size.

1.8.21 Laminated wiring schematics of Pump Control Panel and SCADA Panel shall be provided. Also, each schematic shall be placed in each respective panel.

1.9 STATION CONTROLS, INSTRUMENTATION AND MONITORING

1.9.1 Primary level monitoring and pump control must be of the submersible level transmitter type. Accepted manufacturers are Siemens (Milltronics HydroRanger 200), Greyline Instruments, and Drexelbrook for controller. Submersible level transmitter approved manufacturer is Mercoid model PBLT2 or equivalent. An equivalent unit must be of equivalent design and weight of at least 4 pounds. A stainless steel 316 stranded cable must be solidly fastened to the instrument for removal ease. A 24Vdc power supply shall be included in the pump control panel to feed the submersible level transmitter.

1.9.2 Place the wet well level transmitter in a stilling well. Stilling well shall be 6-inch perforated PVC, terminating 1 inch above the bottom of the wet well.

1.9.3 Place the backup float switches in an area of the wet well which is removed from the effects of the influent flow being received.

1.9.4 A common junction box that houses the motor power cable splice, motor sensor cable, low-low-level and high-level float, and wet well level transmitter shall be located on side of the wet well.

1.9.5 Lift station shall be capable of discharging all anticipated peak wet weather flows. The “lead” pump is turned on at the first “on control elevation” and the “lag” pump will start with a rising liquid level at the “second on” control elevation. The “lead”

and “lag” pumps will continue to operate until the “pump off control elevation” is reached. The “lead” and “lag” shall automatically alternate between the two pumps at the completion of each pumping cycle.

1.9.6 Install elapsed time meters and overload reset with metal extension and plastic cap on the inner panel of the pump control enclosure. Meters shall be five digits, indicate tenths of hours, and be non-resetting. Operating power shall be 120 volts. Approved manufacturers are Cramer, Hobbs, Honeywell, and Redington

1.9.7 Provide structural support of the mounting rack that houses electrical, communication, control, and instrumentation components.

1.10 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

1.10.1 All lift stations shall include a High Tide Technologies SCADA remote terminal unit.

1.10.2 SCADA system shall monitor for each pump all the following, but not limited to: Pump Hand/Off/Auto Status, Pump Run, Pump Stator Leak, Motor High Temp, Motor Overload. In addition, the SCADA system shall monitor all the following, but not limited to: Low Level Alarm, High Level Alarm, Utility Power On, Generator Power On, Transfer Fail, and Wet Well Continuous Level.

1.10.3 SCADA panel must include isolation relays for all digital inputs. Isolation relays must be located within the SCADA panel to separate 120Vac circuits or others from SCADA 24Vdc.

1.10.4 SCADA Panel will be provided with an uninterruptible power supply of 24Vdc. The power supply will provide reliable power for a minimum of 2 hours. Power supply will be used exclusively for the 24Vdc loads within the SCADA panel and pressure transmitter located in the header. The wet well level controller and any other 24Vdc load located within the Pump Control Panel and automatic transfer switch (if any) shall not be powered by the SCADA power supply.

1.10.5 Install a din rail mounted transient voltage surge protector and lightning arrestor inside the SCADA panel. Approved manufacturer is Phoenix Contact, model Combotrab 2856702, or approved equal.

1.11 STANDBY GENERATOR

1.11.1 Permanent stationary standby generator set shall be provided for all lift stations.

1.11.2 The generator transfer switch shall be of the automatic type. The generator shall be fueled by diesel. Diesel fuel tanks shall be base tanks integrated into generator unit by OEM, shall include double wall containment, and shall be sized to run the generator for at least 10 hours continuously at 100 percent load. The concrete base to install the generator shall be provided with a spill containment structure to capture any spillage. The generator shall have a 4-foot clearance all around, and it shall be provided with noise control package. Sound attenuation system performance shall result in measured sound levels not to exceed 78 dB @ 7 meters (23 feet), 60 Hz.

1.11.3 The generator shall have a motor starting kVA capacity to limit the voltage dip to no more than 15 percent for any motor starting conditions. Such generator load analysis must be included in the engineering report. Approved manufacturers are Kohler or Caterpillar.

1.12 ODOR CONTROL

1.12.1 The lift station design shall minimize odor potential. Locate incoming wet well gravity pipe to reduce turbulence. Minimize detention times in wet well during all phases of development. If detention times are greater than 180 minutes, the Town may require odor control measures based on evaluation of, but not limited to, construction phasing, prevailing wind direction, and proximity to neighborhoods. If odor control measures are needed, it shall consist of a chemical drum scrubber with top mounted blower to absorb odorous compounds for oxidizing. The drum scrubber shall be designed to operate at 99.5 percent gas removal. The design specification shall be prepared by the drum scrubber and media supplier. Approved manufacturers are HiBocs, Purafil, or approved equal.

1.13 SITE DEVELOPMENT

1.13.1 Lift Station site layouts shall consider clearances for unimpeded maintenance operations. The area surrounding the lift station components including, but not limited to, the wet well, valve slabs, generator, electric service rack shall be large enough to permit heavy equipment and vehicles ample room to maneuver. The lift station site shall be designed to allow maintenance vehicles to have direct access to the wet well, electric controls, and generator.

1.13.2 The lift station shall have an access road, located in a dedicated right-of-way or permanent easement. The access road surface shall have a minimum width of 16 feet and the pavement shall meet AASHTO HS 20-44 standard. Crushed stone, flexible base or similar materials are not considered all weather materials and will not be accepted. The access road surface shall be designed to be above the water level caused by a 25-year storm event. The design of the access road shall include plan, section and profile sheets of the access road, drainpipes and details. The design shall limit the slope to no more than 8 percent and grade break to 3 percent and provide soil erosion protection to prevent collection of sedimentation along the access road. Inside the boundary of a proposed residential development, design of the access road, either temporary or permanent, shall minimize turns and achieve the straightest possible alignment.

1.13.3 Provide two 8-foot gates for a 16-foot clearance to allow access by large maintenance equipment. Lift stations with relatively long driveways must include pole gates at the entrance of the driveway. Turnarounds shall be required for at all station, unless otherwise approved by the Town. Allow sufficient space for large maintenance vehicles to have unhindered access to the wet well, generator, by-pass and on-site manhole. Entries located parallel to the roadway should also be considered. Lift stations are not allowed within the street right-of-way. All parking and driving areas within the fence shall be paved with asphalt.

1.13.4 The lift station, including all electrical and mechanical equipment, shall be protected from a 100-year flood event and remain fully operational during such event.

1.13.5 Provide protection of the lift station, including mechanical and electrical equipment, from access by any unauthorized person. The lift station shall be enclosed within an intruder resistant fence consisting of a black vinyl coated chain link fence 6-feet minimum in height, with a 1-foot section above consisting of 3 strands of barbed wire "up-riggers." HDPE, UV resistant fence slats shall be included in the fence. Color shall be selected by the Town. Privacy fences shall complement the character of the lift station location and will be evaluated on a case-by-case basis.

1.13.6 Design shall provide for ¾-inch minimum freeze proof water service with hose bib vacuum breaker attached to the hose connection. It shall be located within 10-foot radius of wet well.

1.13.7 Lift station site shall be located or designed in a manner that will be protected from storm runoff entering the lift station site and that will allow storm water to drain away from lift station site.

1.14 FORCE MAIN

1.14.1 Forcemain shall be as specified in Section 12.

END OF SECTION

SECTION 16
CHECKLIST

PART 1. GENERAL

1.1 SANITARY SEWER GENERAL SPECIFICATIONS

1.2 SEWER EXTENSION AND/OR SERVICE CONNECTION: The following are guidelines for the preparation of sanitary sewer plans and should not be construed as being the total requirements. The Town may at its option require additions to be made in the plans where circumstances warrant.

1.2.1 Five hard copy sets and one electronic copy of drawings including vicinity map shall be submitted for approval.

1.2.2 Electronic files shall be submitted to the Town's electronic development review system.

1.2.3 Submittals shall be at least 14 days prior to a scheduled meeting in order to be considered at that meeting.

1.2.4 After approval, drawings shall be submitted to the Tennessee Department of Environment and Conservation for their approval. Approval of the plans and specifications by the Tennessee Department of Environment and Conservation, Tennessee Department of Transportation, Railroads, Corps of Engineers, Tennessee Valley Authority, and any other agency having jurisdiction is required before beginning construction.

1.2.5 One state approved set of drawings and one copy of the State approval letter shall be provided to the Wastewater Operator prior to beginning construction.

1.2.6 Prior to acceptance of lines by the Town, a set of reproducible "Record Drawings" showing all work, changes, service locations, and other data not shown on the original set shall be given to the Wastewater Operator after each project or phase of a project is completed. Developer shall provide one hard copy and one electronic copy of the Record Drawings. Record Drawings shall include GPS coordinates of manholes, air release valves, fittings, wet wells, and valve vaults and shall adhere to the Town's as-built requirements as described in the Land Development Manual.

1.2.7 Detail drawings and specifications shall be submitted to the Town by an Engineer employed by the Developer for any special condition or structures such as pump stations, creek crossings, etc., and approved by the Town before beginning any construction.

1.2.8 Plans shall be drawn on a standard 24-inch x 36-inch sheet and stamped by a licensed Tennessee Engineer.

1.2.9 A cover sheet shall be made a part of all plans and shall incorporate a location map on an approximate scale not less than 1" = 1,000', the name of the project, and the names, addresses and telephone numbers of the Developer and the Engineer.

1.2.10 Include a key map indicating sheet numbers for each sewer line.

1.2.11 Sewer plans must be on plan and profile sheets, with contour lines shown in the plan portion and the lowest elevation of the sewer line beginning on the left side of the sheet in the profile.

1.2.12 All plans shall show conduits for all utilities including, but not limited to, gas lines, underground telephone conduits, power and telephone poles, water mains, sanitary sewer lines, storm sewers, etc.

1.2.13 The scale of the plan/profile sheet will be: Plan 1" = 50' horizontal; Profile 1" =50' horizontal, 1" = 5' or 1" = 10' vertical.

1.2.14 All sewer plans shall include at least one benchmark based on U.S.G.S. Datum. Additional benchmarks shall be shown at approximately 1,500-foot intervals. The use of a manhole invert elevation or an assumed elevation will not be approved.

1.2.15 Show all topographic features, such as driveways, pavement, rights-of-way, property lines, storm drainage structures, etc.

1.2.16 The direction of north should be clearly shown on all plans.

1.2.17 All property lines should be shown on the plans and each parcel should show the map and parcel number, lot number and/or house number.

1.2.18 A connection must be provided for each parcel or proposed lot. The connection will be shown as a SDR 35 PVC tee wye (machine made only) and a 6-inch SDR 35 PVC service line extension. Handmade tees and wye connections are not acceptable. When sewers are constructed by private Developers to serve proposed developments and are to be constructed in public right-of-way in areas currently without sewer service, the Developer shall provide a service line extension and tee wye in accordance with the requirements mentioned above. All parcels currently unserved along the route shall receive a service line extension. When laying the mains in private property a wye and 10 feet of service line shall be provided for each existing parcel.

1.2.19 A maximum of two 6-inch service lines will be allowed into permanent end manholes, and a minimum 45-degree alignment differential must be maintained between them. At no time will an angle less than 90 degrees be permitted between them and the out or downstream sewer main. The service lines must enter the manhole within 1.9 feet of the base of the manhole and the invert must be properly shaped for them. The maximum length of a service line from the sewer main to property line shall be 75 feet.

1.2.20 Special pipe considerations are as follows:

1.2.20.1 The same type of pipe material must be used from manhole to manhole; jointing of two different type pipes between manholes will not be permitted.

1.2.20.2 Due to maintenance considerations, it will be Town's policy to require that all lateral sewers proposed at depths greater than 14 feet be constructed of ductile iron pipe and any service line risers from this depth also be ductile iron pipe. This condition should be avoided whenever possible and first consideration given to other routes.

1.2.20.3 All sanitary sewers shall have a minimum of 30 inches cover in private property and 48 inches in paved areas subject to vehicular traffic.

1.2.21 Manholes shall be installed at the upper end of each line, at all changes in grades, size or alignment, at all intersections, and at distances not greater than 300 feet. Manhole spacing greater than 300 feet shall require Town approval.

1.2.22 When sewers are proposed along drains and lie within a potential flood plain or lie adjacent to a drainage ditch or drainage structure in which there is a potential problem of storm water entering the sanitary sewer, the Town will require approved watertight frames and covers (with brass bolts) to be installed on the manholes.

1.2.23 A vent stack assembly will be required on watertight manholes at 1,000-foot intervals.

1.2.24 When sewers are proposed to serve new subdivisions, at least one copy of the subdivision plans, including grading, drainage, and roadway plans must be submitted with the sewer plan for review. The roadway plans must contain a typical section of the proposed roadway. A statement should be incorporated into the letter for transmittal for plans designating which roads are to be public and which are to be private, as well as designating which sewer lines are to be public.

1.2.25 Smaller lines shall not be connected to larger lines by utilizing a concrete collar. Only an approved compression or rubber O-ring style coupling will be acceptable. The practice of "hammer tapping" a sewer line is not in conformance with the Standard Plumbing Code and is not an acceptable method of connecting a service line to a new or existing sewer line. In all cases, a tee, wye, or tapping saddle shall be used.

1.2.26 Any time sewer lines are proposed to serve property where the "serviceability" of a lot or residence is questionable, the lot or residence must be identified with the following note: The service tee is to be placed at the lowest possible elevation on the main line and the service line is to be laid on a minimum slope. The home builder is responsible for locating the elevation of the end of the service line and setting building finished floor elevations such that gravity service is available. This note is also to be put on the recorded plat identifying critical lots.

1.2.27 The profiles of all drains adjacent to and crossing proposed sewers must be shown on the sewer plan profile. Concrete protection must be provided on sanitary sewers across drains where there will be less than 2.5 feet of cover.

1.2.28 Whenever wastewater lift stations are proposed, the following information must be submitted along with the design drawings:

1.2.28.1 Complete design criteria for the proposed pumping station including pump curves and hydraulic calculations.

1.2.28.2 Topographic map with the drainage area clearly defined and the acreage shown.

1.2.28.3 Complete information concerning the proposed area of service, including the number and type of proposed units.

1.2.28.4 Complete anticipated average, maximum, and peak flow data based on Tennessee Department of Environment and Conservation design criteria and utilizing a peak factor not less than 2.5.

1.2.28.5 Complete details of possible alternate gravity sewers to serve the same area, including cost estimates of both type systems.

1.2.29 In general, wastewater collection extensions shall be designed for the estimated ultimate tributary population.

END OF SECTION

SECTION 17
PRECAST CONCRETE GREASE INERCEPTORS

PART 1. GENERAL

1.1 This specification covers design, installation and testing guidelines and acceptable manufacturers for precast concrete grease interceptors and related appurtenances.

1.2 The requirement for a grease interceptor and its volumetric capacity in gallons shall be determined in accordance with the Town's Fats, Oils, and Grease (FOG) Policy.

PART 2. PRODUCTS

2.1 GREASE INTERCEPTORS

2.1.1 Structural Requirements:

2.1.1.1 Grease interceptor tanks shall be designed to meet the structural requirements of ASTM C1613.

2.1.1.2 Grease interceptor tanks shall be monolithic precast concrete structures. Sectional precast concrete grease interceptors will not be considered for acceptance if a sectional joint exists at or below the crown of the inlet piping core of the structure.

2.1.1.3 Grease interceptor tanks shall be designed so that they will not collapse or rupture when subjected to anticipated earth and hydrostatic pressures when the tanks are either full or empty. The structural design shall take into consideration the number, placement, and size of all openings.

2.1.1.4 Grease interceptor tanks shall be designed to accommodate AASHTO HS-20 live loads.

2.1.1.5 The concrete's minimum compressive strength for design shall be 4,000 psi at 28 days. The concrete cover for reinforcing bars, mats, and/or fabric shall not be less than 1 inch.

2.1.2 Physical Design Requirements:

2.1.2.1 The inlet and outlet piping shall have 2-way cleanout tees installed.

2.1.2.2 The inlet piping shall enter the receiving chamber 3-inches above the invert of the outlet piping.

2.1.2.3 On the inlet pipe, inside the receiving chamber, a sanitary influent tee of the same size pipe in the vertical position with the top unplugged shall be provided as a turndown. To provide air circulation and to prevent "air lock", a pipe (nipple) installed in the top tee shall extend to a minimum of 6-inch clearance from the interceptor ceiling, but not less than the inlet pipe diameter.

A pipe installed in the bottom of the tee shall extend to a point two-thirds the depth of the tank.

2.1.2.4 The outlet piping shall be no smaller than the inlet piping, but in no case smaller than 4-inch internal diameter.

2.1.2.5 The outlet piping shall extend 12 inches above the floor of the interceptor and shall be made of a non-collapsible material.

2.1.2.6 The outlet piping shall contain a tee installed vertically with a pipe (nipple) installed in the top of the tee to extend to a minimum of 6-inch clearance from the interceptor ceiling, but not less than the pipe diameter, with the top open.

2.1.2.7 The grease interceptor shall have a non-flexing (i.e. concrete, steel, etc.) baffle the full width of the interceptor, sealed to the walls and the floor, and extend from the floor to within 6-inches of the ceiling. The baffle shall have an inverted 90 degree sweep fitting at least equal in diameter to the inlet piping, but in no case less than 6-inch internal diameter. The bottom of the sweep shall be placed in the vertical position in the inlet compartment 12 -inches above the floor. The sweep shall rise to the horizontal portion, which shall extend through the baffle into the outlet compartment. The baffle wall shall be sealed to the sweep.

2.1.2.8 The inlet compartment shall be two-thirds of the total liquid capacity with the outlet compartment being one-third of the liquid capacity of the interceptor.

2.1.3 Access Requirements:

2.1.3.1 Access to grease interceptors shall be provided at a minimum of one manhole per interceptor division (baffle chamber) and of 24-inch minimum dimensions terminating 1-inch above finished grade with cast iron frame and cover. One manhole shall be located above the inlet tee hatch and the other manhole shall be located above the outlet tee hatch. A minimum of 24 inches of clear opening above each manhole access shall be maintained to facilitate maintenance, cleaning, pumping, and inspections.

2.1.3.2 Access opening shall be mechanically sealed and gas tight to contain odors and bacteria and to exclude vermin and ground water, in a manner that permits regular reuses.

2.1.3.3 GCE shall be located so as to be readily accessible for cleaning, maintenance, and inspection. GCE should be located close to the fixture(s) discharging the FOG waste stream. Grease interceptor access manholes shall not be paved over.

PART 3. EXECUTION

3.1 GENERAL

Grease interceptors will be immediately rejected under the following circumstances:

3.1.1 Grease interceptor is not approved by the Town prior to installation.

3.1.2 Grease interceptor's total volumetric capacity is less than the required capacity as determined by the Town in accordance with its Fats, Oils, and Grease (FOG) Policy.

3.1.3 Grease interceptor tank does not comply with the structural or dimensional requirements of this specification.

3.2 WATERTIGHTNESS TESTING

3.2.1 Precast concrete grease interceptors shall be constructed to be watertight. A static water test shall be conducted by the installer and timed so as to permit verification through visual inspection. The water test shall consist of plugging the outlet (and the inlet if necessary) and filling the tank(s) with water to the top a minimum of 24 hours before the inspection. The tank shall not lose water during this test period.

3.2.2 Repairs of precast concrete grease interceptors, when required shall be performed by the manufacturer in a manner ensuring that the repaired grease interceptor tank will conform to the watertightness requirements of this specification. Repairs and/or replacement of precast concrete adjusting rings, plastic gaskets, cast iron frames and/or covers may be performed by the installer.

3.2.3 Grease interceptor tanks shall be rejected if, after failing the watertightness testing and repairs have been made, the grease interceptor again fails the watertightness testing as described in this specification.

END OF SECTION

SECTION 18
SUBSURFACE LAND APPLICATION SYSTEMS

PART 1. GENERAL

1.1 This specification covers design, installation and testing guidelines and acceptable manufacturers for subsurface land application systems.

1.2 All operations, excavation, backfill, plowing/trenching or other construction activities pertaining to the installation of the drip irrigation tubing, distribution manifold, or collection manifold.

1.3 Pipe shall be of the same manufacturer throughout to assure compatibility.

1.4 Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards.

PART 2. PRODUCTS

2.1 DRIPLINE TUBING AND FITTINGS

2.1.1 Low volume dripline designed for use with onsite wastewater drip dispersal systems. Dripline shall have integral and evenly spaced pressure compensating drippers inside the tubing and shall be available in the discharge rate with emitters spaced as shown on the drawings.

2.1.1.1 Construction: Dripline shall consist of nominal sized one-half inch (½") low-density linear polyethylene tubing with internal pressure compensating, continuously self-cleaning, integral drippers at the specified spacing, (12-inch, 18-inch, or 24-inch centers) or blank tubing without drippers. The tubing shall be purple in color and shall conform to an outside diameter (O.D.) of 0.66 inches and an inside diameter (I.D.) of 0.57 inches. Individual pressure compensating drippers shall be welded to the inside wall of the tubing as an integral part of the tubing assembly and shall be impregnated to prevent the buildup of microbial slime. These drippers shall be constructed of plastic with a continuously self-flushing silicon diaphragm capable of flushing dirt or debris that may enter the dripper. Each dripper shall have an individual filter at the inlet and it shall be integral to the dripper. The dripper shall have a built-in physical root barrier whereby water/effluent shall exit the dripper from a point different than where it shall exit the tubing. This physical barrier shall create an air gap inside the exit portion of the dripper.

2.1.1.2 Operation: Each dripper shall have the ability to independently regulate discharge rates, with an inlet pressure between 7 and 58 pounds per square inch (psi), at a constant rate of flow and with a manufacturer's coefficient of variability (Cv) of 0.03 or less. Recommended operating pressure shall be up to 58 psi. The dripper discharge rate shall be 0.62 gallons per hour (GPH)

utilizing a combination turbulent flow/reduced pressure compensation cell mechanism and diaphragm to maintain uniform discharge rates. The drippers shall be capable of continuously cleaning themselves while in operation. The dripline shall be available with 24-inch spacing between drippers unless otherwise specified. Filtration shall be 120 mesh (130 microns) or finer. Bending radius shall be 7 inches.

2.1.1.3 Dripline shall be Netafim Bioline, Rainbird XFS with Copper Shield, or approved equal.

2.1.2 Dripline Fittings.

2.1.2.1 Description: Dripline fittings shall be constructed in one of the following end configurations: barbed insert fittings only, either male pipe threads (MPT) with barbed insert fittings, or female pipe threads (FPT) with barbed insert fittings.

2.1.2.2 Construction: All fittings shall be constructed of injection molded, brown plastic having a nominal outside dimension of 0.57 inches). Female and male threaded ends shall be capable of mating to standard PVC pipe with tapered threads.

2.1.2.3 Operation: Dripline fittings shall be mated with dripline by pushing the fitting into the tubing while twisting side to side until the tubing abuts to either adjoining tubing or a fitting stop.

2.1.2.4 Dripline fittings shall be Netafim, Rainbird, or approved equal.

2.2 PIPING MATERIALS

2.2.1 Low volume dripline designed for use with onsite wastewater drip dispersal systems. Dripline shall have integral and evenly spaced pressure compensating drippers inside the tubing and shall be available in the discharge rate with emitters spaced as shown on the drawings.

2.2.1.1 Galvanized steel pipe shall be ASTM A53/A53M, Schedule 40. Fittings shall be ASME B16.3, Class 150.

2.2.1.2 Polyvinyl chloride (PVC) pipe shall be ASTM D2241, PVC 1120 SDR 21, Class 200. Provide integral lavender-color pipe for non-potable use. Fittings shall be solvent welded socket type ASTM D2466, Schedule 40. Provide lavender-colored fittings. Solvent cement shall conform to ASTM D2564.

2.2.1.3 Polyethylene (PE) plastic piping shall be AWWA C901, outside diameter (od) base with dimension ratio (DR) of 9.3 to provide 150 psi minimum pressure rating. Fittings shall conform to ASTM D3261, DR of 9.3.

2.2.1.4 Pipe sleeving: Provide PVC piping two times the diameter of main or lateral piping.

2.2.1.5 Provide grey PVC electrical conduit sized according to the number of control wires. Minimum 2 inch size.

2.3 VALVES

2.3.1 All manual valves shall conform to the criteria set forth.

2.3.1.1 Isolation valves for main irrigation and flush headers shall be Type 502 Butterfly Valves.

2.3.1.2 Isolation valves for zone dose valves and flush assemblies shall be Type V101 Resilient Seated Gate Valves.

2.3.1.3 Ball valves on zone drains shall be Type V403 PVC Ball Valves.

2.3.2 All solenoid control valves shall conform to the criteria set forth.

2.3.2.1 All zone dosing valves in the dosing valve installation assemblies shall be Netafim/Dorot globe configuration pressure regulating valves with electric solenoid or approved equal. Valves shall have ductile iron, epoxy-coated body and bonnet, 316 stainless steel spring, EPDM diaphragm, and 316 stainless steel nuts and bolts. Three-inch and smaller shall have threaded end connections. Larger valves shall have flanged connections. Provide full union on each side of each valve smaller than 3".

2.3.2.2 Solenoid pilot valves for both the zone dosing valves and the flush return control valve shall be 24VAC-activated power-to-open valves with 1/8-inch port (GEVA 75 or equal).

2.3.3 Air Release/Vacuum Relief Valves in the drip system shall be 1 inch unless otherwise show on the drawings provided by Netafim, Rainbird, or approved equal, configured as shown on the plans in a stand-alone configuration on the supply and force main or installed as part of the zone dosing and flushing valve installations.

2.3.4 Check valves installed as part of the zone flush valve installation shall be sized as shown on the drawings. Check valves shall be wafer style check valves with nylon body, nylon flap, EPDM seal, stainless steel spring, and EPDM O-rings. Valves shall be rated for 3 to 230 psig operating pressure. Valves shall be ARI/Netafim 2-inch Schedule 40 PVC flap check valves with threaded connections or approved equal.

2.3.5 Air relief valves, where shown on the piping drawings, shall be Valmatic Air Release Valves, Series 22, Model 22.3, or equal, with 1-inch NPT inlet, 0.5-inch outlet, and 3/32-inch orifice size. Air relief valve shall be rated for 175 psig operating pressure.

2.3.6 Combination Air/Vacuum Relief Valves for dose and flush manifolds in individual zones shall be Netafim Guardian Air & Vacuum Relief vent valves or approved equal installed at locations shown on individual zone layouts.

2.4 VALVE BOXES AND EXTENSION STEMS

2.4.1 All valves shall be equipped with valve boxes. The valve boxes shall be cast iron two piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6 inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "EFFLUENT" or "SEWER" cast into them.

2.4.2 Valve box covers shall be purple/lavender.

2.5 MANHOLES AND PRECAST CONCRETE PRODUCTS

2.5.1 Provide precast concrete products as described in this Article. Boxes shall be Oldcastle Duralite or equal.

2.5.2 Flat tops shall be manufactured to withstand Medium/Heavy Duty: Non-Deliberate Traffic, ANSI/SCTE-77, Tier 22.

2.5.3 Covers shall be lavender/purple in color.

2.5.4 Covers used on manholes which house air valves shall be provided with 1 inch holes to provide equivalent opening as the air valve, but not less than two. The quantity for each valve size is as follows: 2 inch, 4; 3 inch, 9; 4 inch, 16; 6 inch, 36; 8 inch, 64.

2.6 VALVE KEYS

2.6.1 The Contractor shall provide to the Owner one valve key for every five valves provided, but no more than three and not less than one valve key. Valve keys shall be 72 inches long with a tee handle and a 2-inch square wrench nut. Valve keys shall be furnished by the valve manufacturer. Valve keys shall be equal to Mueller A 24610 or ACIPCO No. 1303.

PART 3. EXECUTION

3.1 LAYING AND JOINTING PIPE AND ACCESSORIES

3.1.1 Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.

3.1.2 Pipe Installation.

3.1.2.1 Proper implements, tools and facilities shall be provided for the safe performance of the work. All pipe, fittings, and valves shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.

3.1.2.2 All pipe, fittings, valves, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.

3.1.2.3 The outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.

3.1.2.4 Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.

3.1.2.5 As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

3.1.2.6 Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade, shall not be permitted.

3.1.2.7 Provide detection tape for all non-metallic pipe 4" and larger. Detection tape shall be buried 4 to 10 inches deep. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch-wide tape. In no case shall detection tape be buried greater than 20 inches from the finish grade surface.

3.1.2.8 Where pipes of dissimilar materials are joined together, provide adapters as shown on the drawings.

3.1.3 Alignment and Gradient.

3.1.3.1 Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

3.1.3.2 Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.

3.1.3.3 All distribution piping (supply and flushing return lines, zone supply headers and zone return headers) shall be 24-30 inches deep. Air release/vacuum installation shall be installed at the high points on lines distribution lines.

3.1.4 Joint Assembly: Push on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

3.1.5 Cutting Pipe: Cut PVC pipe using a suitable saw; remove all burrs and smooth the end before jointing. The Contractor shall cut the pipe and bevel the end, as recommended by the manufacturer, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location.

3.1.6 Valve and Fitting Installation.

3.1.6.1 Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected. Valves shall be closed before being installed.

3.1.6.2 Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this section for cleaning, laying and joining pipe. Valves shall be installed plumb.

3.1.6.3 A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30 inches beneath finished grade so as to set the top of the operating nut 30 inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Engineer

3.1.6.4 Zone supply and return control valve installations and air release/vacuum installations shall be in precast concrete boxes the tops of which are 2-3 inches above the ground level. Two fiberglass utility location markers shall be installed at each utility box marking its location and extent. The utility boxes shall be sized for adequate access to all valves (control, air release/vacuum relief, check and hand ball valves.)

3.1.6.5 In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

3.1.7 Installation of Tubing.

3.1.7.1 All tubing shall be installed at a depth of 6 to 10 inches beneath the native surface of the soil. All tubing shall be placed using a vibratory plow or trenched with a 6-inch maximum width trencher.

3.1.7.2 Prior to the supply manifold being attached to the dripperline, all supply and manifold piping shall be adequately flushed to protect the emitters from being clogged with particulate matter.

3.1.7.3 Installation during soil conditions leaving permanent depressions in the drip absorption field is forbidden. If in doubt the contractor should obtain permission from the engineer prior to installation.

3.2 THRUST RESTRAINT

3.2.1 Provide restraint at all points where hydraulic thrust may develop.

3.2.2 Retainer Glands: Provide retainer glands where shown on the Drawings and on fittings, valves and related piping 4 inches and larger. Retainer glands shall be installed in accordance with the manufacturer's recommendations.

3.2.3 Concrete Blocking.

3.2.3.1 Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the drawings.

3.2.3.2 Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the Engineer. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.

3.2.3.3 Concrete shall be as specified in Section 14.

3.3 INSPECTION AND TESTING

3.3.1 Pressure and Leakage Testing.

3.3.1.1 Main line sections of the irrigation main shall be pressure tested in accordance with AWWA C605. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.

3.3.1.2 Each segment of main between main valves shall be tested individually.

3.3.1.4 Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.

3.3.1.5 The differential pressure across a valve shall equal the maximum possible, but not exceed the rated working pressure. Where necessary, provide temporary backpressure to meet the differential pressure restrictions.

3.3.1.6 Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure.

3.3.1.7 Test Pressure: Test the pipeline at 150 psi measured at the lowest point for at least two hours. Maintain the test pressure within 5 psi of the specified test pressure for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not greater than 5 psi.

3.3.2 Make-up Water Allowance.

3.3.2.1 Make-up water allowance shall be defined as the sum of the quantity of water that must be pumped into the test section, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Make-up Water Allowance shall be the total cumulative amount measured on a water meter.

3.3.2.2 The Town assumes no responsibility for leakage occurring through existing valves.

3.3.2.3 Test Results.

3.3.2.3.1 PVC Pipe: No test section shall be accepted if the make-up water required exceeds the limits determined by the following formula:

$$L=(N*D\sqrt{P})/7,400$$

Where:

L = allowable make-up water, in gallons per hour

N = number of pipe joints in tested section

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under AWWA C605.

3.4.2.4 If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.

3.3.3 Completion: After a pipeline section has been accepted, relieve test pressure. Record the type, size and location of all outlets on record drawings.

END OF SECTION

SECTION 19
PACKAGED IRRIGATION PUMP STATIONS

PART 1. GENERAL

1.1 This specification covers design, installation and testing guidelines and acceptable manufacturers for packaged irrigation pump stations.

PART 2. PRODUCTS

2.1 PUMP STATION, ENCLOSURE

2.1.1 Codes and Standards – Enclosures shall be in complete conformance with ANSI C57.12.28, Pad Mount Equipment Enclosure Integrity Standard.

2.1.2 The enclosure shall be anchored to the slab or pump base with wedge anchors and sealed with latex or silicon sealer. A base mounting gasket shall be included if the selected enclosure fits flush to a mounting slab.

2.1.3 The enclosure shall be provided by the package pump station manufacturer. The enclosure shall be designed to provide full access to the pumps for service and maintenance. All doors shall be mounted on continuous piano hinges, with provisions for padlocking.

2.1.4 Construction – The materials shall be new, unused, and fabricated in a workmanlike manner in a factory environment.

2.1.4.1 Locking devices shall be three-point latch type with provisions for padlocking.

2.1.4.2 All hardware shall be made of stainless steel.

2.1.4.3 Enclosure shall be removable without disturbing enclosed equipment or piping.

2.1.4.4 Stainless steel louvers shall be provided with stainless steel screen baffle for adequate air flow and heat dissipation as required by the enclosed equipment.

2.1.4.5 An exhaust fan shall be located inside the pump enclosure. The exhaust fan shall be activated upon pump start and shall run until the pump stops.

2.1.4.6 A stainless-steel identification plate shall be affixed outside the enclosure which identifies the manufacturer, model number of the equipment, and date of manufacture.

2.2 MAIN PUMP

2.2.1 The pumping units provided under this section shall be supplied and manufactured domestically by one manufacturer. Approved manufacturers are Goulds, Patterson, or approved equal.

2.2.2 Each pumping unit shall be provided with a stainless-steel nameplate, which shall contain the following minimum information: Manufacturers name, address and telephone number; model number; serial number; head, capacity, and RPM at the rated condition; and motor horsepower, rpm and frame size.

2.2.3 Materials.

2.2.3.1 Casing: Cast Iron (ASTM A48).

2.2.3.2 Impeller: Nickel-Aluminum Bronze (ASTM B148) or Type 316 Stainless Steel.

2.2.3.3 Shaft: Alloy steel type AISI 1141.

2.2.3.4 Shaft Sleeve: Stainless Steel.

2.2.3.5 Case Wear Ring: Nickel-Aluminum-Bronze (ASTM 184-958) or Type 316 Stainless Steel.

2.2.4 Pump shall be electric motor driven, horizontal centrifugal with mechanical shaft seal, volute case and impeller. The shaft seal shall be a self-adjusting mechanical type to prevent leakage and eliminate the need for drain piping. The volute case shall be precision machined from gray cast iron and engineered to modern hydraulic standards. It shall be possible to rotate the discharge connection to any of four positions. A heavy cast iron bracket shall maintain alignment between the motor and volute case. The impeller shall be an enclosed type and balanced to provide smooth operation. The impeller shall be keyed to the shaft and locked with a special cap screw and washer. The motor shaft is to be manufactured from high grade steel and of reduced length to increase shaft rigidity, extend bearing life, and reduce the overall length of the pump and motor assembly. The motor shaft shall be protected with a replaceable stainless steel sleeve. The pump motor and impeller shall be removable from the back of volute case for service without disturbing the plumbing.

2.2.5 Motors.

2.2.5.1 Pump motor shall be a squirrel cage induction horizontal solid shaft type. The pump impeller shall be direct mounted and keyed to the motor shaft with a stainless steel protective sleeve.

2.3 PRESSURE MAINTENANCE PUMP

2.3.1 The Contractor shall provide a multistage centrifugal pump unit/s, Model e-SV as manufactured by Goulds Water Technology, a Xylem brand, or equal.

2.3.2 Pump Construction, Pump End Components.

2.3.2.1 Casing: The pump casing shall be of deep drawn, laser welded AISI 304L or 316L stainless steel and shall be capable of withstanding maximum working

pressures of 360 psi. Piping connections shall be in-line and shall be compatible with ANSI raised face flanges or NPT.

2.3.2.2 Wear Ring: Wear rings composed of PPS shall be provided within each stage. Wear rings must be self-centering and easily replaceable.

2.3.2.3 Impeller: Impellers shall be of enclosed design and constructed of AISI 316L or AISI 304L stainless steel. Impellers shall provide internal thrust balance in each stage.

2.3.2.4 Diffuser Bowl: Each stage shall have a bowl with attached diffuser and be constructed of AISI 304L or 316L stainless steel.

2.3.2.5 Seal Housing: The seal housing shall be of concave design and shall hold the seal faces below the topmost part of the pump casing.

2.3.2.6 Mechanical Seal: The pump shaft seal shall be silicon carbide graphite filled with Viton or EPR elastomer.

2.3.2.7 Shaft Sleeve and Bearing: The pump shall have shaft sleeves made of Tungsten Carbide and ceramic bearings. Shaft height shall be set with a standard spacer.

2.3.3 The pump drive motor shall be NEMA standard design TC frame suitable for vertical mounting and close coupled to the pump unit. Motors shall be of standard manufacturers catalog design and must not use special bearings as a thrust handling device. The motor rating shall be as shown in the pump schedule.

2.4 PIPING

2.4.1 All piping shall be designed based on the maximum working pressure of the system. Piping shall be the standard schedule S steel sized per drawings. Steel pipe flanges shall conform to ANSI/AWWA C207-07 Class D; or ANSI/AWWA C207-07 Class E and/or ANSI/ASME B16.5 based on system pressure. The pipe shall be given a hydrostatic test to 125 percent of the maximum pump shut-off pressure. If the pumps are not fitted with suction and discharge gage taps, the provision for such shall be made in the piping system. Steel piping shall be internally coated with a NSF 61 approved epoxy paint as manufactured by Devoe Series Bar-Rust 233H, or equal; color shall be white. Piping requiring victaulic grooving shall be Schedule 80 for 4” pipe and smaller.

2.4.2 The piping system shall be sized so that pump inlet and outlet velocities are less than 7.5 feet per second and header velocities are less than 5 feet per second.

2.4.3 All piping and fittings less than 1 inch, including control pilot connections, gauge connections and other device piping shall be of non-ferrous material such as stainless steel, copper, brass, bronze or plastic. Plastic fittings and/or piping or tubing shall not be used in locations where the piping is used as support.

2.4.4 Flexible Couplings.

2.4.4.1 Flexible couplings shall have a casing made from ASTM A536, Grade 65-45-12 ductile iron.

2.4.4.2 Gaskets shall be NSF certified, Grade “E” EPDM.

2.4.4.3 Flexible couplings shall be rated for a minimum working pressure of 300 PSI or greater.

2.5 VALVES AND APPURTENANCES

2.5.1 All materials in contact with potable water shall be certified to NSF Standard 61.

2.5.2 Pump check valves shall be provided for each pump. They shall be of the silent type, wafer style and shall be cast from grade 35 cast iron. They shall have machined bronze disc, seat and stem, aligned and spring assisted to allow proper seating and full closure before flow reversal occurs. The valve design shall incorporate a center guided, spring loaded poppet, guided at opposite ends and having a short linear stroke that generates a flow area equal to the pipe diameter. Internals shall be machined bronze disc, seat, and stem guide. Disc shall incorporate a Buna-N insert to provide resilient sealing. Dual disc style or swing check valves shall not be accepted. Valves shall be sized to permit full pump capacity to discharge through them without exceeding a pressure drop of 2.5 PSI. Check valves through 8 inches shall be model 1406R rated at 400 psi working pressure as manufactured by Valmatic. Valve size shall be selected to maintain velocities below 7 feet per second.

2.5.3 Pump isolation valves shall be provided for each pump to allow for pump removal for repair and other maintenance considerations without disrupting the operation of the overall pump station.

2.5.3.1 Isolation valves shall be provided on the discharge of each pump. The isolation valves shall be of the victaulic type with flexible couplings at both ends of the valve to provide for flexibility and vibration dampening. All grooves shall conform to the requirements of AWWA standard C606.

2.5.3.2 A lug style butterfly valve shall be installed at the discharge of the station to isolate the station from the supply & system. Valves shall be manufactured in accordance with the latest revisions of AWWA C504, Class 150B. The valve shall have an ASTM A126 cast iron body with 316 stainless steel edge, lens shaped design, and be rated for 200 psi. Shaft shall be of the one-piece style made of 416 stainless steel. Bushings shall be made of acetyl, disc shall be 316 stainless steel and seat shall be EPDM. Valves 4 inches and smaller shall have a ten-position lever handle, valves 6 inches and larger shall have a hand wheel operator.

2.5.4 Drains are to be provided from any possible low point in the system and are to consist of 1/4-inch brass petcocks.

2.5.5 A foot valve shall be installed on the end of the pump suction pipe.

2.5.5.1 Foot valve shall be of the full flow globe style designed to provide silent operation, positive seating, and full flow area. The valve design shall incorporate a center guided disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the pipe size.

2.5.5.2 All component parts shall be field replaceable without the need of special tools. A replaceable guide bushing shall be provided and held in position by threaded bushing retainer.

2.5.5.3 The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.

2.5.5.4 The valve disc and seat shall have a seating surface finish of 32 micro-inch or better to ensure positive seating at all pressures. A Buna-N seal shall be provided on the seat to provide for zero leakage at both high and low pressures without overloading or damaging the seal. The seal design shall provide both a metal to metal and a metal to Buna-N seal.

2.5.5.5 A heavy duty basket type screen shall be bolted to the inlet flange outside diameter and provide 3-4 times the pipe area.

2.5.5.6 The valve body shall be constructed of ASTM A126 Class B cast iron.

2.5.5.7 The seat and plug shall be ASTM B584 Alloy C87600 cast bronze. Optional trim material include ASTM A351 Grade CF8M stainless steel.

2.5.5.8 The basket screen shall be stainless steel, Type 304.

2.5.5.9 The valves shall be hydrostatically tested at 1.5 times their rated cold working pressure. Additional tests shall be conducted per AWWA, ANSI, MSS or API standards when specified. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.

2.5.5.10 The exterior of the valve shall be coated with a universal alkyd primer.

2.5.5.11 Foot Valves shall be Series #1900 as manufactured by Val-Matic Valve & Mfg. Corporation, or approved equal.

2.6 ELECTRICAL

2.6.1 Electrical Design.

2.6.1.1 Electrical service provided to the pump station will be 480-volt, 3-phase, 60-hertz. A main disconnect shall be provided to completely isolate all controls and motor starting equipment from incoming power. Main disconnect

shall have a through the door operator, and shall be sized as shown in the pump schedule. Main disconnect shall be interlocked with door.

2.6.1.2 The electrical apparatus and control panel design, assembly, and installation, and the integration of component parts will be the responsibility of the manufacturer of record for this booster pumping equipment. That manufacturer shall maintain at their regular place of business a complete electrical design, assembly and test facility to assure continuity of electrical design with equipment application. Manufacturer, without exception, shall maintain, at his facility, under the same roof as the fabrication, painting, and assembly of the mechanical components, a fully equipped panel shop. Manufacturer, without exception, shall be authorized by Underwriters' Laboratories to label its manufactured control panels as UL Listed under category NITW/NITW7. Manufacturer, without exception, shall conform to the latest edition of NFPA 79 in the manufacturing of its control panels.

2.6.1.3 The manufacture of electrical control panels and their mounting and installation shall be done in strict accordance with the requirements of UL Standard 508A and the National Electrical Code (NEC), latest revision, to afford a measure of security as to the ability of the eventual owner to safely operate the equipment.

2.6.1.4 All service entrance, power distribution, control and starting equipment panels shall be constructed and installed in strict accordance with Underwriter's Laboratories (UL) Standard 508 "Industrial Control Equipment." The UL label shall also include an SE "Service Entrance" rating stating that the main distribution panel is suitable for use as service entrance equipment. The panels shall be shop inspected by UL, or constructed in a UL recognized facility.

2.6.1.5 Control panels shall bear a serialized UL label indicating acceptance under Standard 508A and under Enclosed Industrial Control Panel. In addition, a photocopy of the UL labels for this specific project shall be transmitted to both the project engineer and the contractor for their permanent project files prior to shipment of the equipment covered under these specifications.

2.6.1.6 All control panels shall be E.T.L. Listed under Category 4 - Industrial Control Equipment. Each completed panel shall bear an E.T.L. listing label. The listing label shall include the station manufacturer's name, address and telephone number. The station manufacturer shall have quarterly inspections performed at the manufacturer's facilities to ensure that the products being listed comply with the report and procedural guide for that product.

2.6.1.7 Each electrical equipment item in the station shall be properly grounded per Section 250 of the National Electrical Code. Items to be grounded include, but are not limited to, pump motor frames, control panel, transformer, convenience receptacles, dedicated receptacle for heater, air conditioner, dehumidifier, lights, light switch, exhaust fans and pressure switches.

2.6.1.8 All ground wires from installed equipment shall be in conduit and shall lead back to the control panel to a plated aluminum ground bus specific for grounding purposes and so labeled. The ground bus shall be complete with a lug large enough to accept the installing electrician's bare copper earth ground wire. The bus shall serve as a bond between the earth ground and the equipment ground wires.

2.6.2 Conduit.

2.6.2.1 All wiring within the equipment enclosure and outside of the control panel or panels shall be run in conduit or metallic wire-ways, except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized.

2.6.2.2 Service entrance conduits shall be intermediate metal conduit (IMC) and shall be sized to accept the inbound service conductors in accordance with the National Electric Code.

2.6.2.3 Conduit and metallic wire-ways shall be sized for the type, number and size of equipment conductors to be carried, in compliance with Article 358, Article 376 or Article 344 of the National Electrical Code as applicable and NEMA TC-2, Federal WC-1094A and UL-651 – Underwriter's Laboratory Specifications.

2.6.2.4 Where flexible conduit is necessary, the conduit shall be liquid-tight, flexible, metal, corrosion resistant, non-conductive, UL listed flexible conduit. Flexible conduit shall be sized for the type, number and size of equipment conductors to be carried, in compliance with Article 350 of the National Electrical Code.

2.6.3 Wiring.

2.6.3.1 Motor circuit wiring shall be sized for load.

2.6.3.2 Control and accessory wiring shall be sized for load.

2.6.4 Variable Frequency Drives.

2.6.4.1 The Drive shall be solid state, with a Pulse Width Modulated (PWM) output. The drive shall be a sensorless Vector AC to AC converter utilizing the latest isolated gate bipolar transistor (IGBT) technology. The Drive shall employ a Sensorless Vector inner loop torque control strategy that mathematically determines motor torque and flux. The drive must also provide an optional operational mode for V/Hz or closed loop Flux Vector Operation. The input circuit breaker shall provide NEC required branch circuit protection. The circuit breaker shall have an external operator. Wiring between the VFD and disconnect shall not be disturbed when removing or installing the VFD controller unit from the control panel.

2.6.4.2 Units should be of modular construction so that it is possible to readily interchange units of the same size without modifications to the internal control panel structure.

2.6.4.3 All conducting parts on the line side of the unit disconnect shall be isolated to prevent accidental contact with those parts.

2.6.4.4 VFD controller units up to 50 hp variable torque shall be plug-on units which connect to the vertical bus through a spring- reinforced stab-on connector. Units larger than 50 hp variable torque shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus.

2.6.4.5 VFD shall include terminal strips for analog (I/O), discrete inputs, three relay outputs, and Modbus interface. The VFD shall also include three relay outputs for use in control and/or signaling through SCADA system.

2.6.5 PLC Controls System, Variable Speed.

2.6.5.1 The pump sequence controller shall be an industrial grade PLC with diagnostic LED for monitoring of discrete inputs and outputs. Not less than two additional analog inputs and outputs shall be standard for monitoring and control purposes. The PLC shall contain two communication ports for monitoring and programming purposes. The PLC shall contain an EEPROM, battery backed RAM and non-volatile memory for storage of critical configuration data.

2.6.6 Communication: The control system shall accommodate Modbus RTU and Ethernet TCP/IP communication protocols for remote monitoring and control of the pump station

2.6.7 Operator Interface: The operator interface shall display pump system running status including timer status and alarm status on a digital display. For security, the operator interface shall have password protection to prohibit unauthorized access to certain parameters. The interface shall also have a built-in diagnostics function for the status of the programmable controller. The operator interface will be able to show current GPM and total GPM and Elapsed Run Time.

2.7 INSTRUMENTATION

2.7.1 Pressure Gauges.

2.7.1.1 All gauges will be panel mounted off the pipeline and be connected to their respective sensing point via stainless steel tubing. The gauge trim tubing shall be complete with both isolating and vent valves, and the tubing shall be so arranged as to easily vent air and facilitate gauge removal. Gauges mounted directly to the pipeline or at the sensing point will not be accepted.

2.7.1.2 Combination pressure gauge range and scale graduations shall be in PSI and feet of water. Pressure gauges shall be rated at a minimum of 30 percent

higher pressure than the highest attainable pressure from operations of the pumps at shutoff head conditions. Gauges shall include bronze internals.

2.7.2 Low Discharge Pressure Safety Shutdown.

2.7.2.1 Low discharge pressure is to be sensed by the pump starting set point. When the station discharge pressure decreases to this point and maintains a start signal for the time called out in the Technical Specifications, the pumps will be de energized and remain so until the circuit is manually reset. The operator interface shall illuminate to indicate a low discharge pressure shutdown has occurred.

2.7.3 High Discharge Pressure Safety Shutdown.

2.7.3.1 High discharge pressure is to be sensed by the pump starting set point. When the station discharge pressure increases to this point and maintains a start signal for the time called out in the Technical Specifications, the pumps will be de energized and remain so until the circuit is manually reset. The operator interface shall illuminate to indicate a high discharge pressure shutdown has occurred.

2.7.4 Flow Sensor.

2.7.4.1 The pump station discharge manifold shall incorporate an insertion type, pulse frequency output flow sensor for continuous output to the pump station controls. The flow sensor output pulse shall be conditioned and fed directly to the PLC interrupt input for conversion and display in Gallons Per Minute and totalize. For accuracy and security considerations, conversion to an analog signal prior to PLC input shall not be accepted. Flow sensor accuracy shall be no less than 2 percent for flow velocities ranging from 1-30 feet per second.

2.7.5 Pump Thermal Switch.

2.7.5.1 The water temperature entering the pump shall be sensed by a thermal switch. The thermal switch shall be located at the entrance to the pump and shall be screwed into a pipe fitting either in the pump case or a dedicated pipolet. Externally mounted snap disc type thermal switches will not be accepted. The thermal switch shall activate upon a temperature rise above 120 degrees Fahrenheit.

2.7.6 High Pump Volute Temperature Shutdown.

2.7.6.1 If the pump volute case temperature rises above 120 degrees F. for the time called out in the Technical Specifications, the pump will be de energized and remain so until the circuit is manually reset. The operator interface shall illuminate to indicate a High Temperature Cutout has occurred.

2.8 MANUFACTURER

2.8.1 Acceptable manufacturers are Watertronics, Flowtronex-ITT, or Hydroflo.

2.8.2 The pump station manufacturer shall provide certification that station design, construction and controls have been reviewed and certified by Underwriters Laboratories Inc. The station manufacturer shall have listings under Industrial Control Panels and Factory Automation Equipment (Cat. No. Packaged Pumping Systems). These certifications are to ensure that the customer is receiving a safe, and thoroughly tested product, which meets national quality standards volume.

PART 3. EXECUTION

3.1 INSTALLATION

3.1.1 When discharge piping, electrical connections, and electrical inspection have been completed, the pumping system manufacturer shall be contacted for startup. A minimum one week notice shall be given to the town and manufacturer prior to scheduled startup date. During start up, the complete pumping system shall be inspected for proper installation, and shall be given a running test of normal start and stop, and fully loaded operating conditions. During this test, each pump shall demonstrate its ability to operate without undue vibration, or overheating and shall demonstrate its general fitness for service. All defects shall be corrected and adjustments made at no cost to the town. Test shall be repeated until satisfactory results are obtained.

3.2 FIELD TESTING

3.2.1 Field tests will not be conducted until such time as the entire installation is complete and ready for operation. This includes the completion of all piping, electrical connections and inspections, and availability of supply water. During start-up the system supplier shall run the pumps through normal start and stop, and full load conditions. The pump supplier shall make any adjustments and correct any defects at no cost to the town. Tests shall be performed until satisfactory results are obtained.

END OF SECTION

SECTION 20
IRRIGATION CONTROL SYSTEMS

PART 1. GENERAL

1.1 This specification covers design, installation and testing guidelines and acceptable manufacturers for irrigation control systems.

1.2 All irrigation control systems for effluent land application shall be Motorola IRRInet system.

1.3 Contractor shall provide drip dispersal control system which meets the following requirements.

1.3.1 System shall provide full control of drip dispersal system.

1.3.2 Control amount of effluent water dispensed at each drip zone.

1.3.3 Field controllers shall be provided with onsite power supply. Power supply shall be solar powered with a battery.

1.3.4 Provide means of communication between controllers and main irrigation controller at Regional Wastewater Treatment Facility.

1.3.5 Solenoid valves for drip zones shall be directly actuated by the field controllers.

1.3.6 Field controller shall log irrigation data and communicate with main irrigation controller at Regional Wastewater Treatment Facility on hourly basis to update data to the irrigation control software.

1.3.7 System software shall be PC-based and shall integrate control of existing drip sites.

1.3.8 Controller shall allow for drip irrigation and rest period cycles.

1.4 The Irrigation Central Control (ICC) computer and associated software is located at the Thompson's Station Regional WWTP Operations Building. Contractor shall be responsible for upgrading, if necessary, all irrigation control software to properly control both the existing and proposed irrigation system 1and to monitor and control flow meter.

1.5 All Motorola IRRInet 1irrigation controllers and the flow meter will be monitored and operated through the ICC, including during the construction and warranty period. This will allow for alarm notifications to be monitored. It is the responsibility of the Contractor to ensure that all controllers installed as part of this project communicate effectively with the ICC. The installation of the specified radio or modem along with a suitable antenna, as determined by the Engineer, will be required to ensure communication to the ICC.

1.6 Contractors are to provide suitable controllers for each location.

1.7 Current Motorola IRRInet controllers which are approved for installation.

1.8 All Motorola IRRInet controllers shall be installed such that they operate within the manufacturer's specified conditions.

PART 2. PRODUCTS

2.1 GENERAL

2.1.1 All controllers shall be configured for DC power.

2.1.2 Controller Mounting:

2.1.2.1 All Motorola IRRInet controllers shall be supplied in a lockable cabinet.

2.1.2.2 All indoor mounted controllers shall be supplied in a reinforced polyester key-lock enclosure, as supplied by Hoffman.

2.1.2.3 Contractors must shall design the cabinets and provide sufficient cooling to ensure that the controller under maximum load will not heat the cabinet to greater than 50 degrees C.

2.1.2.4 Provide Grade 304, schedule 40 stainless steel support posts for externally mounted cabinets.

2.1.2.5 Framework must be suitable for mounting a 40-foot (approx.) antenna mast with swivel base for maintenance access.

2.2 CONTROLLER SPECIFICATION

2.2.1 General Controller Specification.

2.2.1.1 All Motorola Irrigation controllers will be supplied from the authorized Motorola IRRInet distributor complete with terminals, relays (if required), power supply, and main isolation switch (except for the Piccolo XR).

2.2.1.2 The Motorola Irrigation controller cabinet will be supplied with all devices assembled, wired and ready for operation.

2.2.1.3 The Motorola Irrigation controller cabinet and components shall conform to the highest standards of design and workmanship and appropriate application to the local, state and federal codes.

2.3 ANTENNAS

2.3.1 Antenna selection shall be by control system manufacturer, based on site-specific parameters to ensure communication back to the ICC.

2.3.2 Antennas shall be installed by a suitably-qualified technician to ensure correct connection and installation.

2.3.3 Telemetry Communications: The IRRInet system shall communicate via radio telemetry utilizing the existing licensed frequency operating between 450 and 470 MHz.

2.3.4 Towers: Radio communication towers shall be erected as needed to meet the telemetry communication requirements of this specification. Each antenna tower shall be a free-standing unit, unless otherwise noted, with the heights as required per the communications path study.

2.3.5 Include in base bid work to raise existing base unit antenna to sufficient height (approximately 50 feet) to ensure line-of-sight communication with new dripfield. Include new antenna, relocating existing antennas, base, mounting, and wiring both new and existing antennas.

2.4 SOLAR PANELS

2.4.1 Provide solar panel/battery combination for all controllers. Units shall be appropriately sized for the controller, and shall include solar panels, charger, and deep cycle battery.

PART 3. EXECUTION

3.1 ELECTRICAL POWER AND SIGNAL WIRING

3.1.1 Restrain control and signal wiring in control panels by plastic ties or ducts. Secure hinge wiring at each end so bending or twisting will occur around the longitudinal axis of wire. Protect bend area with a sleeve.

3.1.2 Arrange wiring neatly, cut to proper length, and remove surplus wire. Install abrasion protection for wire bundles passing through holes or across edges of sheet metal.

3.1.3 Use manufacturer's recommended tool with sized anvil for crimp terminations. No more than one wire may be terminated in a single crimp lug. No more than two lugs may be installed on a single screw terminal.

3.1.4 Do not splice or tap wiring except at device terminals or terminal blocks.

3.1.5 Electrical Circuits to Control Valves

3.1.5.1 Installation: Bury wires beside mainline pipe in same trench. Provide grey electrical conduit where wires run under paved or non-paved pedestrian paths and vehicular roads. Tag wires at controller and control valve location with plastic tie wrapped tags. Provide one control wire to each control valve location and one common wire looped from controller to each control valve. Provide one separate control valve wire of a different color from controller to each control valve cluster.

2.1.5.2 Loops: Provide a 12-inch loop of wire at each valve where controls are connected.

2.1.5.3 Expansion and Contraction: Bundle multiple tubes or wires and tape together at 20-foot intervals with 12-inch loop for expansion and contraction.

2.1.5.4 Splices: Make electrical splices waterproof. Locate all field electrical splices in valve boxes.

3.2 PROTECTION

3.2.1 Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.

3.2.2 During Work, periodically replace capsules in accordance with capsule manufacturer's recommendation. Replace capsules at Substantial Completion.

END OF SECTION

SECTION 21
GRINDER PACKAGE SEWER LIFT STATION

PART 1. GENERAL

1.1 This specification pertains to packaged grinder sewer lift stations which serve multiple or single-family residences and the below specification sections shall govern.

1.2 The grinder sewer lift station, as specified herein, shall be provided by a single pump supplier.

1.2.1 Environment One (E/One) is the approved manufacturer for submersible grinder pumps serving single residences.

1.2.1 Single residence E/One pump installations shall meet the specifications below except that only one pump and corresponding controls shall be required.

1.2.2 Flygt is the approved manufacturer for submersible grinder pumps serving multiple residences.

1.3 The Contractor shall furnish and install a factory assembled submersible grinder pumping station consisting of two submersible grinder pumps, controls, fast-out assemblies, guide rails, liquid level controls, control panel, junction box and electrical connections, meters, meter base, FRP wet well with hatch cover, valve box with hatch cover, and all necessary appurtenances, as shown on the drawings and specified herein, complete, and ready for operation.

1.4 Submittals.

1.4.1 The shop drawings shall include outline dimensions and external connection diagrams. A list of components; certified typical curves showing complete pump performance from shutoff to at least 15 percent below rated head conditions, brake horsepower and NPSH required; control panel one-line wiring diagram and specifications; and a copy of the manufacturer's warranty. Shop drawings shall be submitted for wet well, access covers, pumps, valves, and control panel.

1.4.2 Submit Operations and Maintenance Data in accordance with, the following:

1.4.2.1 Submit manufacturer’s complete parts list showing all parts, spare parts, and bulletins for pump. Clearly show all details, parts, and adequately describe parts or have proper identification marks. The parts lists shall be printed on good quality 8-1/2 by 11-inch paper, bound separately of the Operation and Maintenance manual with a flexible, durable cover. Drawings incorporated in the parts lists may be reduced to page size provided they are clear and legible, or they may be folded into the bound lists to page size. Photographs or catalog cuts of components may be included for identification.

1.4.2.2 Pump Field Test Reports

1.4.2.3 Installation and Start-Up Engineer’s Report

1.4.2.4 Operating and Maintenance Instructions.

1.4.3 Submit Warranty as specified herein

1.5 System Description.

1.5.1 Provide station with two pumps with controls capable of operating the pumps either simultaneously or individually, depending on the flow.

1.5.1.1 Furnish and install each lift station as a complete unit with necessary appurtenances.

1.5.1.2 The pumps shall be easily removable from the lift station for inspection or service without the need for removal of nuts, bolts, or other fasteners and without the need for personnel to enter the wet well. Each pump shall be fitted with a stainless steel chain of adequate strength and length to permit raising the pump for inspection and removal. Manufacturer shall provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

1.6 Quality Assurance.

1.6.1 The pump supplier shall provide a performance affidavit, signed by an officer of the company supplying the pumps and witnessed by a notary public, including the following:

1.6.1.1 Verify conformance of materials and equipment for package lift station to the referenced publications or as specified,

1.6.1.2 Verify that the manufacturer is regularly engaged in the manufacture of such products and systems, and

1.6.1.3 Certify that the Contract Documents have been examined and that the equipment will meet in every way the performance requirements set forth in the Contract Documents for the application specified.

1.6.2 Pump Supplier Qualifications: The pump manufacturer shall have overall responsibility to supply the pumping units (submersible pump/motor, discharge elbow, cables, instrumentation and accessories) that meet the requirements of this specification. Thus, during start-up, installation, and performance evaluation, the pump manufacturer is the sole responsible party. The pump manufacturer shall supply a list of installations at which pumps of his manufacture, and ones similar to those specified, have been operating for at least 2 years.

1.6.3 Warranty.

1.6.3.1 Provide a manufacturers' warranty for pumps, float switches, and control panel. Create a list or reference all specific operation and maintenance procedures that are required to keep the warranty valid.

1.6.3.2 The manufacturer of the pump station shall guarantee for a period of one year from substantial completion that the entire station and all equipment therein shall be free from defects in design, materials, and workmanship. Normal use items, such as grease, light bulbs, and mechanical seals, are excluded.

1.7 Extra Materials.

1.7.1 Spare parts for routine maintenance and repair for a period of one year as recommended by the equipment manufacturer shall be provided by the Contractor.

1.8 Delivery, Storage, and Handling.

1.8.1 Contractor shall inspect materials delivered to site for damage or other distress. Unload and store with minimum handling. Store materials onsite, in enclosures, or under protective covering, as recommended by the manufacturer. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and wet well free of dirt and debris. The manufacturer's instructions shall be followed for extended storage. Proper equipment for handling the pumps shall be supplied and shall be considered as special tools if not completely standard. Follow the manufacturer’s recommendations for handling of the pump.

PART 2. PRODUCTS

2.1 Pump Design.

2.1.1 Pump shall be centrifugal type with volute case and semi-open impeller with pump-out vanes on the back shroud. Grinder impeller shall discharge directly into inlet of centrifugal impeller leaving no exposed shaft to cause packing of ground solids. The grinder unit shall consist of a primary grinder ring and impeller to macerate the solids for pumping by the centrifugal impeller. This arrangement shall be capable of handling large quantities of solids with a minimum of water. All parts of the grinder unit shall be hardened stainless steel. Complete grinder assembly shall be removed from pump without disturbing pumps, seals, or motor.

2.2 Submersible Grinder Pump.

2.2.1 All major parts, such as the pump casing, seal housing, motor housing, motor and cap, sliding bracket, and impeller, shall be of gray iron and shall be painted with a red primer and finished with an epoxy acrylic paint. All nuts, bolts, and miscellaneous hardware in contact with pumped material and inside wet well shall be stainless steel (Type 316), unless otherwise indicated on plans.

2.2.2 Each pump shall be provided with a mechanical rotating shaft seal in an oil reservoir. The seals shall require neither maintenance nor adjustment but shall be easily inspected and replaceable. The pump impeller and grinder unit shall be mounted on the common stainless steel extended motor shaft. The impeller shall be statically and dynamically balanced and shall be non-overloading for operation at any capacity within its range.

2.2.3 The electric motor shall be NEMA Design B with Class F insulation and designed for continuous duty. Motor winding, rotor and bearings shall be completely sealed in oil. Oil shall lubricate bearings and transmit heat from winding to outer shell. Motor shaft shall be stainless steel. No lubrication of motor or seals shall be required. The shaft shall be sealed with two mechanical face type seals with an oil chamber between the seals to lubricate running faces.

2.2.4 The cable entry seal design shall be such to ensure a watertight and submersible installation. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be sized to allow motor voltage conversion without replacing the cable.

2.2.5 Each motor shall incorporate an ambient temperature compensated overheated sensing device and a moisture sensing device wired in series. The protective devices shall be wired into the pump controls in such a way that if either device operates, the pump will shut down.

2.2.6 The manufacturer shall provide cast iron fast-out fixtures to allow the pump to be installed or removed without requiring personnel to enter the wet well. The fixtures shall consist of a discharge elbow permanently mounted to the floor of the wet well, a sliding guide bracket which shall be an integral part of the pump unit, two stainless steel slide rails which will guide the pump into position, and stainless steel lifting cable, as shown on the plans.

2.3 Wet Well.

2.3.1 Basin shall be molded of fiberglass reinforced polyester resin of the lay-up and spray technique to assure that the interior surface is smooth and resin rich. 25% glass fibers shall be used and resin shall be POLYCOR 939-X-100 as manufactured by Cook Paint & Varnish Co. or equal. The basin shall have a minimum wall thickness of 1/4". A heavy rib shall extend vertically around the basin for strength and shall have holes through the rib for anchoring in concrete to prevent flotation.

2.4 Access Covers.

2.4.1 Wet Well: The Contractor shall furnish and install one single leaf aluminum access door within alum basin cover. Door leaf shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 300 pounds per square foot. Access covers shall be hinged and hasp-equipped, including stainless steel guide rail bracket and holders for lifting chain and motor cable. Access cover shall be provided with stainless steel hardware.

2.4.2 Valve Box: The Contractor shall furnish and install one double leaf aluminum access door. Door leaf shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 300 pounds per square foot. Access covers shall be hinged and hasp-equipped with stainless steel hardware.

2.5 Controls.

2.5.1 General.

2.5.1.1 All electrical equipment and materials supplied by the Contractor shall be coordinated to function according to the design indicated on the Drawings. All materials and equipment shall be new and a standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer. Equipment or materials found to be defective or damaged shall be replaced or repaired by the Contractor at no additional cost to the Town.

2.5.1.2 Electrical work shall be in accordance with the latest edition of the National Electric Code and with all applicable local codes, regulations, and ordinances in effect at the place of the work.

2.5.2 Scope and Panel Operation.

2.5.2.1 The control logic shall operate two electrical submersible grinder pumps at the power characteristics as specified.

2.5.2.2 The control logic shall provide for the operation of the pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump will automatically start to handle the increased flow. As the liquid level decreases, the pumps will shut off at the elevations shown on the plans. In the event of a malfunction or a flow that exceeds the capacity of the pumps, a high level audible and light alarm will be excited to indicate alarm conditions. A silencer shall lock out the audible alarm; however, the alarm light shall release only with the correction of the high-level condition.

2.5.3 Construction and Materials.

2.5.3.1 The control panel shall be NEMA 3R of fiberglass, Type 304 stainless steel or aluminum construction, with dead front aluminum inner door, and mounted on a concrete post and of adequate size to install all electrical components necessary. The junction box shall be heavy duty plastic (English Electric type APO weather tight or approved equal).

2.5.4 Panel Exterior.

2.5.4.1 Panel to have heavy duty key locking door handle. Mounted on the exterior enclosure shall be an alarm light, a high water level audible alarm with silencer button, and a standby generator receptacle.

2.5.4.2 All exterior mounted accessories shall be constructed of corrosion proof materials such as stainless steel or aluminum.

2.5.4.3 Control wiring from the wet well shall enter the panel in a manner to prevent the possible entry of gases from the wet well, in accordance with NEC Article 501 for Class 1, Division I locations.

2.5.5 Panel Inner Door.

2.5.5.1 The inner aluminum door mounted on a continuous hinge shall be furnished for protection against exposed wiring and shall have cutouts for access to the circuit breakers and pump resets. Mounted on the inner door will be pump run lights, level indication lights, seal failure/over temp lights, hands-off automatic switches, elapsed time meters, main circuit breaker, a fifteen (15) ampere ground fault duplex receptacle, motor resets, emergency circuit breaker with transfer interlock, control circuit breaker, duplex receptacle breaker, motor circuit breakers, lightning arrestor, and surge arrestor.

2.5.5.2 A permanently affixed 11" x 17" (minimum), laminated panel wiring schematic and pump data sheet shall be installed on the interior of the enclosure door.

2.5.6 Control Circuits.

2.5.6.1 In order to ensure maximum personnel safety, all wet well (level sensor) circuits shall be run at 24 volts AC. The control circuit breakers shall be run at 115 volts.

2.5.7 Panel Components.

2.5.7.1 Circuit Breakers: All circuit breakers shall be heavy duty ER molded case breakers as manufactured by Square D or equal. The main circuit breaker shall be mounted on the exterior panel side and be provided with provisions for locking in an "on" or "off" position.

2.5.7.2 Auxiliary Power Connection: A receptacle for the connection of a standby generator and a manual transfer switch to select either main or standby power shall be provided. Plugs and receptacles shall be as approved by the Engineer.

2.5.7.3 Duplex Service Receptacle: A duplex service receptacle supplying 30 amps at 115 volts shall be provided on the panel door. The duplex receptacle shall be provided with ground fault protection.

2.5.7.4 Lightning Arrestor and Surge Capacitor: A lightning arrestor and surge capacitor shall be installed and wired to protect motors and control equipment from lightning induced line surges and transient voltage surges.

2.5.7.5 Elapsed Time Meters: Elapsed time meters shall be 115 volt non-reset types and shall indicate pump running time in hours and tenths of hours to 99999.9 hours.

2.5.7.6 Motor Starters: The panel shall contain two NEMA FVNR starters. The motor starters shall be across the line magnetic starters with individual overload protection on each power leg with motor resets installed through the dead front door. Acceptable manufacturers are Allen Bradley, Square D, and Cutler Hammer or equal.

2.5.7.7 Phase Monitor (for 3-phase pump motors only): A 3-phase shall be installed and wired to disconnect control power from the motor starters in the event of loss of power, phase reversal, loss of any phase or phase balance, or low voltage. The phase monitor shall automatically reset upon removal of any and all of the preceding conditions.

2.5.7.8 Pump Run Lights: A 115 volt pump run lights shall be connected in parallel with each motor starter and indicate when a particular pump is running.

2.5.7.9 Control System: The control system shall consist of: 24 volt transformer; plug-in relays; plug-in solid state automatic alternator with test switch; plug-in three phase monitor (as required); and terminal strip for the installation of four level regulators. All control wiring shall be color coded (minimum of 18 colors) size 18, rated for 300 volts, 80 C stranded tinned copper, PVC insulated, and shall be installed in wiring duct with cover.

2.5.7.10 Liquid Level Indication Lights: A 115 volt level indication light shall be connected in parallel with each liquid level control sensor and indicate when a particular liquid level sensor is activated.

2.5.7.11 Red Alarm Light with Flasher: The alarm light shall consist of a weatherproof light with lexan globe. The alarm circuit will automatically reset when the high liquid level condition is corrected.

2.5.7.12 Moisture and Temperature Sensors: One moisture and temperature sensing relay with associated red indicator light for each pump shall be mounted in the dead front panel. These sensors shall detect moisture in the casing of the submersible pump and excessive heat within the pump motor. If either condition is noted, then the indication light shall light, the pump disconnects and the alarm sound.

2.5.7.13 Terminal Strip: Terminal strip for pumps shall be of the lug type, rated for 600 volts. Amperage rating shall match the largest pump in the station and will accommodate the control circuit amperage.

2.5.8 Scope and Panel Operation.

2.5.8.1 Liquid level sensors with electrical cables (of the proper lengths) shall be provided to control the pumps based upon the control level elevations as shown on the drawings.

2.5.8.2 The liquid level sensors shall be hollow and hermetically sealed, rigidly molded in abrasion and corrosion resistant polypropylene which contains a hermetically sealed SPDT mercury switch, cushioned and mounted along the main axis at about a 65° inclination. A three conductor oval cable, heavily sheathed in PVC for resistance to immersion, corrosion and abrasion, to convey electrical signals and to provide support for the unit, shall be assembled into the small end of the sensor.

2.5.8.3 The liquid level sensors shall contain an eccentric metal weight. When not immersed in liquid, the weight shall cause the sensor body to hang straight down from the cable, providing one stable position for both body and circuit. As liquid immerses the body, the free end shall rise as the weighted end holds the cable taut, retaining a vertical position. This ensures the proper switch position for repeatable circuit closure at the given inclination.

PART 3. EXECUTION

3.1 Installation.

3.1.1 When the pumping facility is complete and ready for operation, then the station shall be inspected and tested for compliance to the contract documents. Test of the equipment shall be made in the presence of the Engineer, the Contractor, the Electrical Subcontractor (if used), the equipment manufacturer's representative, and the Town's representative. The equipment tests shall include, but not be limited to, the following:

3.2 Field Quality Control.

3.2.1 Field Test.

3.2.1.1 Recorded readings shall be made of voltage and amperage on all electrical components at start and operating conditions. Such readings shall be recorded on a form provided by the manufacturer and the results shall meet the manufacturer's prescribed limits. If a tested item fails to meet its requirements, then it shall be replaced. Results of the tests shall be given to the Engineer with the serial number of the accessory tested.

3.2.2 Pumps and Motors.

3.2.2.1 Pump shall be run and a determination made of the pumping capacity. Performance of the pump shall meet the specified criteria when field tested.

3.2.2.2 Contractor shall have suitable pressure gauges installed on each pump discharge for use during testing. Once satisfactory performance of pumps has been demonstrated, Contractor shall remove pressure gauges and install removable plugs.

3.2.3 Electrical.

3.2.3.1 Recorded readings shall be made of voltage and amperage on all electrical components at start and operating conditions. Such readings shall be recorded on a form provided by the manufacturer and the results shall meet the manufacturer's prescribed limits. If a tested item fails to meet its requirements, then it shall be replaced. Results of the tests shall be given to the Engineer with the serial number of the accessory tested.

3.2.4 Controls.

3.2.4.1 Controls shall be tested to determine satisfactory performance for starting and stopping at the proper liquid levels, pump sequence and alarm actuation.

3.2.5 Equipment.

3.2.5.1 Equipment shall be operated to determine if the alignment is visually correct, that there is no overload or overheating or objectionable vibration and that all the operating features are in working order. Submersible pumps shall be raised completely and reset to assure proper seating and operation.

3.2.6 Inspection.

3.2.6.1 A thorough inspection of all mechanical and electrical equipment and controls, piping, valves, fittings, brackets, mountings, seals, conduit, painting, sleeves, components, and features shall be made while the station is being tested to determine performance and compliance with design requirements and specifications.

3.2.7 Structure.

3.2.7.1 The station shall be inspected for performance, structural soundness, and water tightness.

3.2.8 Repairs, Adjustments and Replacements.

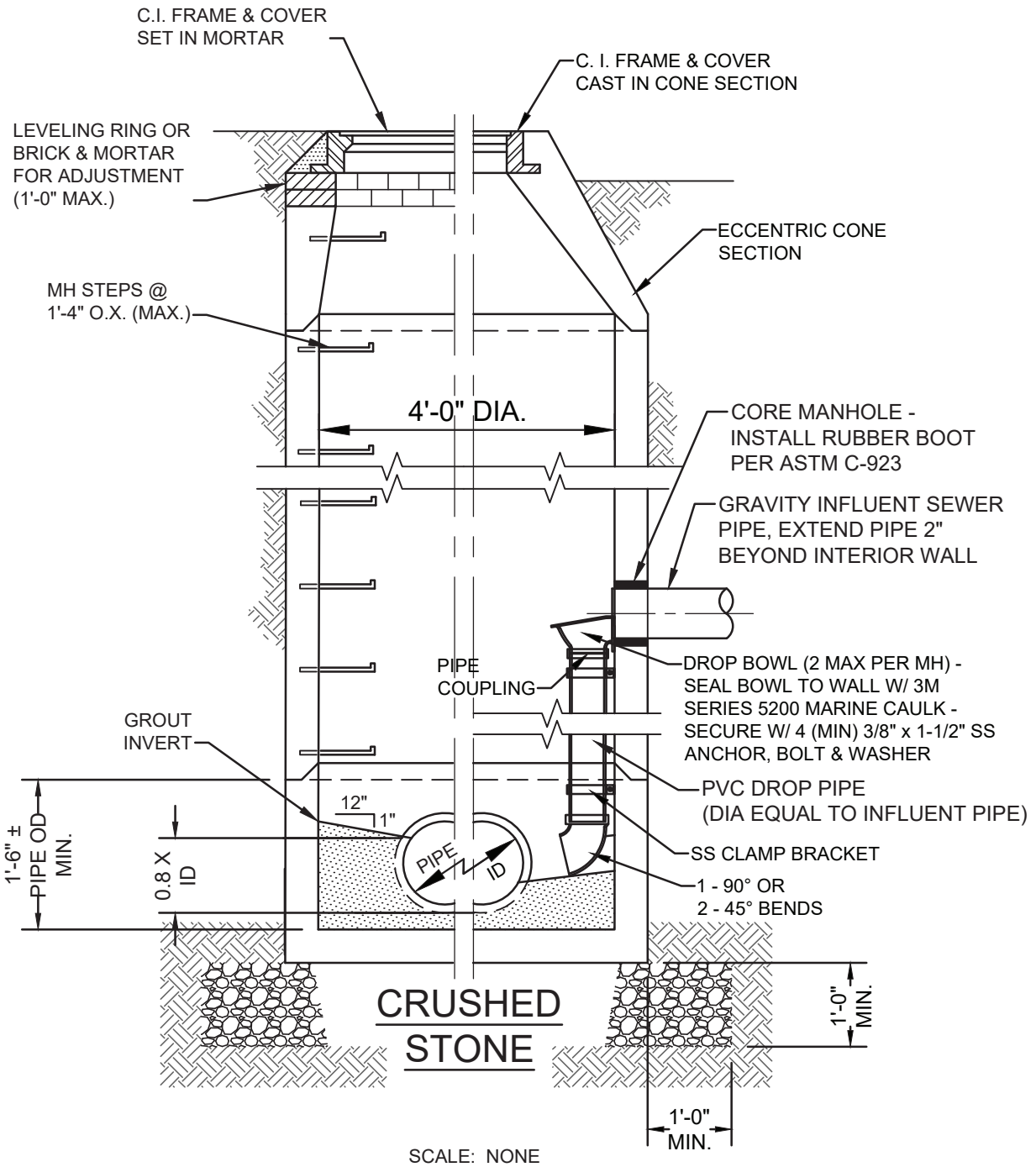
3.2.8.1 The Contractor shall make any and all necessary repairs, adjustments, and replacements until performance has been demonstrated to the satisfaction of the Engineer. The Contractor shall bear the cost of any repair, adjustment, and replacement.

3.2.9 Manufacturer’s Representative.

3.2.9.1 The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble free operation and instruct the operating personnel in the proper care and operation of the equipment.

TOP AT GRADE

TOP ABOVE GRADE



SCALE: NONE

HALF SECTION STANDARD MANHOLE

HALF SECTION DROP MANHOLE

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PRECAST CONCRETE MANHOLE

TOWN OF THOMPSON'S STATION
STANDARD SEWER SPECIFICATIONS
THOMPSON'S STATION, TENNESSEE

DRAWN BY:	CHECKED BY:
BM	PB

DRAWING NO.: DETAIL 1

PROJECT NO.:	DATE:
36724-23	MARCH 2026

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FRAME AND RING JOINT

RISER JOINT

BUTYL ROPE MATERIAL SHALL HAVE A NOMINAL CROSS SECTION DIMENSION OF ONE INCH FOR 4 FT DIA MANHOLES AND ONE AND ONE HALF INCHES FOR 5 FT AND 6 FT DIA MANHOLES.

SCALE: NONE

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SANITARY MANHOLE JOINT

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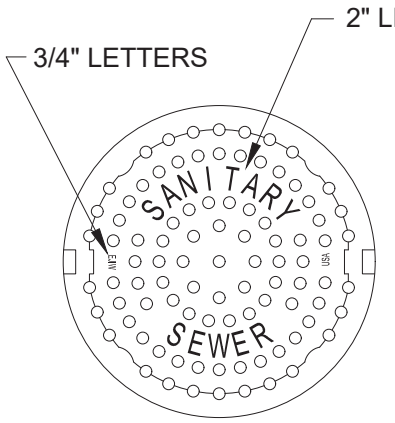
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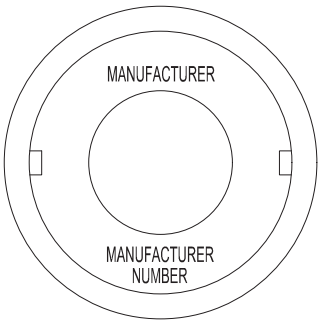
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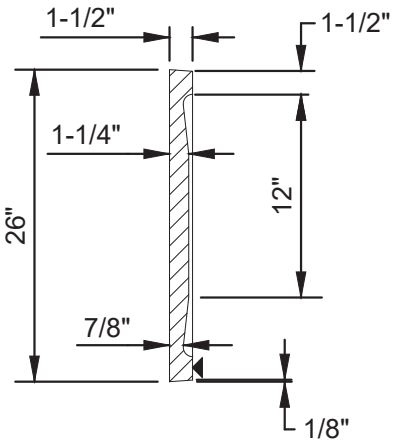
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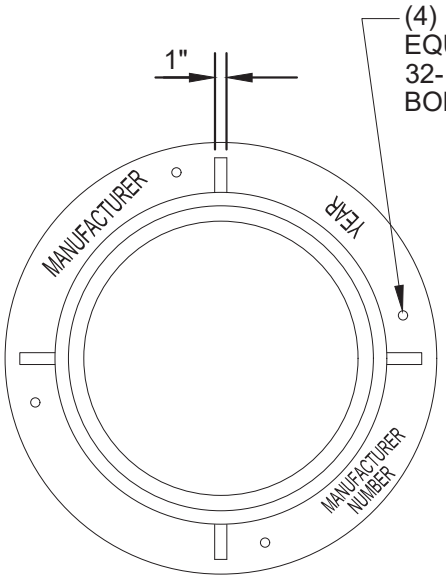
COVER FACE



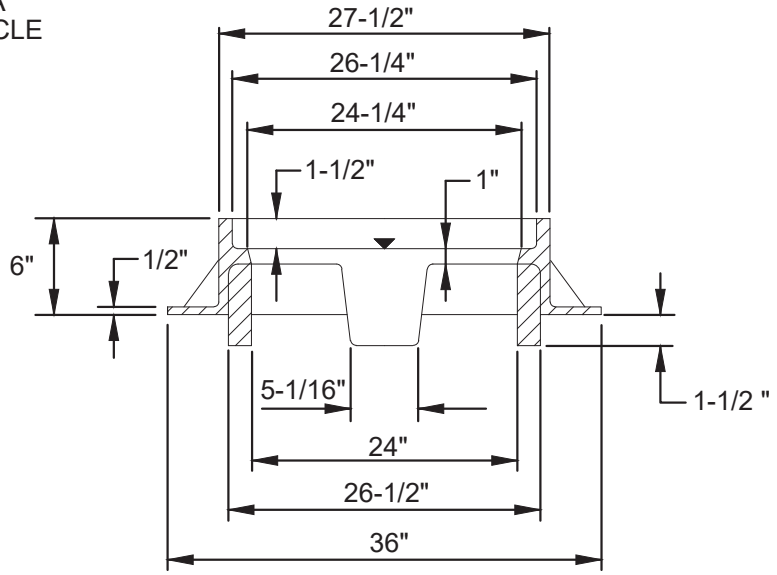
COVER BACK



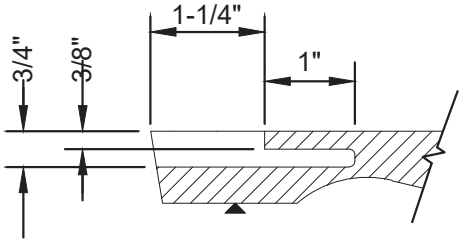
COVER SECTION



FRAME TOP VIEW



FRAME SECTION



(2) TYPE TWO NON-PENETRATING PICKHOLES

PICKHOLE

ESTIMATE WEIGHT

COVER 165 LBS
FRAME 250 LBS
TOTAL 415 LBS

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SANITARY MANHOLE FRAME & COVER

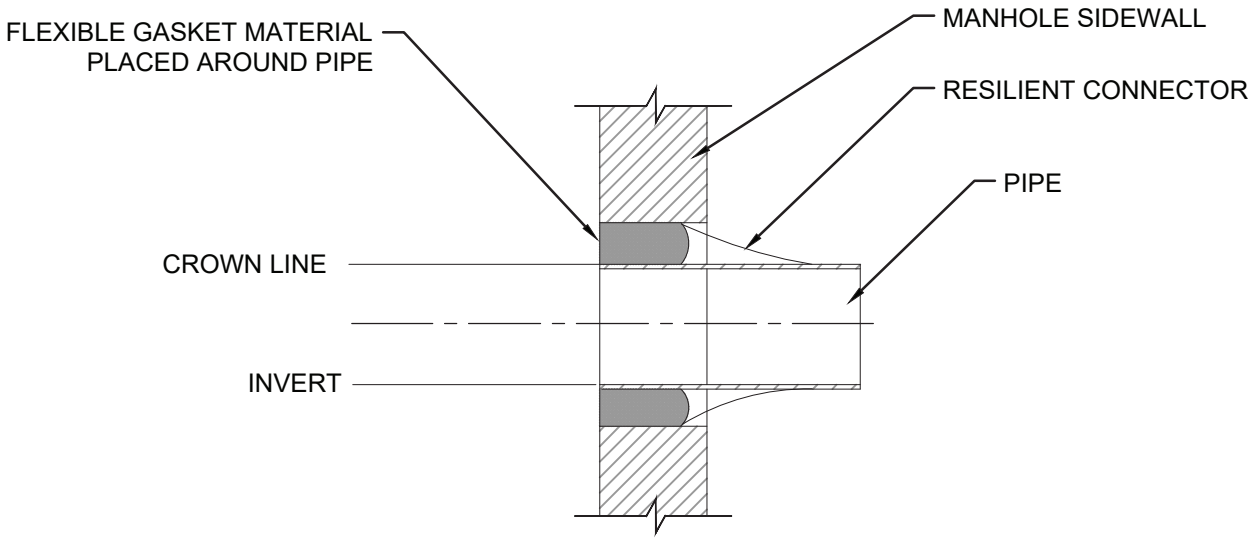
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RESILIENT PIPE CONNECTOR TO MANHOLE

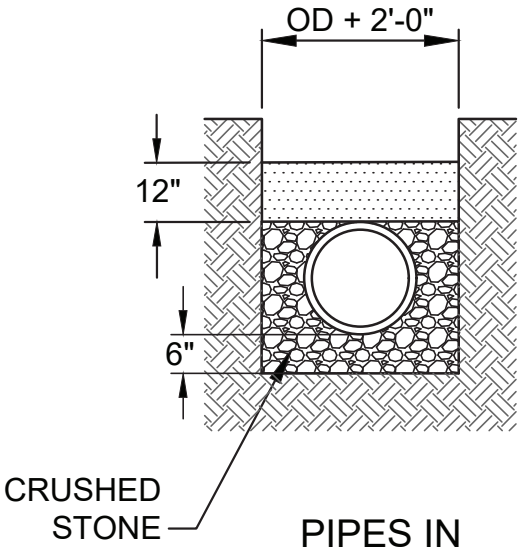
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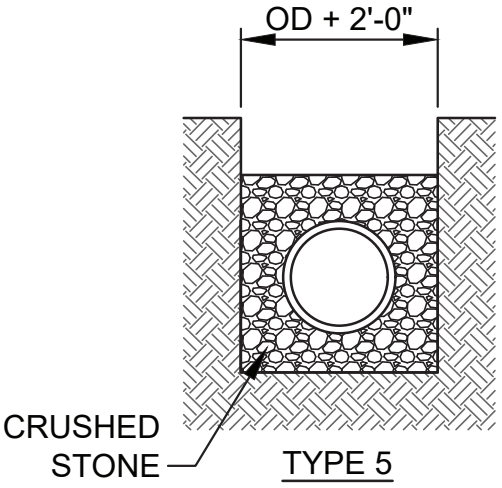
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PIPES IN
UNPAVED AREAS

PIPE BEDDED TO ITS CENTERLINE IN COMPACTED GRANULAR MATERIAL, 6" MINIMUM UNDER PIPE. COMPACTED GRANULAR MATERIAL TO 12" ABOVE TOP OF PIPE. (APPROXIMATELY 90% STANDARD PROCTOR, AASHTO T-99.)



PIPES IN
PAVED AREAS

PIPE BEDDED TO ITS CENTERLINE IN COMPACTED GRANULAR MATERIAL, 6" MINIMUM UNDER PIPE. COMPACTED GRANULAR MATERIAL TO TOP OF PIPE. (APPROXIMATELY 90% STANDARD PROCTOR, AASHTO T-99, COMPACTED IN 6" LIFTS.)

SCALE: NONE

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SEWER PIPE BEDDING & HAUNCHING

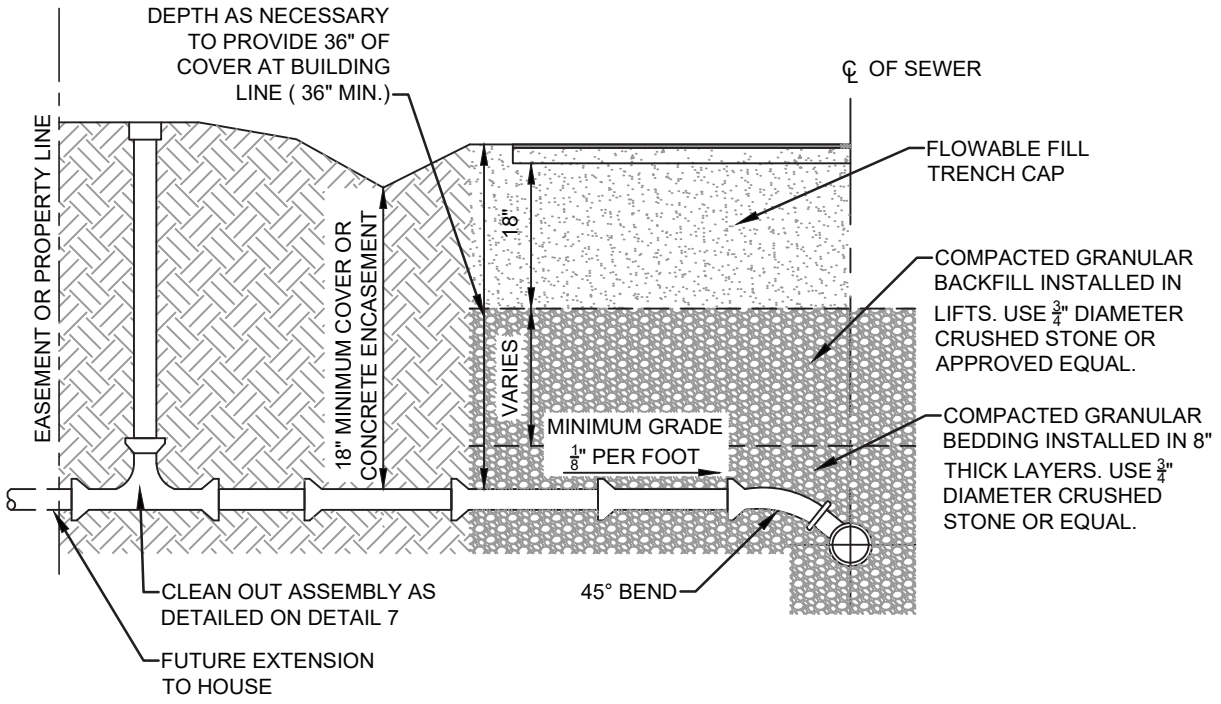
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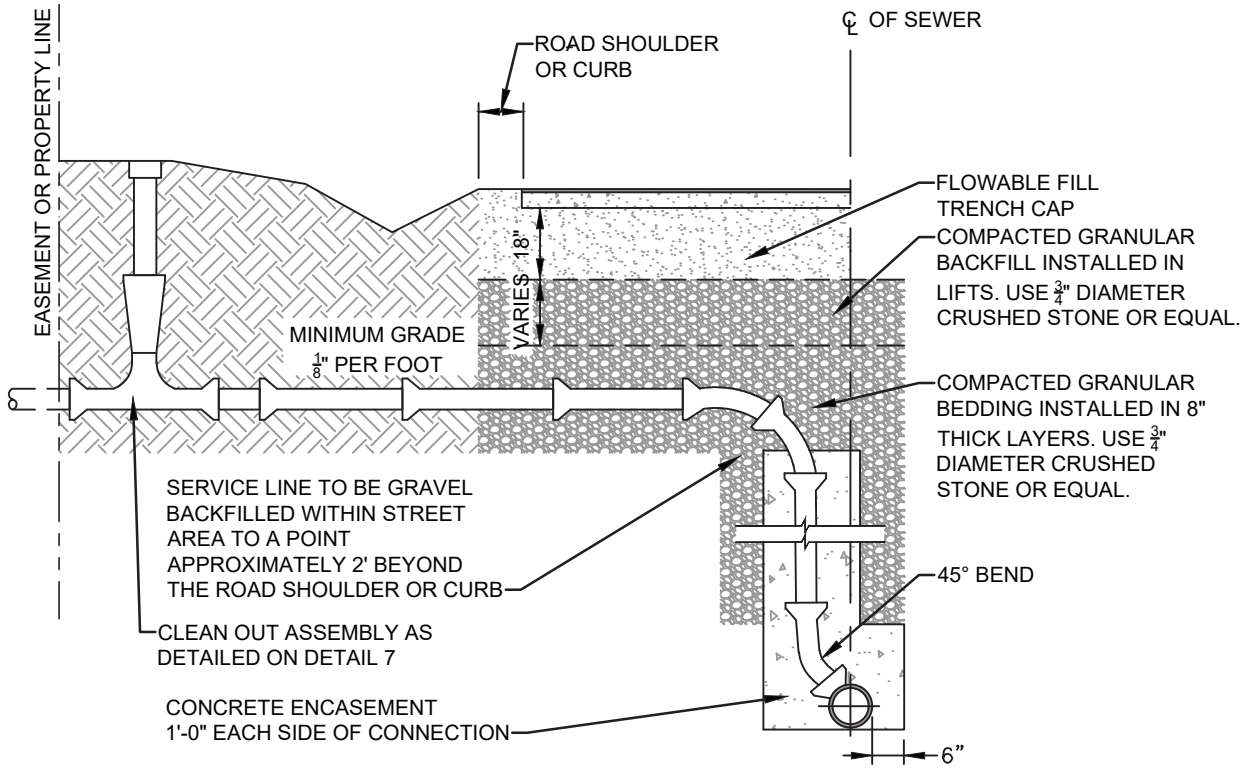
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SEWER SERVICE



RISER PIPE FOR SEWER SERVICE

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SERVICE REPAIR

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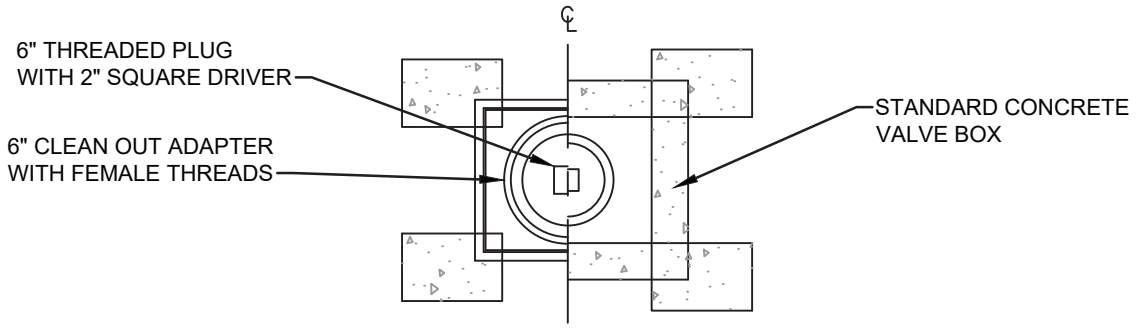
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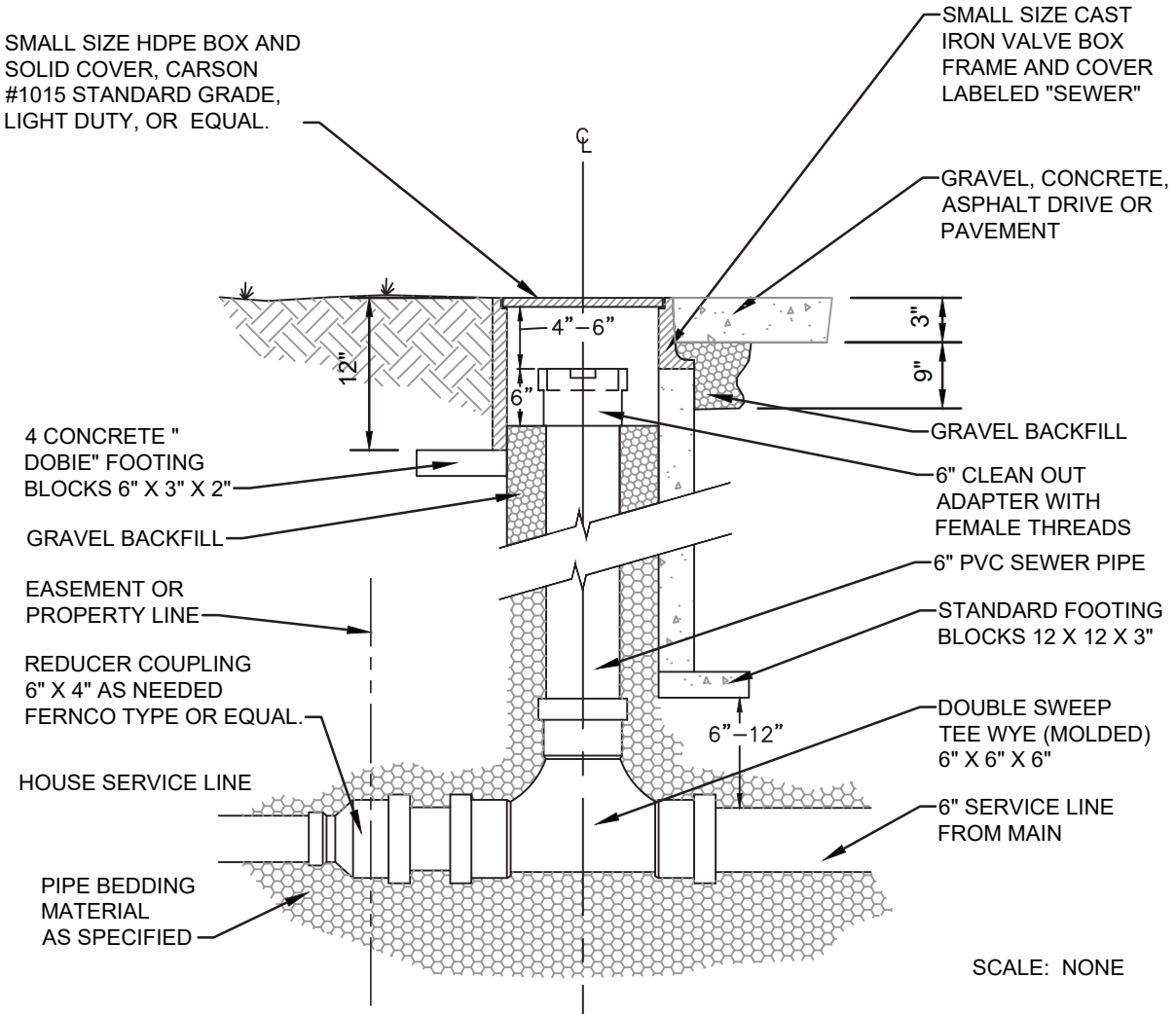
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OUTSIDE PAVEMENT DETAIL | UNDER PAVEMENT / GRAVEL DETAIL



TOP VIEW



SCALE: NONE

OUTSIDE PAVEMENT DETAIL | UNDER PAVEMENT / GRAVEL DETAIL

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CLEANOUT

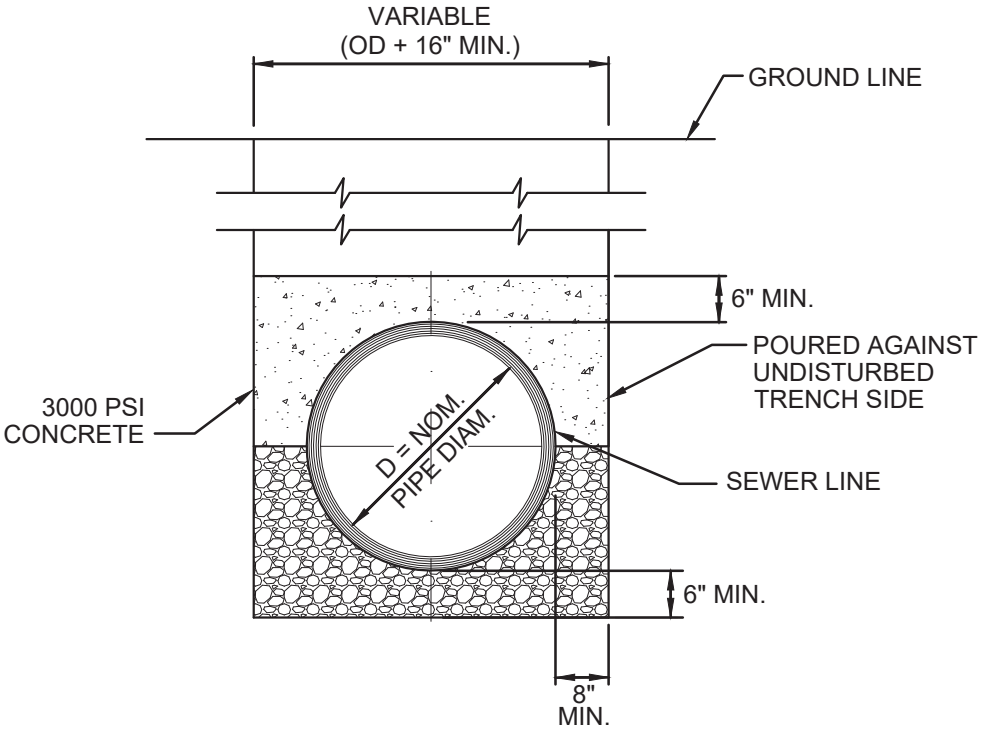
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CONCRETE CAP

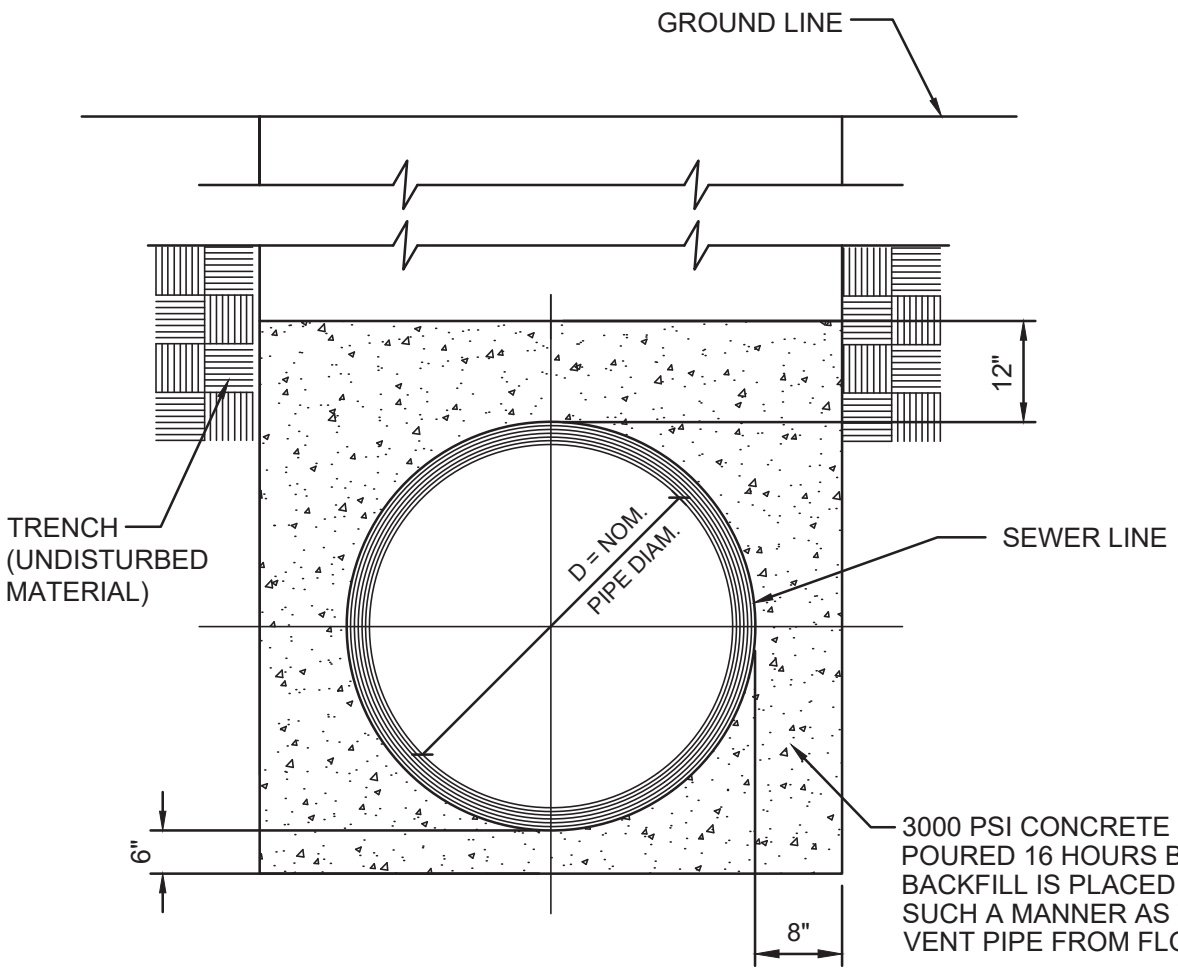
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CONCRETE ENCASEMENT

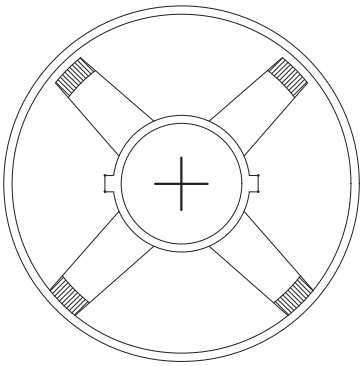
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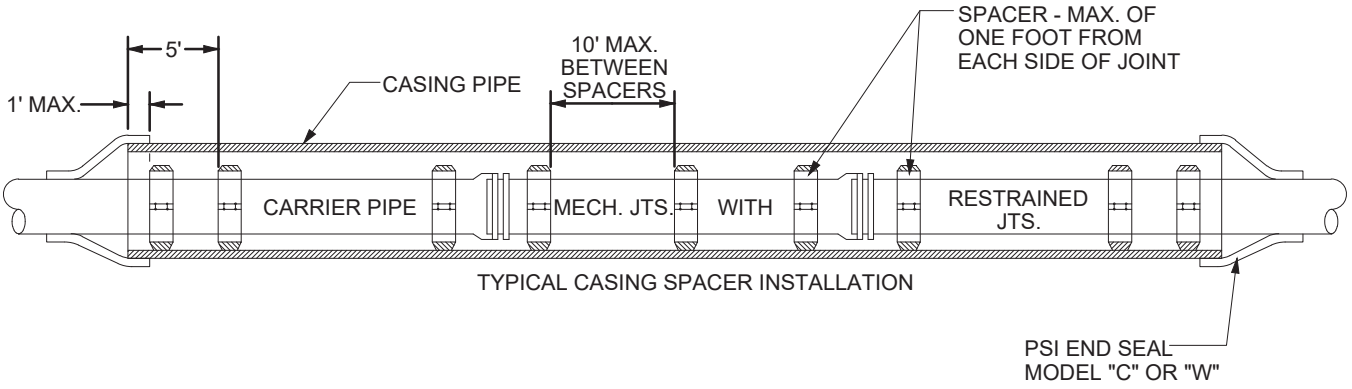
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TYPICAL CASING SPACER INSTALLATION

NOTES:

1. CASING PIPE SHALL BE CARBON STEEL WITH A MINIMUM SPECIFIED YIELD STRENGTH OF 35,000 PSI.
2. CASING PIPE, CARRIER PIPE, SPACERS, AND END SEALS SHALL BE AS SPECIFIED IN SECTION 13.

SCALE: NONE

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UTILITY CASING PIPE

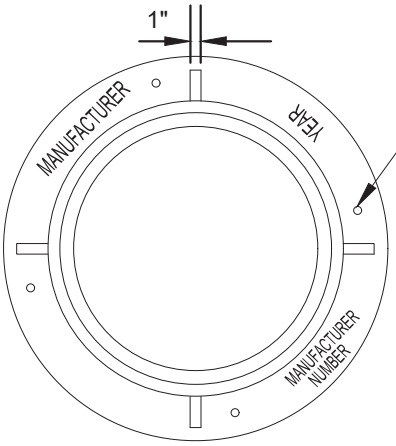
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STANDARD SEWER SPECIFICATIONS
THOMPSON'S STATION, TENNESSEE

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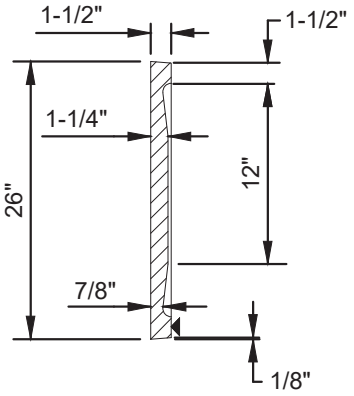
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36724-23	MARCH 2026

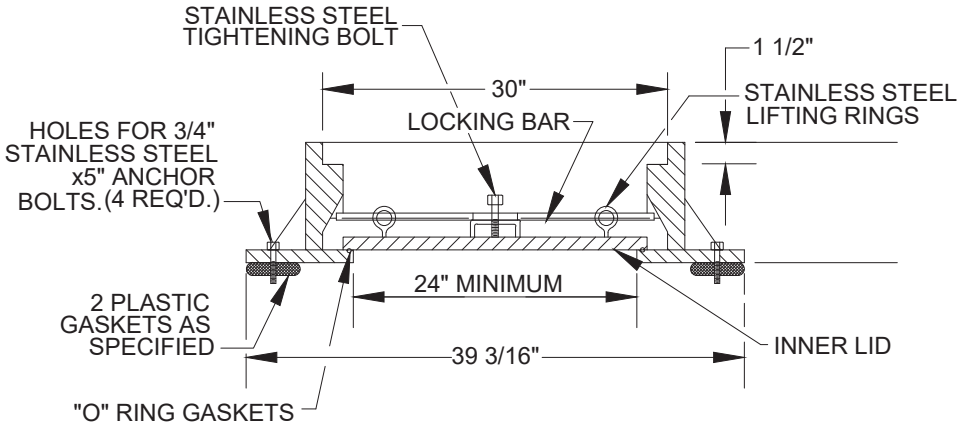
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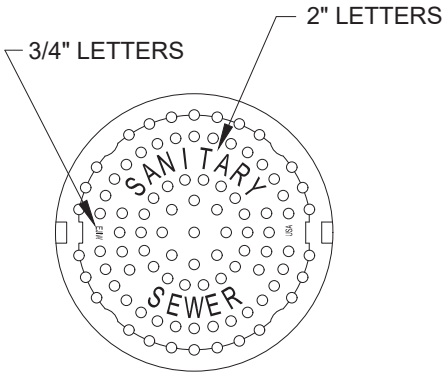
FRAME TOP VIEW



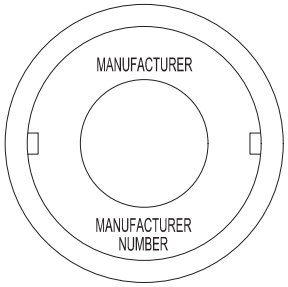
COVER SECTION



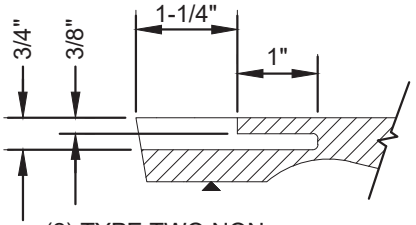
SECTION



COVER FACE



COVER BACK



(2) TYPE TWO NON-PENETRATING PICKHOLES

PICKHOLE

SCALE: NONE

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615 3rd Avenue South // Suite 700 // Nashville, Tennessee 37210
PHONE (615) 254-1500 // FAX (615) 255-6572

WATER-TIGHT MANHOLE COVER

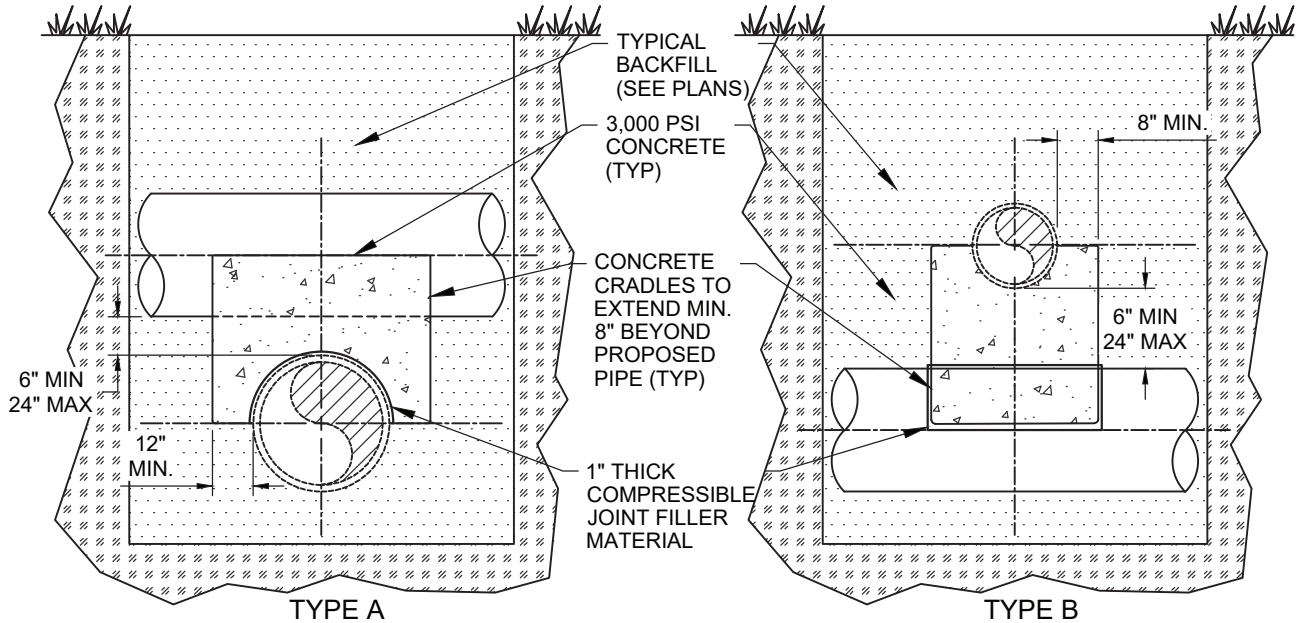
TOWN OF THOMPSON'S STATION
STANDARD SEWER SPECIFICATIONS
THOMPSON'S STATION, TENNESSEE

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TYPE A
PROPOSED PIPELINE OVER EXISTING PIPE

TYPE B
PROPOSED PIPELINE UNDER EXISTING PIPE

NOTES:

1. CONCRETE TO BE POURED 16 HOURS BEFORE BACKFILL IS PLACED AND IN SUCH A MANNER AS TO PREVENT THE PIPE FROM FLOATING.
2. SEE PLANS FOR SPECIFIED BACKFILL AND DETAILS.
3. PROPOSED PIPE(S) TO BE LAID BEFORE CONCRETE HARDENS.
4. NO CONCRETE ENCASEMENT REQUIRED FOR VERTICAL SEPARATION GREATER THAN 18" AS MEASURED FROM OUTSIDE OF INTERSECTING PIPES.
5. AT MINIMUM, CONCRETE CRADLES SHALL PROVIDE 8" OF COVER FROM OUTSIDE PIPE WALLS.
6. IF SPECIFIED IN PLANS, CONCRETE CAPS MAY BE BURIED BELOW THE SURFACE. IF BURIED, THE TOP OF CAP CAN BE NO CLOSER THAN 6" FROM FINISHED GRADE.

SCALE: NONE

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PIPE SEPERATION

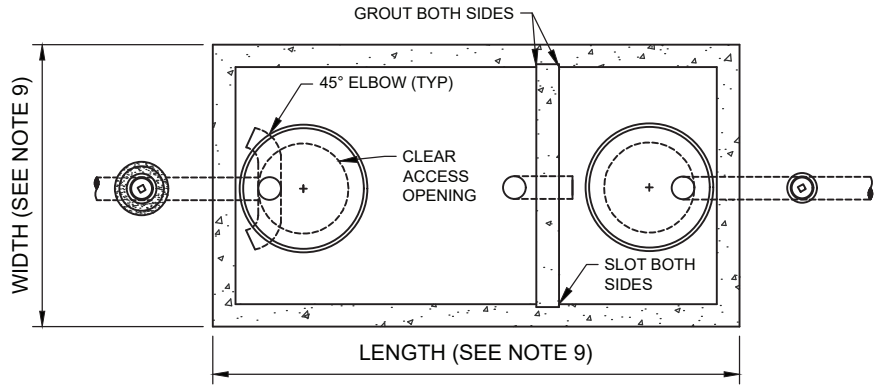
TOWN OF THOMPSON'S STATION
STANDARD SEWER SPECIFICATIONS
THOMPSON'S STATION, TENNESSEE

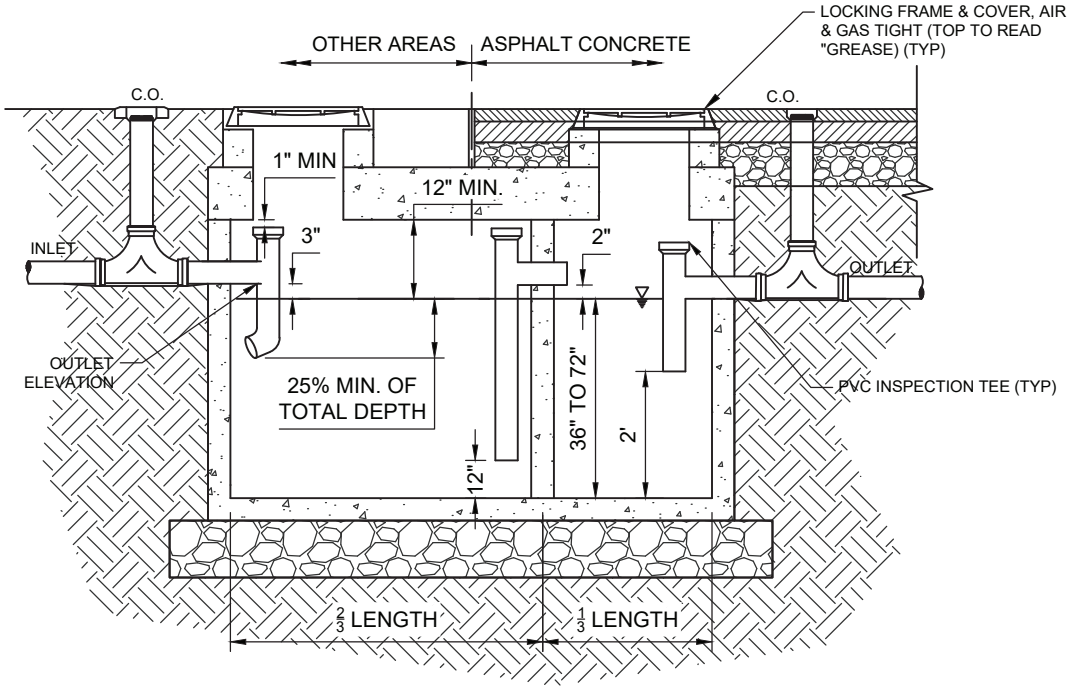
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NOTES:

1. CONCRETE: 28 DAY ≥ 4500 psi.
2. REBAR: ASTM A615 GRADE 60.
3. MESH: ASTM A.185 GRADE 65.
4. DESIGN: ACI318.83 BUILDING CODE - ASTM C.857 MINIMUM STRUCTURAL DESIGN LOADING FOR UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES.
5. LOADS: H-20 TRUCK WHEEL w/30% IMPACT PER AASHTO.
6. FILL w/CLEAN WATER PRIOR TO START UP OF SYSTEM.
7. CONTRACTOR TO SUPPLY & INSTALL ALL PIPING AND SANITARY TEEs. 2 DOUBLE-SWEEP CLEAN OUTS (FOR CLEANING TOWARD AND AWAY FROM TANK ON BOTH THE INLET AND OUTLET SIDES).
8. GREY WATER ONLY, BLACK WATER SHALL BE CARRIED.
9. THE LENGTH OF THE TANK SHALL BE ONE AND ONE HALF (1.5) TIMES THE WIDTH.
10. IN UNPAVED AREAS, PROPERLY BED AND SET EDGE OF PRECAST CONCRETE COLLAR FLUSH WITH FINISHED GRADE. NO COLLAR IS REQUIRED IN PAVED AREAS, SET CLEANOUT FLUSH WITH PAVEMENT.

SCALE: NONE

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GREASE INTERCEPTOR

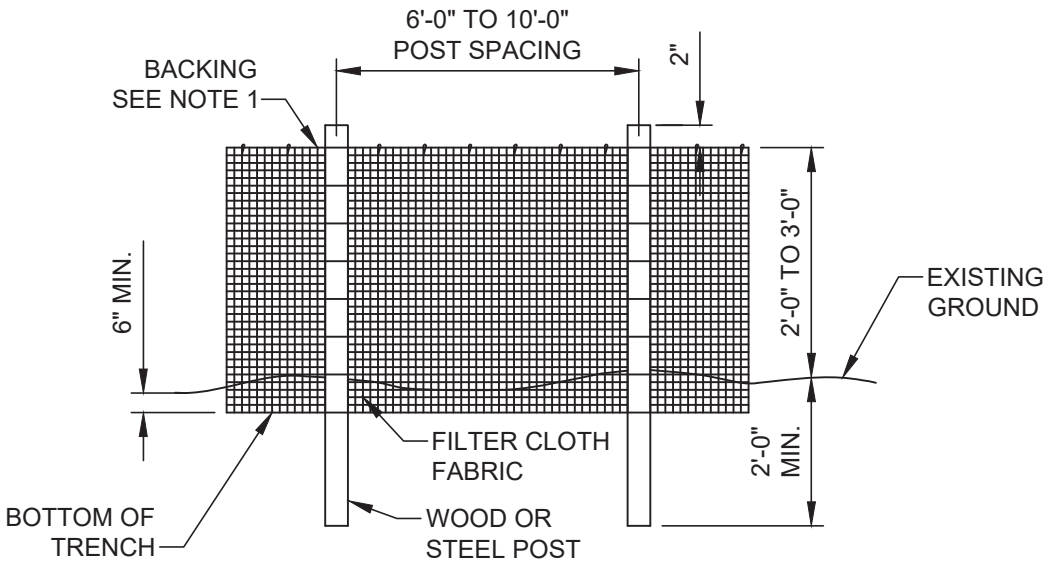
TOWN OF THOMPSON'S STATION
STANDARD SEWER SPECIFICATIONS
THOMPSON'S STATION, TENNESSEE

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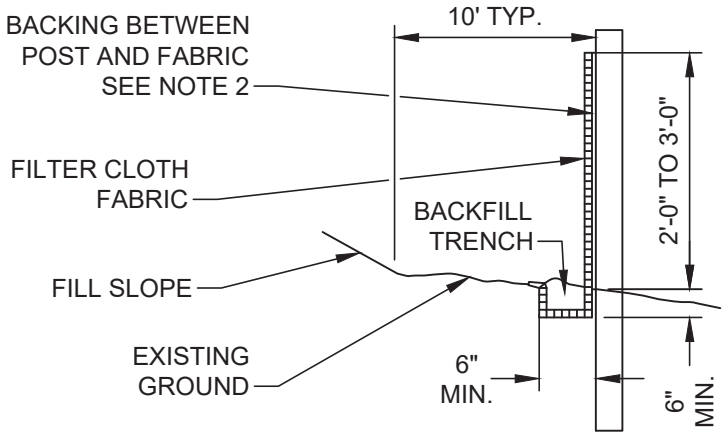
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ELEVATION



SECTION

NOTES:

1. FILTER CLOTH SHALL HAVE APPROVED BACKING OR A BUILT-IN REINFORCED STRUCTURE, AS RECOMMENDED BY THE MANUFACTURER TO SUPPORT THE FILTER CLOTH.

2. A PREASSEMBLED SILT FENCE MEETING THE REQUIREMENTS OF THIS DRAWING IS ACCEPTABLE IN LIEU OF A FIELD CONSTRUCTED SILT FENCE.

3. FILTER FABRIC SHALL BE MIRAFI 500X, AMOCO 2002 OR EXXON GTF-200.

SCALE: NONE

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TEMPORARY SILT FENCE

TOWN OF THOMPSON'S STATION
STANDARD SEWER SPECIFICATIONS
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USF FABRICATION TPD MIN.
HATCH 300 LB/SF W/ DUAL S
APPROVED EQUAL. VERIFY
PUMP SUPPLIER.

