STANDARD SEWER SPECIFICATIONS AND DETAILS FOR SANITARY SEWER SYSTEM

CITY OF WHITE HOUSE, TENNESSEE

City of White House
Wastewater Department
725 Industrial Road
White House, TN 37188

Revised April 2021

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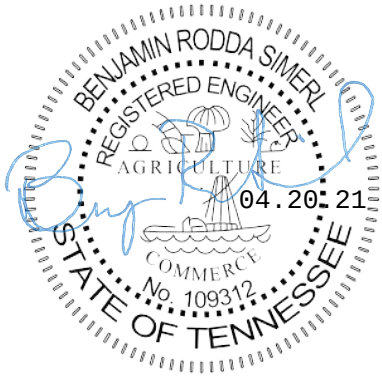

City of White House
Wastewater Department
725 Industrial Road
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Approved by:

_____

City of White House

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PART 1: GENERAL

1.01 SCOPE OF THESE SPECIFICATIONS

A. INTENT

It is the intent of these Specifications to provide the minimum acceptable standards for materials, equipment, and design parameters for furnishing and installation of various components for the City of White House Sewer System. These components include, but are not limited to, gravity sewer lines, manholes, service connections and lines, pumping stations, grinder pumps, force mains, vacuum sewers, vacuum valves and accessories, odor control facilities, meters and telemetry, sampling equipment, corrosion control, and other special structures, equipment, materials, and appurtenances required for a complete and operable system.

In addition to the Special Conditions of this Section, the Specifications include a section of Detailed Specifications for Sanitary Sewer System Construction with various subsections and component detail sheets.

B. REGULATORY REQUIREMENTS

It is the intent that all sanitary sewerage works to be included in and serviced by the City's Sanitary Sewer System be done in compliance with applicable and current City, State, County, and Federal acts, regulations, and/or guidelines. These acts, regulations, and guidelines include, but are not limited to:

1. City Special Conditions and Standard Specifications and Details for Sanitary Sewer System Construction; (This document.)

2. City Sewer Use Ordinance;

3. City Sewer Rate Ordinance;

4. City Developer's Agreement;

5. Occupational Safety and Health Act – P.L. 91-596;

6. Contract Work Hours and Safety Standards Act – P.L. 91-54;

7. Tennessee Department of Environment and Conservation, Division of Water Resources, “Tennessee Design Criteria,” current edition;

8. Tennessee Department of Environment and Conservation “Guidelines for Erosion and Sediment Control” as promulgated by the Tennessee Erosion and Sediment Control Handbook, current edition; and

9. City “Permit-Required Confined Spaces Entry Policy.”

It is not the intention of these Specifications to conflict with these acts, regulations, or guidelines in any way, and where conflicts may arise, the acts, regulations, or guidelines shall govern. Requirements by the Specifications that are more stringent than those of the acts, regulations, or guidelines shall not be considered conflicts.

The City does not assume responsibility for enforcing County, State, or Federal acts, regulations, or guidelines and will not be considered in charge of or responsible for acts of the Contractor, methods of construction, construction, construction progress, construction forces or equipment, or safety procedures.

1.02 SYSTEM DESIGN AND REVIEW REQUIREMENTS

A. PRELIMINARY ENGINEERING STUDY

1. The City’s Sewer System is unusual in that it incorporates standard gravity sewers, grinder pumps with low pressure force mains, and vacuum valves with vacuum sewer lines. Because of the complexity of the System, a Preliminary Engineering Study is required for any significant additions to the System. Any Customer or Developer proposing to connect to the system shall contact the City and perform a study for their proposed project.

2. The Developer shall include the basic information in the study, including, but not limited to:

   a. project location,

   b. general layout,

   c. number of customers,

   d. required capacity, and

   e. possible future expansions.

3. The Developer shall submit two (2) copies of the Preliminary Engineering Study and any preliminary drawings to the Director for

review. The study will assist the City in determining if service is feasible, the type of system that will be required, and the size and location of the connection to the City's system.

4. The requirement for the Preliminary Engineering Study may be waived at the City's discretion for short line extensions or service connections to existing lines.

B. DESIGN AND PERMITTING REQUIREMENTS

Following the Engineering Study, the Developer, at his own expense, shall have the system designed by a Tennessee-licensed Professional Engineer qualified to design the type system required.

1. The Plans and Specifications shall be submitted to the City for review and approval.

2. After receiving the City's approval, the Developer shall submit Plans and Specifications to the Tennessee Department of Environment and Conservation Division of Water Resources for review. Review fees required by the Division of Water Resources will be paid by the customer or Developer. Two (2) copies of the Plans and Specifications stamped "Approved" by the Division of Water Resources shall be provided to the City before construction on the project is begun.

3. In general, proposed sewer collection systems shall be designed in accordance with the Tennessee Department of Environment and Conservation Division of Water Resources Guidelines.

1.03 CONSTRUCTION PHASE

A. PRE-CONSTRUCTION CONFERENCE

1. The Developer shall notify the City at least forty-eight (48) hours in advance to schedule the pre-construction conference.

2. The conference shall include representatives of the Developer, the Contractor, City, and all other utilities having an interest in the project. The conference will be held at the City Wastewater Treatment Plant.

3. The roles, responsibilities, and authority of the various parties shall be defined and discussed. Other subjects regarding the project may be covered at the pre-construction conference.

4. At the conclusion of the conference, a “Notice to Proceed” may be issued with the concurrence of the City. No work on the sewer system shall be performed prior to the pre-construction conference.

   Note: Submittals shall be submitted a minimum of five (5) days before the pre-construction conference.

B. CONSTRUCTION INSPECTION

The City will provide an inspector to determine if the installation of the sewer system complies with the requirements of the approved Plans and Specifications. Other duties of the inspector may include, but not be limited to, witnessing tests, inspecting material and equipment incorporated into the work, and reporting project progress and status to the Developer and the City. It is the Contractor’s responsibility to maintain project records and prepare field record drawings. The inspector will not supervise or direct the work of the Contractor.

The inspector also will not be responsible for or assist in any required re-design. Design responsibility falls on the Contractor and Design Engineer.

C. CONTRACTOR

All sewer system components to be performed for the City Sewer System shall be installed by a fully bonded and insured General Contractor (with Utilities License), properly licensed in the State of Tennessee to perform the type of work required by the project.

D. RECORD DRAWINGS

Upon completion of the project, a set of Record Drawings showing any deviations from the Approved Plans and Specifications, location and depth of all service connections, and other pertinent construction or field data shall be provided to the City in both PDF and CADD format.

E. START-UP OF FACILITIES

1. No sewage shall be discharged into the City Sewer System without prior written authorization by the City. The City shall not be responsible for utility bills on stations until after the completion of all homes/commercial buildings in the first phase of development. At

the City's discrimination, individual line segments or parts of a total project may be allowed to connect to the system, provided the segments or partial sections have been successfully tested, inspected, and approved by the City.

2. Pumping, metering, and other facilities utilizing mechanical equipment shall not be started up until:

    a. Three (3) bound copies of shop drawings and operation and maintenance manuals have been turned over to the City;

    b. Electrical and any other required codes inspections have been completed and approved;

    c. The installation of the facility has been inspected and start-up authorized by the City; and

    d. Start-up services of a factory-authorized technician have been scheduled.

3. The initial start-up of the facility shall be performed by the factory-authorized technician in the presence of representatives of the Contractor and the City.

    a. As part of the start-up service, the technician shall train and instruct the City's operating and maintenance personnel in the proper operation and maintenance of the facility.

    b. The Developer or Contractor shall provide sufficient service time to start-up and adjust the facility and to instruct and train the City's personnel.

    c. The factory-authorized technician shall submit a written start-up report certifying that the equipment has been properly installed, is operating satisfactorily, and that the City personnel have been trained and instructed in the operation and maintenance of the facility.

4. For pump stations, vacuum/pump stations, metering facilities and other mechanical facilities, a thirty (30)-day "trial run" period shall be in effect following the initial start-up, during which the Developer or his Contractor shall make necessary adjustments, verify that the equipment meets performance requirements, and provide additional operation and maintenance instructions to the City's

personnel. The City will transfer the necessary utilities for these facilities at the end of the thirty (30)-day trial run.

F. WARRANTY

1. The Developer will provide the City a maintenance bond guaranteeing the work. As a minimum, all sewerage facilities will be guaranteed by the Developer for a period of twelve (12) months against defects in material and workmanship from the written date of acceptance by the City.

2. If certain segments or facilities are accepted and put into service before a total project is completed, the warranty for those segments or facilities will begin upon written acceptance by the City. Providing the equipment meets required performance requirements and the facility is operating properly at the end of the thirty (30)-day "trial run," the City will accept the facility and the twelve (12)-month warranty period will start. This beginning date for the twelve (12)-month warranty period shall supersede any limitations on the warranty period by the manufacturer or supplier. If the equipment does not meet the performance requirements at the end of the thirty (30)-day "trial run," the beginning of the warranty period will be delayed until the performance requirements are met.

3. In certain instances, extended or graduated warranties may be required for specific pieces of equipment or material. Any such extended or graduated warranties specified or provided by the manufacturer shall accrue to the City upon acceptance of the equipment or material.

G. PROGRESS MEETINGS

1. The Contractor and any subcontractors, material suppliers, or vendors whose presence is necessary or requested shall attend meetings, referred to as Progress Meetings, when requested by the City or his representative for the purpose of discussing the execution of work.

2. Each meeting will be held at the time and place designated by the City or his representative. These meetings shall be binding and conclusive on the Contractor and such decisions, instructions, and interpretations shall be confirmed in writing by the City or his representative.

3. The proceedings of these meetings will be recorded, and the Contractor will be furnished with a reasonable number of copies for his use and for his distribution to the subcontractors, material suppliers, and vendors involved.

1.04 SUBMITTALS

A. GENERAL

All transmittals from the Contractor shall be accompanied by a transmittal cover form that includes pertinent information related to the project and the particular transmittal. The Contractor shall use the "Transmittal Form" provided at the end of this section or a similar form that includes the required information.

B. CONSTRUCTION SCHEDULE

The Contractor shall prepare and communicate to the City a tentative construction schedule discussing the order in which the Contractor proposes to carry on the work, the estimated date(s) on which they will start the several salient features, and the contemplated dates for completing such salient features. The schedule may be in any form, at the option of the Contractor, and contain at least the following information:

1. The various classes and areas of work, broken down into times projected for submittals, approvals, and procurement; times for installation and erection; and times for testing and inspection;

2. The work completed and the work remaining to complete the project; and

3. Any items of work that will delay the start or completion of other major items of work so as to delay completion of the whole project.

C. MATERIAL SUPPLIERS AND SUBCONTRACTOR LISTINGS

The Contractor shall supply the names and addresses of all major material suppliers and subcontractors to the City.

D. SHOP DRAWINGS AND SAMPLES

The Contractual requirements for shop drawings and samples are specified below and in the individual Specification Sections for each item. The Contractor shall submit shop drawings and samples accompanied by the "Submittal and Routing Form" included at the end of this section a

minimum of five (5) days prior to the pre-construction conference. Resubmissions, where required, shall be in accordance with the procedures established for the initial submittal.

Submittals required by the City are identified in the individual Specification Sections for each item.

1. Shop Drawings

   The data shown on the shop drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show City the services, materials, and equipment Contractor proposes to provide and to enable City to review the information for the purposes stated below.

2. Samples

   Each sample required will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as City may require to enable City to review the submittal for the purposes stated below.

3. Where a shop drawing or sample is required by the Specifications, any related work performed prior to the City's review and approval of the pertinent submittal will be at the sole expense and responsibility of the Contractor.

4. Submittal Procedures

   a. Before submitting each shop drawing or sample, Contractor shall have determined and verified:

      i. All field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

      ii. All materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

      iii. All information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto.

b. Contractor shall also have reviewed and coordinated each shop drawing or sample with other shop drawings and samples and with the requirements of the Work and the Specifications.

c. Each submittal shall bear a stamp or specific written indication that Contractor has satisfied his obligations under the Specifications with respect to Contractor's review and approval of that submittal.

d. At the time of each submittal, Contractor shall give city specific written notice of such variations, if any, that the shop drawing or sample submitted may have from the requirements of the Specifications, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each shop drawing and sample submitted to City for review and approval of each such variation.

5. City's Review

a. City will perform review in a timely fashion.

b. City's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the work, conform to the information found in the Specifications and Drawings and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Specifications and Drawings.

c. City's review and approval will not extend to means, methods, techniques, procedure of construction, or safety precautions or programs incident thereto except where expressly called for in the Specifications. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

d. City's review and approval of shop drawings or samples shall not relieve Contractor from responsibility for any variation from the requirements of the Specifications and Drawings unless Contractor has in writing called City's attention to each such variation at the time of each submittal, and City has given written approval of each such variation by specific written notation thereof incorporated in or

accompanying the shop drawing or sample approval; nor will any approval by City relieve Contractor from responsibility required within these Specifications.

6. Resubmittal Procedures

Contractor shall make corrections required by City and shall return the required number of corrected copies of shop drawings and submit as required new samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by City on previous submittals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for delivery, storage, and handling of all materials and equipment, unless otherwise noted. All material and equipment shall be shipped to arrive at the job site on the dates indicated on the purchase order. The following information shall be supplied:

1. The contents, bill of lading, and number of shipments;
2. The method of shipments;
3. The date of shipment; and
4. The name of the construction project.

B. Prior to shipment, all items shall be properly prepared to protect all critical areas from the effects of weather, normal expected transport, and on-site handling.

C. Items shall be tagged and marked with equipment and/or motor numbers as per the manner stipulated in the purchase order.

D. All spare parts and expendable supplies shall be properly crated, marked, and shipped to the job site on the date specified.

PART 2: PRODUCTS

2.01 EQUIPMENT AND MATERIAL STANDARDS

All equipment and materials of construction described in this Specification shall meet the more stringent requirements of the applicable codes listed below:

A. OSHA - Occupational Safety and Health Administration;
B. ASTM - American Society for Testing Materials;

C. ANSI - American National Standards Institute;

D. AGMA - American Gear Manufacturers Association;

E. AISC - American Institute of Steel Construction;

F. AWS - American Welding Society;

G. NEC - National Electric Code;

H. NEMA - National Electrical Manufacturers Association; and

I. API - American Petroleum Institute.

2.02 QUALITY ASSURANCE

A. All equipment shall, after installation by the Contractor, be inspected, tested, and started up by a qualified representative of the equipment manufacturer. The Contractor and the manufacturer's representative shall complete the "Equipment Start-up Form" provided at the end of this section and submit the completed form to the City.

B. The listing of a manufacturer in the Specifications does not necessarily imply that the manufacturer's standard equipment meets the requirements of the specifications, but that the manufacturer listed has the capability to meet the requirements of the Specifications.

PART 3: EXECUTION

3.01 SPECIAL REQUIREMENTS

A. LIMITS OF CONSTRUCTION

The Contractor shall confine all operations and personnel to the limits of construction as shown on the plans. There shall be no disturbance whatsoever of any areas outside the limits of construction nor shall the workmen be allowed to travel at will through the surrounding private property.

B. CONSTRUCTION SUPERINTENDENT

The Contractor shall place in charge of the work a competent and reliable superintendent, who shall have the authority to act for the Contractor and who shall be accountable to the City. The Contractor shall, at all times, employ labor and equipment sufficient to accomplish the several classes of work to full completion in the manner and time specified.

C. SITE CONDITIONS

1. The Contractor shall maintain the work and project grounds free from rubbish, debris, and waste materials during all phases of the work.

2. Immediately upon completion of the work and prior to final acceptance, the Contractor shall remove all rubbish, debris, temporary structures, equipment, and excess or waste materials and shall leave the work and project grounds in a neat and orderly condition that is satisfactory to the City.

D. RIGHT OF ENTRY

The City and their representative will at all times have access to the work. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records.

E. TEMPORARY CONSTRUCTION SERVICES AND FACILITIES

The Contractor shall obtain all necessary permits, licenses, etc., and shall pay all costs incident to the furnishing, installing, and maintenance of temporary utility services and facilities required for the duration of the work.

F. CONTROL OF EROSION, SILTATION, AND POLLUTION

1. The Contractor shall fully conform to the Tennessee Department of Environment and Conservation Division of Water Resources, Rule 0400-40-10-.03, “National Pollutant Discharge Elimination System General Permits” and Rule 0400-40-07-.04, “Aquatic Resource Alteration.”

2. For sewers in relation to streams, the Contractor shall employ special design requirements to prevent stream drainage from sinking at the crossing and following along the sewer pipe bedding. The Tennessee Department of Environment and Conservation Division of Water Resources requires an in-trench impounding structure of compacted clay or concrete check dams. Other proposals can be considered.

3. Surface drainage from cuts and fills within the construction limits, whether or not completed, and from borrow and waste disposal areas, shall, if turbidity producing materials are present, be graded

to control erosion within acceptable limits. Temporary erosion and sediment control measures such as berms, dikes, or drains, if required to meet the above standards, shall be provided and maintained until permanent drainage and erosion control facilities are completed and operative. The area of bare soil exposed at any one time by construction operations should be held to a minimum. Fills and waste areas shall be constructed by selective placement to eliminate silts or clays on the surface that will erode and contaminate adjacent streams.

4. The Contractor shall take whatever measures are necessary to minimize soil erosion and siltation, water pollution, and air pollution caused by his operations. The Contractor shall also comply with the applicable regulations of all legally constituted authorities relating to pollution prevention and control. The Contractor shall keep himself fully informed of all such regulations that in any way affect the conduct of the work and shall at all times observe and comply with all such regulations. In the event of conflict between such regulations and the requirements of the specifications, the more restrictive requirements shall apply.

5. The City shall have the authority to limit the area over which clearing and grubbing, excavation, borrow, and embankment operations are performed whenever the Contractor's operations do not make effective use of construction practices and temporary measures that will minimize erosion, or whenever construction operations have not been coordinated to effectively minimize erosion, or whenever permanent erosion control features are not being completed as soon as permitted by construction operations.

6. The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project, including, but not specifically limited to, unpaved secondary roads, haul roads, access roads, disposal sites, borrow and material pits, and production sites. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition

G. DISPOSAL OF MATERIALS

Debris and waste materials, including all combustibles, shall be removed by the Contractor from the construction area unless otherwise approved in writing by the City or their Representative.

H. UTILITY COORDINATION

The Contractor shall make all necessary arrangements with private and public utility companies to avoid any possible damage to or interruption of utility equipment or service. The Contractor shall be responsible for all inquiries concerning locations of utility lines. Repair of any damage to public or private utilities resulting from this work shall be the responsibility of the Contractor.

I. CONSTRUCTION SURVEYING

1. All work shall be constructed in accordance with the lines, grades, and elevations shown on the Plans. The Contractor shall be fully responsible for maintaining alignment and grade.

2. The Contractor shall protect and safeguard all points, stakes, grade marks, monuments, and benchmarks at the site of the work and shall re-establish, at his own expense, any marks that are removed or destroyed due to his construction operations.

J. USE OF CHEMICALS

1. All chemicals used during project construction, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA.

2. Use of all such chemicals and disposal of residues shall be in conformance with instructions provided by the manufacturers of said chemicals.

K. SAFETY AND HEALTH REGULATIONS

1. The Contractor shall comply with all Federal, State, and Local Safety and Health Regulations, including the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (P.L. 91 - 596) and under Section 107 of the Contract Work Hours and Safety Standards Act (P.L. 91-54).

2. The Contractor shall provide continuous, safe access to all properties, both public and private, along the project in all cases where such access will be provided by the completed facility and shall conduct his operations in such a manner that inconvenience to the property owners will be held to a minimum.

3. The Contractor shall comply with Tennessee's drug-free workplace law (Tennessee Code Annotated, Section 50-9-101 through 50-9-112).

L. EQUIPMENT AND MATERIAL STORAGE

The Contractor shall plan his activities so that all materials and equipment can be stored within the project limits. There shall be no disturbance whatsoever of any areas outside the project limits without the prior approval of the City.

M. DISTURBED AREAS

All areas disturbed as a result of the work of the Contractor shall be restored to the original or better condition. Reasonable care shall be taken during construction to avoid damage to the owner's property or that of any adjacent property owner(s).

N. TEMPORARY SANITARY FACILITIES

1. The Contractor shall be solely responsible for furnishing and maintaining temporary sanitary facilities during the construction period. Such facilities shall include, but not be limited to, potable water supply and toilet facilities.

2. Such facilities shall be in compliance with all applicable State and Local laws, codes, and ordinances and shall be placed convenient to workstations and secluded from public observation.

3. Once the project is completed, all temporary sanitary facilities shall be removed by the Contractor.

O. TRAFFIC MAINTENANCE

1. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient warning lights, danger signals, and signs; shall provide a sufficient number of flagmen to direct traffic; and shall take all necessary precautions for the protection of the work and the safety of the public.

2. All barricades and obstructions or hazardous conditions shall be illuminated as necessary to provide for safe traffic conditions.

3. Warning and caution signs shall be posted throughout the length of any portion of the project where traffic flow is restricted.

END OF SECTION

(Recommended Standard Forms follow)

TRANSMITTAL FORM

( ) Shop Drawings
( ) Printed Materials
( ) Other

Transmittal Date: _____
Return Date: _____

REFERENCE: _____
Project
_____
Owner
_____
Address
_____
Location

FOR:
( ) Transmittal Only
( ) Approval
( ) Approved as noted
( ) Revise & Resubmit

FROM: _____
Name
_____
Company
_____
Address
_____
telephone/fax

TO _____
Name
_____
Company
_____
Address
_____
telephone/fax

Log #	Description	Copies	Sheet/Drawing #	Status

Project Ref. No. _____

By: _____
Signature

ATTENTION: CONSTRUCTION ADMINISTRATION

SUBMITTAL AND ROUTING FORM

(TO BE USED WITH EACH INDIVIDUAL PLAN SUBMITTAL OR SHOP DRAWING)

SUBMITTAL AND APPROVAL (Contractor to complete)

Project Name: _____ Project #: _____

Contractor: _____ Submittal #: _____

Contract for: _____ Specification Section: _____

Submittal Title: _____

Sheet/item numbers: _____

_____

_____

Subcontractor: _____ Supplier: _____

Date Transmitted: _____ Date Needed: _____

Change from Contract Documents? Yes ____ No ____ Attached documentation: _____

Complete Submittal? Yes ____ No ____ _____

The Contractor must review and approve this submittal for all requirements and conformance to Contract documents prior to submittal to City of White House. Submittals forwarded without the Contractor's approval will be returned without review or comment.

Reviewed by: _____ Date: _____

SUBMITTAL ROUTING (City of White House to complete)

Date Received: _____ Logged _____ To: _____ Return by: _____

REVIEW CODES: 1 = **Approved**: 2 = **Approved as Noted**: 3 = **Revise & Resubmit**: 4 = **Not Approved**

Reviewed by (in order)	Review Code	**COMMENTS**	Date	Initials

City's approval: _____ Date _____

CITY OF WHITE HOUSE	**EQUIPMENT START-UP FORM NO.**	Proj. # _____ Date: _____

PROJECT DATA

NAME: _____ NUMBER: _____

LOCATION: _____ DATE: _____

OWNER: _____ DRAWING NO.: _____

OTHER: _____ SPEC. SECTION: _____

NAME OF EQUIPMENT CHECKED: _____

NAME OF MANUFACTURER OF EQUIPMENT _____

1. The equipment furnished by us has been checked on the job by us. We have reviewed (where applicable) the performance verification information submitted to us by the Contractor.
2. The equipment is properly installed, except for the items noted below.*
3. The equipment is operating satisfactorily, except for the items noted below.*
4. The written operating and maintenance information (where applicable) has been presented to the Owner, and gone over with him in detail. Three (3) copies of all applicable operating and maintenance information and parts lists have been furnished to him.

CHECKED BY:

Name of Manufacturer's Representative	Name of General Contractor
Address & Phone No. of Representative	Authorized Signature/Title/Date
Signature and Title of Person Making Check	Name of Subcontractor
Date Checked	Authorized Signature/Title/Date

MANUFACTURER'S REPRESENTATIVE Notations: Exceptions noted at the time of check were:

Manufacturer's Representative to note adequacy of related equipment that directly affects operation, performance or function of equipment checked. (No comment presented herein will indicate adequacy of related systems or equipment.)

COPIES TO:

☐ OWNER: _____ ☐ CONTRACTOR: _____

☐ ENGINEER: _____ ☐ FIELD: _____

☐ ARCHITECT: _____ ☐ OTHER: _____

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SECTION 02220 EXCAVATION AND BACKFILL

PART 1: GENERAL

1.01 SCOPE OF WORK

A. GENERAL

1. The work covered by this Section shall consist of furnishing all materials, labor, equipment, and services for the excavation and backfill at all areas within the limits of the project. Work is limited to the areas of construction, and includes, but is not limited to, stockpiling of topsoil, site grading, excavation of footings and trenches, filling, backfilling, compaction, finish grading, spreading of topsoil, disposal of waste material, and proof rolling.

2. Perform all excavation, dewatering, sheeting, bracing, and backfilling in such a manner as to eliminate all possibility of undermining or disturbing the foundations of existing structures.

3. Provide all labor, materials, equipment, and services indicated on the Drawings, or specified herein, or reasonably necessary for or incidental to a complete job.

4. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

5. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

6. Backfilling during freezing weather shall not be done except by permission of the City. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment.

1.02 SYSTEM DESCRIPTION

Excavation consists of the removal and disposal of all materials encountered for footings, foundations, pipework, and other construction as shown on the Drawings. Perform all excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.03 QUALITY ASSURANCE

A. REFERENCED STANDARDS

Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Any requirements of these Specifications shall in no way invalidate the minimum requirements of the referenced standards. Comply with the provisions of the following codes and standards, except as otherwise shown or specified.

1. ASTM C33: "Standard Specifications for Concrete Aggregate";

2. ASTM D698: "Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12" Drop";

3. ASTM D3282: "Standard Recommended Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes";

4. Standard Specifications for Road and Bridge Construction, Tennessee Department of Transportation, March 1, 1995 edition; and

5. Erosion and Sediment Control Planning and Design Manual.

B. UNAUTHORIZED EXCAVATION

Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the Contractor, with concrete placed at the same time and monolithic with the concrete above.

C. EXISTING UTILITIES

1. Locate existing underground utilities in the area of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the City immediately for directions as to procedure. Cooperate with City and utility companies in keeping respective services and facilities in

operation. Repair damaged utilities to the satisfaction of utility companies.

1.04 SITE CONDITIONS

No test borings or related subsurface information is available for the project area. Test borings and other exploratory operations may be undertaken by the Contractor at his own expense provided such operations are acceptable to the City.

PART 2: PRODUCTS

2.01 MATERIALS

A. CLASSIFICATION OF EXCAVATED MATERIALS

All materials excavated for this project, regardless of its nature or composition shall be classified as Unclassified Excavation.

B. CLASSIFICATION OF OTHER MATERIALS

1. Satisfactory Subgrade Soil Materials

Soils shall comply with ASTM D 3282, soil classification Groups A-l, A-2-4, A-2-5, and A-3.

2. Unsatisfactory Subgrade Soil Materials

Soils described in ASTM D 3282, soil classification groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7; also peat and other highly organic soils shall not be used, unless otherwise acceptable to the City.

3. Cohesionless Soil Materials:

Gravels, sand-gravel mixtures, sands, and gravelly-sands are classified as cohesionless soil materials.

4. Cohesive Soil Materials

Clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands are classified as cohesive soil materials.

5. Backfill and Fill Materials

Provide satisfactory soil materials for backfill and fill, free of masonry, rock, or gravel larger than four inches (4”) in any dimension, and free of metal, gypsum, lime, debris, waste, frozen materials, vegetable, and other deleterious matter. Use only excavated material that has been sampled, tested, and certified as satisfactory soil material.

6. Select Backfill

Select backfill is defined as backfill and fill material that is transported to the site from outside the project limits, and which meets the soil requirements specified above under “Backfill and Fill Materials.” Material excavated in conjunction with the construction of this project cannot be considered as “select backfill” for payment purposes.

7. Pipe Bedding

Crushed stone or crushed gravel used in pipe bedding shall meet the requirements of ASTM C 33, Gradation 67.

8. Inundated Sand:

Sand for inundated sand backfill shall be clean with not more than twenty-five percent (25%) retained on a No. 4 sieve and not more than seven percent (7%) passing a No. 200 sieve and shall have an effective size between 0.10 mm and 0.30 mm. Sand shall be deposited in, or placed simultaneously with application of, water so that the sand shall be compacted by a mechanical probe type vibrator. Inundated sand shall be compacted to seventy percent (70%) relative density as determined by ASTM D4253 and D4254.

9. Graded Gravel

Gravel for compacted backfill shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
1”	l00
3/4”	85 - 100
3/8”	50 - 80
No. 4	35 - 60
No. 40	15 - 30
No. 200	05 - 10

The gravel mixture shall contain no clay lumps or organic matters. The fraction passing the No. 4 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5. Gravel backfill shall be deposited in uniform layers not exceeding twelve inches (l2") in uncompacted thickness. The backfill shall be compacted by a suitable vibratory roller or platform vibrator to not less than seventy percent (70%) relative density as determined by ASTM D4253 and D4254.

2.02 EQUIPMENT

A. MECHANICAL EXCAVATION

1. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

2. Mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot (1') above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

PART 3: EXECUTION

3.01 PREPARATION

A. DEWATERING

1. The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface water and groundwater entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

2. All excavations for concrete structures or trenches that extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations twelve inches (12”) or more below the bottom of the excavation.

3. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

4. The Contractor shall be responsible for the condition of any pipe or conduit that he may use for drainage purposes, and all such pipes or conduit that he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

5. Where trench sheeting is left in place, such sheeting shall not be braced against the pipe, but shall be supported in a manner that will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed.

B. STABILIZATION

1. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud and muck; and sufficiently stable to remain firm and intact under the feet of the workmen.

2. Subgrades for concrete structures or trench bottoms, which are otherwise solid but that become mucky on top due to construction operations, shall be reinforced with one (1) or more layers of crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than four inches (4”); if the required depth exceeds four inches (4”), the material shall be furnished and installed as specified for granular fills. Not more than one-half inch (1/2”) depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

C. CUTTING CONCRETE OR ASPHALT SURFACE CONSTRUCTION

1. All pavement cutting and repair shall be done in accordance with Local ordinances. Cutting shall be performed with a concrete saw in a manner that will provide a clean groove the complete thickness of the surface material along each side of the trench and along the perimeter of cuts for structures. Cutting of concrete and asphaltic concrete driveways, sidewalks, and curbs shall be made from expansion joint to expansion joint as needed and shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances.

2. Concrete and asphaltic concrete over trenches excavated for pipelines shall be removed so that a shoulder not less than twelve inches (12”) in width at any point is left between the cut edge of the surface and the top edge of the trench. Trench width at the bottom shall not be greater than at the top, and no undercutting will be permitted. Cuts shall be made to and between straight or accurately marked curved lines that, unless otherwise required, shall be parallel to the center line of the trench.

3. Pavement or other surfaces removed for connections to existing lines or structures shall not be of greater extent than necessary for the installation.

4. Where the trench parallels the length of concrete walks and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and replaced between existing joints or between saw cuts as specified for payment.

D. SITE GRADE

1. <u>General</u>

Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finish the surface within specified tolerances; compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

2. Ground Surface Preparation

Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontals so that fill material will bond with existing surface. Shape the subgrade as indicated on the Drawings by forking, furrowing, or plowing so that the first layer of new material placed thereon will be well bonded to it.

3.02 FIELD MEASUREMENTS

A. ALIGNMENT, GRADE, AND MINIMUM COVER

1. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the Section covering installation of pipe.

2. Where pipe grades or elevations are not definitely fixed by the Contract Drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation except where future surface elevations are indicated on the Drawings.

B. LIMITING TRENCH WIDTHS

Trenches shall be excavated to a width that will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. Maximum trench widths shall be no greater than the pipe outside diameter plus twenty-four inches (24”) (twelve inches (12”) on either side of pipe).

3.03 PROTECTION

A. TEMPORARY PROTECTION

Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. SHEETING AND BRACING

Make all excavations in accordance with the rules and regulations promulgated by the Department of Labor, Occupational Safety and Health Regulations for Construction. Furnish, put in place, and maintain such sheeting, bracing, etc., as may be necessary to support the sides of the excavation and to prevent any movement of earth that could in any way diminish the width of the excavation to less than that necessary for proper construction, or could otherwise injure or delay the work, or endanger adjacent structures, roads, utilities, or other improvements.

C. BLASTING

1. The Contractor shall be responsible for all damage caused by blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

2. All rock that cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials, except as specified or directed.

D. CARE AND RESTORATION OF PROPERTY

1. Any trees, shrubs, decorative plants, etc., within City Right-of Way and/or purchased easements shall be removed and not replaced.
2. Enclose the trunks of trees that are to remain adjacent to the work with substantial wooden boxes of such height as may be necessary to protect them from piled material, equipment, or equipment operation. Use excavating machinery and cranes of suitable type and operate the equipment with care to prevent injury to remaining tree trunks, roots, branches, and limbs.

3. Do not cut branches, limbs, and roots except with permission of the City. Cut smoothly and neatly without splitting or crushing. In case of cutting or unavoidable injury to branches, limbs, and trunks of trees, neatly trim the cut or injured portions and cover with an application of grafting wax and tree healing paint as directed.

4. Protect by suitable means all cultivated hedges, shrubs, and plants that might be injured by the Contractor's operations. Promptly heel in any such trees or shrubbery necessary to be removed and

replanted. Perform heeling in and replanting under the direction of a licensed and experienced nurseryman. Replant in their original position all removed shrubbery and trees after construction operations have been substantially completed and care for until growth is reestablished.

5. Replace cultivated hedges, shrubs, and plants injured to such a degree as to affect their growth or diminish their beauty or usefulness, by items of kind and quality at least equal to the kind and quality existing at the start of the work.

6. Do not operate tractors, bulldozers, or other power-operated equipment on paved surfaces if the treads or wheels of the equipment are so shaped as to cut or otherwise injure the surfaces.

7. Restore all surfaces, including lawns, grassed, and planted areas that have been injured by the Contractor's operations, to a condition at least equal to that in which they were found immediately before the work was begun. Use suitable materials and methods for such restoration. Maintain all restored plantings by cutting, trimming, fertilizing, etc., until acceptance. Restore existing property or structures as promptly as practicable and do not leave until the end of construction period.

E. PROTECTION OF STREAMS

Exercise reasonable precaution to prevent the silting of streams. Provide at Contractor's expense temporary erosion and sediment control measures to prevent the silting of streams and existing drainage facilities. A copy of the Contractor's Aquatic Resource Alteration Permit (ARAP) shall be on site when project work crosses any State waterway.

F. AIR POLLUTION

1. Comply with all pollution control rules, regulations, ordinances, and statutes that apply to any work performed under the Contract, including any air pollution control rules, regulations, ordinances and statutes, or any municipal regulations pertaining to air pollution.

2. During the progress of the work, maintain the area of activity, including sweeping and sprinkling of streets as necessary so as to minimize the creation and dispersion of dust. If the City decides that it is necessary to use calcium chloride or more effective dust

control, furnish and spread the material as directed and without additional compensation.

3.04 TRENCH EXCAVATION

A. LENGTH OF TRENCH

1. No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. . Any trench left overnight shall be barricaded to protect the public. No trench shall be left unattended or open along an active road, street, or highway.

2. Except where tunneling is indicated on the Drawings, in the Specifications, or is permitted by the City, all trench excavation shall be open cut from the surface.

B. TRENCH EXCAVATION

1. General

Perform all excavation of every description and of whatever substance encountered so that the pipe can be laid to the alignment and depth shown on the Drawings.

2. Brace and shore all trenches, where required, in accordance with the rules and regulations promulgated by the Department of Labor, Occupation Safety and Health Administration, “Safety and Health Regulations for Construction.”

3. Make all excavations by open cut unless otherwise indicated in the Specifications or on the Drawings.

4. Width of Trenches

Excavate trenches sufficiently wide to allow proper installation of pipe, fittings, and other materials and not more than twelve inches (12”) clear of pipe on either side at any point. Do not widen trenches by scraping or loosening materials from the sides.

5. Trench Excavation in Earth

Earth excavation includes all excavation of whatever substance encountered. In locations where pipe is to be bedded in earth excavated trenches, fine grade the bottoms of such trenches to allow firm bearing for the bottom of the pipe on undisturbed earth. Where any part of the trench has been excavated below the grade of the pipe, fill the part excavated below such grade with pipe bedding material and compact at the Contractor's expense.

6. Trench Excavation in Fill

If pipe is to be laid in embankments or other recently filled material, first place the fill material to the finish grade or to a height of at least one foot (1') above the top of the pipe, whichever is the lesser. Take particular care to ensure maximum consolidation of material under the pipe location. Excavate the pipe trench as though in undisturbed material.

7. Trench Bottom in Poor Soil

Excavate and remove unstable or unsuitable soil to a width and depth as directed by the City, and refill with a thoroughly compacted gravel bedding.

8. Bell Holes

Provide bell holes at each joint to permit the joint to be made properly and to provide a continuous bearing and support for the pipe.

C. TRENCH BACKFILL

1. General

a. Unless otherwise indicated in the Specifications or on the Drawings, use suitable material for backfill that was removed in the course of making the construction excavations.

b. Do not use frozen material for the backfill, and do not place backfill on frozen material. Remove previously frozen material before new backfill is placed.

c. Start backfilling (and proceed until completion) as soon as practicable after the pipes have been laid and the structures have been built, are structurally adequate to support the

loads (including construction loads to which they will be subjected), and have been inspected and approved by a City Wastewater Inspector.

2. Material

a. The nature of the materials will govern both their acceptability for backfill and the methods best suited for their placement and compaction in the backfill. Both are subject to the approval of the City.

b. Do not place stone or rock fragments larger than four inches (4”) in greatest dimension in the backfill.

c. Do not drop large masses of backfill material into the trench in such a manner as to endanger the pipeline. Use a timber grillage to break the fall of material dropped from a height of more than five feet (5’).

d. Exclude pieces of bituminous pavement from the backfill unless their use is expressly permitted.

3. Zone Around Pipe

a. Place bedding material to the level shown on the Drawings and work material carefully around the pipe to ensure that all voids are filled, particularly in bell holes.

b. For backfill up to a level of two feet (2’) over the top of the pipe, use only selected materials containing no rock, clods, or organic materials.

c. Place the backfill and compact thoroughly under the pipe haunches and up to the midline of the pipe in layers not exceeding six inches (6”) in depth. Place each layer and tamp carefully and uniformly so as to eliminate the possibility of lateral displacement. Place and compact the remainder of the zone around the pipe and to a height of one foot (1’) above the pipe in layers not exceeding six inches (6”), and compact to a maximum density of at least one hundred percent (100%) as determined by ASTM D0698.

4. Tamping

   a. Deposit and spread backfill materials in uniform, parallel layers not exceeding twelve inches (12”) thick before compaction.

   b. Tamp each layer before the next layer is placed to obtain a thoroughly compacted mass.

   c. Furnish and use, if necessary, an adequate number of power-driven tampers, each weighing at least twenty (20) pounds for this purpose.

   d. Take care that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted.

   e. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similarly powered equipment instead of by tamping.

   f. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling, and compacting as furnished by the Contractor.

5. Wet the material by sprinkling, if necessary, to ensure proper compaction by tamping (or rolling). Perform no compaction by tamping (or rolling) when the material is too wet either from rain or applied water to be compacted properly.

6. Trench Compaction

   Compact backfill in pipe trenches to the maximum density as shown on the Drawings, or as listed in Subsection entitled Compaction, with a moisture content within the range of values of maximum density as indicated by the moisture-density relationship curve.

3.05 SITE GRADE

A. PLACEMENT AND COMPACTION

1. Place backfill and fill material in layers not more than eight inches (8”) in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to the required percentage of maximum density for each area classification. Do not place backfill or material on surfaces that are muddy, frozen, or contain frost or ice.

2. In areas not accessible to rollers or compactors, compact the fill with mechanical hand tampers. If the mixture is excessively moistened by rain, aerate the material by means of blade graders, harrows, or other approved equipment, until the moisture content of the mixture is satisfactory. Finish the surface of the layer by blading or rolling with a smooth roller, or a combination thereof, and leave the surface smooth and free from waves and inequalities.

3. Place backfill and fill materials evenly adjacent to structures, to the required elevations. Take care to prevent wedging action of backfill against structures. Carry the material uniformly around all parts of the structure to approximately the same elevation in each lift.

4. When existing ground surface has a density less than that specified under the subsection entitled Compaction for the particular area classification, break up the ground surface, pulverize, moisture-condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

B. GRADING OUTSIDE BUILDING LINES

Grade to drain away from structures to prevent ponding of water. Finish surface free from irregular surface changes.

C. PLANTING AREAS

Finish areas to receive topsoil to within not more than one inch (1”) above or below the required subgrade elevations, compacted as specified, and free from irregular surface changes.

D. WALKS

Shape the surface of areas under walks to line, grade, and cross-section, with the finish surface not more than zero inches (0”) above or one inch (1”) below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.

E. PAVEMENTS

1. Shape the surface of the areas under pavement to line, grade and cross-section, with finish surface not more than one-half inch (1/2”) above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction.

2. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material.

3. Shape to line, grade, and cross-section as shown on the Drawings.

F. PROTECTION OF GRADED AREAS

Protect newly graded areas from traffic and erosion and keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

G. RECONDITIONING COMPACTED AREAS

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather prior to acceptance of work, scarify surface, reshape, and compact to required density prior to further construction.

H. UNAUTHORIZED EXCAVATION

1. Unauthorized excavation consists of the removal of materials beyond indicated elevations without the specific direction of the City. Under footings, foundations, bases, etc., fill unauthorized excavation by extending the indicated bottom elevation of the concrete to the bottom of the excavation, without altering the

required top elevation. Lean concrete fill may be used to bring elevations to proper position only when acceptable to the City.

2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the City.

3.06 BACKFILL AROUND STRUCTURES

A. GENERAL

1. Unless otherwise indicated in the Specifications or on the Drawings, use suitable material for backfill.

2. Do not use frozen material for the backfill, and do not place backfill upon frozen material. Remove previously frozen material before new backfill is placed.

B. MATERIAL

1. Approved selected materials available from the excavations may be used for backfilling around structures.

2. Obtain material needed in addition to that of construction excavations from approved off-site borrow pits. Furnish all borrow material needed on the work.

3. Place and compact all material, whether from the excavation or borrow, to make a dense, stable fill.

4. Use fill material which contains no vegetation, masses of roots, individual roots over eighteen inches (18”) long or more than one-half inch (1/2”) in diameter, stones over four inches (4”) in diameter, or porous matter. Organic matter must not exceed minor quantities.

C. PLACING BACKFILL

1. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage.

2. Make special leakage tests, if required, as soon as practicable after the structures are structurally adequate and other necessary work has been done.

3. Use the best of the excavated materials in backfilling within two feet (2') of the structure.

4. Avoid unequal soil pressures by depositing the material evenly around the structure.

3.07 COMPACTION

A. GENERAL

Control soil compaction during construction, providing at least the minimum percentage of density specified for each area classification.

B. PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

1. After compaction, all fill will be tested in accordance with Method "C" of ASTM D-698, unless specified otherwise.

2. Except as noted otherwise for the zone around pipe, provide not less than the following percentages of maximum density of soil material compacted at optimum moisture content, for the actual density of each layer of soil material-in-place:

UNPAVED AREAS	Compact Full Depth to 92%
DRIVES AND PARKING	Top 9" - 100%
TRENCH BACKFILL (PAVED AREAS)	Compact full depth to 95%
TRENCH BACKFILL (UNPAVED AREAS)	Compact full depth to 95%
ALL OTHER BACKFILL	Compact full depth to 95%

C. MOISTURE CONTROL

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing, until moisture content is reduced

to a satisfactory value, as determined by moisture-density relation tests.

3.08 FIELD QUALITY CONTROL

Compaction tests of all fill areas will be made by an independent testing laboratory. Such tests will be provided and paid for by the Developer, except that tests that reveal non-conformance with the Specifications and all succeeding tests for the same area shall be at the expense of the Contractor until conformance with the Specifications is established. The Developer will be responsible for paying for only the successful tests.

END OF SECTION

SECTION 02601 BORE AND ENCASEMENT

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work under this section consists of furnishing all materials, labor, equipment, and services required for the complete installation of encasement pipe and carrier pipes under highways and railroads by boring and jacking as shown on the Drawings and specified herein.

B. All work in connection with constructing encasement pipes under highways and railroads shall comply with all current requirements of governing highway and railroad agencies. The Contractor shall be familiar with these requirements.

C. The Contractor shall inspect the locations at the proposed crossings and shall familiarize himself with the conditions under which the work will be performed, and with all necessary details and the suitability of his equipment and methods for the work required.

PART 2: PRODUCTS

2.01 MATERIALS

A. Encasement pipe shall be smooth wall welded steel conforming to ASTM Designation A139, Grade B. Minimum pipe diameter and wall thickness for casing installation under roadways shall be as follows:

Pipe - Nominal Diameter Inches	Casing - Nominal Diameter Inches	Wall Thickness - Inches
6	12	0.250
8 -10	16	0.375
12	18	0.375
14	22	0.375
16	24	0.375
18 - 20	30	0.375
24	36	0.375

B. CASING SPACERS

Casing spacers shall meet one (1) of the following requirements and shall be installed no more than seven feet (7') apart:

1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch (.09") thick and 85-90 durometer hardness. Runners shall be attached to stainless steel risers, which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the casing.

2. Casing spacers shall be a two-section, flanged, bolt-on style constructed of heat-fused, PVC-coated steel, minimum 14-gauge band and 10-gauge risers, with two inch (2") wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick and 85-90 durometer hardness.

C. GROUT

Grout and brick shall be used for filling the void between the end of the casing pipe and the carrier pipe. Cement shall conform to ASTM C 150, Type I or Type II. Grout shall have a minimum compressive strength of one hundred (100) psi attained within twenty-four (24) hours. Neoprene wrap-around rubber end seals can be used as an alternative to grout and brick.

PART 3: EXECUTION

3.01 INSTALLATION

A. Encasements shall be installed by boring and jacking unless field conditions require otherwise. It shall be the Contractor's responsibility to notify the City immediately if conditions do not permit a jack and bore installation.

B. Installation of encasement pipe shall include all related work and services such as mobilization of equipment, constructing and maintaining working pits, right-of-way maintenance and restoration, traffic maintenance, mining, check dams, excavations, dewatering, sheeting, shoring and bracing for embankments, and operating pits, and, as elsewhere required, shall be placed and maintained in order that work may proceed safely and expeditiously.

C. Installation of the casing pipe shall be carried out without disturbance of the embankment, pavement, tracks, or other railroad or highway facilities and without obstructing the passage of traffic at any time.

D. The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained by the Contractor from the City.

E. The alignment and grade shall be carefully maintained, and the encasement pipe installed in a straight line.

F. The space outside the encasement and the ground shall be filled with grout, sand or pea gravel, as directed by the City. The City will direct that this space be filled if the space is large enough to cause any earth settling.

END OF SECTION

SECTION 02730 SANITARY SEWER PIPE AND APPURTENANCES

PART 1: GENERAL

1.01 DESCRIPTION

A. Furnish all labor, equipment, materials, and incidentals necessary to install and complete the sanitary sewer and/or force main installation in accordance with the Plans. All pipe and appurtenance material shall be of the type and class specified herein.

B. All sewer pipe and force main excavation, bedding, pipe laying, jointing and coupling of pipe joints, and backfilling shall be completed as described herein.

C. All requirements of the Tennessee Department of Environmental Conservation (TDEC) shall be complied with in addition to the criteria contained within.

1.02 REFERENCE DOCUMENTS

- American Association of State Highway & Transportation Officials (AASHTO)
- American Concrete Institute (ACI)
- American National Standard Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- American Society of Sanitary Engineers (ASSE)
- American Society for Testing and Materials (ASTM)
- American Water Works Association (AWWA)
- Tennessee Department of Transportation (TDOT)
- Portland Cement Association (PCA)
- TDEC Design Criteria for Sewage Works
- Uni-Bell Plastic Pipe Association

As particular Specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, title or to superseding Specifications under a new number except provisions in revised Specification that are clearly inapplicable.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. For City projects, shop drawings and related manufacturer's product certifications shall be made in accordance with the General and Special Conditions of the Contract for approval prior to purchase or fabrication of the material by the manufacturer. The following items require Shop Drawings. This list may not include all items for which shop drawing submittals are required to complete the project:

1. Detail Drawings of all classes of pipe, joints, fittings and couplings.

2. Pipeline laying schedule tabulated and referenced to construction line and grade controls shown on plans, with station, offset, and elevations. References shall be provided for pipe fittings and other important features of the pipeline.

3. All valves, valve boxes, manholes, manhole frames and covers, air relief valves, or any other appurtenances required for completion of the project.

4. Service Connections.

5. Contractor’s cleaning and testing plans for all gravity system piping and manholes.

6. Certification and test reports for the materials, manufacturing, and testing of the types of pipe supplied shall be performed and furnished by the pipe manufacturer in accordance with the latest standards of the industry as described in Section 5.01 herein.

1.04 DESIGN EXCEPTIONS

Submit a request for any design exception prior to installation. Design exceptions are issued by the City of White House Wastewater (COWHWW) Department. Any deviation from the specifications requires a design exception.

PART 2: DESIGN

2.01 FLOW CRITERIA

A. Flow estimates for design shall be calculated based on full or projected ultimate development. The average daily flow (ADF) for single family shall be 100 gallons/capita/day or master-metered residences shall be the per unit demand factors contained in the most current White House City Ordinance. Industrial and commercial design flows for sanitary wastewater shall be in accordance with TDEC Design Criteria for Sewerage Works Appendix 2-A.

B. Wastewater gravity collection systems, pumping stations, and force mains shall be designed for average daily flow times the appropriate peaking factor. Peaking factors shall be applied per TDEC Design Criteria for Sewerage Works Section 2.2.2.1 to ADF. For laterals and submains minimum peak is 400% of the ADF. For mains, trunk lines and Interceptor sewers minimum peak is 250% ADF as defined by TDEC (same section).

2.02 GRAVITY MINIMUM LINE SIZE

A. Gravity Mains: Gravity mains shall be sized to accommodate peak flow (ref. Section 2.01) when flowing 1/2 full. Flow calculations shall apply a Manning's n of 0.013 for PVC pipe and minimum velocity of 2.0 feet/sec (fps). No gravity sewer main shall be less than eight inches in diameter.

B. Services: Minimum diameter shall be six inches for residential and commercial services.

2.03 ALIGNMENT

A. All gravity mains shall be laid with straight alignment between manholes.

B. Wastewater collection systems are to be constructed within City right-of-way.

2.04 DEPTH OF COVER

A. The depth of cover over all mains, within City right-of-way or easement, shall be not less than 48 inches (except for services).

B. The depth of the services at the property line (measured from the crown of pipe) shall be no less than 36 inches and no greater than 48 inches below design grade.

2.05 SLOPE

A. Gravity mains shall be designed with the following minimum grades:

Gravity Main	Minimum Grade
8”	0.40%
10”	0.28%
12”	0.22%
15”	0.15%
18”	0.12%
21”	0.10%
24”	0.08%
30”	0.058%

B. Mains with diameters greater than 12 inches shall be designed to have mean velocities when flowing half full of not less than 2.0 feet per second. For velocity determinations, Manning's Formula "N" value shall be 0.013 for PVC pipe.

2.06 HORIZONTAL SEPARATION

A. Wastewater gravity sewers shall be laid at least 10 feet horizontally from any existing or proposed potable water main.

B. A five (5) foot horizontal separation shall be maintained between a wastewater gravity/force main and all other pipelines. The distance shall be measured face to face. If this distance cannot be met, then the pipe will have to be encased in concrete.

C. All gravity sewer shall have a minimum of one hundred feet (100’-0”) of horizontal separation from wells or other water supplies.

D. In cases where it is not practical to maintain the specified separation a design exception must be granted from COWHWW Department, and, any other affected utility prior to construction.

2.07 VERTICAL SEPARATION (CROSSINGS)

A. Vertical separation between wastewater gravity sewers crossing potable water mains, and other pipelines/utility lines shall be a minimum vertical

distance of 18 inches between the outside of the other utility line(s) and the outside of the gravity sewers.

B. Potable water main crossings below the gravity sewer should be avoided whenever possible. If the potable water main must cross under a gravity sewer, the crossing shall have a vertical clearance of 18 inches (minimum) and be arranged so that the gravity sewer joints will be equidistant and as far as possible from the potable water main joints. Further requirements may be imposed by the potable water district.

C. If the above vertical separation is not possible, a design exception must be granted from COWHWW Department and other affected utility prior to construction. In the event that these separations cannot be met, sanitary sewer and the water main, if applicable, shall be encased in concrete. Encasement shall be extended a minimum of six feet (6') beyond the utility crossing.

2.08 GRAVITY SERVICES

A. Each lateral shall be supplied with a WYE fitting and 22.5° bend (or 11.25° bend with prior approval from COWHWW Department) at the main and laid at a minimum slope of 1/4-inch per foot to one foot past the right-of-way line or one foot past the sidewalk (if present), where a clean out will be installed in accordance with City of White House Standard Drawing STD-WW-11.

B. Services shall be straight from the clean-out to the WYE fitting at the main, Services cannot connect to manhole unless the manhole is terminal.

C. Services that connect into terminal manholes shall be considered a "secondary" line. The manhole shall not be cored. Rather the Manhole shall be formed and poured with the service line connection as a lateral would. The flow line or trough shall be established for flow through the manhole.

D. Services shall connect to the gravity main at a minimum distance of 4 feet apart and a minimum of 4 feet away from manholes.

E. Services in new subdivision shall be marked in the field with white PVC pipe with green paint on the top to denote location until finish grade is established and meter box with cast iron lid labeled "Sewer" is in place.

2.09 WASTEWATER MANHOLES

A. Manholes shall be installed at the end of each line, at all changes in grade, size or alignment, and at all gravity line collection intersections.

B. The distance between manholes shall not be greater than 300 feet unless prior approval is obtained from the COWHWW Department. Cleanouts may be used only for special conditions with COWHWW Department approval prior to installation. Cleanouts shall not be substituted for manholes.

C. Manholes shall be minimum 48 inches inside diameter where incoming lines are 16 inches or less in diameter, or 60 inches minimum inside diameter where incoming lines are larger than 16 inches diameter or depth of manhole exceeds 15 feet. A minimum access diameter of 24 inches shall be provided.

D. The minimum manhole depth is five feet from the top of the manhole cover to the bottom invert.

E. A drop manhole connection shall be provided for any gravity main entering at a vertical distance of 2.0 feet, or more, above the outgoing channel invert. In cases where the vertical distance is less than 2.0 feet, a drop pipe is not required, but a channel shall be constructed to guide the flow into the outgoing channel. The bottom drop section shall be monolithically cast with the bottom manhole section.

PART 3: PRODUCTS

3.01 MATERIALS

A. Alternative materials may be considered by the COWHWW Department if proper testing documentation, performed by recognized industry authorities, is submitted for review to the COWHWW engineer prior to commencement of design. Tests on alternative materials should be at least as rigorous as testing conducted by ASTM, AWWA and ANSI. A letter of variance must be issued by COWHWW Department prior to design approval.

B. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout.

C. All materials shall be subject to the inspection of the COWHWW at the plant, upon delivery on-site, trench or other point of delivery, for the purpose of culling and rejecting materials that do not conform to the requirements of these specifications. Such material shall be marked by the City and the Contractor shall remove it from the project site upon notice of its rejection.

D. The entire product of any plant may be rejected when, in the opinion of the City, the methods of manufacture fail to secure uniform results, or where the materials used produce an inferior final product.

E. As particular Specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding Specifications under a new number except provisions in revised Specifications that are clearly inapplicable.

3.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Gravity PVC pipe shall be as manufactured in accordance with ASTM D-3034, latest edition, and shall be suitable for use as a gravity sanitary sewer pipe. The standard dimension ratio (SDR) shall be SDR 26 for pipes buried at depths of five feet (5') to sixteen feet (16'), C900 for pipes buried at depths of less than five feet (5') and at depths between sixteen feet (16') and twenty-four feet (24'), and ductile iron pipe (DIP) at depths beyond twenty-four feet (24') deep.

B. All PVC pipe joints shall be of an integral bell and spigot of the same material as the pipe. It shall have a solid cross-section with rubber "O"-ring securely locked in place at the point of manufacture.

C. Force Main PVC pipe shall be as manufactured in accordance with ASTM D-2241, latest edition, and shall be suitable for use as a sanitary sewer force main pipe. The standard dimension ratio (SDR) shall be 18 or 21, as shown on the Drawings.

D. Where PVC pipe is installed in iron pipe size (IPS), an IPS gasket shall be furnished with each fitting to insure compatibility.

E. Wastewater Gravity Pipe and Fittings: The following table lists the allowable pipe and fitting material for the various size wastewater gravity mains and services:

Diameter	Material	General Specifications
4" to 15"	PVC	ASTM D3034, DR 26
16” and greater	PVC	C905, DR 26

F. All pipe, fittings and appurtenances shall be supplied in accordance with the approved material list.

G. PVC pipe and fittings, including laterals, shall be made of PVC material having a cell classification of 12454 B, 12454 C or 13354 B as defined in ASTM D1784.

H. Provisions must be made for contraction and expansion at each joint with an elastomeric gasket.

I. The last run of PVC gravity line from the receiving manhole to the pump station shall be of the material appropriate to the depth of the line, as specified in this document, unless otherwise requested by the City.

J. The bell shall consist of an integral wall section with solid cross-section elastomeric gasket ring, factory assembled and securely locked in place to prevent displacement and meeting requirements.

K. Gaskets: All pipe gaskets shall conform to AWWA C111, and be made of Viton, EPDM, or SBR depending upon the service/soil conditions.

L. Standard minimum laying lengths shall be 20.0 feet and 1-inch. Pipe shall be tested in accordance with ASTM D3212.

M. Each length of PVC pipe shall be marked with the following information: size, manufacturer, PVC sewer pipe, ASTM designation, manufacturer's code, and cell classification that will remain legible during normal handling, storage, and installation.

N. Where PVC enters a manhole, a suitable manhole coupling, or flexible manhole connector designed to produce a positive watertight connection shall be installed in the wall section of the manhole. See Section 3.06.N for approved products.

O. The Developer/Contractor shall furnish to the City a one-year warranty on the materials, fabrication, and workmanship of any and all polyvinyl chloride pipe and fittings furnished and installed. Warranty period shall commence upon written acceptance of particular component or appurtenance by City for ownership and operation.

3.03 DUCTILE IRON SEWER PIPE (DIP) AND FITTINGS

A. DIP shall be as manufactured in accordance with ASTM A 746, ANSI Specification A21.50 and A21.51, and shall be Class 350, unless otherwise indicated in the Specifications or on the Drawings.

B. The pipe interior shall be lined with epoxy or Protecto 401.

C. The exterior of all pipe shall be coated with either a coal or asphaltic base bituminous pipe coating in accordance with ANSI Specification A21.8.

D. Pipe shall be furnished with slip joints, mechanical joints, or flanged joints as indicated on the Drawings and in accordance with the Specifications described below:

1. Slip Joints

a. This pipe joint shall be done by guiding the plain end of the pipe into the bell end until contact is made with a gasket and by exerting a sufficient compressive force to drive the plain end through the gasket until the plain end makes full contact with the base of the bell.

b. Bells of slip-joint pipe shall be contoured to receive a circular rubber gasket, and plain ends shall have a slight taper to facilitate installation.

c. The circular gasket shall be furnished by the pipe Manufacturer and shall be manufactured in accordance with ANSI Specification A21.11.

d. The pipe Manufacturer shall also furnish the lubricant used to assist in the pipe installation.

2. Mechanical Joints

a. This pipe joint is essentially the same as the slip joint except that it is furnished with a cast iron clamp that acts as a retainer to hold circular rubber gasket in place.

b. All mechanical joints shall be furnished by the pipe manufacturer and manufactured in accordance with ANSI Specification A21.11.

c. All bolts shall be tightened by means of torque wrenches in such a manner that the following shall be brought up toward the pipe evenly. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

3. Flanged Joints

a. The flanged pipe joint is composed of a flat steel plate shop-fitted on the threaded end of the ductile iron pipe. The flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true.

b. Flanged joints shall be furnished with one hundred twenty-five-pound (125 lb.) flanges drilled in accordance with ANSI Specification B16.1.

c. In general, flanged joints shall be made up with through bolts of the required size. Stud or tap bolts shall be used only where shown or required.

d. Gaskets for flanged joints shall be the ring type of cloth inserted rubber or rubber with a minimum thickness of one-eighth of an inch (1/8”).

e. Connecting flanges shall be in proper alignment, and no external force shall be used to bring them together. Bolts and gaskets for joints connecting the piping with equipment and for joints between pipe and fittings shall be provided by Contractor, whether or not Contractor supplies such equipment and piping.

4. Restrained Joints

a. Restrained joints four inches (4”) and larger shall be EBAA Iron Mega lug, without exception.

b. Whenever the sanitary sewer force main has a significant change in alignment or grade, it will be necessary to furnish and install a fitting made of cast/ductile iron that meets the Specifications below:

1. All cast iron and ductile iron fittings shall be mechanical joints manufactured in accordance with ANSI Specification A-21.1 and AWWA Standard C-153 for underground piping.

2. Where flanged pipe is used, ductile iron fittings shall be manufactured in accordance with AWWA C110 for exposed piping. All flanges shall be Class 125, unless otherwise noted.

3. The interior of the fittings shall be lined with epoxy or Protecto 401.

3.04 VALVES

A. All valves shall be designed for a working pressure of two hundred (200) psi unless otherwise specified and shall have a clear waterway equal to the full nominal diameter of the pipe and shall be opened by turning counterclockwise (left).

B. Each valve shall have the initials of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure.

C. Valves shall be operated by handwheel or operating nut as herein specified and shall have an arrow cast in the metal indicating the direction of opening.

D. Valves to be installed underground shall be non-rising stem type while valves installed above ground or in buildings and structures shall have rising stems.

E. Resilient Seated Gate Valve

1. Gate valves three-inch (3”) through twenty-four-inch (24”) diameter shall be of the ductile iron body, resilient seated wedge type meeting the requirements set forth in AWWA C-509 and AWWA C-500.

2. All valves shall be from one (1) Manufacturer and parts shall be interchangeable.

3. Gate valves shall have body, bonnet, and gate manufactured of ductile iron conforming to ASTM A-536.

4. The shell thickness of all components shall conform to the thicknesses in Table 2, Section 4.4, of AWWA C-509 and C-500.

5. The valve body and bonnet shall be coated on both the interior and exterior surfaces with a fusion-bonded epoxy paint conforming to AWWA C-550.

6. The gate shall be fully covered with a rubber cover over all exterior and interior ferrous surfaces. The rubber shall be securely bonded to the gate body, including the part that houses the stem nut. The gate and rubber coat shall conform to ASTM D429.

7. Valve stems shall be cast bronze.

8. The stuffing box shall use an “O”-ring seal with two (2) rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.

9. Valves larger than twelve-inch (12”) diameter shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve.

10. All gate valves sixteen inches (16”) or larger shall have a three-inch (3”) bypass with valve.

11. Gate valves shall be manufactured by Mueller, M&H Valve, or approved equal.

F. Bronze Plug Valves

1. Valves two inches (2”) and smaller shall be bronze plug valves built to Manufacturer's standards with material and construction conforming to AWWA C-500.

2. Each valve shall have a two-inch (2”) operating nut. Valves shall have screwed ends conforming to National Pipe Thread (NPT) standards.

G. Sewage Air Relief Valves

1. The air/vacuum release valve shall be designed specifically for use on sanitary sewer pressure (force) mains. It shall exhaust large volumes of air that may be present in a system during filling of the main or on pump start-up. It shall also allow air to re-enter when

the system is drained intentionally or due to a break in the main (prevents vacuum from forming).

2. The valve shall feature stainless steel trim as standard manufacture with stainless steel floats and Buna-N seating.

3. Sewage air release valves shall be as manufactured by ARI or as approved by City.

3.05 FLEXIBLE COUPLINGS

A. Whenever it becomes necessary to join gravity service connections of dissimilar materials or pipe sizes, Contractor shall be required to use a flexible coupling.

B. The coupling shall be made of virgin PVC and shall not harden and shall be impervious to all known soil conditions.

C. The coupling shall provide a permanent, leakproof seal approved by the International Building Code and manufactured in accordance with ASTM #C-425-04.

D. The couplings shall be as manufactured by Fernco Joint Sealer Company or an approved equal.

3.06 MANHOLES

A. Manholes shall consist of a base with a monolithically cast bottom barrel section, vertical pipe barrel sections, concentric top section, adjustment section or grade ring(s), and a frame and cover. **Eccentric manholes are not allowed.**

B. Manhole base, steps and ladders, barrel sections, and concentric top section shall conform to the design requirements of ASTM C-478 & TDOT D-MH-4, except as modified herein. Steps shall be 12” spacing.

C. Tapered section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections.

D. Flat slab tops shall be required for very shallow manholes and where shown or specified. Cast iron manhole covers and assemblies shall be cast into slab tops for access into manholes.

E. Minimum compressive strength of concrete shall be four thousand (4,000) psi, and the maximum permissible absorption shall be six and one-half percent (6.5%).

F. Cement shall meet the requirements of ASTM C-150, Specification for Portland cement, Type II. All precast manhole sections shall have admixture XYPEX C-1000 Red or approved equal incorporated into the concrete mix to provide waterproofing and corrosion protection.

G. The interior of the adjustment section (i.e. grade rings) shall be concrete **or approved equal (i.e. HDPE plastic as defined in ASTM D-4976).** Grade rings shall meet the requirements of ASTM C-150, Specification for Portland cement, Type II and shall have admixture XYPEX C-1000 Red or approved equal incorporated into the concrete mix to provide waterproofing and corrosion protection.

H. The manhole adjustment section (grade rings) shall be a minimum of three inches and shall not exceed 18 inches in height. The adjustment section for new construction shall not exceed 12 inches in height.

I. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches for larger sizes.

J. Precast manhole sections shall fit together readily and shall be joined with a self-contained layer of butyl mastic conforming to ASTM C-443.

K. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C-478.

L. Vertical barrel sections shall be custom-made with openings to meet indicated pipe alignment conditions and invert elevations.

M. Joint contact surfaces shall be formed with mechanical castings; they shall be parallel with two degrees slope, single offset, and nominal 1/16-inch clearance. Gaskets shall conform to ASTM C-443, "Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gasket."

1. Joint contact surfaces shall be sealed using a rubber gasket per the manufacturer’s recommendations. Butyl and mastic sealants are not acceptable.

2. An alternate joint contact seal may be used when the joint surface is manufactured with the tongue equipped with a proper recess (confined groove) for the installation of an "O"-ring, conforming to ASTM C443.

N. Connector components for connections into manholes shall be flexible connectors meeting the requirements of ASTM C923. COWHWW approved flexible manhole connectors shall be Fernco, Kor-N-Seal, A-Lok or approved equal. For new manholes the connectors shall be integrally cast into the manhole.

O. Minimum wall thickness shall be five (5) inches.

P. Flow channel(s) in the manhole base shall be formed of 4,000 psi concrete, Type II Portland cement.

1. The first upstream manhole in each line shall have the flow channel extended full width of the manhole to accommodate a CCTV camera.

2. Cut off pipes at inside face of the manhole within two inches of the manhole sidewall and construct flow channel(s) to invert of the pipe entering the manholes.

3. Changes in direction of the gravity main and entering branch(s) shall be laid out in smooth curves of the longest possible radius which is tangent to the centerlines of adjoining pipelines.

Q. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the City and their inspector.

R. <u>Frames and Covers</u>

1. Manhole frames and covers, for structures and for manholes, shall be heavy-duty cast-iron frames and covers designed for traffic loads. Manhole frame and cover shall be designed to withstand an HS20-44 loading defined in the AASHTO Specifications. The minimum inside access diameter shall be 24 inches.

2. Frames and covers shall be machined or ground at touching surfaces so as to seat firmly and prevent rocking and/or rattling. Any set not matching perfectly shall be removed and replaced.

3. The cover and frame castings shall meet the requirements of ASTM A48, Specifications for Gray Iron Castings, Class No. 35, or Grade 65-45-12 ductile iron meeting the requirements of ASTM A536. Castings shall be free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, well-cleaned, and coated with asphalt paint. This paint will result in a smooth coating, tough and tenacious when cold, not tacky and not brittle.

   a. The standard manhole casting shall be designed for heavy duty use with a one hundred ninety-pound (190 lb.) frame and one hundred twenty-five-pound (125 lb.) cover.

   b. Acceptable products include U.S. Bouchard 1155, Vulcan, or approved equal.

   c. Rain Guard or Rain Sentry waterproofing devices shall be installed only at those manholes indicated by the City.

   d. The frame and cover shall be properly set in a bed of mortar and aligned to fit the top section of the manhole.

   e. **"CITY OF WHITE HOUSE TN / SANITARY SEWER"** shall be embossed in the cover.

   f. Adjusting rings for adjusting existing manhole covers to new grade shall be heavy-duty cast-iron manhole adjusting rings for two-inch or greater adjustment, and for one-inch adjustment shall be steel adjusting rings. Rings shall be coated with an acid resistant coating.

S. Manhole Inverts and Benches

1. Manhole inverts and benches shall be constructed in accordance with the Standard Details shown on the Drawings.

2. Invert shall be a “U”-shaped channel with a height of 0.8 of the diameter and be a smooth continuation of the pipe.

3. The benches shall be constructed with a slope of one inch (1”) per foot to the channel.

4. The channel and invert shall be constructed with a minimum of two thousand (2,000) psi concrete.

5. Where sewer changes directions at the manhole, channel shall be constructed with a smooth curve and as large a radius as the diameter of the manhole will allow.

T. Manhole Drops

1. Standard drop manholes will be constructed only at those locations shown on the Drawings or as approved by the City.

2. The design of the drop connection shall be in accordance with the Standard Detail Drawing, STD-WW-04.

3. The cost of the extra pipe, labor, etc., required to construct a drop manhole will be included in the unit price for the drop manhole at the depths listed.

4. Precast drop assemblies shall be utilized at all locations where drop manholes are required, unless the slope of the inlet pipe is steeper than recommended by the drop assembly Manufacturer.

U. Manhole Vents

1. Where designated on the Drawings, a four-inch (4”) diameter vent pipe shall be installed as an integral part of the manhole.

2. The vent pipe is to be tapped into the uppermost section of the manhole, anchored in concrete and extended vertically to the elevation shown on the Drawings.

3. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.

4. The pipe material shall be ductile iron coated with epoxy or Protecto 401.

V. Manhole Coatings

Protective coating(s) shall be applied to all interior surfaces of manholes and lift station wet wells when specified by the City of White House. The coating shall be Sprayroq as applied by Moore Construction, Inc., Raven 405 Lining System, or approved equal.

PART 4: EXECUTION

4.01 GENERAL INFORMATION

A. Any field changes to signed approved plans will require COWHWW Department approval prior to installation.

B. The provisions set forth herein shall be applicable to all underground wastewater piping installations.

C. All connections to pipe, fittings, or apparatus shall be made plumb, so to ensure no negative pressure is placed, or potentially placed, against the joint, or connection, thereby causing a malfunction or failure of the mechanical joint, or connection.

D. It shall be the Contractor's and Developer's responsibility to verify all existing conditions and to locate all structures and utilities along the proposed utility alignment in order to avoid conflicts. Where conflicts exist, work shall be coordinated with the COWHWW and affected facility owner and performed so as to cause minimum interference with the service rendered by the facility disturbed.

E. Facilities or structures damaged shall be repaired and/or replaced immediately at the Contractor's and/or developer's expense according to the direction of the owner of such facility.

F. For Bore and Encasement specifications see the City of White House Standard Sewer Specifications and Details for Sanitary Sewer System, Section 02601.

G. No pipe shall be laid when the trench conditions or the weather is unsuitable for such work. Trenches must be dry enough for side and bottom of excavations to be stable. COWHWW reserves the right to determine when trench conditions have become unsuitable.

H. PVC pipe may be damaged by prolonged exposure to direct sunlight. The Contractor shall take necessary precautions during storage and installation to avoid prolonged exposure to sunlight. Pipe shall be stored under cover and sufficient backfill shall be placed to shield it from the sun as the pipe is installed. **Pipe cannot be used if the manufacture date that is stamped on the pipe is more than one (1) year prior to installation date.**

I. Excavation, trenching and backfilling shall be in accordance with the requirements of the applicable portions of these specifications. Pipe

installation shall conform to Uni-Bell Plastic Pipe Association Standard Uni-B-5 and ASTM 2321.

4.02 WORK AT TDOT HIGHWAY

Construction work to be performed at any City/TDOT highway shall not commence until all right-of-way permits for the pipeline occupancy have been obtained.

4.03 PRECONSTRUCTION SEWER APURTENANCES INSPECTION/ CERTIFICATION

A. The Contractor shall obtain from the pipe manufacturer a certificate of inspection to the effect that the pipe and fittings supplied for the project have been inspected at the plant and that they meet the requirements of these specifications.

1. For City Contracted projects, the Contractor shall submit these certificates to the COWHWW Engineer prior to installation of the pipe materials.

2. For developer projects, the Contractor shall submit these certificates to the COWHWW Inspector prior to the installation of the pipe materials.

4.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall unload pipe and appurtenances so as to avoid deformation or other injury thereto.

B. Pipe shall not be placed within pipe of a larger size and shall not be rolled or dragged over gravel or rock during handling.

a. The Contractor shall store the pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated.

b. When any material is damaged during transporting, unloading, handling, or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the City will reject the material as being unfit for installation.

c. In any pipe showing a distinct crack and in which it is believed there is no incipient fracture beyond the limits of the

visible crack, the cracked portion, if so approved by COWHWW, may be cut off before the pipe is laid. The cut shall be made in the sound barrel at a point of at least 12 inches from the visible limits of the crack. All cutting shall be done with a machine adapted to the purpose. All cut ends shall be examined for possible cracks caused by cutting.

d. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating.

e. Any fitting showing a crack, and any fitting or pipe which has received a severe blow that may have caused an incipient fracture (even though no such fracture can be seen) shall be marked as rejected and removed at once from the work.

4.05 TRENCH EXCAVATION

The work covered by this Section consists of the excavation and satisfactory disposal of all materials excavated in the construction of trenches.

A. Trenches will be defined as all excavation for the installation of storm sewers, sanitary sewers, water pipe, manholes, catch basins, hydrants, water gates, sewer services, water taps, drainage structures, drainage ditches, and other unclassified excavation as may be deemed necessary by the City.

B. All excavations shall be open cut, wide enough to allow approximately **eight (8) inches** of clearance on each side of the pipe and comply with OSHA and TOSHA Standards or other regulations having jurisdiction at the project site.

C. The excavation shall be done to the lines, grades, typical sections, and details shown on the Plans or established by the City.

D. All work covered by this Section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be maintained in a satisfactory condition so that adequate drainage is provided at all times. Any roots that protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipelines shall be completed before the pipe is installed unless otherwise permitted by the City.

E. The trench floor shall provide a uniform bearing for each full length of pipe section. Excavate bell holes after trench has been graded. **Pipe bedding material shall be 67 stone with a minimum depth of 6" when laying pipe in stable clay-based soils, and a minimum depth of 12" when laying pipe is unstable, loose soils.** The excavation shall be of sufficient width to allow a clearance of not less than six inches (6") between the side of the trench and the outside of the pipe, or in case of pipe with a bell, the outside of the bell of the pipe. This rule will apply at all times, and consequently, proper allowance must be made for additional space required for sheeting the trench where necessary. Maximum trench width, unless as otherwise authorized by the City, as measured at a depth of two feet (2'-0") above the top of the pipe shall be thirty inches (30") total or ten-inch (10") clearance from the outside of the pipe, whichever is greater.

F. In the event unsuitable or unstable soil is encountered, remove it to a depth of six (6") inches (minimum) below the bottom elevation of the pipe (12 inches if rock or boulders are encountered) and replace with material meeting AASHTO Soil Classification A-1, A-2, or A-3, as approved by the COWHWW Inspector or Engineer. Reference TDOT Standard Specifications for Road and Bridge Construction Section 203.04.D.

G. Dewatering: Remove all water from excavations and maintain the excavations free of water while construction therein is in progress. Provide dewatering equipment as necessary to conform to this requirement. Dewatering procedure must meet all regulatory requirements.

H. Protection of Trees: Trenching shall not take place within the root zone of trees with a trunk diameter six inches or larger. The root zone shall be defined as the greater of one) the drip line of the tree or two) a circular zone extending outward from the base of the tree a distance equivalent to 1/2-foot for every inch of trunk diameter as measured 4-1/2 feet above natural grade.

I. <u>Sheeting, Bracing Trenches, and Trench Boxes</u>

1. If necessary, the Contractor will be required to keep the sides of the excavation vertical by sheeting and/or bracing or the use of a trench box to prevent movement by slides or settling of the sides of the trench, in such manner as to prevent injury or displacement of the pipe or appurtenances or diminish the working space required at the sides of the pipe. Also, the Contractor may be required for the purpose of preventing injury to persons or property or adjacent structures in place or to be constructed, to leave sheeting and bracing in place. Sheeting and bracing shall be provided in

accordance with all applicable Federal, State, and Local safety and health regulations.

2. No sheeting or bracing shall extend closer than two feet (2'-0") off the ground surface or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. It is understood that the City will be under no obligation to pay for sheeting or bracing left in place by the Contractor. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom

J. Excavated materials to be used for backfilling will be approved by the City, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance. Materials that are excess to the needs of the project will be disposed of according to the Section on "Waste Material Disposal."

K. Pipe Foundations

1. The preparation of the pipe bedding shall be in accordance with the typical trench cross-sections shown on the Plans for the type of pipe being installed.

2. If SDR 35 PVC sewer pipe is used, Contractor shall install six inches (6") of TDOT No. 67 crushed stone below the pipe, hand haunch No. 67 stone around the pipe, and install six inches (6") of No. 67 stone above the pipe, in accordance with the Standard Details.

3. The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the Plans. Any deviation or field adjustment will require the approval of the City. When a representative of the City is present on the site and is so requested by the Contractor, he may check the position of grades and lines, but the Contractor shall be responsible for the finished work conforming to exact and proper line and grade.

4. Whenever the nature of the ground will permit, the excavations at the bottom of the trench shall have the shape and dimensions of

the outside lower third of the circumference of the pipe, and care shall be taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade.

5. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and earth of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe.

6. Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, the City will require the pipe to be laid on a flowable fill or concrete cradle foundation. Such foundations, whether washed stone or a poured concrete cradle, shall be placed by the Contractor.

7. The Contractor shall remove all water that may be encountered or that may accumulate in the trenches by pumping or bailing, and no pipes shall be laid until the water has been removed from the trench. Water so removed from the trench must be disposed of in such a manner as not to cause injury to work completed or in progress.

4.06 CUTTING PIPE

A. When cutting short lengths of pipe, a pipe cutter, as approved by the City, will be used, and care shall be taken to make the cut perpendicular to the longitudinal axis of the pipe or on the exact skew as shown on the Plans. Rough ends or spurs will be satisfactorily removed prior to installation and seating. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder or coarse file to match the manufactured taper.

4.07 PIPE LAYING

A. Pipe shall be constructed of the materials specified and as shown on the drawings. The Contractor shall do all layout work for lines and grades from that information shown on the Drawings.

B. Installation of PVC pipe and fittings shall be in accordance with the installation requirements established by the manufacturer and ASTM D2321.

C. Proper tools, implements, and facilities satisfactory to the City shall be provided and used for the safe and convenient execution of pipe laying. All pipe and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean, sound, and free from defects. It shall be laid on the prepared foundation, as specified elsewhere, to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line. Pipe shall be removed at any time if broken, injured, or displaced in the process of pipe laying or of backfilling the trench.

D. During times when pipe laying is not in progress, the open ends of pipe shall be closed, and no trench water or other material shall be permitted to enter the pipe.

E. When a laser beam instrument is used to set line and grade, the unit must be maintained in good working order, and the calibration checked daily for both alignment and percent grade twice a day at temperatures above 90º F. In the event the required accuracy of alignment and grade is not adhered to, the City will prohibit the use of laser beams.

F. Pipe shall be laid with bell ends facing in the upstream direction, in the direction of pipe laying (opposite the direction of flow), unless directed otherwise by the COWHWW Inspector. In all cases, pipe is to be installed in strict accordance with the Manufacturer's recommendations and the contract material specifications. The City may augment any Manufacturer's installation recommendations if it will best serve the interest of the City.

G. Cradle: Upon satisfactory excavation of the pipe trench and completion of the pipe bedding, a trough recess for the pipe bells and joints (or couplings) shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

H. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be

kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

I. Gradient

1. Lines shall be laid straight, and depth of cover shall be maintained uniform with respect to finish grade, whether final grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Construction Drawings, means shall be used by the Contractor to assure conformance to required grade.

2. Any pipe which has its grade or joint disturbed after lying shall be taken up and re-laid.

3. Where the pipe is laid on a grade of ten percent (10%) or greater, the laying shall start at the bottom of the slope and proceed upward with the bell end of the new pipe upgrade. All pipe laid on a grade of twenty percent (20%) or greater shall require thrust blocking or keying as shown on the Drawings and Standard Details.

J. Pipe/Joint Deflection: Whenever it is desirable to deflect PVC pipe/joints, the amount of deflection shall not exceed 5%.

K. Any section of pipe already laid which is found to be defective or damaged shall be replaced with new pipe prior to acceptance by the COWHWW Department or placed into use.

L. The joints of all pipelines shall be assembled in straight alignment and made tight. The particular joint used shall comply with the requirements of Section 3.2. For City contracted projects, the particular joint used shall be reviewed and approved by the COWHWW Inspector or Engineer prior to installation.

M. Bell and Gasket: Bell and Gasket joints shall be made in strict compliance with the manufacturer's recommendations.

1. Lubricant shall be an inert, non-toxic, water soluble compound.

2. Insert the spigot end into the bell so that it is in uniform contact with the gasket. Push the spigot until the reference mark on the spigot

end is flush with the end of the bell. If the reference mark is not visible after assembly, the joint is to be cut out.

N. Joint Compounds: Sulfur based joint compounds shall not be used.

4.08 INSTALLING MANHOLES

A. The base section shall be set in the leveling course of crushed stone sub-base compacted to not less than 98% of maximum dry density as determined by the Modified Proctor Test ASTM D1557. Base Foundation to be constructed level with a minimum of 12" #67 stone. See Part 4.11 for backfill and compaction requirements.

B. The manhole sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the heavy concrete pieces. The manhole shall be set plumb.

C. Connections

1. Pipe openings shall be exactly aligned to that of the pipe entering and leaving the manhole. The gravity sanitary sewer pipelines shall be placed in the manhole openings, properly aligned, and set to grade. Sanitary sewer shall be connected to the manholes using lock joint flexible manhole sleeves or equal.

2. For large-diameter pipe where a flexible rubber sleeve is not available, the pipeline shall be sealed into the manhole using an expanding or non-shrink type grout.

D. Manhole Riser Sections

1. Sewer manhole risers shall be watertight.

2. Assemble cone section of manhole as detailed on the Construction Drawings. Make watertight connection between the cone section and the riser sections.

3. Concrete riser adjusting rings shall be a minimum of three inches (3") to a maximum of twelve inches (12") in height. Riser adjusting rings of one-inch (1") or two-inch (2") height shall be made of foam-filled plastic.

E. Manhole Frames and Covers

1. Install a cast iron frame and cover for each manhole and adjust the frame and cover to proper grade. All castings shall be set flush in paved areas and flush with finished grade in unpaved areas unless shown otherwise on plans. Frame and cover shall be neatly grouted with non-shrink grout.

2. Frames on manhole cones shall be set concentric with the precast cone in mastic. A full bed of mortar shall be placed so that the space between the top of the manhole masonry and the bottom flanges of the frame shall be completely filled and made watertight.

3. Manhole frame and cover shall be properly set in a bed of concrete and riser rings and ram neck aligned to fit to adjust the top of the frame and cover to finished grade.

4. For off-site manholes a ring of mortar at least one-inch thick and pitched to shed water away from the frame shall be placed around the outside of the bottom flange. Mortar shall extend up to the outer edge of the masonry and shall be finished smooth and flush with the top of the flange.

5. For roadway manholes, the mortar shall cover the entire frame casting base and pitch down to the top of the corbel or manhole ring.

4.09 INSTALLING OTHER APPURTENANCES

A. Fittings (Force Main)

1. Thrust Blocks

a. All plugs, caps, tees, bends, and other fittings shall be provided with adequate thrust blocks.

b. Force mains 8-inch in diameter or larger required bell restraints one full length of pipe on both sides of a mechanical bend.

c. All mechanical joint fittings require 401 Protecto or approved equal and Mega-lug restraints.

d. Thrust blocks shall be constructed to the minimum dimensions shown on the Drawings or as directed.

e. Thrust blocks shall be made of concrete and shall bear directly against the undisturbed trench wall. Concrete for thrust blocks shall consist of a mix of Portland Cement, fine and coarse aggregate, and water to produce concrete with a minimum compressive strength at twenty-eight (28) days of not less than three thousand (3,000) psi when tested in accordance with ASTM Specifications C 39 or C 42. Sakrete or any similar material will not be permitted under any circumstances.

f. Where possible, the backing shall be so placed that the fitting joints will be accessible for repair.

g. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a polyethylene film placed between the fittings and the poured concrete.

h. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three (3) days after installation of the concrete thrust blocks, unless otherwise approved by the City.

i. Where trench conditions are, in the opinion of the City, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.

B. Gate Valve and Valve Box (Force Main)

1. When shown on the Drawings, a standard gate valve shall be installed in the sanitary sewer force main. Before setting each valve, the Contractor shall make sure the interior is clean and shall test the valve for proper opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the Drawings, and at the exact location(s) shown on the Drawings.

2. A standard type valve box shall be installed over each underground sanitary sewer force main valve. All valve boxes shall be set plumb with their top set flush with the finished grade.

3. Trench backfill shall be properly tamped for a distance of three feet (3'-0") on each side of the valve and valve box.

C. Sewage Combination Air Relief Valve (Force Main)

1. If necessary, a sanitary sewage combination air relief valve shall be installed at the locations shown on the Drawings and relocated to the actual high points in the line.

2. A combination air relief valve installation, as shown in detail in the Drawings, shall consist of the force main tap, air relief valve, and two-inch (2") meter box with cast iron lid (painted green with epoxy paint, as specified below).

D. Exposed Pipe

1. Exposed pipe to be installed inside tank wet wells, vaults, and buildings shall be installed as shown on the Drawings and field painted as described below. All exposed DIP shall utilize flanged joints unless otherwise noted.

2. All exposed cast or ductile iron pipe, fittings, and valves shall be field painted with two (2) coats of epoxy paint as recommended by the paint Manufacturer. Color of paint shall be selected by the City.

4.10 GRAVITY SERVICES

A. Open ends of laterals shall be securely sealed with appropriate stoppers as recommended by the pipe manufacturer.

B. The cleanout(s) shall be extended 30–40 inches above design grade and shall be attached to a green painted wood two-inch by four-inch stake, to avoid damage by equipment during construction. On both single and double service cleanouts the final grade shall be marked on each cleanout two (2) inches from the top of the cleanout. After connection to the building, the lateral cleanout shall be cut down to design grade and a cast iron valve box cover installed as shown Standard Drawing STD-WW-11.

4.11 BACKFILL/COMPACTION

A. Backfilling and compaction shall be conducted in a manner as to preclude subsequent settlement and provide adequate support for the surface treatment, pavement, pipelines, or structures to be placed thereon. See

COWHWW Standard Sewer Detail STD-WW-02 for manhole requirements. All trenches shall be prepared per the requirements of Part 4.05.

B. Backfill trenches immediately after approval of the pipeline construction.

C. Backfill and bedding material shall be common fill material free from organic matter, muck or marl, and rock exceeding 2-1/2 inches in diameter, and shall not contain broken concrete, masonry, rubble or other similar materials. When unstable or unsuitable material is encountered replace with AASHTO soil classification A-1, A-2, or A-3.

D. Method of Compaction: The Contractor shall adopt compaction methods which will produce the degree of compaction specified herein without damage to the new or existing facilities. The degree of compaction specified in Section 4.11.E.3 shall be considered the minimum allowable.

E. Backfilling Procedures: The backfilling procedures outlined in the following shall be for gravity mains and related structures.

1. Pipe

a. In the second stage, the Contractor shall obtain a well-compacted bed and fill along the sides of the pipe **and to a point of at least two feet above the top of the pipe.** The width of backfill and compaction to be done under this second stage shall be the width of the portion of the trench having vertical sides; or, when no portion of the trench has vertical sides, it shall be to a width at least equal to three times the outside diameter of the pipe. The bedding and fill material for this stage is to be #57 or #67 stone only. **Material to be placed in six (6”) inch layers (loose thickness).**

b. In the third stage, the remainder of the trench shall be backfilled with suitable material in layers not to exceed twelve (12”) inch loose thickness and compacted. If under existing road, **the last twelve (12”) inches to meet existing top of pavement shall be filled with crusher run (pug mix)** until such time the asphalt can be replaced.

c. Areas of backfill two feet (2’-0”) over top of pipe to top of trench shall be backfilled with a material containing no rocks larger than six inches (6”) in the greatest dimension and shall be free of material with an exceptionally high void content.

d. The initial backfill shall meet the same requirements except that no rocks over four inches (4”) in diameter will be allowed.

e. If SDR 35 PVC sewer pipe is used, Contractor shall install six inches (6”) of TDOT No. 67 crushed stone below the pipe, hand haunch No. 67 stone around the pipe, and install six inches (6”) of No. 67 stone above the pipe, in accordance with the Standard Details.

F. If material excavated from the trench is unsuitable to be used as backfill, select backfill shall be transported to the site by the Contractor from outside the project limits to be used as backfill material. Material excavated in conjunction with the construction of the project is not considered select backfill for payment purposes. The City shall approve the borrow source and all select backfill material. Select backfill shall be high quality clay soil and shall be free of foreign debris such as roots and rock. Stone shall not be acceptable in place of select backfill.

G. Roadways and Road Crossings

1. Use #67 stone backfill placed in uniform layers not exceeding six inches (6”) in thickness for full trench depth and width, thoroughly compacted with mechanical tampers to ninety-five percent (95%) compaction; one hundred percent (100%) for the top two feet (2’-0”) of subgrade beneath pavements. Replace removed paving and base course with new material of equal or better quality and of the same texture and color as the adjacent roadway.

H. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to ninety-five percent (95%) of the Standard Proctor Test for the various types of backfill material; one hundred percent (100%) for the top two feet (2’-0”) of subgrade beneath pavements. Methods of backfilling shall be in strict accordance with the pipe Manufacturer's recommendations. All backfill material shall have been approved by the City.

I. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints.

J. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.

K. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the Plans and Specifications. Pipe that becomes misaligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced by the Contractor at no cost to the City.

L. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material at no cost to the City.

M. The Contractor shall maintain all pipes installed in a condition that they could function continuously from the time the pipe is installed until the project is accepted.

N. Manholes

1. The Contractor shall provide well-compacted sub-base under the manhole per Part 4.08.A and COWHWW Standard Sewer Detail STD-WW-02.

2. From the bedding up to grade the Contractor shall backfill around the manhole **with ASTM 67 stone (nominal size 3/4"- No 4).** The width of the backfill and compaction shall be the width of the excavation.

O. Compaction Density

The excavation backfill density for all stages shall be provided as follows:

1. From right-of-way line to right-of-way line and including all structures: Compaction shall be 98% of the maximum density as determined by AASHTO T-180 (ASTM D-1557 - Modified Proctor) **with no tolerance.**

2. For outside of the right-of-way (but within maintenance easements): Compaction shall be 95% of the maximum density as determined by AASHTO T-180 (ASTM D-1557 - Modified Proctor**) with no tolerance.**

P. Compaction Test Requirements

1. Compaction test results shall be submitted for all work.

2. Results of compaction tests must meet minimum requirements prior to proceeding with the next stage of the work.

3. For developer projects, one complete set of all test reports shall be submitted with the as-built package to the COWHWW Department prior to proof rolling for roadway subgrade.

4. For City run projects, one complete set of all test reports shall be submitted with the as-built package to the Project Manager upon project completion.

5. The Contractor shall employ an independent testing laboratory, acceptable to the City and pay for all required tests.

6. The laboratory shall submit one copy of the certified test reports, after testing in each phase, to the COWHWW Inspector, for approval.

7. In the second and third stage of backfilling, density tests shall be made every one foot vertically, staggered every 200 feet (minimum) horizontally. There shall be a minimum of one test (per vertical foot) between structures, and a minimum of one test per day.

8. For manholes, density tests shall be every two feet vertically, staggered spirally around the manhole, and a minimum of one test per day.

Q. Cleanup

1. Grade all areas disturbed to a finish ordinarily obtained from a blade grader with no abrupt changes in grade or irregularities that will hold water.

2. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.

3. Cleanup and seeding is part of the pipeline installation. No more than three thousand linear feet (3,000 LF) of sewer line may be laid prior to completion of cleanup of the first section of pipeline laid. To facilitate this, the City reserves the right to withhold up to thirty percent (30%) of the unit price bid for sewer line if, in the opinion of the City, completed sections have not been properly cleaned.

4.11 CONNECTIONS TO GRAVITY SYSTEMS

A. Connections to the existing sanitary sewer system shall be made as shown in the Construction Drawings. Coordination between the City and the Contractor shall be required in order to accomplish this task. The Contractor shall supply a connection schedule to the City two weeks prior to the proposed connections. Connections of 6" shall be made through a lateral connection into the existing gravity line whenever possible. Connections 8" and greater shall connect into an existing manhole.

B. After approval of the schedule, the City shall be responsible for shutting down any City owned pump stations or valves as applicable. The Contractor will then make the required connection as quickly as possible. The Contractor shall be responsible for the coordination of any/all of the existing private pump stations shut down. The Contractor is responsible to coordinate and provide any and all pumping, bypass pumping and/or removal of effluent at connection points to existing mains and at affected pump/lift stations (City owned or private) during wastewater connection operations. Contractor is also responsible for any trucking of effluent and the proper disposal of wastewater, and any other work required to maintain existing services until and during transfer to the new service.

C. Connections to an existing manhole shall be made after complete flushing of the new system and shall be made under the direction of the COWHWW Inspector.

D. The Contractor shall cut suitable openings into the existing manholes or remove the existing pipe to accommodate the pipelines as indicated on the Construction Drawings and as herein specified. The portion of each existing structure removed for new installation shall be confined to the smallest opening possible, consistent with the work to be done.

E. The manhole shall be properly prepared to receive the connection by carefully coring drilling the wall of the existing manhole through the use of

mechanical drilling equipment. The perimeter of the penetration shall not be closer than 12 inches to a barrel section joint.

F. A Fernco, Kor-N-Seal, A-Lok, or approved equal connector shall be installed prior to pipe insertion into the manhole.

G. Any penetration to a manhole liner, or coating, must be properly sealed to restore the integrity of the liner/coating.

H. After the pipe is installed the Contractor shall carefully repair the existing manhole invert in accordance with manufacturer recommendations and in a manner satisfactory to White House City COWHWW Project Manager, or Inspector, as applicable. Manhole inverts shall be reshaped as required by the new connection to provide a smooth flowing channel of the exact shape of the gravity main to which it connects.

4.12 TAKING EXISTING WASTEWATER SYSTEMS OUT OF SERVICE

A. Existing wastewater gravity pipelines shall be taken out of service when indicated on the Construction Drawings. When lines are taken out of service, backfill the line with flowable fill (TDOT Standard Specifications for Road and Bridge Construction) or grout if the line is not removed.

B. Existing wastewater systems to be taken out of service shall be plugged after the relief interceptor and appurtenances downstream have been constructed, successfully tested, and approved by the Engineer, and after the City permits the existing wastewater system to be taken out of service.

C. The upper portion of manholes to be taken out of service shall be removed to not less than 36 inches below the proposed finish grade. The remaining portion of the structure shall be filled with sand or other approved granular fill material. The material used to fill the abandoned structure shall be clean, granular, well graded and free of any organic matter or deleterious material. Before filling, the bottom shall be punctured with a hole of 6-inch (minimum) diameter.

PART 5: QUALITY CONTROL

5.01 INSPECTION AND TESTING

A. General

1. All construction within existing or proposed public right-of-way or within an easement dedicated to the City shall be inspected by a

representative of COWHWW for compliance with approved construction plans and requirements of the COWHWW Technical Specifications. The level of inspection will be based on the size and complexity of the project.

2. The City Project Manager, Engineer, or COWHWW Inspector shall designate the locations of tests, the extent of the system to be tested, approve the methods of testing, and the requirements for recording test results. All manhole risers and gravity lines, including laterals, shall at a minimum be tested for leakage upon completion of installation. **It is highly recommended that pavement, sidewalks, and curbs over newly installed COWHWW utilities are not constructed until the COWHWW utilities have been tested and have passed inspection.**

3. Prior to acceptance of developer-projects, the developer shall have all testing performed, repairs (as required) completed, and shall supply to the COWHWW Inspector a report Certified by the Engineer of Record that the construction, test, and inspection results are in compliance with City and State standards. **At the discretion of the City, any system that is not accepted and not in service within nine months of being inspected shall be re-inspected and re-Certified before project acceptance and subsequent release of performance bonds.**

4. For City-run projects and prior to Substantial Completion, it is the responsibility of the Contractor to perform all testing, repair all defects, and submit a report to the Project Manager or Engineer certifying completion and compliance with City and State standards. The report shall include all test and inspection results.

5. The Contractor shall at their expense supply all materials and equipment necessary to perform the required inspections and tests. All tests shall be witnessed by the Engineer of Record, or a responsible person under their charge. Contractor shall notify the Engineer of Record a minimum of seven days in advance of all tests.

6. All testing equipment shall be calibrated annually by an independent testing agency. Upon request, a copy of the calibration report shall be submitted to the City Project Manager, Engineer or COWHWW Inspector.

7. All equipment used in testing shall be suitable to the application and shall be subject to the approval of the COWHWW Department.

8. Piping shall be properly backfilled and compacted before testing.

9. Prior to tests, all gravity lines shall be cleaned and flushed with an appropriately sized cleaning ball. At the discretion of the City, pre-cleaning by high velocity jet or other methods may also be required.

10. Contractor shall adequately brace and support all piping during testing so that no movement, displacement, or damage shall result from the application of test procedures.

11. All associated strength-specified concrete shall be tested, and results submitted to the Engineer of Record and COWHWW Inspector for acceptance.

12. If any manhole or section of the sewer fails to pass the tests, the Contractor shall perform an inspection of the faulty section, locate the defects, and repair or replace all defective materials, or correct workmanship issues, at their own expense.

    a. Repairs shall be made using new materials.

    b. No caulking of threaded joints, cracks, or holes, will be acceptable.

    c. Where it becomes necessary to replace pieces of pipe, the replacement shall be the same material and thickness as the defective piece.

    d. The Contractor shall obtain approval in advance for all materials and methods used for repairs from either the COWHWW Project Manager, or Engineer. Tests or inspections after correction of defects shall be repeated until the work is completed to the satisfaction of the City Project Manager or Engineer of Record, and the COWHWW Inspector.

13. Anomalies detected or suspected as a result of the visual inspection may prompt additional testing requirements.

B. <u>Low Pressure Air Testing</u>

1. Low pressure air testing for all pipes shall be conducted per ASTM-C-828.

2. The time required for the pressure to drop from the stabilized 3.5 psig to 2.5 psig should be greater than or equal to the minimum calculated test time.

3. The testing method should take into consideration the range in groundwater elevations projected and the situation during the test. The height of the groundwater should be measured from the top of the invert (one foot of water = 0.433 psi).

4. Minimum test times and allowable air loss values for various pipe size per 100ft are as follows:

Pipe Size (inches)	Time, T (sec/100ft)	Allowable Air Loss, Q (ft^3/min)
6	42	2.0
8	72	2.0
10	90	2.5
12	108	3.0
15	126	4.0
18	144	5.0
21	180	5.5
24	216	6.0
27	252	6.5
30	288	7.0

5. An allowable alternative to low pressure air testing is vacuum testing as outlined in Section C.4 and/or Infiltration/Exfiltration Testing as outlined in Sections E.2 and E.3.

C. Vacuum Testing Gravity Systems

1. The Contractor may desire to make a **vacuum** test prior to backfill for his own purposes, but the line acceptance test shall be conducted after backfilling has been completed in accordance with other portions of these specifications.

2. All wyes, tees, or ends of lateral stubs shall be suitably capped to withstand the internal test pressures. Such caps shall be easily removed for future lateral connections or extensions.

3. Testing manholes:

   a. Manholes shall be constructed to provide a true circular inside diameter with properly corbeled tops, satisfactory inverts, and properly placed steps and castings. Non shrink grout at manhole seams and around inlet and outlet piping shall be completed prior to testing. Any visible leaks in the manholes shall be completely stopped to the satisfaction of the City.

   b. Test using vacuum whenever possible prior to backfilling to assist in locating leaks. Make joint repairs on both outside and inside of joint to ensure permanent seal. All lifting holes shall be plugged with an approved non-shrink grout inside and out. Manhole joints shall be grouted from the outside only. All pipes entering the manhole shall be plugged. The Contractor shall securely brace the plugs in order to keep them from being drawn into the manhole. The test head shall be placed at the inside of the top of the cone section of the manhole and the seal inflated in accordance with the manufacturer's recommendations. Test manholes with manhole frame set in place.

   c. Vacuum test manholes in accordance with ASTM C-1244 and as follows:

      i. Plug pipe openings; securely brace plugs and pipe.

      ii. Inflate compression band to affect seal between vacuum base and structure; connect vacuum pump to outlet port with valve open; draw vacuum to 10 inches of Hg; close valve; start test.

      iii. Determine test duration for manhole from the following tables:

NO LEAKAGE IS PERMITTED

Manhole Diameter	Test Period
4 feet	60 seconds
5 feet	75 seconds
6 feet	90 seconds

Depth of Manhole (feet)	Minimum Test Time (minutes)
0-8	1:00
8-10	1:15
10-12	1:30
12-14	1:45
14-16	2:00
Each additional 2 feet	Add 0:15

iv. Record vacuum drop during test period; when vacuum drop is greater than 1 inch of Hg during test period, repair and retest manhole; when vacuum drop of 1 inch of Hg does not occur during test period, discontinue test and accept manhole.

v. If the manhole fails the initial test, necessary repairs shall be made or the manhole shall be replaced, as directed by the City, and the manhole shall be retested until it passes. A significant number of leaks on a single manhole or a significant number of manholes leaking shall be considered as a basis for rejection and replacement of manholes. This shall be done at the Contractor's expense.

vi. Manholes shall be tested/retested following paving, sidewalk installation, or final grading and landscaping to protect against damage during these processes.

4. Vacuum Testing for Gravity Sewer Pipe

a. No testing shall be performed until the pipe has been laid and backfilled for sixty (60) days and cleaning and video inspection is completed.

b. When the sewers are completed, they shall be inspected by the City for conformance with the provisions of the Plans and Specifications, particularly line and grade, and tested to determine the amount of ground water infiltration into the sewer. All visible and audible leaks will be stopped.

c. A vacuum of five (5) inches Hg shall be drawn on the manhole, the pump shut off, and the appropriate valves closed. The following table shows times for the test to be held according to pipe depth.

NO LEAKAGE IS PERMITTED

Size Pipe (inches)	Test Period Duration (minutes)
8	4.0
10	5.0
12	6.0
15	7.0
18	8.5
21	10.0
24	11.5
27	13.0
30	14.0
36	17.0
42	20.0
48	23.0
54	25.5
60	28.5

Depth of Main (feet)	Minimum Test Time (minutes)
0 – 8	1:00
8 – 10	1:15
10 – 12	1:30
12 – 14	1:45
14 – 16	2:00
Each additional 2 feet	Add 0:15

d. If the test fails, the Contractor will be required to locate the cause of the failure, make necessary repairs, and repeat all testing of the line until the test is passed. If required by the City, the Contractor shall repeat video inspection of any sections of the pipeline that have failed a portion of the testing.

D. Inspection and Testing for Force Main

1. When the sanitary sewer force main is completed, the City shall inspect the line for conformance with the provisions of the Plans and Specifications, particularly with respect to alignment and depth.

2. All newly constructed sanitary sewer force main and valved sections shall be subjected to a hydrostatic pressure-leakage test. Force mains shall be tested in sections not to exceed four thousand linear feet (4,000 LF) per test section. The Contractor shall install sufficient additional valves, if not shown on the Drawings, to allow testing.

j. Testing Procedure

a. Each completed section of the pipeline shall be plugged at both ends and slowly filled with water.

b. As the main is being filled with water in preparation of the test, all air shall be expelled from the pipe.

c. The main shall be subjected to hydrostatic pressure of one hundred (100) psi or one and a half (1.5) times operating pressure, whichever is greater, for a period of two (2) hours, unless otherwise specified. Pressure shall be applied to the

main by means of a hand pump for small lines or by use of a gasoline pump for larger lines.

k. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated at the Contractor's expense until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.

l. Tests of insulated and concealed piping shall be made before the piping is covered or concealed.

m. The Contractor shall notify the City when the work is ready for testing, and all testing shall be done in the presence of the City. All labor, equipment, water, and materials, including meters and gauges, shall be furnished by the Contractor at his own expense.

E. Water Infiltration/Exfiltration Testing

1. Wastewater Manhole Risers

a. Air testing is not acceptable for use on Manhole Risers.

b. All wastewater manhole risers shall be vacuum tested for leakage.

c. The COWHWW Inspector is required to sign off all manhole leakage tests.

2. Infiltration Testing of Wastewater Systems

a. Where the groundwater elevation is four feet or higher than the crown of the pipeline throughout the section being tested the Contractor may desire to test the wastewater system for infiltration rather than air testing.

b. The allowable rate of infiltration shall be zero for the entire section being tested, when the hydrostatic pressure at the centerline of the pipe doesn't exceed 25 feet. No visible leakage shall be allowed.

c. If any section of the wastewater system fails to meet this requirement, the Contractor shall perform an inspection of

the faulty section and repair or replace at his own expense all defective materials or workmanship. The test procedure shall be repeated until the results are acceptable.

3. Exfiltration Testing of Wastewater System

a. Where the groundwater elevation is less than four feet above the crown of the pipeline, the Contractor may desire to test the wastewater system for exfiltration rather than vacuum testing.

b. Plug the pipeline to be tested at the downstream manhole and fill the line with water. The test shall run for 24-hours minimum. The water level inside the manhole should be two feet higher than the top of the pipe or two feet higher than ground water level, whichever is greater. The maximum internal pipe pressure at the lowest end should not exceed 25 feet of water or 10.8 psi.

c. The allowable rate of exfiltration shall be zero for the entire section being tested.

d. If any section of the wastewater system fails to meet this requirement, the Contractor shall repair or replace at his own expense all defective materials or workmanship. The test procedure shall be repeated until the results are acceptable.

F. Deflection Tests for PVC

1. PVC pipe shall pass a go/no go Mandrel sized to ninety-five percent (95%) of the pipe diameter with the pipe in place and properly backfilled. The mandrel can either be blown or pulled.

a. The Contractor shall perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D-3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of the line segment.

b. Mandrel Sizing: The rigid mandrel shall have an outside diameter (O.D.) equal to 95 percent of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel,

shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe. Dimensions shall be per appropriate standard. Statistical or other “tolerance package” shall not be considered in mandrel sizing.

c. The Mandrel shall have an odd number of legs, or vanes, with a quantity of such equal to or greater than nine (9). The legs of the Mandrel shall be permanently attached to the Mandrel.

d. The Mandrel shall be constructed of steel, aluminum, or other material approved by the City, and shall have sufficient rigidity so the legs of the Mandrel will not deform when pulling through a pipe.

e. A Mandrel with variable sizes shall not be allowed. The Mandrel dimensions shall be checked by the City before use by the Contractor.

f. The allowable deflection shall be as shown in the table below and shall be calculated using the pipe stiffness formula in ASTM D 2321.

Nominal Pipe Diameter	Maximum Allowable Deflection
< 12-inches	5%
15 to 30-inches	4%
> 30-inches	3%

f. Proving Ring. Furnish a “proving ring” with each mandrel. Fabricate the ring of 2- inch-thick, 3-inch-wide bar steel to a diameter 0.02-inches larger than approved mandrel diameter.

2. The Project Manager, Engineer or COWHWW Inspector (as applicable), may determine that deflection testing is unnecessary when using proper construction practices and inspection during pipe installation and when using embedment material which has been properly selected, placed and compacted. However, random deflection testing of pipe may be required at locations where construction encountered unstable trench walls or bottoms, heavy

rainfall, high ground water levels, deep lines, difficulty in obtaining compaction, or where other problems are indicated.

3. Locations with excessive deflection shall be excavated and repaired by re-bedding or by replacing pipe. Optional devices for testing include a deflector-meter, a properly sized "go, no go" mandrel or sewer ball.

4. The Contractor shall furnish the mandrel, labor, materials, and equipment necessary to perform the tests as approved by the Project Manager, Engineer or COWHWW Inspector (as applicable).

    a. Prior to performing the deflection tests, the Contractor shall submit certification that the 9-arm mandrels are preset as previously stated.

    b. Each mandrel shall be engraved with the following:

        i. Serial Number

        ii. Nominal pipe diameter

        iii. "ASTM D 3034" and either "SDR-26"

        iv. % deflection as previously stated

5. Failure of any section of the pipeline to meet the requirements of this test shall cause the Contractor to determine, at his own expense, the source(s) of deformity, excavate, and repair or replace all defective materials or workmanship, and repeat all testing until results are satisfactory. The Contractor shall excavate to the point of excess deflection and carefully compact around the point where excess deflection was found. After the permanent pavement base has been compacted and resealed, the line shall be retested. If the mandrel fails to pass a second time, the section shall be replaced. Re-rounding is not permitted.

5.02 TELEVISING OF GRAVITY SEWER LINES

The following procedures shall be followed on all sanitary sewer mains which are to be accepted by the City:

A. The City of White House requires a closed-circuit television (CCTV) inspection of the interior of the installed pipe prior to final acceptance. This inspection will be performed by the Contractor. All CCTV inspections must be monitored by the City inspector and the original video must be signed by the inspector. Reports and tapes shall be supplied to the COWHWW Inspector.

B. Camera and Related Equipment

1. A remote controlled, adequately lit camera that will travel the length of each section of gravity sewer main from manhole to manhole shall be used to televise all newly installed sewer mains.

2. The camera shall be of suitable design and manufactured for the express purpose of televising gravity sanitary sewer mains. All gravity sewer mains shall be CCTV'd utilizing a 360-degree pan and tilt color camera. The camera shall be of the self-propelled tractor type, with a measuring device mounted to the front capable of being read as the tractor moves and capable of accurately measuring depth of standing water up to and including one inch. **A pull type camera may be used only as a system backup.**

3. The camera's path shall be recorded with an onscreen display of footage traveled.

4. Auditory notations by the camera operator regarding locations of service connections, pipe defects, indications of faulty installation, and all other important points of interest shall be recorded as permanent record. Audio quality shall be adequate to clearly understand remarks of the camera operator.

5. The view recorded by the camera shall also include an object to assist the viewer in determining the scale of objects within the pipe.

6. Video quality of the recording shall be such that the condition of all interior sections of the main and service laterals on that section of the main are easily discernable. The camera shall allow for articulation that enables a clear view of service laterals in a direction perpendicular to the direction of the main and at a variety of vertical angles to allow viewing of laterals at varying slopes. The image must be clear to the test cap or first bend on the service lateral.

C. All gravity sewer mains shall require the base to be placed and compacted prior to CCTV inspection. All mains not filled to subgrade shall have at least 10-foot of compacted backfill.

D. All gravity sewer mains shall be CCTV'd in a downstream direction wherever possible.

E. Inverts will be constructed in manholes prior to CCTV inspection.

F. CCTV inspection for the Contractor's own use may be done at any time; however, the City inspector shall be notified in advance of all televising for acceptance and the procedures listed herein shall be followed.

G. Mains shall be flushed and cleaned thoroughly prior to CCTV inspection. Builders shall be responsible for cleaning gravity lines at the completion of each phase buildout. Lift station cleaning shall be required at the City's request.

1. Line cleaning and video inspection may begin after successful installation of mainlines, services, manholes, and manhole coating system, and testing and cleaning of the manholes. Video shall commence immediately after cleaning, so that any swag or changes in grade shall be revealed and evidenced by puddling in areas where positive slope is not maintained.

2. Washings from cleaning shall be prevented from entering lift station and shall be disposed of properly by the Contractor.

3. At least 24 hours prior to, and no more than 48 hours prior to televising, sufficient water shall be run through each section of main until water runs through each downstream manhole. No lines shall be televised which are dry or that enough water has not run through to reach the end of each section.

4. Mains which are dirty (dirty walls and/or debris in the inverts) shall be re-flushed and cleaned before rescheduling another CCTV inspection with the COWHWW inspector. The City inspector may require pigging of specific sections, if necessary.

H. There shall be no dips in the mains. Any dips which are found shall be reviewed and a decision made by the COWHWW Engineer as to whether to accept the main as is or to have the dip removed. Decisions will be made on a case-by-case basis; however, **normally any dip one-inch, or greater, will be required to be removed.**

I. The Contractor shall be entitled to a second inspection on lines requiring repairs. Second inspections for dirty lines and additional inspections for repairs after the second free inspection shall be billed by the City for each section of main televised.

J. Deliverables Format

1. The COWHWW inspector shall initial each video tape utilized in CCTV inspection and that tape will be submitted to the City for its records. **Copies of the original tape will not be accepted.** The original tape and the CCTV reports shall be submitted to the City prior to the inspector signing-off on the project.

2. The Contractor shall deliver to the City on CD-ROM or DVD media two (2) copies of digital files that represent the videotaping of all sewer mains in a project. The video record of each section of gravity main between manholes shall be represented by a separate MPEG or AVI format digital file.

3. The disk and its jacket shall be clearly labeled with the name of the subdivision or project and its phase and/or section, as well as the installation date. All references to manholes and mains with regard to videotaping shall be by the same naming convention as that shown on construction plans approved by the City. An index file shall be provided with each disc that explains the meaning of each file name and the company that produced it.

4. Additionally, two (2) sets of hard copy printouts of the sewer line drawings, noting distances to services, the downstream manhole, and any defects or other points of interest, shall be provided.

5.03 FINAL ACCEPTANCE

A. The City will notify the Contractor, in writing, as to the satisfactory completion of the work in any or all sections of gravity sanitary sewer pipe, force main, and manholes included in the project.

B. The Contractor shall submit as-built drawings in both .pdf and .dwg formats. As-builts should include invert elevations and GPS coordinates on service and top of casting locations prior to final acceptance.

C. Upon such notification, the Contractor shall immediately remove all construction equipment, excess materials, tools, debris, etc., from the site(s) and leave the same in a neat, orderly condition acceptable to the City.

D. Final landscaping requirements and restoration of surfaces shall then be completed by the Contractor in accordance with their respective Specifications and as shown on the Drawings.

END OF SECTION

SECTION 02740 LOW PRESSURE SEWER SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

The work covered by this Section shall consist of furnishing all materials, labor, equipment, and services for the installation of a low-pressure sewer system. The Contractor shall be responsible for the satisfactory operation of the entire system.

1.02 SUBMITTALS

The Contractor shall provide a minimum of five (5) sets of shop drawings detailing the equipment to be furnished, including dimensional data and materials of construction. The City shall endeavor to promptly review this data and shall return two (2) copies as accepted or pending requested modifications.

1.03 MANUFACTURER

Grinder pump stations, complete with all appurtenances, form an integral system, and as such, shall be supplied by one (1) grinder pump station Manufacturer.

A. All Manufacturers proposing equipment for this project shall have at least ten (10) years of experience in the design and manufacture of grinder pumps for specific use in low pressure sewage systems and of identical size(s) and performance to the specified units.

B. All Manufacturers proposing equipment for this project must have no fewer than five hundred (500) successful installations of low-pressure sewer systems utilizing grinder pumps such as those specified herein. An installation is defined as a minimum of twenty-five (25) pumps discharging into a common force main, which forms a low-pressure sewer system.

C. The Manufacturer shall:

1. Provide detailed installation and user instructions for its product;

2. Submit evidence of an established service program, including complete parts and service manuals;

3. Maintain a continuing inventory of grinder pump replacement parts; and

4. Provide a reference and contact list of ten (10) of its largest contiguous grinder pump installations of the type specified herein that have been in operation for at least ten (10) years.

1.04 OPERATING CONDITIONS

The pumps shall be capable of delivering fifteen (15) gpm against a rated total dynamic head of zero (0) feet (0 psig) and nine gpm against a rated total dynamic head of one hundred thirty-eight (138) feet (60 psig). The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

1.05. WARRANTY

The grinder pump Manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, panel and redundant check valve for a period of sixty (60) months after notice of City acceptance, but no greater than sixty-three (63) months after receipt of shipment. Any manufacturing defects found during the warranty period will be reported to the Manufacturer by the City and shall be corrected by the Manufacturer at no cost to the City.

PART 2: PRODUCTS

2.01 PUMP

A. The pump shall be a custom-designed, integral, vertical rotor, motor-driven, solids-handling pump of the progressing-cavity type with a single mechanical seal.

B. The rotor shall be constructed of stainless steel. Plating on the rotor will not be acceptable due to its tendency to delaminate.

C. The stator shall be of a specifically compounded ethylene-propylene synthetic elastomer. The material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

2.02 GRINDER

A. The grinder shall be placed immediately below the pumping elements and shall be direct driven by a single, one-piece motor shaft.

B. The grinder impeller assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable.

C. The grinder shall be of the rotating type with a stationary hardened and ground stainless steel shredding ring spaced in close annular alignment with the driven impeller assembly, which shall carry two (2) hardened type 400 series stainless steel cutter bars. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures.

D. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions, including starting.

E. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks that would impair the operation of the pump.

F. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of “foreign objects,” such as paper, wood, plastic, glass, rubber, and the like, to finely divided particles that will pass freely through the passages

of the pump and the one and one quarter inch (1-¼") diameter discharge. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

2. The maximum flow rate through the cutting mechanism must not exceed four feet (4') per second; this critical design element will prevent jamming.

3 The inlet shroud shall have a diameter of no less than five inches (5"). Inlet shrouds that are less than five inches (5") in diameter will not be accepted due to their inability to maintain the specified four feet (4') per second maximum inlet velocity.

4 The impeller mechanism must rotate at a nominal speed of no greater than 1,800 rpm.

2.03 ELECTRIC MOTOR

A. As a maximum, the motor shall be a one (1) horsepower (hp), 1,725 rpm, 240 volt (V), 60 hertz (Hz), single-phase, capacitor start, ball bearing, air-cooled induction type with a low starting current not to exceed 30 amperes (A) and a high starting torque of 8.4.

B. Conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., (UL) for the application.

C. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability.

D. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

2.04 MECHANICAL SEAL

The pump core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with precision-lapped and held in position by a stainless-steel spring.

2.05 TANK

A. The tank shall consist of a single wall of laminated fiberglass construction.

B. The resin used shall be of a commercial grade suitable for the environment.

C. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin.

D. The inner surface shall have a smooth finish and be free of cracks and crazing.

E. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present.

F. The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available tank height.

G. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth.

H. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation.

I. The tank shall include a solid fiberglass cover, secured with threaded stainless-steel fasteners, providing low profile mounting.

J. The tank shall also be vented to prevent sewage gases from accumulating in the tank.

K. The tank dimensions shall be twenty-four inches (24”) in diameter and sixty inches (60”) tall per the City Standard Sewer Details.

2.06 DISCHARGE HOSE AND DISCONNECT/VALVE

A. All discharge fittings and piping shall be constructed of 304 Series stainless steel, polypropylene, ethylene propylene diene monomer (EPDM), or PVC.

B. The discharge hose assembly shall include a shut-off valve rated for two hundred (200) psi water, oil, or gas (WOG) and a quick disconnect feature to simplify installation and pump removal.

C. The bulkhead penetration shall be factory-installed and warranted by the Manufacturer to be watertight.

2.07 ELECTRICAL QUICK DISCONNECT

A. The grinder pump unit shall include a single NEMA 6P EQD for all power and control functions. J-box type disconnects will not be accepted due to their tendency to leak and inherent issues associated with J-box serviceability.

B. An integral tube shall allow venting of the control compartment to ensure proper operation of the pressure switch level system.

C. The grinder pump will be furnished with a length of 6-conductor, 14-gauge, type-SJOW cable, pre-wired and watertight to meet UL requirements.

2.08 ANTI-SIPHON VALVE

The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge assembly.

A. Moving parts will be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.

B. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure.

C. The valve body shall be injection-molded from a glass-filled thermoplastic resin.

D. Holes or ports in the discharge piping are not acceptable anti-siphon devices, due to their tendency to clog from the solids in the slurry being pumped.

2.09 CHECK VALVE

The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge assembly.

A. The check valve will provide a full-ported passageway when open and shall introduce a friction loss of less than six inches (6”) of water at maximum rated flow.

B. Moving parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.

C. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure seating even at a very low back pressure.

D. The valve body shall be an injection molded part made of glass-filled PVC.

E. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

F. Each grinder pump installation shall also include one (1) separate check valve of the type detailed in this section for installation in the one and one quarter-inch (1¼”) service lateral between the grinder pump station and the sewer main, preferably next to the curb stop. The separate check valve shall be provided as a separate line item in the bid schedule.

2.10 CORE UNIT

A. The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, EQD, and wiring.

B. The pump core shall be suitably mounted on an integral stand of stainless steel.

C. The watertight integrity of the core unit shall be established by one hundred percent (100%) factory test at a minimum of five (5) pounds per square inch, gauge (psig).

2.11 CONTROLS

A. All necessary controls, including motor and level controls, shall be located in the top housing of the core unit. The top housing will be attached with stainless steel fasteners.

B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. High-level sensing will be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type.

C. The level detection device shall have no moving parts in direct contact with the wastewater.

D. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit.

E. For increased reliability, pump power and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices.

F. To ensure reliable operation of the pressure switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent accidental entry of water into the motor compartment.

G. The grinder pump will be furnished with a 6-conductor, 14-gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a factory-installed NEMA 6P EQD half attached to it.

2.12 ALARM PANEL

Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall mounting.

A. The NEMA 4X enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, lockable cover, pad lock, and secured dead front. The enclosure shall not exceed 11.38” wide x 13.5” high x 5.63” deep.

B. For each core, the panel shall contain one (1) 15-A, double-pole circuit breaker for the power circuit and one (1) 15-A, single-pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, and a complete alarm circuit.

C. The alarm panel shall include the following features: audio and visual alarm, push-to-run switch, and high level (redundant) pump starting control. The visual alarm lamp shall be inside a red fluted lens at least 2-5/8” in diameter and 1-11/16” in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating.

D. The audio alarm shall be a printed circuit board in conjunction with an eighty-six (86) decibel (dB) buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being deactivated by depressing a push-type switch encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.

E. The entire alarm panel shall be UL-listed.

F. The alarm sequence is to be as follows:

1. When liquid level in the sewage wetwell rises above the alarm level, visual and audio alarms will be activated. The contacts on the alarm pressure switch will close. The redundant pump starting system will be energized.

2. The audio alarm may be silenced by means of the externally mounted, push-to-silence button.

3. Visual alarm remains illuminated until the sewage level in the wetwell drops below the “off” setting of the alarm pressure switch.

2.13 SERVICEABILITY

A. The grinder pump core unit shall have two (2) lifting hooks, complete with nylon lift-out harness, to facilitate easy core removal when necessary.

B. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation.

C. A push-to-run feature will be provided for field trouble shooting.

D. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.14 OSHA CONFINED SPACE

All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station as per OSHA 1910.146, “Permit-Required Confined Spaces.”

2.15 SAFETY

A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station in its tank shall be UL-listed to be safe and appropriate for the intended use. UL listing of components of the station or third-party testing to UL standards will not be accepted.

B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences; shall be free from objectionable noise, odor, or health hazards; and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer

system applications. As evidence of compliance with this requirement, the grinder pump shall bear the National Sanitation Foundation (NSF) seal. Third-party testing to NSF standards will not be accepted.

PART 3: EXECUTION

3.01 FACTORY TESTING

A. Each grinder pump shall be submerged and operated for a minimum of five (5) minutes. Included in this procedure will be the testing of all ancillary components such as the anti-siphon valve, check valve, discharge line, and each unit's dedicated level and motor controls. All factory tests shall incorporate each of the above listed items.

B. Actual appurtenances and controls that will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable.

C. The Manufacturer shall provide the City with certified test results showing the operation of each grinder pump at two (2) different points on its curve, with the maximum pressure no less than sixty (60) psi. The City reserves the right to inspect such testing procedures at the grinder pump Manufacturer's facility.

D. Completed basins shall be factory leak tested to assure the integrity of all joints, seams, and penetrations.

3.02 DELIVERY

A. All grinder pump units shall be delivered to the job site one hundred percent (100%) completely assembled, tested, and ready for installation.

B. Grinder pump stations will be individually mounted on wooden pallets.

C. Grinder pump cores will be shipped in a separate container and are only required to be installed in the basin.

3.03 INSTALLATION

A. The Contractor shall be responsible for handling groundwater to provide a firm, dry subgrade for the structure and shall guard against flotation or other damage resulting from general groundwater or flooding.

B. The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the City.

C. Remove packing material. User's instructions shall be given to the City. Hardware supplied with the unit, if required, shall be used at installation. The basin will be supplied with a standard field-installed four-inch (4") inlet grommet (fiberglass tank) or flange (for high-density polyethylene tank); both will accept a 4.50" outside diameter drain, waste, and vent (DWV) pipe for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled, or laid on its side for any reason.

D. Installation shall be accomplished so that one to four inches (1"-4") of access way, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the hole must be large enough to allow for the concrete anchor.

E. A six-inch (6") inch (minimum) layer of TDOT #67 stone shall be used as bedding material under each unit.

F. A concrete anti-flotation collar, as detailed on the drawings, and sized according to the Manufacturer's instructions, shall be required and shall be precast to the grinder pump or poured in place. Each grinder pump station with its precast anti-flotation collar shall have a minimum of three (3) lifting eyes for loading and unloading purposes.

G. The unit shall be leveled and filled with water to the bottom of the inlet to help prevent the unit from shifting while the concrete is being poured and set. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an eight-inch (8") sleeve is required over the inlet prior to pouring the concrete.

H. The Contractor will provide and install a four-foot (4') piece of four-inch (4") SCH 40 PVC pipe with cap, to stub-out the inlet as depicted on the Contract Drawings.

I. The electrical enclosure shall be furnished, installed, and wired to the grinder pump station by the Contractor. An alarm device is required on every installation; there shall be no exceptions.

J. It will be the responsibility of the Contractor and the City to coordinate with the individual property owner(s) to determine the optimum location for the alarm panel. The Contractor shall mount the alarm device in a conspicuous location, as per Federal and Local codes.

K. The alarm panel will be connected to the grinder pump station by a length of 6-conductor, 12-gauge, TC-type cable as shown on the Contract Drawings. The power and alarm circuits must be on separate power circuits. The grinder pumps station will be provided with a minimum of thirty-two feet (32') total, twenty-five feet (25') of usable electrical supply cable outside the station, to connect to the alarm panel. This cable shall be provided with a factory installed EQD half to connect to the mating EQD half on the core.

3.04 BACKFILL REQUIREMENTS

A. Backfill of clean, native earth, free of rocks, roots, and foreign objects, shall be thoroughly compacted in lifts not exceeding twelve inches (12") to a final Proctor Density of not less than eighty-five percent (85%).

B. The grinder pump station shall be installed at a minimum depth from grade to the top of the one and one quarter inch 1-1/4" discharge line to ensure maximum frost protection.

C. The finish grade line shall be one to four inches (1"-4") below the bottom of the lid, and final grade shall slope away from the grinder pump station.

3.05 START-UP AND FIELD TESTING

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

B. All equipment and materials necessary to perform testing shall be the responsibility of the Contractor. This will include, as a minimum, a portable generator (if temporary power is required) and water in each basin.

C. The services of a trained factory-authorized technician shall be provided at a rate of two (2) days for each two hundred (200) grinder pump stations supplied. Projects with fewer than two hundred (200) units shall provide a trained factory-authorized technician for a minimum of one (1) day. Each day shall be ten (10) person hours in duration.

D. Upon completion of the installation, the authorized factory technicians will perform the following test on each station:

1. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating. In some installations, there may be a valve(s) at the street main that must also be open.

2. Turn on the alarm power circuit.

3. Fill the wet well with water to a depth sufficient to verify the high-level alarm is operating. Shut off water.

4. Turn on pump power circuit. Initiate pump operation to verify automatic power controls are operative. Pump should immediately turn on. Within one (1) minute, alarm light will turn off. Within three (3) minutes, the pump will turn off.

E. Upon completion of the start-up and testing, the Manufacturer shall submit to the City the start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

PART 4: OPERATION AND MAINTENANCE

4.01 SPARE CORE

The manufacturer will supply one (1) spare grinder pump core for every fifty (50) grinder pump stations installed, complete with all operational controls, level sensors, check valve, anti-siphon valve, pump/motor unit, and grinder.

4.02 MANUALS

The manufacturer shall supply four (4) copies of Operation and Maintenance Manuals to the City.

END OF SECTION

(Recommended form follows.)

WARRANTY CERTIFICATION

I, _____, by and through my duly authorized signature below as its most senior operating executive, certify that _____ will provide a five (5) year warranty on grinder pump equipment manufactured and supplied by _____ _____ _____ for the _____ project. I further certify that, other than failure to install equipment in accordance with manufacturer's instructions, no exclusions and/or cost items to maintain said equipment in warrantable condition, including labor, travel and shipping fees, exist.

_____ _____

Signature Date

_____

Title

SECTION 02742 DUPLEX LOW PRESSURE SEWER PUMPS

PART 1: GENERAL

1.01 SCOPE OF WORK

The work covered by this Section shall consist of furnishing all materials, labor, equipment, and services for the installation of a centrifugal duplex low-pressure sewer pump system for commercial and high-density residential developments. The Contractor shall be responsible for the satisfactory operation of the entire system.

1.02 SUBMITTALS

The Contractor shall provide a minimum of five (5) sets of shop drawings detailing the equipment to be furnished, including dimensional data and materials of construction. The City shall endeavor to promptly review this data and shall return two (2) copies as accepted or pending requested modifications.

1.03 MANUFACTURER

Centrifugal duplex grinder pump stations, complete with all appurtenances, form an integral system, and as such, shall be supplied by one (1) grinder pump station Manufacturer.

Pump shall be Grundfos, Zoeller Model 840, or City approved equal with an integrally built-in grinder unit and submersible type motor. Discharge shall be 1-1/4" NPT.

1.04 OPERATING CONDITIONS

Pump shall have a capacity of _____ GPM at a total head of _____ feet and shall use a 2 HP motor operating at 3450 RPM. Pump capacity and TDH shall be determined by the developer's engineer and approved by the City.

1.05. WARRANTY

The grinder pump Manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to,

panel and redundant check valve for a period of twenty-four (24) months after notice of City acceptance. Any manufacturing defects found during the warranty period will be reported to the Manufacturer by the City and shall be corrected by the Manufacturer at no cost to the City.

PART 2: PRODUCTS

2.01 PUMP

A. The pump shall be a custom-designed, solids-handling pump of the centrifugal type.

B. Centrifugal pumps for commercial service shall be installed in a duplex arrangement.

2.02 ELECTRIC MOTOR

A. Pump motor shall be of the submersible type and shall be of the appropriate voltage, phase and horsepower to meet expected flows and supply power. Single phase motors shall be of capacitor start, capacitor run, NEMA L type. Three phase motors shall be NEMA B type.

B. Stator winding shall be of the open type with Class F insulation good for 155°C (311°F) maximum operating temperature. Winding housing shall be filled with a clean high dielectric oil that lubricates bearings and seals and transfers heat from windings and rotor to outer shell. Air-filled motors that do not have the superior heat dissipating capabilities of oil-filled motors shall not be considered equal.

C. Motor shall have two heavy-duty ball bearings to support pump shaft and take radial and thrust loads. Ball bearings shall be designed for 50,000 hours B-10 life. Stator shall be pressed into motor housing.

D. Single-phase motors shall have a heat sensor thermostat and overload attached to the top end of the motor windings to stop the motor if the motor winding temperature reaches 200º F. The high temperature shut-off will cause the pump to cease operation, should a control failure cause the pump to run in a dry wet well.

The thermostat shall reset automatically when the motor cools to a safe operating temperature.

E. The common motor pump and grinder shaft shall be of #416 stainless steel threaded to take pump impeller and grinder impeller.

2.03 SEALS

A. Motor shall be protected by two mechanical seals mounted in tandem with a seal chamber between the seals. Seal chamber shall be oil filled to lubricate seal face and to transmit heat from shaft to outer shell.

B. Seal face shall be carbon and ceramic and lapped to a flatness of one light band.

C. An electrode shall be mounted in the seal chamber to detect any water entering the chamber through the lower seal. Water in the chamber shall cause a red light to turn on at the control box. This signal shall not stop the motor but shall act as a warning only, indicating service is required.

2.04 PUMP IMPELLER

The pump impeller shall be of the recessed Myers type to provide an open unobstructed passage through the volute for the ground solids. Impeller shall be cast iron and shall be threaded onto stainless steel shaft. Minimum impeller diameter is 3-3/4".

2.05 GRINDER CONSTRUCTION

A. Grinder assembly shall consist of grinder impeller and shredding ring and shall be mounted directly below the volute passage. Grinder impeller to be threaded onto stainless shaft and shall be locked with screw and washer. The shredding ring shall be pressed into iron holding flange for easy removal. Flange shall be provided with tapped back-off holes so that screws can be used to push the shredding ring from housing. All grinding of solids shall be from action of the impeller against the shredding ring.

B. Both grinder impellers and shredding ring shall be of 440C stainless steel hardened to 58-60 Rockwell C.

2.06 CORROSION PROTECTION

The pump shall be painted with waterborne hybrid acrylic/alkyd paint. This custom engineered, quick dry paint shall provide superior levels of corrosion and chemical protection. All fasteners to be 302 stainless steel.

2.07 POWER CORD

The motor power cord shall be SOOW and shall be fastened by means of a cord grip in the top of the pump. The top of the pump shall contain a waterproof junction box which will provide space to connect the power cord to the motor leads. The motor leads shall seal between the motor housing and junction box by means of a rubber compression fitting around each wire. Power cord shall have a green carrier ground conductor that attaches to motor frame.

2.08 TANK

A. The tank shall consist of a single wall of laminated fiberglass construction.

B. The resin used shall be of a commercial grade suitable for the environment.

C. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin.

D. The inner surface shall have a smooth finish and be free of cracks and crazing.

E. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present.

F. The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available tank height.

G. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth.

H. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation.

I. The tank shall include a solid fiberglass cover, secured with threaded stainless-steel fasteners, providing low profile mounting.

J. The tank shall also be vented to prevent sewage gases from accumulating in the tank.

K. The tank dimensions shall be a minimum of twenty-four inches (24”) in diameter and sixty inches (60”) tall per the City Standard Sewer Details.

2.09 DISCHARGE HOSE AND DISCONNECT/VALVE

A. All discharge fittings and piping shall be constructed of 304 Series stainless steel, polypropylene, ethylene propylene diene monomer (EPDM), or PVC.

B. The discharge hose assembly shall include a shut-off valve rated for two hundred (200) psi water, oil, or gas (WOG) and a quick disconnect feature to simplify installation and pump removal.

C. The bulkhead penetration shall be factory-installed and warranted by the Manufacturer to be watertight.

2.10 ELECTRICAL QUICK DISCONNECT

A. The grinder pump unit shall include a single NEMA 6P EQD for all power and control functions. J-box type disconnects will not be accepted due to their tendency to leak and inherent issues associated with J-box serviceability.

B. An integral tube shall allow venting of the control compartment to ensure proper operation of the pressure switch level system.

C. The grinder pump will be furnished with a length of 6-conductor, 14-gauge, type-SJOW cable, pre-wired and watertight to meet UL requirements.

2.11 ANTI-SIPHON VALVE

The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge assembly.

A. Moving parts will be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.

B. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure.

C. The valve body shall be injection-molded from a glass-filled thermoplastic resin.

D. Holes or ports in the discharge piping are not acceptable anti-siphon devices, due to their tendency to clog from the solids in the slurry being pumped.

2.12 CHECK VALVE

The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge assembly.

A. The check valve will provide a full-ported passageway when open and shall introduce a friction loss of less than six inches (6”) of water at maximum rated flow.

B. Moving parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength.

C. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure seating even at a very low back pressure.

D. The valve body shall be an injection molded part made of glass-filled PVC.

E. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

F. Each grinder pump installation shall also include one (1) separate check valve of the type detailed in this section for installation in the one and one quarter-inch (1¼") service lateral between the grinder pump station and the sewer main, preferably next to the curb stop. The separate check valve shall be provided as a separate line item in the bid schedule.

2.13 CONTROLS

A. All necessary controls, including motor and level controls, shall be located in the top housing of the core unit. The top housing will be attached with stainless steel fasteners.

B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. High-level sensing will be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type.

C. The level detection device shall have no moving parts in direct contact with the wastewater.

D. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit.

E. For increased reliability, pump power and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices.

F. To ensure reliable operation of the pressure switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent accidental entry of water into the motor compartment.

G. The grinder pump will be furnished with a 6-conductor, 14-gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a factory-installed NEMA 6P EQD half attached to it.

H. The control panel shall be NEMA 4X rated and mounted on uni-strut. Wood mounted panels are not acceptable.

2.14 ALARM PANEL

Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall mounting.

A. The NEMA 4X enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, lockable cover, pad lock, and secured dead front. The enclosure shall not exceed 11.38” wide x 13.5” high x 5.63” deep.

B. For each core, the panel shall contain one (1) 15-A, double-pole circuit breaker for the power circuit and one (1) 15-A, single-pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, and a complete alarm circuit.

C. The alarm panel shall include the following features: audio and visual alarm, push-to-run switch, and high level (redundant) pump starting control. The visual alarm lamp shall be inside a red fluted lens at least 2-5/8” in diameter and 1-11/16” in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating.

D. The audio alarm shall be a printed circuit board in conjunction with an eighty-six (86) decibel (dB) buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being deactivated by depressing a push-type switch encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.

E. The entire alarm panel shall be UL-listed.

F. The alarm sequence is to be as follows:

1. When liquid level in the sewage wet well rises above the alarm level, visual and audio alarms will be activated. The contacts on the alarm pressure switch will close. The redundant pump starting system will be energized.

2. The audio alarm may be silenced by means of the externally mounted, push-to-silence button.

3. Visual alarm remains illuminated until the sewage level in the wet well drops below the “off” setting of the alarm pressure switch.

2.15 SERVICEABILITY

A. The grinder pump core unit shall have two (2) lifting hooks, complete with nylon lift-out harness, to facilitate easy core removal when necessary.

B. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation.

C. A push-to-run feature will be provided for field trouble shooting.

D. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

2.16 OSHA CONFINED SPACE

All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station as per OSHA 1910.146, “Permit-Required Confined Spaces.”

2.17 SAFETY

A. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station in its tank shall be UL-listed to be safe and appropriate for the intended use. UL listing of components of the station or third-party testing to UL standards will not be accepted.

B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences; shall be free from objectionable noise, odor, or health hazards; and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the National Sanitation

Foundation (NSF) seal. Third-party testing to NSF standards will not be accepted.

PART 3: EXECUTION

3.01 FACTORY TESTING

A. Each grinder pump shall be submerged and operated for a minimum of five (5) minutes. Included in this procedure will be the testing of all ancillary components such as the anti-siphon valve, check valve, discharge line, and each unit's dedicated level and motor controls. All factory tests shall incorporate each of the above listed items.

B. Actual appurtenances and controls that will be installed in the field shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable.

C. The Manufacturer shall provide the City with certified test results showing the operation of each grinder pump at two (2) different points on its curve. The City reserves the right to inspect such testing procedures at the grinder pump Manufacturer's facility.

D. Completed basins shall be factory leak tested to assure the integrity of all joints, seams, and penetrations.

3.02 DELIVERY

A. All grinder pump units shall be delivered to the job site one hundred percent (100%) completely assembled, tested, and ready for installation.

B. Grinder pump stations will be individually mounted on wooden pallets.

C. Grinder pump cores will be shipped in a separate container and are only required to be installed in the basin.

3.03 INSTALLATION

A. The Contractor shall be responsible for handling groundwater to provide a firm, dry subgrade for the structure and shall guard

against flotation or other damage resulting from general groundwater or flooding.

B. The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the City.

C. Remove packing material. User's instructions shall be given to the City. Hardware supplied with the unit, if required, shall be used at installation. The basin will be supplied with a standard field-installed four-inch (4") inlet grommet (fiberglass tank) or flange (for high-density polyethylene tank); both will accept a 4.50" outside diameter drain, waste, and vent (DWV) pipe for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin may not be dropped, rolled, or laid on its side for any reason.

D. Installation shall be accomplished so that one to four inches (1"-4") of access way, below the bottom of the lid, extends above the finished grade line. The finished grade shall slope away from the unit. The diameter of the hole must be large enough to allow for the concrete anchor.

E. A six-inch (6") inch (minimum) layer of TDOT #67 stone shall be used as bedding material under each unit.

F. A concrete anti-flotation collar, as detailed on the drawings, and sized according to the Manufacturer's instructions, shall be required and shall be precast to the grinder pump or poured in place. Each grinder pump station with its precast anti-flotation collar shall have a minimum of three (3) lifting eyes for loading and unloading purposes.

G. The unit shall be leveled and filled with water to the bottom of the inlet to help prevent the unit from shifting while the concrete is being poured and set. The concrete must be manually vibrated to ensure there are no voids. If it is necessary to pour the concrete to a level higher than the inlet piping, an eight-inch (8") sleeve is required over the inlet prior to pouring the concrete.

H. The Contractor will provide and install a four-foot (4') piece of four-inch (4") SCH 40 PVC pipe with cap, to stub-out the inlet as depicted on the Contract Drawings.

I. The electrical enclosure shall be furnished, installed, and wired to the grinder pump station by the Contractor. An alarm device is required on every installation; there shall be no exceptions.

J. It will be the responsibility of the Contractor and the City to coordinate with the individual property owner(s) to determine the optimum location for the alarm panel. The Contractor shall mount the alarm device in a conspicuous location, as per Federal and Local codes.

K. The alarm panel will be connected to the grinder pump station by a length of 6-conductor, 12-gauge, TC-type cable as shown on the Contract Drawings. The power and alarm circuits must be on separate power circuits. The grinder pumps station will be provided with a minimum of thirty-two feet (32') total, twenty-five feet (25') of usable electrical supply cable outside the station, to connect to the alarm panel.

L. Service disconnect is required in plain sight of the control panel.

3.04 BACKFILL REQUIREMENTS

A. Backfill of clean, native earth, free of rocks, roots, and foreign objects, shall be thoroughly compacted in lifts not exceeding twelve inches (12") to a final Proctor Density of not less than eighty-five percent (85%).

B. The grinder pump station shall be installed at a minimum depth from grade to the top of the discharge line to ensure maximum frost protection.

C. The finish grade line shall be one to four inches (1"-4") below the bottom of the lid, and final grade shall slope away from the grinder pump station.

3.05 START-UP AND FIELD TESTING

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

B. All equipment and materials necessary to perform testing shall be the responsibility of the Contractor. This will include, as a minimum, a portable generator (if temporary power is required) and water in each basin.

C. The services of a trained factory-authorized technician shall be provided at a rate of two (2) days for each two hundred (200) grinder pump stations supplied. Projects with fewer than two hundred (200) units shall provide a trained factory-authorized technician for a minimum of one (1) day. Each day shall be ten (10) person hours in duration.

D. Upon completion of the installation, the authorized factory technicians will perform the following test on each station:

1. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating. In some installations, there may be a valve(s) at the street main that must also be open.

2. Turn on the alarm power circuit.

3. Fill the wet well with water to a depth sufficient to verify the high-level alarm is operating. Shut off water.

4. Turn on pump power circuit. Initiate pump operation to verify automatic power controls are operative. Pump should immediately turn on. Within one (1) minute, alarm light will turn off. Within three (3) minutes, the pump will turn off.

E. Upon completion of the start-up and testing, the Manufacturer shall submit to the City the start-up authorization form describing the results of the tests performed for each grinder pump station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed and any installation deficiencies corrected.

PART 4: OPERATION AND MAINTENANCE

4.01 MANUALS

The manufacturer shall supply four (4) copies of Operation and Maintenance Manuals to the City.

END OF SECTION

(Recommended form follows.)

WARRANTY CERTIFICATION

I, _____, by and through my duly authorized signature below as its most senior operating executive, certify that _____ will provide a two (2) year warranty on grinder pump equipment manufactured and supplied by _____ _____ _____ for the _____ project. I further certify that, other than failure to install equipment in accordance with manufacturer's instructions, no exclusions and/or cost items to maintain said equipment in warrantable condition, including labor, travel and shipping fees, exist.

_____ _____

Signature Date

_____

Title

SECTION 02745 VACUUM SEWER SYSTEM

PART 1: GENERAL

1.01 SCOPE OF WORK

The work covered by this section shall consist of furnishing all materials, labor, equipment, and services for the installation and testing of vacuum sewerage system.

1.02 QUALITY ASSURANCE

A. MANUFACTURER'S EXPERIENCE

The vacuum system Manufacturer shall have a minimum of five (5) years of experience in the manufacture of vacuum systems and shall have at least ten (10) installations in service within the United States of America. A "system" is defined as a vacuum sewer system collecting domestic wastewater that has been in operation for at least five (5) years that has at least one hundred fifty 150 vacuum interface valves and valve pits. The Manufacturer shall provide verification at the request of the City. All vacuum system equipment shall be provided by AIRVAC, Inc., or approved equal.

B. ALTERNATIVE MANUFACTURERS

Contractors may offer proposals for alternative manufacturers, but proposals shall not affect award of project. Proposals for alternative manufacturers shall be submitted no later than fifteen (15) days before the bid date to give the City time to review and accept or reject said proposal. The proposal shall be the sole responsibility of the Contractor and shall include, at a minimum, the following:

1. A complete set of plans, specifications, and detailed descriptive material of proposed products that identifies all technical and performance requirements as stated in this Specification;

2. A list showing materials of construction of all components;

3. A list of Manufacturer's recommended spare parts;

4. Information detailing field assembly and installation of proposed equipment;

5. Detailed documentation with discussion of all deviations from criteria included within this Specification;

6. A complete list of all installations of proposed equipment, with contact information;

7. All labor, material, and restoration costs associated with installation of the revised vacuum sewer system based on alternative manufacturer's design criteria; and

8. All electrical and mechanical revisions required at the vacuum station.

Alternates will be considered if and only if said alternate is demonstrated to conform to all pertinent Specification sections. Failure to meet these specifications or deadlines in part or whole will constitute sufficient reason for rejection of the bid proposal. The City shall be the sole authority for determining conformance of a proposed substitute and will not be required to justify the decision to accept or reject a proposal. The Contractor shall reimburse the City for all charges associated with this evaluation, whether it is accepted or rejected.

1.03 SUBMITTALS

Shop drawings or submittals shall be required for the following under provisions in the applicable Sections:

A. Any equipment noted elsewhere in this Specification, including materials of construction, physical properties, controls, operational requirements, and details;

B. Manufacturer's recommended line flushing procedure for City's approval;

C. Manufacturer's installation instructions under provisions specified elsewhere in this Specification;

D. Manufacturer's operation and maintenance data, including spare part list and start-up, operation, and maintenance procedures;

E. A certificate from the pipe Manufacturer stating that the pipe has been tested at twenty-two (22) inches Hg vacuum with no leakage, in accordance with ASTM 3139, and is guaranteed for use in a vacuum system;

F. A certificate from the fittings Manufacturer stating that these fittings are suitable for operation in a vacuum of twenty-two (22) inches of Hg and that the fittings have been tested at a minimum of twenty-two (22) inches of Hg vacuum; and

G. A certificate from the division valve Manufacturer stating that valve will not leak when subject to a vacuum of twenty-two (22) inches Hg for one (1) hour in both open and closed position.

1.04 DELIVERY, STORAGE, AND HANDLING

Deliver pipe, vacuum valves, division valves, valve pits and, castings to site as directed by City's representative.

1.05 WARRANTY

Provide two (2) year manufacturer's warranty. Warranty shall cover materials and workmanship of products supplied, along with installation of vacuum valve pits. Warranty shall commence on date of substantial completion.

PART 2: PRODUCTS

2.01 The gravity sewer line from residence to the collection sump, all buried vacuum mainlines, branch lines, and service laterals shall be SCH40 solvent weld pipe.

2.02 CONFORMANCE:

A. PIPE

All pipe shall be ASTM D-2241, ASTM D-1784 Cell Classification 12454-B.

B. JOINTS

All joints shall be ASTM D-3139 with elastomeric seals. This pipe must be certified as noted in Subsection 1.03.E. above. Elastomeric joints to be Rieber style or approved equal.

C. FITTINGS

All PVC Schedule 40 (pressure rated) pipe fittings shall be produced by Spears Manufacturing Company, or approved equal, from a PVC compound having a cell classification of 12454, conforming to ASTM D-1784. All PVC Schedule 40 fittings shall be injection molded in accordance with ASTM D-2466, with the exception of wye fittings. These wye fittings may be fabricated on the condition that fitting dimensions shall not deviate significantly from fitting dimensions shown on the standard details. Wye fitting sockets shall be made in accordance with ASTM D-2466. A written certification is required from the Manufacturer as noted in Subsection 1.03.F above.

D. No solvent-welded fittings or pipe will be acceptable.

E. WYE FITTINGS

Forty-five-degree (45°) ells shall be used throughout. A three-inch (3") 90° ell may be used at the entering side of the three-inch (3") vacuum valve and at the wye connection to the vacuum main. Tee fittings and vent-type ells are prohibited exclusively.

2.03 VACUUM VALVE AND VALVE PIT: GENERAL REQUIREMENTS

These components are integral to each other and form the most critical components of a vacuum system. Therefore, the following performance standards are considered critical to the successful operation of this vacuum and are not negotiable:

A. All valve pits shall incorporate a physical barrier that separates the valve chamber from the sanitary sewage sump. This barrier and attachments are described in Subsections 2.08 A through 2.08 C.

B. Valve pit pricing shall include an independent laboratory certification that the entire valve pit assembly is loadable to H20 traffic wheel loads. Calculated data is not acceptable.

C. All valves shall include an internal "in-sump" breather. No external breather piping or tubing will be acceptable. The sump breather is to be as described in Section 2.06.

D. All potential vacuum valve suppliers shall submit a written letter indicating acceptance of the Plans and profiles as designed.

2.04 VACUUM VALVE

A. CONFORMANCE

Vacuum valves shall be designed such that head loss through the valve is at minimum. The “Cv” factor for these valves shall be 268 or better. Independent laboratory certificate to be supplied on request. Vacuum valves shall be internal breather Type F as manufactured by AIRVAC. Vacuum valves shall be furnished by the Contractor and installed by the City.

B. VALVE CONSTRUCTION

1. All valves shall be true three-inch (3”) diameter valves capable of passing at least three-inch (3”) solids while matching the outside diameter of three-inch (3”) SDR 21 PVC pipe.

2. Valves shall be vacuum operated on opening and spring-assisted on closing.

3. Valve shall be configured so that the sewer vacuum ensures positive valve seating.

4. Valve plunger and shaft shall be arranged to be completely out of the flow path when valve is in open position.

C. VACUUM OPERATOR

Self lubricating, rolling diaphragm type; diameter sufficient to open valve fully using line vacuum to overcome sealing force; equipped with elastomer seal where shaft enters housing; vacuum drain connected to housing to return seal leakage to sewer when valve cycles.

D. Operation of valve and sensor/controller shall require no outside power service.

E. All materials of valve and sensor/controller shall be chemically resistant to sewage and sewage gases.

F. The valve shall be manufactured such that small objects may be removed from the valve seat area by means other than complete valve removal and disassembly.

G. Valve and sensor/controller shall be capable of operation when submerged in water to a depth of two feet (2') above the uppermost component.

2.05 VALVE SENSOR / CONTROLLER

A. The valve shall be equipped with a sensor/controller that shall rely on atmospheric air and vacuum pressure from the downstream side of the valve for its operation, thereby requiring no other power source. Rising liquid within the holding sump shall initiate the opening of the valve when sufficient head pressure is reached in the holding sump. The activation point shall equate to approximately ten (10) gallons of liquid. The controller shall apply line vacuum from the downstream side of the vacuum valve and apply it to the actuator chamber and fully open the valve.

B. The controller shall be capable of maintaining the valve fully open for a fixed period of time. This shall be field adjustable over a range of three (3) to ten (10) seconds. After this time period has elapsed, the controller shall apply atmospheric air to the actuator chamber, permitting spring-assisted closure of the valve.

C. The controller shall be serviceable by factory-trained personnel and shall be removable from the valve by means of a sliding key device. There shall be no tools required to remove and replace the controller from the vacuum valve, with the exception of tubing clamp nut drivers.

D. The entire body shall be constructed to allow visual inspection of the internal mechanism without disassembly. The controller shall be equipped with external test ports for bench testing of various chambers during rebuild.

2.06 SUMP BREATHER

The only source of atmospheric air necessary for controller operation shall be drawn from the collection sump and its associated gravity sewer piping. With the exception of the four-inch (4") gravity line air inlet, there shall be no other external sources of air necessary or permitted as a part of this valve assembly. A factory-provided internal sump breather unit arrangement shall connect the controller to its air source and provide a means of ensuring that no liquid can enter the controller during system shutdowns and restarts. It shall also be so arranged to prevent sump pressure from forcing the valve to open during low vacuum conditions and provide positive sump venting regardless of traps in the home gravity service line.

2.07 VALVE, CONTROLLER, AND ACCESSORY MATERIALS

The valves shall be constructed from materials described in the following table. Materials of equal or higher standard are all that will be acceptable and must be approved by the City.

Component	Material
Valve Body	Glass-Filled Polypropylene
Valve Shaft	316 Stainless Steel
Valve Shaft Seal	Buna N Rubber
Valve "O"-Rings	Buna N Rubber
Valve Spring	304 Stainless Steel
Valve Plunger	Polypropylene
Valve Seat	EPDM Rubber
Valve Piston Cup	Polypropylene
Valve Seal Retainer	Polypropylene
Controller Body	Clear Nylon 11
Controller Shaft	Acetal and Nylon
Controller Springs	304 Stainless Steel
Controller "O"-Rings	Buna N Rubber
Controller Tubing	Polypropylene
Fasteners	304 Stainless Steel

2.08 VALVE PITS

The entire valve pit assembly including the sump and all accessories shall be traffic loadable to H20 standards. Manufacturer shall provide a certificate of conformance from a recognized independent test laboratory.

A. VALVE PIT

1. Valve pit shall be manufactured by filament winding fiberglass process.

2. Valve pit shall have a three-foot (3') inside diameter at the bottom and shall be conically shaped to allow a twenty-three and a half-inch (23.5") clear-opening cast iron frame and cover to fit.

3. Floor depth shall be three and a half feet (3.5')

4. Walls shall be 3.16 inch (3.16") thick.

B. VALVE PIT BOTTOM

1. Valve pit bottom shall be manufactured from the reaction injection molding process (RIM) using heavy duty liquid molding resin polymer trade name: METTON #1539, generic name: Polydicyclopentadiene (DCPD).

2. Nominal thickness shall be 0.320".

3. Sump mating holes, suction pipe, and sensor pipe holes shall be factory cut.

4. Valve pit bottom shall come supplied with grommets.

C. VALVE PIT SUMP CONSTRUCTION

1. Valve pit sump shall be fiberglass, minimum 3/16-inch wall thickness.

2. Design for H20 traffic loading at two-foot (2') depth of cover.

3. Field assemble, incorporating valve pit bottom as lid.

4. Seal collection sump to valve pit bottom in the field using an approved “O”-ring sealing gasket of closed cell neoprene material only.

5. Holes for service pipes to be field located and cut.

6. Standard sump

A standard sump shall be installed to the following specifications:

a. Type A Installation:

b. Tapered so that the top diameter same as valve pit bottom;

c. 30 inch deep; and

d. 55-gallon capacity.

7. Deep sump:

A deep sump shall be installed to the following specifications:

a. Type B Installation;

b. Tapered so that the top diameter same as valve pit bottom;

c. 54 inch deep; and

d. 100-gallon capacity.

D. ACCESSORIES

1. Provide elastomer seal/grommet for each pipe passing through valve pit, valve pit bottom, and sump to provide a seal against groundwater without the use of threaded fasteners.

2. Install an anti-buoyancy collar as shown and described on the Plans and Standard Details.

3. The collar shall be made from reinforced fiberglass and shall be of sufficient size to eliminate movement in the valve pit assembly when ground water is present at grade. Buoyancy calculation sheets shall be provided with the submittal.

4. AIRVAC Cycle Counter

Each AIRVAC valve controller, two inches (2”) or three inches (3”), shall be equipped with a port for connecting a portable, self-contained valve cycle counter. Each time the valve opens, the counter will advance by one (1) cycle. This counter will be supplied as a part of special tools, which are listed elsewhere.

5. AIRVAC Three-inch (3”) Flexible Pipe

This product is shipped from AIRVAC with an overall length of eight feet, two inches (8’-2”). One end of this product is a plain piece of three-inch (3”) SDR 21 PVC pipe joined to the specially manufactured flexible pipe with a three-inch (3”) Sch. 40 coupling. The overall length of three-inch (3”) flexible pipe is four feet, six inches (4’-6”), and it is equipped with a three-inch (3”) Sch. 40 PVC coupling at its opposite end. The specially manufactured flexible pipe has the proper outside diameter for solvent welding into PVC fittings.

2.09 VALVE PIT COVERS

A. Provide Model R5900 by Neenah Foundry or approved equal.

B. Design for H20 loading.

C. Castings shall meet ASTM A-48, Class 30 gray cast iron.

D. Covers shall bear the name “SANITARY SEWER” on top in raised letters, along with the name of the valve pit Manufacturer.

2.10 BUFFER TANKS

Where indicated on the Plans, the Contractor shall furnish all material associated with this Specification, with the exception of the vacuum valves and appurtenances.

A. QUANTITY OF VACUUM VALVES

The number of valves will vary from one (1) to three (3). Refer to Drawings for quantity. See previous Section for valve Specification.

B. VALVE PIT

Reinforced precast concrete manhole sections with integral base; forty-eight-inch (48”) diameter.

C. MANHOLE JOINTS

Tongue and groove in precast wall with preformed flexible plastic gaskets; shall be Type 1, rope form, and shall meet or exceed FS-SS-S-00210.

D. MANHOLE CASTING AND FRAME

1. Manholes shall be of clear, even grain, tough, Class 30 gray iron, smooth, true to pattern, and free of projections, sand holes, warp, and other defects.

2. Manhole covers shall be designed for H20 traffic loading.

3. Materials shall conform to ASTM A48.

4. Manholes shall be Model R5900 Neenah Foundry or approved equal.

2.11 VACUUM LINE DIVISION VALVES:

A. Valves shall conform to AWWA C509087, Standard for Resilient Seated Gate Valves, as manufactured by Waterous Company or approved equal.

B. Wedge shall be constructed of ductile iron, fully encapsulated in synthetic rubber except for guide and wedge nut areas.

C. Wedge rubber shall be molded in place and bonded to the ductile iron portion and shall not be mechanically attached with screws, rivets, or similar fasteners.

D. Wedge shall seat against seating surfaces arranged symmetrically about the centerline of the operating stem, so that seating is equally effective, regardless of direction of pressure imbalance across the wedge.

E. All seating surfaces in body shall be inclined to the vertical at a minimum angle of 32° (when stem is in a vertical position) to eliminate abrasive wear of rubber sealing surfaces.

F. Stem shall be sealed by at least two (2) “O”-rings; all stem seals shall be replaceable with valve wide open and while subjected to full rated pressure.

G. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or sealing.

H. Valve body and bonnet shall be coated, inside and out, with fusion-bonded epoxy. Coating shall conform to AWWA C550-81, Standard for Protective Interior Coating for Valves and Hydrants.

I. Mechanical joint connections with transition to PVC gaskets shall be provided.

J. Two (2) valve keys shall be provided for each valve size required.

K. Buried valves shall be provided with valve boxes and the operating nut shall be extended to within nine inches (9”), plus or minus six inches (+/- 6”), of the finished grade. The valve box cover shall have the words “SEWER” and “OPEN” with a directional arrow cast on it.

L. Valves shall be supplied with a full ten (10) year money back warranty.

PART 3: EXECUTION

3.01 INSTALLATION:

A. All vacuum sewers shall be laid to the line and grade shown on the Drawings with the use of construction laser beam equipment. All pipe shall be installed as shown on the Drawings. There shall be no abrupt sags or bellies in the line. The maximum deviation from planned elevations shall not exceed five hundredths of a foot (0.05’) in any one hundred feet (100) feet of length. This is a plus or minus tolerance and applies to all pipe sizes.

B. Use proper tools and appliances for handling and laying of pipe and fittings.

C. Prevent entrance of dirt or foreign matter or damage to pipe lining or coating. Plug the pipe any time work is stopped.

D. No defective pieces are permitted. Defective pieces discovered after use will be removed and replaced with a sound piece.

E. Fully bare pipe along its entire length.

F. Lay and join pipe in accordance with Manufacturer's instructions to allow pipe thermal expansion and contraction. Lay pipe with spigot end downstream.

G. Place compacted fill in entire space between the fitting and the trench walls. Use temporary plugs in end of pipes when work is not in progress.

H. Provide pipe through casing with support skids to hold pipe to center of casing as shown on Detail Drawings. Alternate support methods acceptable contingent upon City's approval.

I. Bed pipe as specified in section describing trenching.

J. Verify pipe grade and elevation at each change in grade and record in a manner acceptable to the City.

3.02 DIVISION VALVE AND GAGE TAP INSTALLATION

A. Division valves shall be resilient wedge gate valves.

B. Furnish and install valves under provisions in a separate section.

C. Install gage tap adjacent to division valve where shown in Standard Detail.

D. Provide concrete collar around each division valve and gage tap.

3.03 VALVE PIT INSTALLATION

A. Install complete valve pits in accordance with Manufacturer's instruction.

B. The two-inch (2”) sensor line shall be factory tested for leaks prior to installation in the valve pit bottom. Prior to fitting the valve pit bottom, the flanges and mating surfaces shall be clean and dry.

C. Lay “O”-ring sealing gasket in preformed groove in sump, fit, and tighten bolts and nuts.

D. PVC caps shall be solvent bonded to the stub-outs for the gravity line inlets to the holding tank. A stop shall be solvent bonded around the gravity line four inches (4”) from the end that is inserted into the holding tank.

3.04 AIRVAC SUMP TESTING

A. Following proper assembly, prior to installation, the collection sump shall be tested on-site as follows:

1. First make a three-inch (3”) test plug using a three-inch (3”) PVC cap glued onto a six-inch (6”) length of three-inch (3”) pipe.

2. Tap a 1/8” tubing connection and an air valve fitting into the three-inch (3”) PVC cap, and using a three-inch (3”) no-hub coupling, attach to the installed three-inch (3”) suction pipe.

3. Fabricate a two-inch (2”) test plug using a two-inch (2”) PVC cap glued onto a six-inch (6”) length of two-inch (2”) PVC pipe and insert into the two-inch (2”) sump vent grommet.

4. Insert the tested sensor tube into its four-inch (4") grommet in pit bottom.

5. Using a length of 3/8” AIRVAC tubing, attach one end to the spigot end of sensor tube and the other to a zero to fifty-inch (0-50”) Magnehelic gauge.

6. Connect an air supply to the air valve fitting.

7. Bring water gauge to forty inches (40”) and watch for leaks. Leakage must be under one-inch (1”) water gage in one (1) minute.

8. Contractor shall provide forty-eight (48) hours’ notice to the City prior to all testing.

B. Following initial testing, excavate and prepare bedding for holding sump as shown on construction Plans or as field instructed. Check to ensure adequate slope exists between the home and the holding tank.

EXAMPLE: For thirty-inch (30”) sump installations, the gravity lines will enter the sump at a minimum depth of 4.65 feet. If the gravity line leaves

the home at a depth of approximately two (2) feet, and slope of gravity sewer is two percent (2%), the home must be no farther than one hundred thirty feet (130') from the sump. If insufficient fall exists, contact your project representative.

1. Mark and cut the five-inch (5") holes in the holding sump at the appropriate locations for gravity lines. There are four (4) raised surfaces suitable for gravity connections. Install 4" grommets into openings and lubricate as before.

2. Lower the assembled holding sump into the excavation, taking care that no material is allowed to enter the sump.

3. Install the prefabricated four-inch (4") gravity stubs into their grommets with stop coupling firmly against the grommet.

4. Retest complete assembly in place as outlined above in Subsection 3.04 A. 1.

5. After testing, installation may proceed in accordance with installation instruction manual.

6. Installation may include but is not limited to:
   a. Placement of buoyancy collar as directed;
   b. Proper use of correct backfill material; and
   c. Pouring concrete collar around cast iron manhole frame as needed in traffic areas.

3.05 BUFFER TANK INSTALLATION:

A. Install buffer tank as indicated on the Drawings and Specifications.

B. Construct a bottom sump as shown on the Drawings. This sump shall be a one foot, six-inch (1'-6") diameter circular sump one foot deep (1'-0") deep. Slope bottom of the tank as shown on the Drawings from the gravity inlets to the sump.

C. Manhole steps shall be as located on the Drawings. They shall be aligned vertically and be spaced uniformly sixteen inches (16") apart. Steps shall be firmly embedded into sidewalls of the buffer tank. Material shall be a minimum 304 stainless steel. All pipe penetrations through the buffer tank

walls shall be watertight. Contractor shall submit material for sealing technique to the City.

D. Install suction and sensor pipes as shown on the Drawings. Attach these lines to the buffer tank sidewalls using stainless steel brackets and fasteners. The three-inch (3") service lateral is to be stubbed into the buffer tank and capped or otherwise sealed until the vacuum valve is installed.

E. Install factory-provided internal breather assembly as shown on the Standard Details. There shall be no external breathers necessary or permitted as a portion of these assemblies.

3.06 BUFFER TANK TESTING:

A. Buffer tanks shall be tested after assembly.

B. Stub-ins and pipe plugs shall be secured to prevent movement while tests are conducted.

C. Installation and operation of vacuum equipment and indicating devices shall be in accordance with Manufacturer's recommendations.

D. TESTING PROCEDURE

1. Contractor shall provide City with forty-eight (48) hours' notice before all testing.

2. Contractor shall fill the entire buffer tank with water to a point even with the top frame of the manway.

3. If any water level in the buffer tank falls one-half inch (1/2") or more during a twenty-four (24) hour period, the cause of the leakage shall be determined, and appropriate repairs made. The assembly shall be retested in this manner until no leakage in excess of one-half inch (1/2") in twenty-four (24) hours is achieved.

E. Any visible leak shall also be repaired even though the water tightness test may be successful. After final testing, the buffer tank is to be de-watered by means other than by the vacuum system.

3.07 FIELD QUALITY CONTROL

Contractor shall provide forty-eight hours' notice to the City prior to all testing.

A. TWO (2) HOUR VACUUM LINE TEST

1. Provide daily testing of all sewer mains and lateral connections laid.

2. Plug all open connection with rubber stoppers or temporary caps, fitted to the pipe by "no-hub" couplings.

3. Apply a vacuum to twenty-two (22) inches Hg to the pipes and allow the pressure to stabilize for fifteen (15) minutes. There shall be no loss of vacuum in excess of one percent (1%) per hour for a two (2) hour test period. There shall be absolutely no water allowed to be admitted into the piping network during this test.

4. As pipe is laid, the new section shall be tested in addition to the previously laid pipe on that main.

5. The Contractor should leave uncovered the sewer main pipe joints until after the daily vacuum test is complete so that any leaks can be easily located and repaired.

B. TWO (2) HOUR VACUUM LINE TEST MODIFICATION PROVISION

If the Contractor succeeds in meeting the daily two (2) hour test for seven (7) consecutive working days or two thousand (2,000) LF of pipe, he may alter the procedure to allow the trench to be covered as work progresses rather than keeping the trench open all day as is the norm with the daily two (2) hour test. Should a line fail the vacuum test while utilizing this test modification, the Contractor shall take whatever action necessary at his cost to pass the test including the re-excavation of the trench, leak detection and line repair, and additional cleanup as required by the city. After the failure, the Contractor must "re-qualify" as specified above.

Note: This test modification is optional, and as such, the Contractor assumes all liability in its use.

C. REQUIRED FINAL ACCEPTANCE TESTING ON COMPLETE SYSTEM

1. Subject the entire sewerage system to a vacuum of twenty-two (22) inches Hg and allow to stabilize for fifteen (15) minutes.

2. There shall be no loss greater than one percent (1%) per hour over a four (4) hour test period. There shall be absolutely no water allowed to enter the piping system or the vacuum station during this test.

3. Contractor shall provide forty-eight (48) hours' notice to City prior to Final Acceptance Test.

4. Contractor to ensure all division valves are open prior to beginning of Final Acceptance Test.

5. Final Acceptance Test shall be recorded on approved vacuum chart recorder. This chart will not be considered valid unless witnessed by City's representatives on test equipment at beginning and end of vacuum test period.

6. City representative will sign and date chart to verify witness of test. This signature does not indicate acceptance of the system.

3.08 LINE FLUSHING

A. After Final Acceptance Testing, flush lines to remove debris and foreign materials that accumulated in the lines during construction.

B. SUGGESTED PROCEDURE

This procedure requires the use of vacuum valves, which must be installed by the City. Coordination is therefore required.

1. Place system under vacuum.

2. Add water and air in controlled amounts to valve pits at extreme ends of system.

3. Utilize system vacuum to transport water and debris to collection point.

4. Continue procedure until water entering at collection point is free of contamination or debris. If vacuum collection tank is used as collection point, monitor volume of liquid in tank and pump out as

necessary. Use system sewage pumps only after verifying that no debris is present in collection tank. If debris is present, use other methods to empty collection tank. At completion of flushing, clean collection tank of all collected debris.

5. Seal system and make ready to place into operation.

C. Alternate flushing procedure subject to City's approval.

PART 4: SPARES AND SPECIAL TOOLS

The Contractor shall provide the following spare parts and special tools.

4.01 SPARES

For each one hundred (100) AIRVAC Valves installed, the following spare parts will be kept on hand:

Quantities	Part
3	Three-inch (3") vacuum valves
3	Sump breathers
2	Complete six-foot (6') deep pit packages with covers and flotation collars
1	Complete eight-foot (8') deep pit packages with covers and flotation collars
25 feet	3/8" Clear tubing
50 feet	5/8" Clear tubing
6	Controllers
3	Three-inch (3") valve rebuild kits
3	Controller rebuild kits
1	Tube of controller grease
1	Tube of three-inch (3") valve shaft grease
6	Three-inch (3") no-hub clamps
6	Controller mounting "O"-rings
10	Tubing clamps
3	Controller mounting keys
3	Surge suppressors

4.02 RECOMMENDED SPECIAL TOOLS

Quantities	Tool
1 (Per service truck)	Sensor pipe puller
2 (per service truck)	No-hub clamp torque wrenches
1	0-50” Magnehelic gauge
1	24-Hour portable chart recorder
1 (Per service truck)	AIRVAC portable test box
1	AIRVAC three-inch (3”) valve repair stand
2 (Per each 100 AIRVAC valves)	AIRVAC cycle counter

END OF SECTION

SECTION 02905 RESTORATION OF SURFACES

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This Section covers the furnishing of all labor, equipment, and materials necessary for the proper restoration of existing surfaces disturbed or damaged as a result of construction operations that are not specifically scheduled or specified for topsoil and seeding, paving, landscaping, or other surfacing.

B. In general, the types of replacement included in this section are seeding along pipelines, concrete sidewalks, driveways, roadways, ditches, lawns and landscaped areas, and curb and gutter.

C. Any damage to existing structures shall be repaired using materials and workmanship equal to those of original construction.

PART 2: NOT USED

PART 3: EXECUTION

3.01 RESTORATION OF SURFACES

A. SEEDING ALONG PIPELINES

1. All ground surfaces along pipelines that are not classified as lawns, landscaped areas, or pavement areas, but would be classified as open fields, shall be raked smooth and seeded in accordance with Section 02931. Large rocks, clumps of earth, and excessive spoil material shall be removed from the area prior to seeding.

2. Shoulders of all roads shall be restored as specific for lawns and landscaped areas.

3. Wooded areas not classified as lawns shall be restored to as near their original condition as possible.

B. SIDEWALKS

1. Concrete walks removed in connection with, or damaged as a result of, construction operations under the Contract shall be replaced with new construction. Such walks shall be constructed of Class A concrete on a thoroughly compacted subgrade or mineral aggregate base as shown. Concrete walks shall have a vertical thickness of not less than four inches (4") or not less than the thickness of the replaced walk where greater than four inches (4").

2. Walks shall be float finished, edged with an edging tool, and grooved at intermediate intervals not in excess of the width of the walk, uniform throughout the length of the walk in any one direction.

3. Concrete sidewalks require seam-to-seam cuts. No patches of concrete surfaces are allowed.

4. Aggregate sidewalks will be pressure-washed and sealed to obtain as close of a match to the existing sidewalk as possible.

C. DRIVEWAYS

1. Unpaved driveways shall be surfaced with not less than three inches (3") of mineral aggregate base, topped with three inches (3") of stone, gravel, or other materials equal to that found in the original driveway. Driveways shall be left in a condition better than their original condition.

2. Unless otherwise specified, concrete drives shall be replaced with Class A concrete and shall have equal thickness and reinforcing steel to that of the original drive. Prior to placing the concrete, a six-inch (6") layer of compacted mineral aggregate base shall be placed in the drive area.

3. Bituminous or asphaltic concrete drives shall be restored with a six-inch (6") layer of compacted mineral aggregate base and a two-inch (2") layer of compacted asphaltic concrete surface (hot mix), grading E.

4. Concrete driveways require seam-to-seam cuts. No patches of concrete surfaces are allowed.

5. Aggregate driveways shall be pressure-washed and sealed to obtain as close of a match to the existing driveway as possible.

D. ROADWAY REPLACEMENT

1. Bituminous or asphaltic pavements shall include all areas paved with blacktop, built-up pavements of oil and stone or tar and stone, and similar pavements constructed with bituminous or asphaltic and stone materials.

2. Immediately upon completion of installation of underground piping and structures, the trench shall be backfilled, and the roadway shall be repaired. Unless otherwise noted, in the excavated area, the repair shall consist of a six-inch (6") aggregate base course (No. 57 Stone), minimum eight-inch (8") pug mix in 4-inch (4") lifts, compacted to a minimum of 98% maximum theoretical density, and a two-inch (2") surface course. Trackless tack is to be used where directed. Asphalt repairs require infrared treatment to ensure a seamless repair.

3. If, in the opinion of the City, the area adjacent to the excavation has not been damaged to the extent that the base course need to be replaced, restoration may consist of a surface course of sufficient thickness to meet the existing pavement.

4. Portland cement concrete roadways shall be replaced with Class A concrete and shall have equal thickness and reinforcing steel as the original roadway. A mineral aggregate base layer of six inches (6") compacted thickness shall be placed prior to the placing of concrete.

5. Differential settlement of restored pavements shall be corrected immediately.

6. The Contractor shall repair and restripe any traffic markings that were damaged, removed, or covered during construction. All work shall be done in accordance with TDOT requirements and specifications.

7. All existing manhole and valve covers shall be raised as required by the Contractor prior to paving. The cost of this work shall be included in the unit bid prices for other related work and no additional payment shall be made, unless otherwise noted.

E. DITCHES

Ditches shall be regraded to the original grade and line. The surface of all ditches shall be returned to the same condition as found before commencing work and provide positive drainage.

F. LAWNS AND LANDSCAPED AREAS

1. Lawns and landscaped areas shall be regraded and replaced as follows:

   a. Grading shall be to the grade existing before construction of the work under this Contract.

   b. Lawn replacement shall be in accordance with the Section 02931. Topsoiled areas shall be replaced with topsoil of equal quality and quantity.

2. Landscaped areas shall be replaced with shrubs, hedges, ornamental trees, flowers, or other items to original condition.

G. CURB AND GUTTER

Curb and gutter removed with, or damaged as a result of, construction operations or injured or disturbed by the Contractor, his agents, or employees shall be replaced with new construction to a condition equal to that existing before damage was incurred. Class A Concrete shall be used in curb and gutter replacement.

H. DAMAGE TO STRUCTURES

Any damage to existing structures shall be repaired of materials and workmanship equal to those of original construction. Extensively damaged structures, where the structural stability has been affected or that cannot be repaired in a suitable fashion shall be replaced entirely. Replacement shall not commence until approval of the plan of replacement has been given by the City. Replacement costs shall be responsibility of the Contractor.

END OF SECTION

SECTION 02931 SEEDING, FERTILIZING, AND MULCHING

PART 1: GENERAL

1.01 SCOPE OF WORK

A. This section covers the furnishing of all labor, equipment, and materials necessary for the landscaping of all areas of the site disturbed by construction operations and all earth surfaces of embankments, including rough and fine grading, topsoil if required, fertilizer, lime, seeding, and mulching. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the successful establishment and growth of the grasses or legumes.

PART 2: PRODUCTS

2.01 MATERIALS

A. FERTILIZER

1. The quality of fertilizer and all operations in connection with the furnishing of this material shall comply with regulations adopted by the Tennessee Department of Agriculture.

2. Fertilizer shall be 10-10-10 grade. Upon written approval of the City, a different grade of fertilizer may be used, provided the rate of application is adjusted to provide the same amounts of plant food.

3. During handling and storing, the fertilizer shall be cared for in such a manner that it will be protected against hardening, caking, or loss of plant food values. Any hardened or caked fertilizer shall be pulverized to its original condition before being used.

B. LIME

1. The quality of lime and all operations in connection with the furnishing of this material shall comply with the requirements of the Tennessee Department of Agriculture.

2. During the handling and storing, the lime shall be cared for in such a manner that it will be protected against hardening and caking. Any hardened or caked lime shall be pulverized to its original condition before being used.

3. Lime shall be agriculture grade ground dolomitic limestone. It shall contain not less than eighty-five percent (85%) of the calcium and magnesium carbonates and shall be of such fineness that at least ninety percent (90%) will pass a No. 10 sieve and at least fifty percent (50%) will pass a No. 100 sieve.

C. SEED

1. The quality of seed and all operations in connection with the furnishing of this material shall comply with the regulations adopted by the Tennessee Department of Agriculture.

2. Seed shall have been approved by the Tennessee Department of Agriculture or any agency approved by the City before being sown, and no seed will be accepted with a date of test more than nine (9) months prior to the date of sowing. Such testing, however, will not relieve the Contractor from responsibility for furnishing and sowing seed that meets these specifications at the time of sowing. When a low percentage of germination causes the quality of the seed to fall below the minimum pure live seed specified, the Contractor may elect, subject to the approval of the City, to increase the rate of seeding sufficiently to obtain the minimum pure live seed contents specified, provided that such an increase in seeding does not cause the quantity of noxious weed seed per square yard to exceed the quantity that would be allowable at the regular rate of seed.

3. During handling and storing, the seed shall be cared for in such a manner that it will be protected from damage by heat, moisture, rodents, or other causes.

4. Seed shall be entirely free from bulblets or seed of Johnson Grass, Nutgrass, Sandbur, Wild Onion, Wild Garlic, and Bermuda Grass. The specifications for restricted noxious weed seed refers to the number per pound, singly or collectively, of Blessed Thistle, Wild Radish, Canada Thistle, Corncockle, Field Bindweed, Quack grass, Dodders, Dock, Horse nettle, Bracted Plantain, Buckhorn, or Wild Mustard; but in no case shall the number of Blessed Thistle or Wild Radish exceed twenty-seven (27) seeds of each per pound. No tolerance on weed seed will be allowed.

D. TACKIFIER

Emulsified asphalt or organic tackifier such as Reclamare R2400 shall be sprayed uniformly on mulch as it is ejected from blower or immediately thereafter. Tackifier shall be applied evenly over area creating uniform appearance. Rates of application will vary with conditions. Asphalt shall not be used in freezing weather.

PART 3: EXECUTION

3.01 PREPARATION

A. PROTECTION OF EXISTING TREES AND VEGETATION

1. Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking, or skinning of roots; skinning and bruising of bark; smothering of trees by stockpiling construction materials or excavated materials within drip line; excess foot or vehicular traffic; or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

2. Provide protection for roots over one and a half inch (1-1/2”) diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out and cover with earth as soon as possible.

3. The Contractor shall not remove or damage trees and shrubs that are outside the Clearing Limits established by the Owner or those within the Clearing Limits designated to remain.

4. Repair trees scheduled to remain and damaged by construction operations in a manner acceptable to the City. Repair damaged trees promptly to prevent progressive deterioration caused by damage.

5. Replace trees scheduled to remain and damaged beyond repair by construction operations, as determined by the City with trees of similar size and species. Repair and replacement of trees scheduled to remain and damaged by construction operations or lack of adequate protection during construction operations shall be at the Contractor's expense.

B. GRADING

1. Rough grading shall be done as soon as all excavation required in the area has been backfilled. The necessary earthwork shall be accomplished to bring the existing ground to the desired finish elevations as shown on the Contract Drawings or otherwise directed.

2. Fine grading shall consist of shaping the final contours for drainage and removing all large rock, clumps of earth, roots, and waste construction materials. It shall also include thorough loosening of the soil to a depth of six inches (6”) by plowing, discing, harrowing, or other approved methods until the area is acceptable as suitable for subsequent landscaping operations. The work of landscaping shall be performed on a section by section basis immediately upon completion of earthwork.

3. Upon failure or neglect on the part of the Contractor to coordinate his grading with seeding and mulching operations and diligently pursue the control of erosion and siltation, the City may suspend the Contractor's grading operations until such time as the work is coordinated in a manner acceptable to the City.

C. SEEDBED PREPARATION

1. The Contractor shall cut and satisfactorily dispose of weeds or other unacceptable growth on the areas to be seeded. Uneven and rough areas outside of the graded section, such as crop rows, farm contours, ditches and ditch spoil banks, fence line and hedgerow soil accumulations, and other minor irregularities that cannot be obliterated by normal seedbed preparation operations, shall be shaped and smoothed as directed by the City to provide for more effective seeding and for ease of subsequent mowing operations.

2. The soil shall then be scarified or otherwise loosened to a depth of not less than 6” except as otherwise provided below or otherwise directed by the City. Clods shall be broken and the top two to three inches (2”-3”) of soil shall be worked into an acceptable seedbed by the use of soil pulverizers, drags, or harrows; or by other methods approved by the City.

3. On 2:1 slopes, a seedbed preparation will be required that is the same depth as that required on flatter areas, although the degree of smoothness may be reduced from that required on the flatter areas if so, permitted by the City.

4. On cut slopes that are steeper than 2:1, both the depth of preparation and the degree of smoothness of the seedbed may be reduced as permitted by the City, but in all cases the slope surface shall be scarified, grooved, trenched, or punctured so as to provide pockets, ridges, or trenches in which the seeding materials can lodge.

5. On cut slopes that are either 2:1 or steeper, the City may permit the preparation of a partial or complete seedbed during the grading of the slope. If at the time of seeding and mulching operations such preparation is still in a condition acceptable to the City, additional seedbed preparation may be reduced or eliminated.

6. The preparation of seedbeds shall not be done when the soil is frozen, extremely wet, or when the City determines that it is in an otherwise unfavorable working condition.

D. APPLICATION RATES

Seed shall be applied by means of a hydro-seeder or other approved methods. The rates of application of seed, fertilizer, and limestone shall be as stated below.

1. Lime and Fertilizer

In the absence of a soil test, the following rates of application of limestone and fertilizer shall be:

a. 4,000 pounds limestone per acre;

b. 1,000 pounds 10-10-10 ($N\text{-}P_2O_5\text{-}K_2O$) fertilizer per acre and the remaining quantity applied when vegetation is three inches (3”) in height or forty-five (45) days after seeding, whichever comes first.

2. Mulch

Mulch shall be applied at the following rates per acre:

a. 3,000-4,000 pounds straw mulch;

b. 1,500-2,000 pounds wood cellulose fiber;

c. 35-40 cubic yards of shredded or hammermilled hardwood bark; or

d. 1,200-1,400 pounds of fiberglass roving.

3. Seed

The kinds of seed and the rates of application shall be as contained in this table. All rates are in pounds per acre. *See Notes 1 and 2*.

a. Fall and Winter (Normally September 1 to May 1)

80 pounds of Ky-31 Tall Fescue and 15 pounds of Rye Grain

b. Summer (Normally May 1 to September 1)

100 pounds of Ky-31 Tall Fescue

NOTE:

1. On cut and fill slopes having 2:1 or steeper slopes, add forty (40) pounds of Sericea lespedeza per acre to the planned seeding (hulled in spring and summer unhulled in fall and winter) plus fifteen (15) pounds of Sudan grass in summer seeding or twenty-five (25) pounds of Rye Cereal per acre in fall and winter seeding, if seeded September to February.

2. These seeding rates are prescribed for all sites with less than fifty percent (50%) ground cover and for sites with more than fifty percent (50%) ground cover where complete seeding is necessary to establish effective erosion control vegetative cover. On sites having fifty to eighty percent (50%-80%) ground cover where complete seeding is not necessary to establish vegetative cover, reduce the seeding rate at least one-half the normal rate.

E. APPLICATION

1. Equipment to be used for the application, covering, or compaction of limestone, fertilizer, and seed shall have been approved by the City before being used on the project. Approval may be revoked at any time if equipment is not maintained in satisfactory working condition or if the equipment operation damages the seed.

2. Limestone, fertilizer, and seed shall be applied within twenty-four (24) hours after completion of seedbed preparation unless otherwise permitted by the City, but no limestone or fertilizer shall be distributed and no seed shall be sown when the City determines that weather and soil conditions are unfavorable for such operations.

3. Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed at the specific rate of application and then

harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed.

4. Seed shall be distributed uniformly over the seedbed at the required rate of application, and immediately harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. The depth of covering shall be as directed by the City. If two (2) kinds of seed are to be used that require different depths of covering, they shall be sown separately.

5. When a combination seed and fertilizer drill is used, fertilizer may be drilled in with the seed after limestone has been applied and worked into the soil. If two (2) kinds of seed are being used that require different depths of covering, the seed requiring the lighter covering may be sown broadcast or with a special attachment to the drill or drilled lightly following the initial drilling operation.

6. When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than thirty (30) minutes prior to application unless otherwise permitted by the City.

7. Immediately after seed has been properly covered the seedbed shall be compacted in the manner and degree approved by the Engineer.

8. When adverse seeding conditions are encountered due to steepness of slope, height of slope, or soil conditions, the City may direct or permit that modifications be made in the above requirements that pertain to incorporating limestone into the seedbed; covering limestone, seed, and fertilizer; and compaction of the seedbed.

9. Such modifications may include but not be limited to the following:

    a. The incorporation of limestone into the seedbed may be omitted on:

        i. cut slopes steeper than 2:1;

        ii. 2:1 cut slopes when a seedbed has been prepared during the excavation of the cut and is still in an acceptable condition; or

        iii. areas of slopes where the surface of the area is too rocky to permit the incorporation of the limestone.

b. The rates of application of limestone, fertilizer, and seed on slopes 2:1 or steeper or on rocky surfaces may be reduced or eliminated.

c. Compaction after seeding may be reduced or eliminated on slopes 2:1 or steeper, on rocky surfaces, or on other areas where soil conditions would make compaction undesirable.

F. MULCHING

1. All seeded areas shall be mulched unless otherwise indicated in the special provisions or directed by the Engineer.

2. It shall be spread uniformly at a rate of two (2) tons per acre in a continuous blanket over the areas specified.

3. Before mulch is applied on cut or fill slopes that are 3:1 or flatter and ditch slopes, the Contractor shall remove and dispose of all exposed stones in excess of three inches (3”) in diameter and all roots or other debris that will prevent proper contact of the mulch with the soil.

4. Mulch shall be applied within twenty-four (24) hours after the completion of the seeding unless otherwise permitted by the City. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations.

5. Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application. An acceptable application will be that that will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture.

6. Mulch shall be held in place by applying a sufficient amount of asphalt or other approved binding material to assure that the mulch is properly held in place. The rate and method of application of binding material shall meet the approval of the City. Where the binding material is not applied directly with the mulch, it shall be applied immediately following the mulch operation.

7. The Contractor shall take sufficient precautions to prevent mulch from entering drainage structures through displacement by wind, water, or other causes and shall promptly remove any blockage to drainage facilities that may occur.

G. MAINTENANCE

1. The Contractor shall keep all seeded areas in good condition, reseeding and mowing if and when necessary as directed by the City, until a good lawn is established over the entire area seeded and shall maintain these areas in an approved condition until final acceptance of the Contract.

2. Grassed areas will be accepted when a ninety-five percent (95%) cover by permanent grasses is obtained and weeds are not dominant. On slopes, the Contractor shall provide against washouts by an approved method. Any washouts that occur shall be regraded and reseeded until a good sod is established.

3. Areas of damage or failure due to any cause shall be corrected by being repaired or by being completely redone as may be directed by the City. Areas of damage or failure resulting either from negligence on the part of the Contractor in performing subsequent construction operations or from not taking adequate precautions to control erosion and siltation as required throughout the various sections of the Specifications, shall be repaired by the Contractor at his cost and as directed by the City.

END OF SECTION

SECTION 11307 SUBMERSIBLE SEWAGE PUMP STATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. The work covered by this Section shall consist of furnishing all materials, labor, equipment, and services for the installation of sewage pumps for use in lift stations. Contractor shall include all labor, materials, equipment, incidentals, and ancillary components to make a complete system.

B. The Contractor shall be responsible for setting the wet well, vaults and metering, the control panel, and connecting supply power to the panel.

C. Unless otherwise noted, all materials and equipment supplied under this Section shall be new, of good quality, and in good condition.

1.02 SYSTEM DESCRIPTION

A. DESIGN REQUIREMENTS

1. Pump(s) shall be installed in such a way that solids are fed in an up flow direction to the non-clog impeller with no feet, rails, or other obstructions below inlet. Pump shall not be intended to handle abrasive materials or sewage containing large amounts of sand, grit, or other stone-like compositions.

2. The principle items of equipment shall include two (2) submersible centrifugal sewage pumps, submersible electric motors, internal piping, valves, motor control panel, liquid level control system, magnetic flowmeter, SCADA as approved by the City and emergency diesel engine generator.

3. The sewage pump station wetwell and valve vault shall be precast concrete.

B. PERFORMANCE CRITERIA

Pumps must be designed to handle raw, unscreened, domestic sanitary sewage and capable of passing a three-inch (3”) spherical solid. Each pump shall be selected to perform under following operating conditions, to be determined by the design engineer on a per-project basis:

Capacity (gpm)	To Be Determined for Specific Conditions
Total Dynamic Head (ft)	To Be Determined for Specific Conditions
Total Discharge Static Head (ft)	To Be Determined for Specific Conditions

C. UTILITY POWER REQUIREMENTS

Site power furnished to pump station shall be three-phase, 480-volt (V), 60 hertz (Hz), three (3) wire, and shall be maintained within industry standards. Voltage tolerance shall be plus or minus ten percent (+/- 10%). Phase-to-phase unbalance shall not exceed one percent (1%) average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 V.

1.03 QUALITY ASSURANCE

A. MANUFACTURER

The submersible pump shall be supplied by a reputable Manufacturer with at least five (5) years' experience in the manufacture of submersible grinder pumps. Acceptable manufacturers include Xylem - Flygt, Sulzer (ABS, Pumpex), Chicago, Yeomans, or approved equal.

B. PUMP STATION WIRING

1. The pump station shall be completely wired at the factory except for the power feeder lines. Wiring diagrams matching the unit wiring shall be provided to the City by the Manufacturer.

2. All components and workmanship shall be UL-certified and bear the UL serialized label.

C. FACTORY TESTS

1. The pumps shall be tested at the factory under simulated field conditions for excessive vibration, leaks, and operation of all automatic systems.

2. The controls shall be adjusted to start and stop the pumps to satisfy field conditions.

3. For each unit, a pump performance curve shall be produced from the factory testing. Its veracity shall be certified, and the curves shall be identifiable by serial numbers of pumps and motors. Manufacturer shall submit size copies of the certified curves to the City. City will judge adequacy of performance and distribute copies of curves appropriately.

1.04 SUBMITTALS

A. SHOP DRAWINGS

The Contractor shall submit five (5) sets of shop drawings and/or wiring diagrams that satisfy the conditions of Subsection 01200, 1.04, for the major equipment to be installed such as the pump, motor starters, instrumentation, and controls.

B. OPERATION AND MAINTENANCE MANUALS

Three (3) copies of a standard operation and maintenance manual for the pump units shall be supplied by the Contractor.

1.05 DELIVERY, STORAGE, AND HANDLING

All equipment shall be delivered, stored, and handled in strict accordance with the Manufacturer's recommendations.

1.06 WARRANTY

A. The Contractor shall include in the bid price for this item a guarantee to the City from the Manufacturer(s), for one (1) year from the date of final acceptance by the City, that the pumps, including ancillary equipment, apparatus and parts, shall be free from defective materials, equipment, or workmanship, including with respect to equipment, the services of qualified factory trained servicemen, as may be required.

B. Under the guarantee, the Manufacturer shall furnish replacements for any component that proves defective, except those items that are normally consumed in service, such as light bulbs, oil, grease, packing, gaskets, "O"-rings, etc.

C. The pump Manufacturer shall be solely responsible for the warranty of the station and all components. Components failing to perform as specified by the City, as represented by the Manufacturer, or proved defective in

service during the warranty period shall be replaced, repaired, or satisfactorily modified by the Manufacturer without cost of parts or labor to the City.

D. The pump Manufacturer shall warrant the pump for a period of five (5) years. Warranty shall include one hundred percent (100%) coverage for shop labor and parts for all five (5) years.

1.07 PUMP PREQUALIFICATION SUBMITTAL

A. Contractors wishing to supply equipment by a manufacturer other than those listed in Subsection 1.03 A, must submit a prequalification submittal for approval to the City. The submittal shall demonstrate that the proposed equipment meets the requirements of the Contract Specifications and Drawings. The prequalification submittal shall include, as a minimum, the following information:

1. Literature and cut sheets from manufacturer(s) describing equipment;
2. Pump operating curves;
3. Proposed motor sizes and speeds;
4. Copy of warranties;
5. List of at least five (5) references for similar installations, including contact names and current telephone numbers; and
6. A written statement from the Manufacturer indicating that the Manufacturer has reviewed the proposed application as detailed in the Contract Drawings and Specifications, and that all equipment, materials, and systems proposed to be supplied are appropriate and compatible for this specific application.

B. The submittal of prequalification information does not omit the requirement for the Contractor and Manufacturer to submit complete shop drawing submittals to the City in accordance with Section 01200, 1.04 of these Specifications.

1.08 MANUFACTURER AND SUPPLIER INFORMATION

A. MANUFACTURER NAMEPLATE

A manufacturer's nameplate shall be securely and permanently mounted to each individual piece of equipment furnished under this Section. The nameplate shall be constructed of a durable, non-corrosive material. Critical information shall be clearly engraved or otherwise permanently

stamped on the nameplate and shall be fully legible. Failure to meet these requirements will be cause for rejection of the equipment. The information contained on the manufacturer nameplate shall include at least the following:

1. Manufacturer's serial number;
2. Name, address, and telephone number of equipment Manufacturer;
3. Model and/or part number, including pump impeller sizes, when applicable;
4. Performance criteria (i.e., capacity, design point, etc.);
5. Motor size, speed, and voltage;
6. Enclosure type or rating; and
7. Any other pertinent information.

B. SUPPLIER AND SERVICE INFORMATION

A durable nameplate, stamp, or sticker shall be adhered to each individual piece of equipment containing the name, address, and telephone number of the local business that supplied the equipment and the name, address, and telephone number of the local business that can provide service and replacement parts for the equipment. A twenty-four (24) hour emergency service telephone number should also be included.

PART 2: PRODUCTS

2.01 PUMPS

A. The pump system shall be vertical, submersible non-clog type.

B. Each pump shall be mounted on a universal, stainless steel, guide rail system designed to permit removal without the need for personnel to enter the wetwell.

C. All openings and passages shall be large enough to permit the passage of a sphere three inches (3") in diameter.

D. The major pump components, including the pump volute impeller, motor, and seal housing shall be high quality gray cast iron, ASTM A-48, Class 25, free from rough spots or other irregularities.

E. All fasteners, washers, brackets, chain, cables, etc., within the wetwell shall be 300 series stainless steel.

F. All mating surfaces where watertight sealing is required shall be machined and fitted Buna-N “O”-rings. Sealing shall be accomplished by automatic compression.

G. Connections requiring specific torque limits or sealing compounds shall not be acceptable. An acceptable alternative is a metal-to-metal discharge connection with contact between two (2) machined surfaces.

H. The impeller shall be of the enclosed, double shroud, dynamically balanced with smooth waterways for non-clogging operation.

I. A bronze or stainless-steel wear ring set shall be installed between volute and impeller to provide efficient sealing. The seal faces shall be tungsten carbide. Recessed impellers will be acceptable.

J. The pump shaft shall be one (1)-piece stainless steel or carbon steel shaft with stainless steel sleeve.

K. Each pump shall be provided with an in-tandem double mechanical shaft seal system. The seals shall operate in an oil reservoir, which provides constant lubrication and is easily accessible for draining and inspection. There shall be an electric probe or seal failure sensor installed in the seal chamber to send a signal providing the operator with an indication of impending seal failure.

L. The complete weight of the pump is to rest on the bottom support plate or base elbow. No weight is to be supported on the guide rails or the discharge elbow.

M. Mounting plate shall be stainless steel coated with coal tar epoxy system.

2.02 MOTORS

A. The maximum allowable speed shall be 3,400 rpm. Motors shall be designed for operation on three-phase, 240 V, 60 Hz electrical current. The pump motor shall be of NEMA B type and the stator windings shall have Class F moisture-resistant insulation rated for 155° C.

B. Each motor shall be protected by one (1) motor temperature switch embedded in each phase winding. Each switch shall be designed to operate at 140° C. Each switch shall be normally closed automatic reset

type rated 5 amps (A) at 120 V alternating current (AC). The switches shall be wired in series with end leads wired to terminals within the motor housing.

C. Thrust bearings shall be protected by bearing temperature switches. The switches shall be normally closed automatic reset type rated 5 amps at 120 V AC.

D. Each motor housing shall be provided with a moisture detection system complete with all sensors, control power transformers, intrinsically safe control modules, and relays.

1. The moisture detection system shall be rated for a 120 V AC or 24 V AC supply.

2. The moisture detection system shall provide two (2) normally open dry output contacts rated 5 A at 120 V AC.

3. The contacts shall close when moisture is detected in the motor housing.

4. All moisture detection system components shall be furnished by the pump supplier and shall be shipped loose for installation into the adjustable frequency drive enclosure.

E. The motor horsepower shall be adequate, so the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

2.03 DISCONNECT SYSTEM

A. The design of the disconnect system shall permit the easy removal of each pumping unit for inspection and service. There shall be no need for personnel to enter the wetwell to inspect or service the pumps.

B. A cast iron discharge elbow, located on the floor of the wetwell, will receive the pump discharge when the pump is lowered into place. The pipe discharge shall be fitted with a resilient seal that provides a positive hydraulic seal for maximum pump system efficiency.

C. Each pumping unit shall be provided with a stainless-steel lifting chain or cable of adequate strength for raising and lowering the pumps. The chain shall be properly secured in a convenient location near the top of the wetwell.

2.04 HOIST ASSEMBLY

A. A flush mounted portable hoist, rated at least one hundred fifty percent (150%) the weight of the pumping units, shall be provide for each lift station.

B. The hoist shall be provided with a zinc-plated winch with a disc brake, and at least thirty feet (30') of 5/16" stainless steel cable equipped with a hook and safety latch.

2.05 WIRING CHANNEL

A. A wiring channel shall be mounted below the pump well cover for the pumps and shall provide cord grip holders for the pump cords and the control cords.

B. The channel box shall have a removable cover for easy adjustment of cords.

C. All cords shall extend from one end of the box and be taken through conduit in the sump cover to the control panel.

D. No splices shall be made in the wiring channel. Continuous cords must be used from the control panel to the pumps and controls.

E. Wiring channel shall mount on supports fastened to access cover frame.

2.06 PUMP CONTROL SYSTEM

A. GENERAL

1. The operation of the pumps shall be controlled by a pump control system (PCS).

2. The PCS equipment shall be constructed in compliance with UL's Industrial Control Panels listing and following-up service, utilizing UL-listed and recognized components where applicable.
3. The pumps shall operate based on variations of the sewage level in the wetwell. An ultrasonic level transmitter shall be installed in the wetwell to provide the depth of sewage in the wetwell.

B. CONTROL PANEL

1. The control panels shall be built in an UL-listed manufacturing facility. The equipment shall be designed to have a useful operating life of no fewer than fifteen (15) years with standard servicing and replacement of parts.

2. Control panel for pumps shall have a NEMA 4X stainless steel low-profile enclosure suitable for pedestal or pole mounting with weather hood and shall be dead front with separate removable inside panel to protect electrical equipment. A lock hasp shall be provided on the outside door.

3. A circuit breaker, elapsed time meter, suitable controller, loss of phase protection, automatic pump alternator, power lightning arrestor, and an H-O-A switch shall be provided. Miniature relays shall not be accepted.

4. Motor status run light shall be provided along with a terminal strip for connecting pump and control wires.

5. Additional terminals shall be provided to connect alarm, heat sensors, and seal failure wires.

6. A transformer shall be supplied to give a 115-volt control circuit. A single weatherproof ground-fault-protected duplex convenience outlet shall be provided on the side of the control panel enclosure.

7. An emergency “Operator Assistance” red push button shall be provided on the outside of the control panel for easy access in an emergency.

8. The control panel shall be completely wired at the factory except for the power feeder lines. Wiring diagrams matching the unit wiring shall be provided.

9. The control panel shall include a digital display for identifying wetwell level and pump discharge flow and pressure. The display unit shall power the 4-20 mA transducer and shall obtain input from the transducers and transmitters. Level shall be displayed as depth in feet from the bottom of the wetwell. Flow shall be displayed in gallons per minute (gpm), and pressure shall be displayed in pounds per square inch (psi).

10. The control panel or remote terminal unit (RTU) shall be provided with a plug-in connector for future connection to a data radio or similar external telemetry system.

11. The control panel shall be equipped with an alarm silence switch to provide maintenance personnel a means to silence the external alarm device while corrective actions are under way. After silencing the alarm, manual reset of the alarm signal shall provide automatic reset of the alarm silence relay.

12. The pump station Manufacturer shall supply one (1) 115 V AC alarm light fixture with vapor-tight, shatter-resistant red globe, conduit box, and mounting base. The design must prevent rainwater from collecting in the gasketed area of the fixture between the base and globe. The alarm light shall be shipped loose for installation by the Contractor.

13. The pump station Manufacturer shall supply one (1) 115 V AC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rainwater from collecting in any part of the horn. The alarm horn shall be shipped loose for installation by the Contractor.

C. INSTRUMENTATION INTERFACE

1. Pump Station Flow Metering

A magnetic flow meter shall be installed in the common discharge header of the Pumps. The flow meter shall provide an instantaneous flow and a pulse totalizing flow signal for monitoring in the pump control system (PCS). Each pulse will equal one hundred (100) gallons. The instantaneous and totalized flow signals for the discharge header will be indicated and summed in the PCS to obtain pump station discharge instantaneous flow and pump station discharge total flow.

2. Pump Station Level

Ultrasonic level element and transmitter will be installed at the pumping station. The transmitter will send a signal to the pump control panel and then to the PCS for level indication. The pump control panel will use this level signal to control the pumps.

3. Pump Station Discharge Pressure

A pressure transducer and transmitter shall be installed in the common discharge header of the pumps. The transmitter will send a signal to the pump control panel for discharge pressure indication.

D. CONTROL DESCRIPTION

1. Each pump station pump shall have control modes “On,” “Off,” and “Auto.”

2. The On mode will energize the pumps until the switch is turned to the Off or Auto modes. The On mode will override any level interlocks calculated from the analog level signal.

3. In the Auto mode, the pumps will be controlled from the local wetwell level control panel. The ultrasonic level transmitter signal will be utilized for the control. The control panel will automatically alternate the lead, lag, and standby pumps. The controller will energize the standby pump if either the lead or lag pump fails to start, or a preset level is reached on the controller.

4. In the Auto mode, seal failure detected in the pump will de-energize the respective pump and activate an alarm.

5. In the Auto mode, high temperature detected in the pump will de-energize the respective pump and activate an alarm.

6. In the Auto mode, moisture detected in the pump will de-energize the respective pump and activate an alarm.

7. The pump control system shall record and display the running status and moisture detected and shall have an alarm, a seal failure alarm, and a pump high temperature alarm.

2.07 INSTRUMENTATION

A. ULTRASONIC LEVEL TRANSMITTERS

1. Each ultrasonic level transmitter shall be a microprocessor-based electronic unit consisting of a sensor assembly, a signal converter/transmitter, and an interconnecting cable.

2. The sensor shall be encapsulated in a chemical and corrosion-resistant material such as Kynar or CPVC, and shall be suitable for operation over a temperature range of -20° to +150° F and a relative humidity of ten to 100 percent (10-100%). The ultrasonic level transmitter shall have automatic compensation for changes in air temperature at the sensor location. If separate temperature sensing probes are provided, they shall be mounted with or adjacent to the ultrasonic sensor, as recommended by the Manufacturer.

3. The transmitter shall have a four (4)-digit LCD display scaled to read in engineering units. Digit height shall be approximately one-half inch (1/2”).

4. The transmitter shall be designed to ignore momentary level spikes, false targets, or momentary loss-of-echo. A loss-of-echo condition shall be indicated on the transmitter unit and shall be available as an alarm contact output.

    a. The transmitter output shall be an isolated 4-20 mA DC signal linearly proportional to the measured level range.

    b. Calibration parameters shall be entered through a keypad on the unit and shall be stored in nonvolatile EEPROM memory.

    c. Accuracy of the transmitted signal shall be plus or minus one-half percent (±0.5%) of the level range.

    d. The transmitter shall contain four (4) independently adjustable level alarm contact outputs. Contacts shall be single-pole, double-throw rated not less than 5 A at 120 V AC.

    e. A sufficient length of sensor-to-transmitter signal cable shall be furnished with the instrument to locate the sensor twenty-five to two hundred feet (25-200’) from the signal converter.

5. The signal converter electronics shall be housed in a weatherproof, corrosion-resistant NEMA Type 4 enclosure suitable for wall or pipe stand mounting and for operating temperatures of -15° to +125°F and a relative humidity of ten to one hundred percent (10-100%).

6. A thermostatically controlled strip heater shall be provided in the signal converter enclosure.

7. The signal converter shall be of the AC-powered type.

8. The ultrasonic level transmitter shall be Labtronics, Milltronics HydroRanger Plus, Endress & Hauser Prosonic, or STI/Magnetrol “Echotel 344,” or approved equal.

B. FLOAT SWITCHES

1. Switches shall be of the floating ball type, with a nominal five and one-half inch (5-1/2”) diameter, Teflon-coated stainless-steel float ball that contains a sealed switch assembly.

2. The float shall be supported with a flexible synthetic rubber hinge fastened to an adjustable mounting bracket. The hinge shall also act as housing for the lead wires from the alarm switch.

3. The lead wire shall be a waterproof cable of such length that no splice or junction box is required in the wetwell.

4. Stainless steel mounting accessories shall be furnished.

5. The switch contacts shall be single-pole-double-throw rated 4 A at 250 V AC.

6. Switches shall be U.S. Filter Control Systems “9G,” Flygt “ENM-10 Level Sensors,” ABS “Float Switches,” or approved equal.

C. PRESSURE TRANSMITTERS

1. Transmitters shall have “smart” electronic circuitry and shall be of the 2-wire type.

2. Process fluid shall be isolated from the sensing elements by AISI Type 316 stainless steel, Hastelloy-C, ceramic, or cobalt-chromium-nickel alloy diaphragms, and the transducer may use a silicone oil fluid fill.

3. Transmitters shall have self-diagnostics and electronically adjustable span, zero, and damping.

4. Transmitters shall be enclosed in a NEMA Type 4X housing and shall be suitable for operation at temperatures from 0° to 180°F, and relative humidity of five to one hundred percent (5-100%).

5. All parts shall be cadmium-plated carbon steel, stainless steel, or other corrosion-resistant materials.

6. Transmitters shall have over-range protection to maximum line pressure.

7. Accuracy of the transmitter shall be one-tenth percent (0.10%) of span, and transmitter output shall be 4-20 mA DC without the need for external load adjustment.

8. Transmitters shall not be damaged by reverse polarity.

9. Transmitters shall have an elevated or suppressed zero as required by the application.

10. For calibrated spans of less than eight (8) psig, a differential pressure type transmitter with side vents shall be utilized.

11. Transmitters shall be provided with brackets for wall and pipe-stand mounting.

12. Transmitters shall be factory calibrated to the required range and provided with the Manufacturer's standard hand-held communications/calibration device.

13. One (1) device shall be furnished for all transmitters provided by a single Manufacturer.

14. Transmitters tagged on the Drawings or specified to be indicating type shall be furnished with LCD digital indicators.

15. Transmitters shall be ABB 600T Series, Foxboro Model IGP10-D, Rosemount Model 3051C, or approved equal.

D. MAGNETIC FLOWMETER

1. The magnetic flowmeter shall be a completely obstructionless, in-line flowmeter with no constrictions in the flow of fluid through the meter.

2. The meter shall consist of a metallic tube with flanged ends and with grounding rings. Flange diameter and bolt drilling pattern shall comply with ANSI/ASME B16.5, Class 150.

3. Flangeless wafer insert style meters may be used for pipe sizes up to six inches (6”) where compatible with adjacent piping flanges.

4. Meters shall be suitable for the maximum range of working pressures of the adjacent piping.

5. Self-cleaning bullet-nosed electrodes shall be provided for all meters used for sludge metering. Electrode and liner materials shall be fully compatible with the process fluid and shall comply with the requirements specified in the instrument device schedules.

6. Each meter shall be factory calibrated, at a facility that is traceable to the National Institute of Science and Technology (NIST), and a copy of the calibration report shall be submitted as part of the operation and maintenance manual submittal.

7. The meter shall be capable of standing empty for extended periods of time without damage to any components.

8. The meter housing shall be of a splashproof and drip-proof design.

9. Meters shall be as manufactured by ABB/Fischer & Porter, Foxboro, Krohne, Rosemount, or approved equal.

E. MAGNETIC FLOWMETER SIGNAL CONVERTER

1. A separately mounted, microprocessor-based signal converter shall be provided for the magnetic flowmeter.

2. The signal converters shall include output damping, self-testing, built-in calibration capability, and an “empty pipe zero” contact input.

3. The overall accuracy of the magnetic flowmeter transmitter and signal converter shall be plus or minus one-half percent (±0.5%) of actual flow rate for full-scale settings of three to thirty (3-30) feet per second (fps).

4. The meter manufacturer shall furnish the signal cable between the converter and the magnetic flowmeter.

5. The signal converter shall be housed in a corrosion-resistant, weatherproof NEMA Type 4X housing and shall be suitable for

operation over an ambient temperature range of -30° to +140°F, and relative humidity of ten to one hundred percent (10-100%).

6. The converter shall have an analog output of 4-20 mA DC.

7. When required, the converter shall also have a pulse output designed to operate a remote seven (7)-digit totalizer and scaled so that the totalizer will operate for sixty (60) days at one hundred percent (100%) flow without repeating. Scaling factors shall be field-adjustable and shall be selected to provide a totalizer multiplier of a power of ten (10).

8. Transmitters tagged on the Drawings or specified to be of the indicating type shall contain a local indicator with a minimum four (4)-digit LCD display, scaled to read in gpm.

9. Magnetic flowmeter systems shall provide zero flow stability by means of automatic zero adjustment of a DC-excited metering circuit.

10. Converters shall be capable of bidirectional flow measurement.

11. Signal converters shall be of the same brand as the magnetic flowmeters.

12. The signal converter shall have a non-reset seven (7)-digit, or a manually reset six (6)-digit, totalizer on the face of the enclosure.

13. The signal converter shall be of the “smart” type that can be diagnosed and recalibrated with the use of a hand-held communicator/calibrator device. One (1) device shall be furnished for all converters provided by a single Manufacturer.

2.08 EMERGENCY DIESEL ENGINE GENERATOR

The sewage pumping station shall be provided with a package diesel engine generator and automatic transfer switch as specified in Section 11910 or natural gas/propane.

2.09 PUMP STATION WETWELL AND VALVE VAULT

A. The pump station wetwell and valve vault shall be constructed of precast concrete.

B. Protective coating(s) shall be applied to all interior surfaces of and lift station wet wells when specified by the City of White House. The coating shall be Sprayroq.

C. The pump station wetwell and valve vault shall be equipped with aluminum access hatches. The access hatches for the pump station shall be provided with a safety net.

D. The following items shall be installed in the valve vault(s):

1. Pump check valves and resilient seated gate valves;
2. Pressure transmitter and flow meter; and
3. Pump-around connection for bypass of pump station pumps.

PART 3: EXECUTION

3.01 INSTALLATION

A. Installation of the pump station and all equipment shall be done in strict accordance with written instructions by the Manufacturer. Manufacturer shall provide four (4) bound copies of these instructions to the City. Installation shall be completed by a certified manufacturer's representative or the representative shall be present during installation.

B. The Contractor shall furnish the services of factory service personnel of the equipment manufacturer to supervise the final adjustments of the system, perform operating tests, assure the City that the equipment is in proper adjustment and satisfactory operating condition, and to instruct and train the City's personnel in the use of this equipment. This service will be rendered after installation of the equipment has been completed and the entire system is ready for operation.

3.02 QUALITY CONTROL AND FIELD TESTING

A. Contractor shall test all equipment for actual operating conditions to show that each unit operates satisfactorily without overheating or overloading and is free from excessive vibration and noise throughout the complete head and capacity range at rated speed.

B. Wet wells shall be vacuum or hydrostatically tested for leakage (similar to manholes) in accordance with ASTM C-1244. **NO LEAKAGE IS PERMITTED.**

C. The City shall observe all field tests. Contractor shall give three (3) days' written notice to the City before performing tests.

D. Successful operation shall be demonstrated to the satisfaction of the City.

E. The Contractor shall make, at his expense, all necessary changes, modifications, and/or adjustments required to assure satisfactory and efficient operation.

F. Pump and pump controls Manufacturers' authorized representatives shall provide written report(s) to the City noting that pumps and controls have been installed in accordance with Manufacturers' recommendations, the materials used in construction of the pumps and controls are the same as submitted for the shop drawing approval, are in conformance with project performance requirements, and are ready for operation.

G. An authorized representative(s) shall be present for start-up of the pumps and controls.

H. On-site training in the operation and maintenance of all equipment shall be performed by factory authorized personnel with personnel from the City.

3.03 SPARE PARTS

A. The Contractor shall furnish one (1) complete set of recommended spare parts for each size pump. All spare parts are to be conveyed to the City.

END OF SECTION

SECTION 11309 SELF-PRIMING SEWER PUMP STATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Work under this section includes, but is not limited to, furnishing and installing a self-priming sewer pump station as indicated on the project Drawings, herein specified, or as necessary for proper and complete performance. The project consists of providing two (2) self-priming sewer pumps complete with electric motor drives, suction and discharge piping and valves, electrical control panels, fiberglass enclosure, and other necessary components for a complete system.

B. Unless otherwise noted, all materials and equipment supplied under this Section shall be new, of good quality, and in good condition.

1.02 SYSTEM DESCRIPTION

A. DESIGN REQUIREMENTS

1. The Contractor shall furnish and install one (1) factory-built above-ground, self-priming centrifugal automatic pump station. The station shall be complete with all equipment specified herein and factory-assembled in a fiberglass reinforced polyester resin enclosure.

2. In addition to the station enclosure, principle items of equipment shall include two (2) horizontal, self-priming, centrifugal sewage pumps; V-belt drives; electric motors; internal piping; valves; motor control panel; liquid level control system; internal wiring; magnetic flowmeter; emergency diesel engine generator; and natural gas powered ‘auto-start’.

B. PERFORMANCE CRITERIA

1. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage and be capable of passing a three-inch (3”) spherical solid. Pumps shall have three-inch (3”) suction connection and three-inch (3”) discharge connection. Each pump shall be selected to perform under operating conditions selected by the Design Engineer.

C. UTILITY POWER REQUIREMENTS

Site power furnished to pump station shall be three-phase, 60 Hz, 480 V, three (3) wire, maintained within industry standards. Voltage tolerance shall be plus or minus ten percent (+/- 10%). Phase-to-phase unbalance shall not exceed one percent (1%) average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 V.

1.03 QUALITY ASSURANCE

A. MANUFACTURER'S QUALIFICATIONS

Upon request from the City, the pump station Manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules.

B. PUMP PERFORMANCE CERTIFICATIONS

1. Solids Handling Capability

All internal passages, impeller vanes, and recirculation ports shall be able to pass a three-inch (3") spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the City, certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

2. Reprime Performance

a. Consideration shall be given to the sanitary sewage service anticipated, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg, and siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air release line installed.

b. During unattended operation, the pump shall retain adequate liquid in the casing to ensure automatic repriming while operating at its rated speed in a completely open system. A suction check valve or external priming device shall not be required.

c. Pump must reprime in accordance with the Manufacturer's recommendations at the specified speed and impeller diameter. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one half (1/2) of the liquid remaining in the pump casing. The pump must reprime and deliver full capacity within five (5) minutes after the pump is energized in the reprime condition. Reprime performance must be confirmed with the following test set-up:

i. A check valve shall be installed downstream from the pump discharge flange.

ii. A length of air release pipe shall be installed between pump and the discharge check valve. This line shall be open to atmosphere at all times duplicating the air displacement rate anticipated at a typical pump station fitted with an air release valve.

iii. The pump suction check valve shall be removed. No restrictions in the pump or suction piping will prevent the siphon drop of the suction leg. Suction pipe configuration for reprime test shall duplicate the suction piping fittings and valves shown on the Contract Drawing.

iv. Impeller clearances shall be set as recommended in the pump service manual.

v. Repeatability of performance shall be demonstrated by testing five consecutive reprime cycles. Full pump capacity (flow) shall be achieved within five (5) minutes during each cycle.

vi. Liquid to be used for reprime test shall be water.

3. Upon request from the City, certified reprime performance test results, prepared by the Manufacturer, and certified by a registered professional engineer, shall be submitted for approval prior to shipment.

C. FACTORY SYSTEM TEST

All internal components including the pumps, motors, valves, piping, and controls will be tested as a complete working system at the factory. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed, and horsepower. Factory operational test shall simulate actual performance anticipated for the complete station.

D. MANUFACTURER'S START-UP SERVICES

The Manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment. Start-up report complete with draw down test results shall be submitted to the City prior to acceptance.

1.04 SUBMITTALS

A. SHOP DRAWINGS

The Contractor shall submit five (5) sets of shop drawings and/or wiring diagrams for the major equipment to be installed such as the pump and motor starters, flowmeter, valves, pressure transducer, level instrumentation, emergency engine generator, and controls. Submittals shall be as specified in Section 01200, 1.04.D.

B. OPERATION AND MAINTENANCE MANUALS

Three (3) copies of a standard operation and maintenance manual for the pump units, valves, controls, and emergency engine generator shall be supplied by the Contractor.

1.05 DELIVERY, STORAGE, AND HANDLING

All equipment shall be delivered, stored, and handled in strict accordance with the Manufacturer's recommendations.

1.06 WARRANTY

A. MANUFACTURER'S WARRANTY

1. All components of the pump station shall be manufactured, assembled, and tested as a unit by a single Manufacturer. The Manufacturer must assume system responsibility by providing a warranty for the complete pump station assembly. Individual component warranties are desirable. However, individual warranties honored solely by the manufacturers of each pump station component will not be acceptable.

2. The pump station Manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below:

   a. Fiberglass components of the station enclosure shall be warranted for ten (10) years to resist UV damage, corrosion from moisture or corrosive soils, or physical failures occurring in normal service, without the need for special protective coatings, when installed according to the Manufacturer's recommendations.

   b. All other equipment, apparatus, and parts furnished shall be warranted for one (1) year, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, “O”-rings, etc. The pump station Manufacturer shall be solely responsible for warranty of the station and all components.

   c. The pump shaft seal shall be warranted for a minimum of two (2) years from date of shipment.

   d. Components failing to perform as specified by the City or as represented by the Manufacturer or proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the Manufacturer without cost of parts or labor to the City.

3. The warranty shall become effective upon the acceptance of the completed station by the City.

1.07 PUMP PREQUALIFICATION SPECIFICATION

A. Manufacturers wishing to supply equipment for this project must submit a prequalification submittal for approval to the City of White House. The submittal shall demonstrate that the proposed equipment meets the requirements of the Contract Specifications and Drawings. The

prequalification submittal shall include, as a minimum, the following information:

1. Literature and cut sheets from Manufacturer(s) describing equipment;
2. Pump operating curves;
3. Proposed motor sizes and speeds;
4. Copy of warranties;
5. List of at least five (5) references for similar installations, including contact names and current telephone numbers; and
6. A written statement from the Manufacturer indicating that the Manufacturer has reviewed the proposed application as detailed in the Contract Drawings and Specifications, and that all equipment, materials, and systems proposed to be supplied are appropriate and compatible for this specific application.

B. The submittal of prequalification information does not omit the requirement for the Contractor and Manufacturers to submit complete shop drawing submittals to the City in accordance with Section 01200, 1.04.D.

1.08 MANUFACTURER AND SUPPLIER INFORMATION

A. MANUFACTURER'S NAMEPLATE

A manufacturer's nameplate shall be securely and permanently mounted to each individual piece of equipment furnished under this Section. The nameplate shall be constructed of a durable, non-corrosive material. Critical information shall be clearly engraved or otherwise permanently stamped on the nameplate and shall be fully legible. The information contained on the manufacturer nameplate shall include at least the following:

1. Manufacturer's serial number;
2. Name, address, and telephone number of equipment Manufacturer;
3. Model and/or part number, including pump impeller sizes, when applicable;
4. Performance criteria (i.e., capacity, design point, etc.);
5. Motor size, speed, and voltage;
6. Enclosure type or rating; and
7. Any other pertinent information.

Note: All equipment shall include a nameplate with a manufacturer serial number validating the equipment as new. Failure to meet these requirements will be cause for rejection of the equipment.

B. SUPPLIER AND SERVICE INFORMATION

A durable nameplate, stamp, or sticker shall be adhered to each individual piece of equipment containing the name, address, and telephone number of the local business that supplied the equipment, and the name, address, and telephone number of the local business that can provide service and replacement parts for the equipment. A twenty-four (24)-hour emergency service telephone number should also be included.

PART 2: PRODUCTS

2.01 STATION ENCLOSURE

A. FEATURES

The station enclosure shall contain and protect all pumps, interior piping, valves, and associated controls. Enclosure shall incorporate the following design and service features:

1. Access panels must be supplied on all sides. Location and size shall permit access for routine maintenance functions such as pump and motor inspection, drive belt adjustment, and pump cleanout. Panels shall be secured with tamper-proof hardware.

2. A continuous hinge and latch shall be installed on at least two (2) access panels. The hinged panels shall allow easy access to the electrical controls for frequent adjustments and inspections. A two (2)-point mechanical latch assembly shall secure the panel at top and bottom. Latch handle locks shall be match keyed, requiring only one (1) key to open all access panels.

3. A vent in one (1) access panel shall allow free air flow for enclosure ventilation.

4. The complete station enclosure, less base, must be completely removable after disengaging reusable tamper-proof hardware. After disassembly, no portion of the enclosure (except electrical service

entrance) shall project above the base surface to interfere with maintenance or endanger personnel.

5. Disassembly and removal of the enclosure shall require no more than two (2) people working without assistance of lifting equipment.

B. MATERIALS

Station enclosure shall be manufactured of molded reinforced orthophthalic polyester resins with a minimum of thirty percent (30%) fiberglass, and a maximum of seventy percent (70%) resin. Resin fillers or extenders shall not be used.

1. Chopped glass fibers of one and one-quarter inch (1-1/4") average length shall be sprayed and rolled. Major design consideration shall be given to structural stability, corrosion resistance, and watertight integrity. The polyester laminates shall provide a balance of mechanical, chemical, and electrical properties to ensure long life. They must be impervious to microorganisms, mildew, mold, fungus, corrosive liquids, and gases that are expected to be present in the environment surrounding the wet well.

2. All interior surfaces of the housing shall be coated with a polyester resin-rich finish providing maintenance-free service, abrasion resistance, and protection from sewage, greases, oils, gasoline, and other common chemicals.

3. Outside surfaces of the enclosure shall be coated with gel coat pigmented resin to ensure long maintenance-free life and UV protection. The color used shall de-emphasize the presence of dirt, grease, etc., and shall be acceptable to the City.

C. STATION BASE

1. Station base shall be constructed of precast, reinforced concrete encapsulated in a fiberglass mold. The design shall resist deformation of the structure during shipping, lifting, or handling.

2. Base shall incorporate drainage provisions and an opening sized to permit installation of piping and service connections to the wet well. After installation, the opening shall serve as a grout dam to be utilized by the Contractor.

3. The base shall incorporate anchor bolt recesses for securing the complete station to a concrete pad (supplied by the Contractor) in accordance with the project Plans.

D. BLOWER

1. A blower mounted in the station roof shall be sized to exchange station air volume at least once every two (2) minutes.

2. Blower motor shall energize automatically at approximately 70^{o}F and turned off at 55^{o}F.

3. The blower motor control circuit shall incorporate a thermal-magnetic circuit breaker providing overcurrent and overload protection.

4. Exhaust and inlet locations shall prevent the entrance of rain, snow, or debris.

E. STATION HEATER

The pump station shall be provided with a 1300/1500-watt, 115 V electric heater with cord and grounding plug. Ungrounded heaters shall not be acceptable. Electrical connections shall be provided by the station supplier.

F. INSULATION PACKAGE

The pump station shall be equipped with a one-inch (1") thick closed cell foam insulation, which shall be applied to the roof, doors, and corner panels.

2.02 PUMP DESIGN

A. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under Part 1 of this Section.

B. MATERIALS AND CONSTRUCTION FEATURES

1. Pump Casing

Casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate the following features:

a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.

b. Fill port cover plate, three- and one-half inch (3-1/2") diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads shall provide slow release of pressure, and the clamp bar shall be retained by detent lugs. A gasket shall prevent adhesion of the fill port cover to the casing.

c. The casing drain plug shall be at least one and one quarter inch (1-1/4") NPT to ensure complete and rapid draining.

2. Cover Plate:

Cover plate shall be cast iron Class 30. Design must incorporate following maintenance features:

a. The cover plate shall be retained by hand nuts for complete access to pump interior. Cover plate removal must provide ample clearance for removal of stoppages and allow service of the impeller, seal, wear plate, or check valve without removing suction or discharge piping.

b. A replaceable wear plate secured to the cover plate by weld studs and nuts shall be AISI 1018 HRS.

c. In consideration for safety, a pressure relief valve shall be supplied in the cover plate. Relief valve shall open at 75-200 psi.

d. "O"-ring of Buna-N material shall seal cover plate to pump casing.

3. Rotating Assembly

A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate, and bearing housing must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate the following features:

a. Seal plate and bearing housing shall be cast iron Class 30. Separate oil-filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped and lip seals will prevent leakage of oil. The bearing cavity shall have an oil level sight gauge and fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

b. The impeller shall be ductile iron, two-vaned, semi-open, non-clog, with integral pump-out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lock screw and conical washer.

c. Shaft shall be AISI 41L40 alloy steel unless otherwise specified by the City, in which case AISI 17-4 PH stainless steel shall be supplied.

d. Bearings shall be anti-friction ball or tapered roller type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil-lubricated from a dedicated reservoir. Pump designs that use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e. Shaft seal shall be oil-lubricated mechanical type.

    i. The stationary and rotating seal faces shall be tungsten titanium carbide alloy.

    ii. Each mating surface shall be lapped to one-half light band flatness (5.8 millionths of an inch), as measured by an optical flat under monochromatic light.

    iii. The stationary seal seat shall be double floating by virtue of a dual “O”-ring design; an external “O”-ring secures the stationary seat to the seal plate; and an

internal “O”-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads that cause shaft deflection, vibration, and axial/radial movement).

iv. Elastomers shall be viton.

v. Cage and spring to be AISI 316 stainless steel.

vi. Seal shall be oil-lubricated from a dedicated reservoir.

vii. Seal shall be warranted in accordance with requirements listed under Part 1 of this Section.

f. Adjustment of the impeller face clearance (distance between impeller and wear plate) shall be accomplished by external means. Stainless steel adjusting shims shall be used to move the entire rotating assembly as a unit when adjusting the working clearances. Clearance adjustment that requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

g. The suction check valve shall be molded Buna-N with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the cover plate opening, without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle.

h. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or discharge ports. Each spool shall have one (1) one and one quarter inch (1-1/4”) NPT and one (1) one quarter inch (1/4”) NPT tapped hole with pipe plugs for mounting gauges or other equipment.

2.03 VALVES AND PIPING

A. VALVES

Each pump station shall be supplied with the following valves as a minimum:

1. Check Valve

   a. Each pump shall be equipped with a full-flow type check valve, with flanged ends and an external lever and weight, and shall be capable of passing a three-inch (3") spherical solid.

   b. The valve seat shall be constructed of stainless steel and shall be replaceable.

   c. The valve body shall be cast iron and incorporate a three-inch (3") cleanout port.

   d. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings.

   e. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings, sealing bushing shall have double "O"-rings. "O"-rings shall be easily replaceable without requiring access to interior of valve body.

   f. Valve shall be rated at 175 psi water working pressure, 350 PSI hydrostatic test pressure.

   g. Valves other than full-flow type or valves mounted in such a manner that prevents the passage of a three-inch (3") spherical solid shall not be acceptable.

2. Plug Valve

   a. A 3-way plug valve must allow either or both pumps to be isolated from the force main.

   b. The plug valve shall be non-lubricated, tapered type.

c. Valve body shall be semi-steel with flanged end connections drilled to one hundred twenty-five-pound (125 lb.) standard.

d. The drip-tight shutoff plug shall be mounted in stainless steel bearings and shall have a resilient facing bonded to the sealing surface.

e. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall have a locking device to hold the plug in the desired position.

3. Air Release Valves:

a. Each pump shall be equipped with an automatic air release valve, designed to vent air to atmosphere during initial priming, or unattended repriming cycles. Upon completion of the priming or repriming cycle, the valve shall automatically close to prevent recirculation. A visible indication of valve closure shall be evident and shall operate solely on discharge pressure.

b. All valve parts exposed to sewage shall be cast iron, stainless steel, or similar corrosion-resistant materials. Diaphragms shall be fabric-reinforced neoprene or similar inert material. Valve design shall incorporate following maintenance features:

i. A cleanout port, at least three inches (3”) in diameter, shall allow easy inspection, cleanout, and service.

ii. Valves shall be field adjustable for varying discharge heads.

iii. Valves shall be installed to suction or discharge piping with a brass corporation stop and stainless-steel nipple.

4. Gauge Kit

a. A gauge kit shall be supplied for each pump.

b. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge.

c. Gauges shall be at least four inches (4”) in diameter, graduated in feet water column. Rated accuracy shall be one percent (1%) of full-scale reading.

d. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.

e. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and fittings, including a shutoff valve for each gauge.

B. PIPING

1. Flanged header pipe shall be centrifugally cast, ductile iron, shall comply with ANSI/AWWA A21.51/C115, and shall be of class 53 thickness. All ductile iron piping shall have Protecto 401 coating or approved equal.

2. Flanges shall be cast iron class 125 and shall comply with ANSI B16.1.

3. Pipe and flanges shall be threaded, and suitable thread sealant applied before assembling flange to pipe.

4. Bolt holes shall be in angular alignment within one-half inch (1/2”) between flanges. Flanges shall be faced with a gasket finish having concentric grooves a minimum of one hundredth of an inch (0.01”) deep by approximately three hundredths of an inch (0.03”) wide, with a minimum of three (3) grooves on any given surface spaced a maximum of one quarter inch (1/4”) apart.

C. SUPPORT AND THRUST BLOCKS

Contractor must ensure that all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where required.

2.04 DRIVE UNIT

A. MOTORS

1. Pump motors shall be ____ hp, horizontal ODP, ____ rpm, NEMA design B; shall have a cast iron frame with copper windings; shall be induction type; shall have class F insulation and 1.15 Service Factor for normal starting torque and low starting current characteristics, and shall be suitable for continuous service.

2. The motors shall not overload at the design condition or at any head in the operating range as specified. Motors shall be suitable for operation using the utility power available specified in PART 1 of this section.

3. Motors shall be tested in accordance with provisions of IEEE Std 112, Method B.

B. DRIVE TRANSMISSION

1. Power to pumps shall be transmitted via V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

2. Each drive assembly shall utilize at least two (2) V-belts providing a minimum combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive Manufacturer.

3. The pump Manufacturer shall submit power transmission calculations that document the following:

   a. Ratio of pump/motor speed;

   b. Pitch diameter of driver and driven sheaves;

   c. Number of belts required per drive;

   d. Theoretical horsepower transmitted per belt, based on Manufacturer's data;

   e. Center distance between pump and motor shafts;

   f. Arc-length correction factor applied to theoretical horsepower transmitted;

g. Service factor applied to established design horsepower; and

h. Safety factor ratio of power transmitted/brake horsepower.

4. Pump drives shall be enclosed on all sides by a guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed one-half inch (1/2”).

a. Guards must be completely removal without interference from any unit component and shall be securely fastened and braced to the unit base.

b. Metal shall be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed five inches (5”). Tack welds shall not exceed four-inch (4”) spacing.

c. The guard shall be finished in accordance with Section 3, Color Definitions of ANSI 253.1; “Safety Color Code for Marking Physical Hazards.”

2.05 FINISH

A. Exterior surfaces of pumps, piping, and steel framework shall be chemically or mechanically cleaned prior to painting.

B. Exposed surfaces to be coated with a primerless, low VOC, alkyd based, high solids, semi-gloss enamel incorporating rust inhibitive additives.

C. The finish coat shall be 1.5 MIL dry film thickness (minimum), resistant to oil mist exposure and solvent contact.

D. Salt spray exposure test shall be rated one hundred (100) hours (minimum). The factory finish shall allow for over-coating and touch up after final installation.

2.06 PUMP CONTROL COMPONENTS

A. PANEL ENCLOSURE

1. Electrical control equipment shall be mounted within a common NEMA 4X stainless steel, dead-front type control enclosures.

2. Doors shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware.

3. Control components shall be mounted on removable steel back panels secured to enclosure with collar studs.

4. All control devices and instruments shall be mounted using threaded fasteners and shall be clearly labeled to indicate function.

B. BRANCH COMPONENTS

1. Motor branch components to be of highest industrial quality, secured to the sub-plate with machine screws and lock washers. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount any component.

2. Circuit Breakers and Operating Mechanisms

a. A properly sized, heavy duty circuit breaker, with RMS interrupting rating of ____ A at ____ V, shall be furnished for each pump motor. The circuit breakers must be sealed by the Manufacturer after calibration to prevent tampering.

b. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in “off” position.

3. Motor Starters

a. An open frame, across-the-line, NEMA-rated magnetic starter with under-voltage release, and overload protection on all three phases shall be furnished for each pump motor.

b. Starters of NEMA size 1 and above shall allow addition of at least two auxiliary contacts. Starters rated “0,” “00,” or fractional size are not acceptable.

c. Power contacts shall be double-break type made of cadmium oxide silver.

d. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils shall be easily

replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability.

4. Overload Relays

a. Overload relays to be block-type with melting alloy spindles, having visual trip indication with trip free operation. Pressing the overload reset lever shall not actuate the control contact until after the overload spindle has reset. Resetting the overload reset lever will cause a snap-action control contact to reset, thus re-establishing a control circuit. Overload relays to be manual reset only, and not convertible to automatic reset. Trip settings shall be governed by the heater element only, and not by adjustable settings. Heater elements must provide NEMA class 20 trip times, selected in accordance with actual motor nameplate data.

b. A reset push button, mounted through the control panel door, shall permit resetting the overload relays without opening the door.

5. Secondary Lightning Arrestor

The pump control panel shall be equipped with a secondary lightning arrestor to minimize damage to the pump motors and controls from transient voltage surges. The arrestor shall utilize silicon oxide varistors encapsulated in a nonconductive housing. The arrestor shall have a current rating of 60,000 A and a Joule rating of 1,500.

6. Pump Start Delay

The control circuit for pump #2 shall be equipped with a time delay to prevent simultaneous motor starts.

7. Pump Control Panel Heater

The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include a thermostat.

8. Phase Monitor

The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, and low voltage. A time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart when power conditions return to normal.

9. Variable Frequency Drives

C. CONTROL CIRCUIT

1. A normal duty thermal-magnetic circuit breaker shall protect all control circuits by interrupting control power.

2. Pump mode selector switches shall permit manual start or stop of each pump individually or permit automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be heavy duty, oil-tight design with contacts rated NEMA A300 minimum.

3. Pump alternator relay shall be electro-mechanical industrial design. Relay contacts to be rated 10 A minimum at 120 V non-inductive. A switch shall permit the station operator to select automatic alternation of pumps, to select pump number one to be lead for each pumping cycle, or to select pump number two to be lead pump for each pumping cycle.

4. A six (6) digit elapsed time meter (non-reset type) shall be connected to each motor starter to indicate total running time of each pump in hours and tenths of hours. An integral pilot light shall be wired in parallel to indicate that the motor is energized and should be running.

5. A high pump temperature protection circuit shall override the level control and shut down the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing and connected to a pump shutdown circuit. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the shutdown circuit to interrupt power to the motor. A visible indicator mounted through the control panel door shall indicate motor stopped due to high pump temperature. The motor shall remain locked out until the pump has

cooled and circuit has been manually reset. Automatic reset of this circuit is not acceptable.

6. A duplex ground fault receptacle, providing 115 V AC, 60 Hz, single phase current, shall be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15 A thermal-magnetic circuit breaker.

   a. Auxiliary Power Transformer

      The lift station shall be equipped with a 3 KVA stepdown transformer to supply 115 V AC, single phase for the control and auxiliary equipment.

   b. The primary and secondary side of the transformer shall be protected by a thermal-magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door, and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in “off” position.

7. <u>Wiring</u>

   a. The pump station, as furnished by the Manufacturer, shall be completely wired, except for power feed lines to the branch circuit breakers and final connections to remote alarm devices.

   b. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electric Code (NEC).

   c. All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:

      i. Line and Load Circuits, AC or DC power ..... Black
      ii. AC Control Circuit Less Than Line Voltage ..... Red
      iii. DC Control Circuit ..... Blue
      iv. Interlock Control Circuit, from External Source . Yellow
      v. Equipment Grounding Conductor ..... Green
      vi. Current Carrying Ground ..... White

vii. Hot With Circuit Breaker Open ..... Orange

d. Control circuit wiring inside the panel, with exception of internal wiring of individual components, shall be 16 gauge minimum, type MTW or THW, 600 V. Power wiring to be 14 gauge minimum. Motor branch wiring shall be 10 gauge minimum.

e. Motor branch and other power conductors shall not be loaded above 60^{o} C temperature rating, on circuits of 100 A or less, nor above 75^{o} C on circuits over 100 A.

f. Wires must be clearly numbered at each end in conformance with applicable standards.

g. All wire connectors in the control panel shall be ring tongue type with nylon insulated shanks.

h. All wires on the sub-plate shall be bundled and tied.

i. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel.

j. All wiring outside the panel shall be routed through conduit.

k. Control wires connected to door mounted components must be tied and bundled. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.

8. Conduit

a. Factory-installed conduit shall conform to following requirements:

i. All conduit and fittings shall be UL listed.

ii. Watertight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, watertight PVC cover.

iii. Conduit to be supported in accordance with articles 346, 347, and 350 of the NEC.

iv. Conduit shall be sized according to the NEC.

9. Grounding

a. The station Manufacturer shall ground all electrical equipment inside the pump station to the control panel back plate. All paint must be removed from the grounding mounting surface before making final connection.

b. The contractor shall provide four (4) earth-driven ground connections to the pump station at the main grounding lug in accordance with the NEC.

10. Equipment Marking

a. Permanent corrosion-resistant nameplate(s) shall be attached to the control and include following information:

i. Equipment serial number;

ii. Supply voltage, phase, and frequency;

iii. Current rating of the minimum main conductor;

iv. Electrical wiring diagram number;

v. Motor horsepower and full load current;

vi. Motor overload heater element;

vii. Motor circuit breaker trip current rating; and

viii. Name and location of equipment Manufacturer.

b. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.

c. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to or above the device.

2.07 PUMP CONTROL SYSTEM

A. GENERAL

1. The operation of the pumps shall be controlled by a pump control system (PCS).

2. The PCS equipment shall be constructed in compliance with UL's Industrial Control Panels listing and following-up service, utilizing UL-listed and recognized components where applicable.

3. The pumps shall operate based on variations of the sewage level in the wet well. An ultrasonic level transmitter shall be installed in the wet well to provide the depth of sewage in the wet well.

B. CONTROL PANEL

1. The control panels shall be built in an UL-listed manufacturing facility. The equipment shall be designed to have a useful operating life of no fewer than fifteen (15) years with standard servicing and replacement of parts.

2. Control panel for pumps shall have a NEMA 4X stainless steel low-profile enclosure suitable for pedestal or pole mounting with weather hood and shall be dead front with separate removable inside panel to protect electrical equipment. A lock hasp shall be provided on the outside door.

3. A circuit breaker, elapsed time meter, suitable controller, loss of phase protection, automatic pump alternator, power lightning arrestor, and an H-O-A switch shall be provided. Miniature relays shall not be accepted.

4. Motor status run light shall be provided along with a terminal strip for connecting pump and control wires.

5. Additional terminals shall be provided to connect alarm, heat sensors, and seal failure wires.

6. A transformer shall be supplied to give a 115-volt control circuit. A single weatherproof ground-fault-protected duplex convenience outlet shall be provided on the side of the control panel enclosure.

7. An emergency "Operator Assistance" red push button shall be provided on the outside of the control panel for easy access in an emergency.

8. The control panel shall be completely wired at the factory except for the power feeder lines. Wiring diagrams matching the unit wiring shall be provided.

9. The control panel shall include a digital display for identifying wet well level and pump discharge flow and pressure. The display unit shall power the 4-20 mA transducer and shall obtain input from the transducers and transmitters. Level shall be displayed as depth in feet from the bottom of the wet well. Flow shall be displayed in gallons per minute (gpm), and pressure shall be displayed in pounds per square inch (psi).

10. The control panel or remote terminal unit (RTU) shall be provided with a plug-in connector for future connection to a data radio or similar external telemetry system.

11. The control panel shall be equipped with an alarm silence switch to provide maintenance personnel a means to silence the external alarm device while corrective actions are under way. After silencing the alarm, manual reset of the alarm signal shall provide automatic reset of the alarm silence relay.

12. The pump station Manufacturer shall supply one (1) 115 V AC alarm light fixture with vapor-tight, shatter-resistant red globe, conduit box, and mounting base. The design must prevent rainwater from collecting in the gasketed area of the fixture between the base and globe. The alarm light shall be shipped loose for installation by the Contractor.

13. The pump station Manufacturer shall supply one (1) 115 V AC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rainwater from collecting in any part of the horn. The alarm horn shall be shipped loose for installation by the Contractor.

C. INSTRUMENTATION INTERFACE

1. Pump Station Flow Metering

A magnetic flow meter shall be installed in the common discharge header of the Pumps. The flow meter shall provide an instantaneous flow and a pulse totalizing flow signal for monitoring in the pump control system (PCS). Each pulse will equal one hundred (100) gallons. The instantaneous and totalized flow

signals for the discharge header will be indicated and summed in the PCS to obtain pump station discharge instantaneous flow and pump station discharge total flow.

2. Pump Station Level

A pressure transducer and transmitter will be installed at the pumping station with three back up control floats (Off/Low Level, Lead, Lag/High Water Alarm). The transmitter will send a signal to the pump control panel and then to the PCS for level indication. The pump control panel will use this level signal to control the pumps.

3. Pump Station Discharge Pressure

A pressure transducer and transmitter shall be installed in the common discharge header of the pumps. The transmitter will send a signal to the pump control panel for discharge pressure indication.

D. CONTROL DESCRIPTION

1. Each pump station pump shall have control modes “On,” “Off,” and “Auto.”

2. The On mode will energize the pumps until the switch is turned to the Off or Auto modes. The On mode will override any level interlocks calculated from the analog level signal.

3. In the Auto mode, the pumps will be controlled from the local wet well level control panel. The ultrasonic level transmitter signal will be utilized for the control. The control panel will automatically alternate the lead, lag, and standby pumps. The controller will energize the standby pump if either the lead or lag pump fails to start, or a preset level is reached on the controller.

4. In the Auto mode, seal failure detected in the pump will de-energize the respective pump and activate an alarm.

5. In the Auto mode, high temperature detected in the pump will de-energize the respective pump and activate an alarm.

6. In the Auto mode, moisture detected in the pump will de-energize the respective pump and activate an alarm.

7. The pump control system shall record and display the running status and moisture detected and shall have an alarm, a seal failure alarm, and a pump high temperature alarm.

2.08 INSTRUMENTATION

A. ULTRASONIC LEVEL TRANSMITTERS

1. Each ultrasonic level transmitter shall be a microprocessor-based electronic unit consisting of a sensor assembly, a signal converter/transmitter, and an interconnecting cable.

2. The sensor shall be encapsulated in a chemical and corrosion-resistant material such as Kynar or CPVC, and shall be suitable for operation over a temperature range of -20° to +150° F and a relative humidity of ten to 100 percent (10-100%). The ultrasonic level transmitter shall have automatic compensation for changes in air temperature at the sensor location. If separate temperature sensing probes are provided, they shall be mounted with or adjacent to the ultrasonic sensor, as recommended by the Manufacturer.

3. The transmitter shall have a four (4)-digit LCD display scaled to read in engineering units. Digit height shall be approximately one-half inch (1/2”).

4. The transmitter shall be designed to ignore momentary level spikes, false targets, or momentary loss-of-echo. A loss-of-echo condition shall be indicated on the transmitter unit and shall be available as an alarm contact output.

   a. The transmitter output shall be an isolated 4-20 mA DC signal linearly proportional to the measured level range.

   b. Calibration parameters shall be entered through a keypad on the unit and shall be stored in nonvolatile EEPROM memory.

   c. Accuracy of the transmitted signal shall be plus or minus one-half percent (±0.5%) of the level range.

   d. The transmitter shall contain four (4) independently adjustable level alarm contact outputs. Contacts shall be

single-pole, double-throw rated not less than 5 A at 120 V AC.

e. A sufficient length of sensor-to-transmitter signal cable shall be furnished with the instrument to locate the sensor twenty-five to two hundred feet (25-200') from the signal converter.

5. The signal converter electronics shall be housed in a weatherproof, corrosion-resistant NEMA Type 4 enclosure suitable for wall or pipestand mounting and for operating temperatures of -15° to +125°F and a relative humidity of ten to one hundred percent (10-100%).

6. A thermostatically controlled strip heater shall be provided in the signal converter enclosure.

7. The signal converter shall be of the AC-powered type.

8. The ultrasonic level transmitter shall be Labtronics, Milltronics HydroRanger Plus, Endress & Hauser Prosonic, or STI/Magnetrol "Echotel 344," or approved equal.

B. FLOAT SWITCHES

1. Switches shall be of the floating ball type, with a nominal five and one-half inch (5-1/2") diameter, Teflon-coated stainless-steel float ball that contains a sealed switch assembly.

2. The float shall be supported with a flexible synthetic rubber hinge fastened to an adjustable mounting bracket. The hinge shall also act as housing for the lead wires from the alarm switch.

3. The lead wire shall be a waterproof cable of such length that no splice or junction box is required in the wet well.

4. Stainless steel mounting accessories shall be furnished.

5. The switch contacts shall be single-pole-double-throw rated 4 A at 250 V AC.

6. Switches shall be U.S. Filter Control Systems "9G," Flygt "ENM-10 Level Sensors," ABS "Float Switches," or approved equal.

C. PRESSURE TRANSMITTERS

1. Transmitters shall have “smart” electronic circuitry and shall be of the 2-wire type.

2. Process fluid shall be isolated from the sensing elements by AISI Type 316 stainless steel, Hastelloy-C, ceramic, or cobalt-chromium-nickel alloy diaphragms, and the transducer may use a silicone oil fluid fill.

3. Transmitters shall have self-diagnostics and electronically adjustable span, zero, and damping.

4. Transmitters shall be enclosed in a NEMA Type 4X housing and shall be suitable for operation at temperatures from 0° to 180°F, and relative humidity of five to one hundred percent (5-100%).

5. All parts shall be cadmium-plated carbon steel, stainless steel, or other corrosion-resistant materials.

6. Transmitters shall have over-range protection to maximum line pressure.

7. Accuracy of the transmitter shall be one-tenth percent (0.10%) of span, and transmitter output shall be 4-20 mA DC without the need for external load adjustment.

8. Transmitters shall not be damaged by reverse polarity.

9. Transmitters shall have an elevated or suppressed zero as required by the application.

10. For calibrated spans of less than eight (8) psig, a differential pressure type transmitter with side vents shall be utilized.

11. Transmitters shall be provided with brackets for wall and pipe-stand mounting.

12. Transmitters shall be factory calibrated to the required range and provided with the Manufacturer's standard hand-held communications/calibration device.

13. One (1) device shall be furnished for all transmitters provided by a single Manufacturer.

14. Transmitters tagged on the Drawings or specified to be indicating type shall be furnished with LCD digital indicators.

15. Transmitters shall be ABB 600T Series, Foxboro Model IGP10-D, Rosemount Model 3051C, or approved equal.

D. MAGNETIC FLOWMETER

1. The magnetic flowmeter shall be a completely obstructionless, in-line flowmeter with no constrictions in the flow of fluid through the meter.

2. The meter shall consist of a metallic tube with flanged ends and with grounding rings. Flange diameter and bolt drilling pattern shall comply with ANSI/ASME B16.5, Class 150.

3. Flangeless wafer insert style meters may be used for pipe sizes up to six inches (6”) where compatible with adjacent piping flanges.

4. Meters shall be suitable for the maximum range of working pressures of the adjacent piping.

5. Self-cleaning bullet-nosed electrodes shall be provided for all meters used for sludge metering. Electrode and liner materials shall be fully compatible with the process fluid and shall comply with the requirements specified in the instrument device schedules.

6. Each meter shall be factory calibrated, at a facility that is traceable to the National Institute of Science and Technology (NIST), and a copy of the calibration report shall be submitted as part of the operation and maintenance manual submittal.

7. The meter shall be capable of standing empty for extended periods of time without damage to any components.

8. The meter housing shall be of a splashproof and drip-proof design.

9. Meters shall be as manufactured by ABB/Fischer & Porter, Foxboro, Krohne, Rosemount, or approved equal.

E. MAGNETIC FLOWMETER SIGNAL CONVERTER

1. A separately mounted, microprocessor-based signal converter shall be provided for the magnetic flowmeter.

2. The signal converters shall include output damping, self-testing, built-in calibration capability, and an “empty pipe zero” contact input.

3. The overall accuracy of the magnetic flowmeter transmitter and signal converter shall be plus or minus one-half percent (±0.5%) of actual flow rate for full-scale settings of three to thirty (3-30) feet per second (fps).

4. The meter manufacturer shall furnish the signal cable between the converter and the magnetic flowmeter.

5. The signal converter shall be housed in a corrosion-resistant, weatherproof NEMA Type 4X housing and shall be suitable for operation over an ambient temperature range of -30° to +140°F, and relative humidity of ten to one hundred percent (10-100%).

6. The converter shall have an analog output of 4-20 mA DC.

7. When required, the converter shall also have a pulse output designed to operate a remote seven (7)-digit totalizer and scaled so that the totalizer will operate for sixty (60) days at one hundred percent (100%) flow without repeating. Scaling factors shall be field-adjustable and shall be selected to provide a totalizer multiplier of a power of ten (10).

8. Transmitters tagged on the Drawings or specified to be of the indicating type shall contain a local indicator with a minimum four (4)-digit LCD display, scaled to read in gpm.

9. Magnetic flowmeter systems shall provide zero flow stability by means of automatic zero adjustment of a DC-excited metering circuit.

10. Converters shall be capable of bidirectional flow measurement.

11. Signal converters shall be of the same brand as the magnetic flowmeters.

12. The signal converter shall have a non-reset seven (7)-digit, or a manually reset six (6)-digit, totalizer on the face of the enclosure.

13. The signal converter shall be of the “smart” type that can be diagnosed and recalibrated with the use of a hand-held communicator/calibrator device. One (1) device shall be furnished for all converters provided by a single Manufacturer.

2.09 EMERGENCY DIESEL ENGINE GENERATOR

The sewage pumping station shall be provided with a package diesel engine generator and automatic transfer switch as specified in Section 11910.

2.10 PUMP STATION WETWELL AND VALVE VAULT

A. The pump station wet well and valve vault shall be constructed of precast concrete.

B. Protective coating(s) shall be applied to all interior surfaces of and lift station wet wells when specified by the City of White House. The coating shall be Sprayroq or approved equal.

C. The pump station wet well and valve vault shall be equipped with aluminum access hatches. The access hatches for the pump station shall be provided with a safety net.

D. The following items shall be installed in the valve vault(s):

1. Pump check valves and resilient seated gate valves;
2. Pressure transmitter and flow meter; and
3. Pump-around connection for bypass of pump station pumps.

PART 3: EXECUTION

3.01 INSTALLATION

A. Install, level, align, and lubricate pump station as indicated on project Drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Installation shall be performed by a factory trained and certified technician. SCADA to be approved by the City.

C. Suction pipe connections are vacuum-tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to

prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve, or pump drain lines) as required in wet well.

D. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

E. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence, and ground before actual start-up.

F. After all anchor bolts, piping, and control connections are installed, completely fill the grout dam in the pump station base with non-shrink grout.

3.02 QUALITY CONTROL AND FIELD TESTING

A. QUALITY CONTROL

Coordinate station start-up with Manufacturer's technical representative. The representative or factory service technician shall inspect the completed installation. He shall calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures. The Manufacturer's representative shall provide two (2) eight (8)-hour days of inspection, testing, and training.

B. FIELD TESTING

1. Prior to acceptance by the City, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the Specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; that it is safe and in optimum working condition; and that it conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed from the wet well, Contractor shall supply clear water volume adequate to operate station through several pumping cycles.

Observe and record operation of pumps, suction and discharge gage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment and test manual control devices and automatic control systems. Be alert to any undue noise, vibration, or other operational problems.

3.03 CLEANING

Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material, or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap, and debris.

3.04 PROTECTION

The pump station should be placed into service immediately. If operation is delayed, drain water from pumps and piping. Open motor circuit breakers and protect station controls and interior equipment from cold and moisture.

3.05 SPARE PARTS

The Contractor shall furnish one (1) complete set of Manufacturer-recommended spare parts for each pump and shall convey the spare parts to the City.

END OF SECTION

SECTION 11910 DIESEL ENGINE GENERATOR

PART 1: GENERAL

1.01 SCOPE OF WORK

A. It is the intent and purpose of this Specification to describe the materials and labor required for the Contractor to furnish and install one (1) standby electric power generating set rated ____ kW, automatic transfer switch, other required switchgear each rated for ____ A at 480 V (designer to verify voltage), and necessary auxiliary equipment. These specifications describe the performance, functions, and quality standards required for the installation, equipment, material, and workmanship that are to be furnished.

B. These specifications cover a complete unit including engine and generator, batteries, chargers, radiator, fan, silencer, air and fuel filters, generator, exciter, and vibration isolators as specified herein. These specifications also include switchgear, piping and wiring external to manufactured units, fuel storage tanks, fuel supply and return lines, and installation.

C. The installation shall include the labor, equipment, tools, supplies and materials, and performance of all operations necessary for the installation of the engine-generator set, switchgear, and auxiliary equipment as specified.

D. Unless otherwise noted, all materials and equipment supplied under this Section shall be new, of good quality, and in good condition.

1.02 SYSTEM DESCRIPTION

A. The equipment covered by these specifications is intended for outdoor installation and use and operation in closed transition standby and/or peak shaving mode separate from the utility power source.

B. RATING

These specifications cover one (1) engine-generator set ready for installation, with the necessary switchgear, controls, and auxiliary equipment and shall include a diesel engine coupled to a generator of the specified rating.

C. OPERATION

Operation shall be fully automatic and shall have the capability of being monitored and initiated in response to an external contact input that shall be wired from a SCADA remote terminal unit.

D. CONNECTION

It is intended that the equipment specified herein will be arranged for closed transition standby and/or peak shaving operation and shall otherwise be electrically separate from the utility source.

E. PERFORMANCE

The Manufacturer shall thoroughly familiarize himself with the conditions and scope of the labor and material to be furnished as a part of this Specification.

1.03 REFERENCES

All equipment covered by these Specifications shall be new and shall conform to the latest applicable standards of ANSI and NEMA, except where the standards conflict with the requirements of these specifications. All electrical equipment shall require UL approval for the intended use.

1.04 SUBMITTALS

A. SHOP DRAWINGS

1. The Contractor shall furnish for approval five (5) sets of shop drawings and instructions covering the physical size, weight, arrangement, dimensions, mechanical and electrical characteristics, wiring and piping diagrams, and other pertinent data for the equipment that is to be furnished. Overall wiring and piping diagrams shall be included.

2. Installation plans shall be provided by the Contractor and shall include the following:

   a. Engine-generator layout with dimensions;
   b. Wiring diagrams for generator and for connection into existing system;
   c. Conduit layouts;
   d. Switchgear interconnection drawings;

e. Engine and generator installation diagrams; and

f. All other necessary interconnection drawings.

3. All Specifications shall follow the requirements outlined in Section 01200, 1.04.D.

B. OPERATION AND MAINTENANCE MANUALS

The Contractor shall furnish three (3) sets of operation and maintenance manuals for all equipment, including written instructions renewal parts lists.

1.05 QUALITY ASSURANCE

The standby diesel generator shall be supplied by a reputable manufacturer with at least ten (10) years of experience in the manufacture of similar types of diesel engine generators. Generators shall be manufactured by Kohler, Caterpillar, Onan, or approved equal.

1.06 DELIVERY, STORAGE AND, HANDLING

All equipment and materials shall be delivered, stored and handled in strict accordance with the Manufacturer's recommendations.

1.07 WARRANTY

The Manufacturer shall warrant all equipment and materials to be free from defects in workmanship and materials for a period of one (1) year after final acceptance.

1.08 MANUFACTURER AND SUPPLIER INFORMATION

A. MANUFACTURER'S NAMEPLATE

A manufacturer's nameplate shall be securely and permanently mounted to each individual piece of equipment furnished under this Section. The nameplate shall be constructed of a durable, non-corrosive material. Critical information shall be clearly engraved or otherwise permanently stamped on the nameplate and shall be fully legible. The information contained on the manufacturer's nameplate shall include at least the following:

1. Manufacturer's serial number;

2. Name, address, and telephone number of equipment Manufacturer;

3. Model and/or part numbers;
4. Performance criteria;
5. Motor size, speed, and voltage; and
6. Any other pertinent information.

Note: All equipment shall include a nameplate with a Manufacturer's serial number validating the equipment as new. Failure to meet these requirements will be cause for rejection of the equipment.

B. SUPPLIER AND SERVICE INFORMATION

A durable nameplate, stamp, or sticker shall be adhered to each individual piece of equipment containing the name, address, and telephone number of the local business that supplied the equipment, and the name, address, and telephone number of the local business that can provide service and replacement parts for the equipment. A twenty-four (24)-hour emergency service telephone number should also be included.

PART 2: PRODUCTS

2.01 MATERIALS

Miscellaneous materials shall include all material and equipment necessary to allow fully automatic operation of the units at the completion of the project. Miscellaneous materials shall include, but shall not be limited to, conduit and wiring for control and connection to the facility electric supply.

2.02 EQUIPMENT

A. ENGINE

These Specifications cover one (1) oil diesel compression-ignition engine, four-stroke cycle, 1,800 rpm, turbo-charged, liquid-cooled, suitable for operation of the attached electric generator for continuous standby duty at an ambient temperature of 110° F. The engine shall be rated not less than 1.5 brake hp per kW at SAE standard rating conditions, in addition to the power required for operation of the radiator fan, oil pump, battery charging alternator, and water pump.

B. ENCLOSURE

If standby generator is to be installed outdoors and shall include a weatherproof enclosure constructed of steel with the Manufacturer's standard shop coating.

C. FUEL SUPPLY SYSTEM

1. A complete fuel supply system shall be furnished and installed as a part of the work covered by these Specifications. The fuel system shall be an integral part of the generator unit and shall include a base mounted fuel tank with a minimum capacity of two hundred fifty (250) gallons or providing for forty-eight (48) hours of continuous engine generator operation, whichever is greater. Unless otherwise shown on the Drawings, the main fuel storage tank shall be skid mounted with the fuel tank located beneath the engine.

2. All above grade piping shall be Schedule 40 seamless black iron.

D. EXHAUST SYSTEM

The Contractor shall furnish and install all exhaust piping, thimbles, and silencer as a part of the work covered by these Specifications. Exhaust piping shall be schedule 40 seamless black iron, sized as required.

E. GROUNDING

The generator and all other metallic equipment shall be bonded and grounded as required by the NEC and applicable Local codes. Grounding conductors shall be soft-drawn stranded copper sized in accordance with the applicable codes and shall be enclosed in PVC conduit in poured concrete.

F. ELECTRICAL SYSTEM

Distances shown on Plans are approximate and intended to allow the Contractor to estimate conduit and conductor requirements. Allowance should be made for additional conductor that may be required for makeup in individual equipment enclosures. Conduit type shall be as previously described in the electrical section of these Specifications. All electrical installations shall comply with the latest edition of the NEC and applicable Local codes.

G. SWITCHGEAR

The Contractor shall be required to receive and completely install the switchgear. All conduit, wiring, and connections for power supply and control wiring shall be supplied as a part of the work of these Specifications.

PART 3: EXECUTION

3.01 PREPARATION

A. EARTHWORK

1. General

The Contractor shall perform all grubbing, excavation, trenching, backfilling, and patching necessary for the execution of the construction.

2. Excavation

a. The Contractor shall excavate, allowing sufficient space to permit erection of forms, sheeting, shoring, and bracing. Excavations carried below the required depths, without specific directions, shall be refilled to the proper grade with thoroughly compacted suitable fill.

b. Trenches for ducts shall have a width to afford a minimum of four inches (4”) of clearance between trench walls and extreme outside dimension of the conduit structure in order to provide space for making the joints.

c. Contractor shall at all times during construction of the work provide and maintain ample means and equipment with which to promptly remove and properly dispose of all waste entering excavations or other parts of the work and keep excavation dry until duct lines or other structures to be built therein are completed.

3.02 INSTALLATION

A. All equipment and materials shall be installed in strict accordance with the Manufacturer’s recommendations and as shown on the Contract Drawings.

3.03 QUALITY CONTROL AND FIELD TESTING

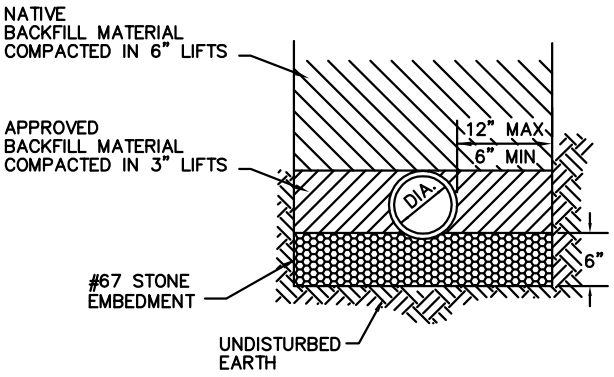
A. QUALITY CONTROL

The Manufacturer shall furnish the services of a qualified technician for one (1) day to inspect the installation, start-up the equipment, and provide operator training to the City's personnel.

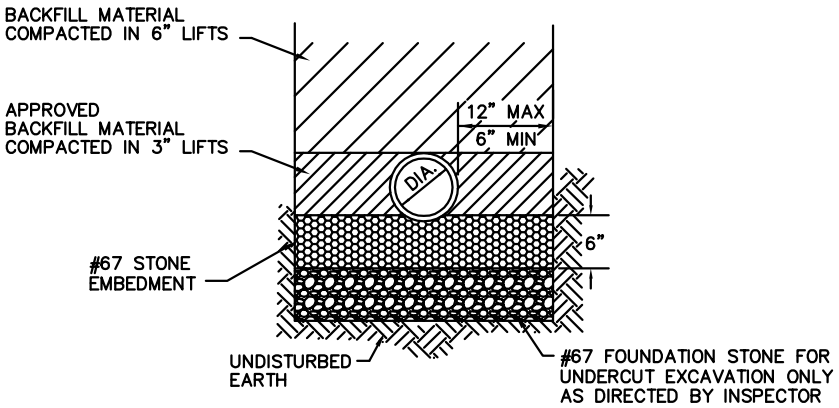
B. FIELD TESTING

The Contractor and Manufacturer shall perform operational tests of the completed installation to verify the proper operation of the equipment. The expenses of the tests, including the time and expenses of qualified test personnel and the use of special tools and test equipment, shall be included in Contractor's proposal. The City reserves the right to reject any and all equipment, material, or design that in their opinion fails to meet the requirements of these Specifications.

END OF SECTION

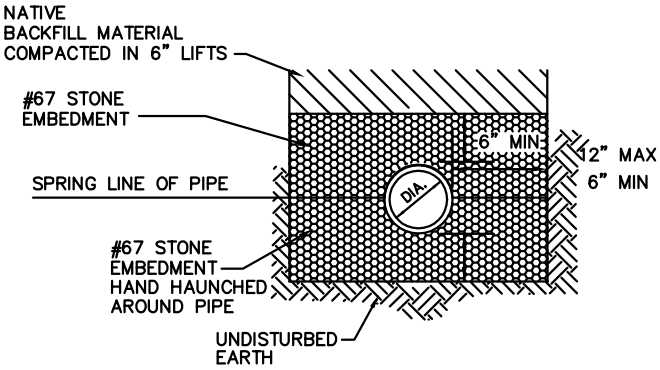


STANDARD EXCAVATION



UNDERCUT EXCAVATION
IN UNSTABLE SOILS TYPES

DUCTILE IRON GRAVITY SEWER



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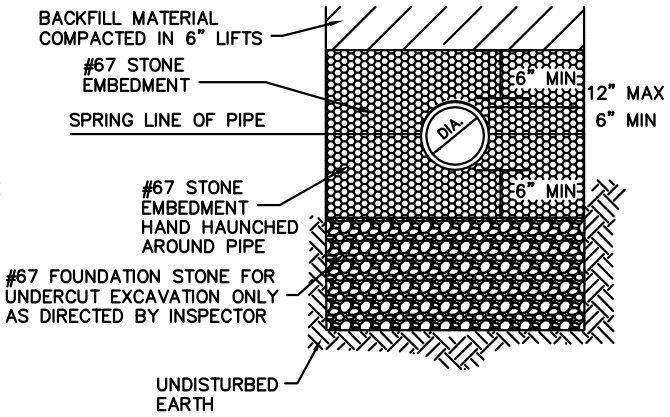


UNDERCUT EXCAVATION
IN UNSTABLE SOILS TYPES

PIPE IN WET OR UNSTABLE CONDITIONS
ALL PIPE TYPES (AS DIRECTED BY INSPECTOR)

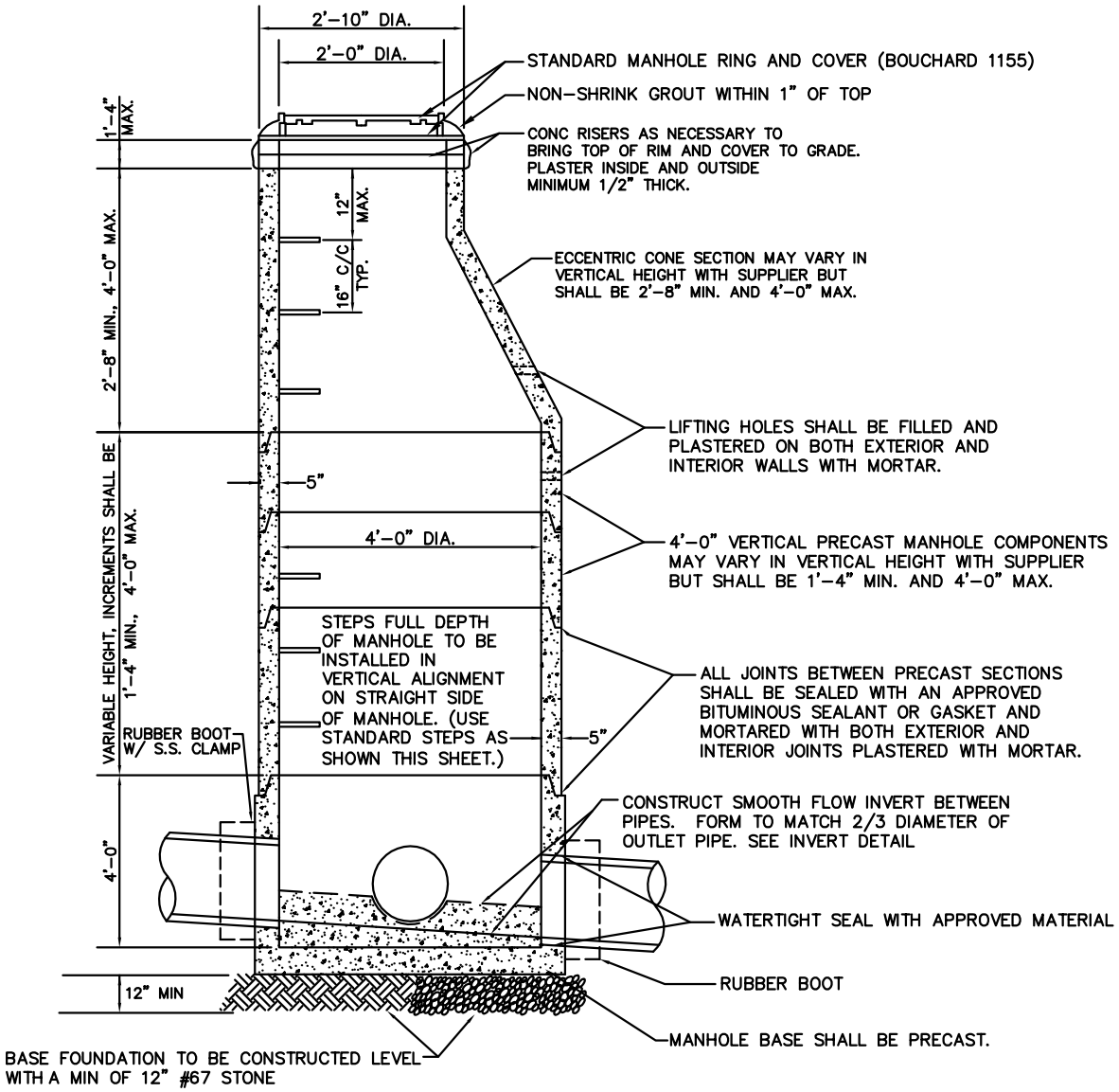
TYPICAL GRAVITY SEWER
TRENCHING DETAILS

NOT TO SCALE

NOTES:

1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.

CITY OF WHITE HOUSE WASTEWATER STANDARD SEWER DETAILS	REVISION NO: 1 DATE: OCTOBER 2006
	STD–WW–01



ELEVATION VIEW

PRECAST MANHOLE NOTES:

1. ALL PRECAST MANHOLE COMPONENTS SHALL MEET REQUIREMENTS OF ASTM C-478, LATEST REVISION.
2. ALL MANHOLES SHALL BE CONSTRUCTED PLUMB.
3. ALL MANHOLE GRADES SHOWN ON THE PLANS ARE FOR THE INVERT OF THE MANHOLE CENTER.
4. IF MANHOLE IS SET IN LOCATION OF HIGH WATER TABLE OR UNDERGROUND WATER IS ENCOUNTERED, THE CONTRACTOR SHALL INSTALL UNDERDRAINS AND STONE AS DIRECTED IN THE FIELD BY THE INSPECTOR.
5. STEPS SHALL BE INSTALLED ON STRAIGHT SIDE OF MANHOLE.

PRECAST CONCRETE MANHOLE

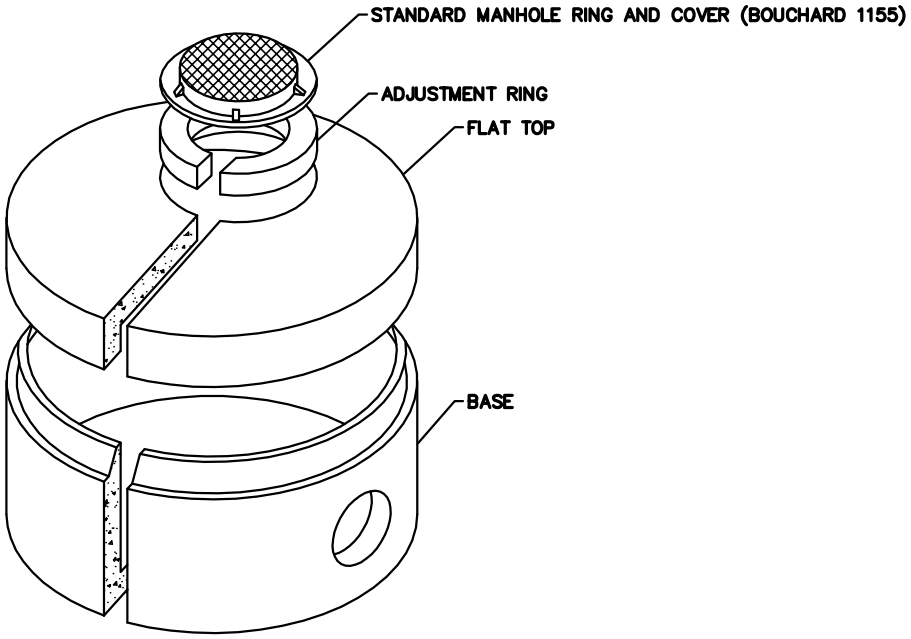
NOT TO SCALE

CITY OF WHITE HOUSE

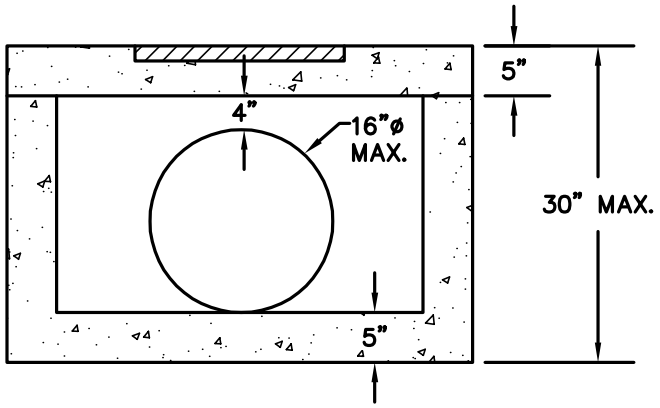
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: OCTOBER 2006

STD-WW-02



SHALLOW FLAT TOP MANHOLE



STANDARD SHALLOW MANHOLE

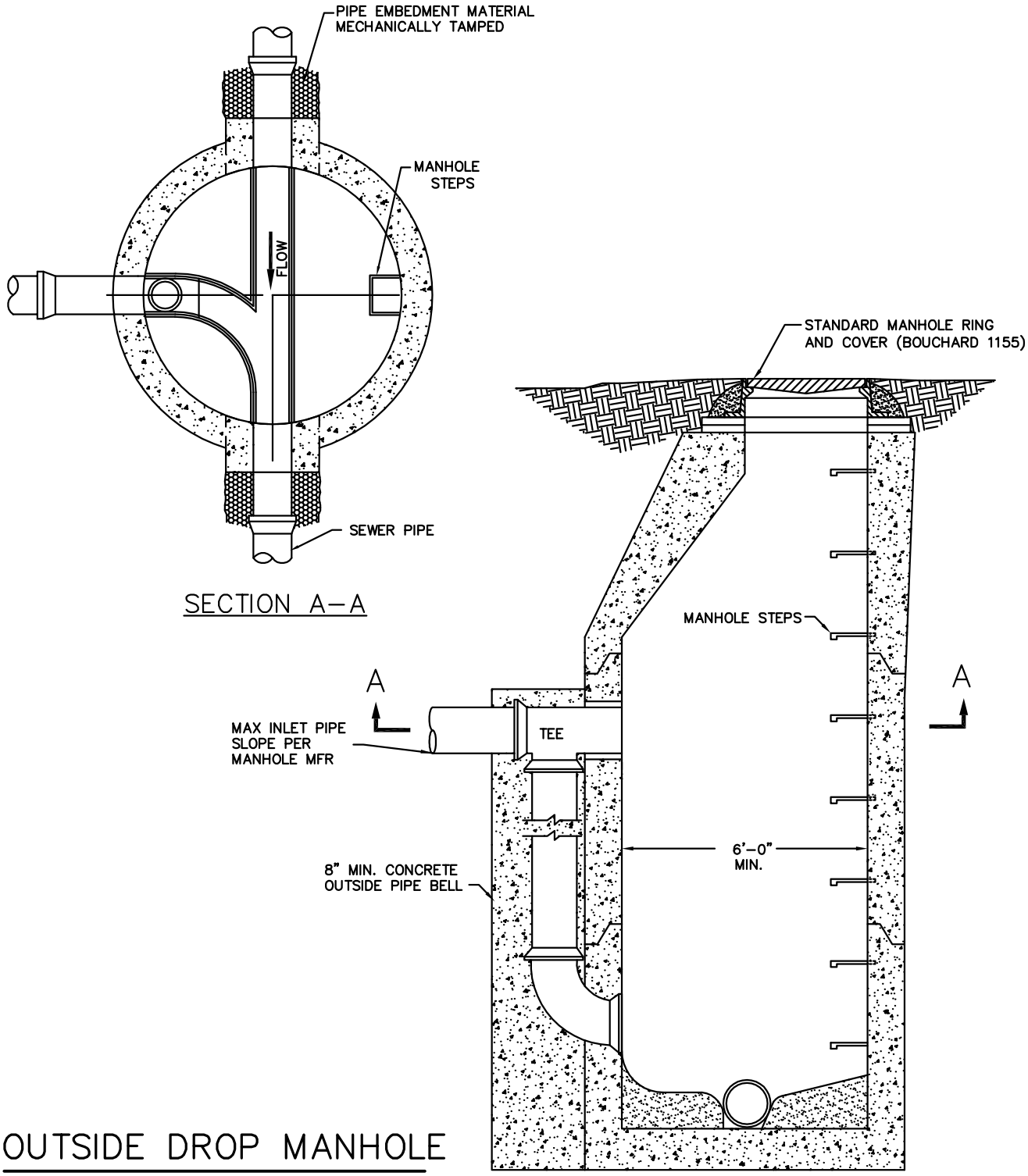
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: OCTOBER 2006

STD–WW–03



OUTSIDE DROP MANHOLE

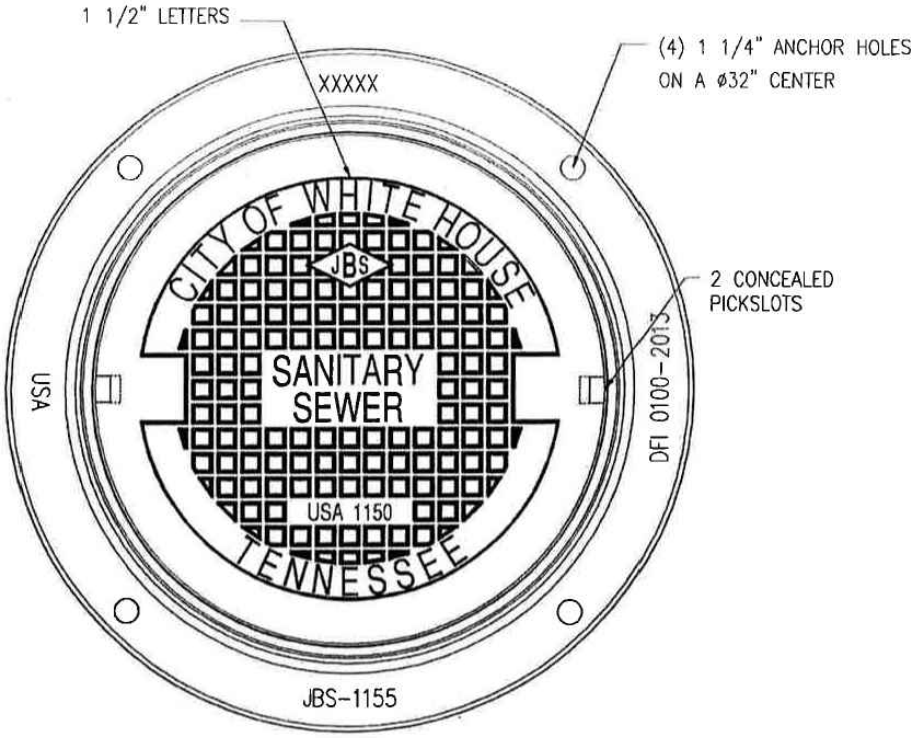
NOT TO SCALE

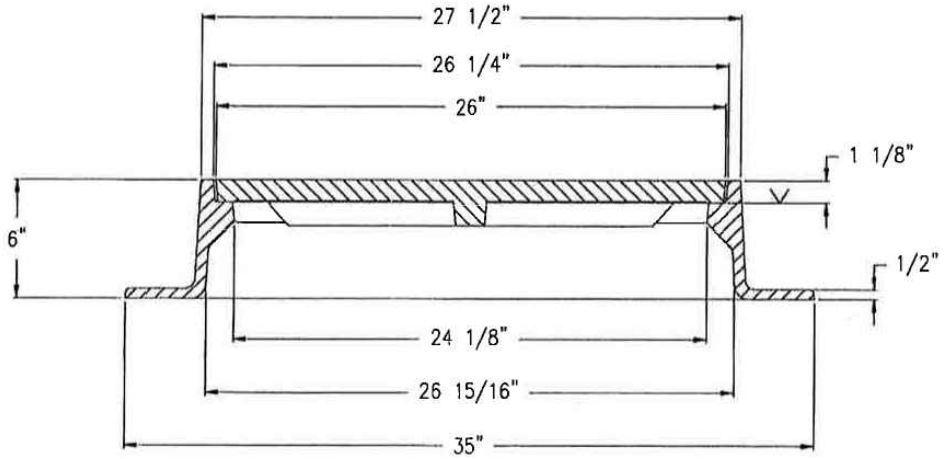
CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: OCTOBER 2006

STD–WW–04





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CLASS 35B GRAY IRON
MACHINED BEARING SURFACES
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www.jbouchard.com email: foundry@jbouchard.com

1155 FRAME & COVER

MANHOLE RING AND COVER

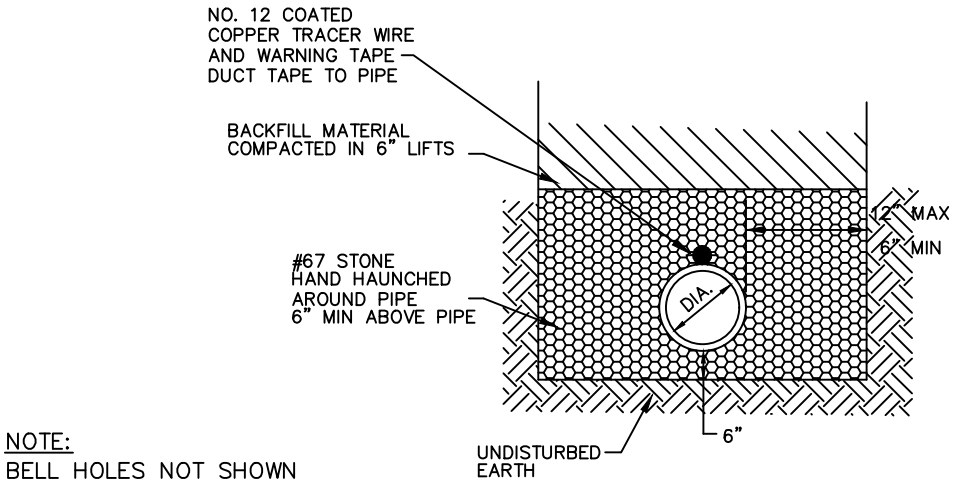
NOT TO SCALE

NOTE: TRAFFIC BEARING RING AND COVER.
MINIMUM WEIGHT 315 POUNDS

CITY OF WHITE HOUSE
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD-WW-05



NOTE:
BELL HOLES NOT SHOWN

STANDARD EXCAVATION

NOTE: 1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.

TYPICAL SEWER FORCE MAIN TRENCHING DETAILS

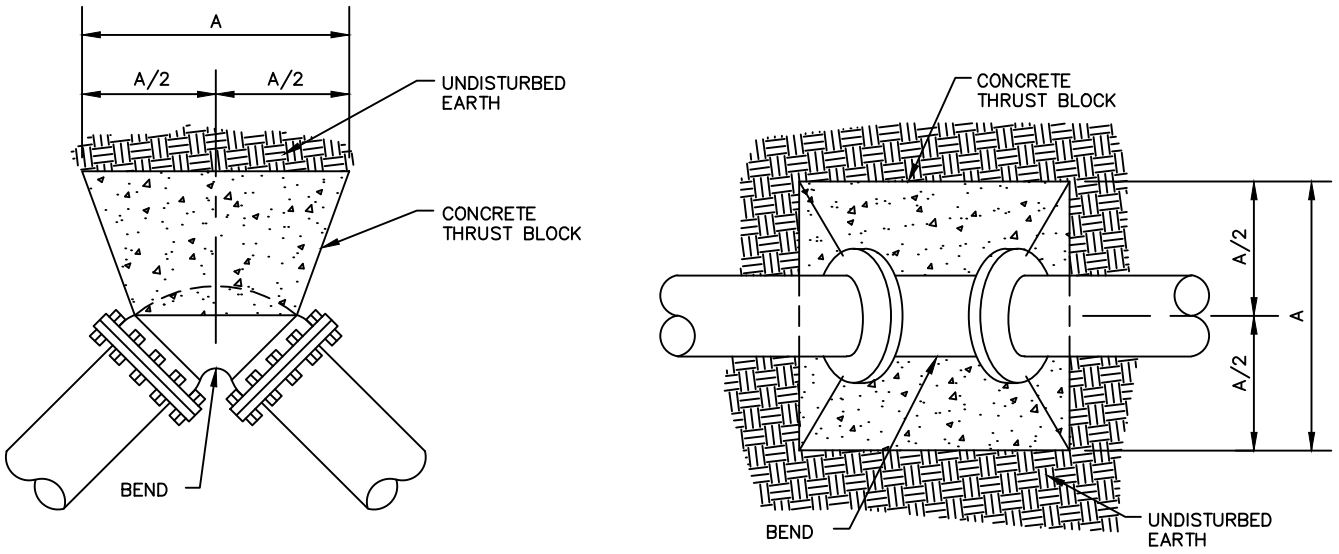
NOT TO SCALE

CITY OF WHITE HOUSE

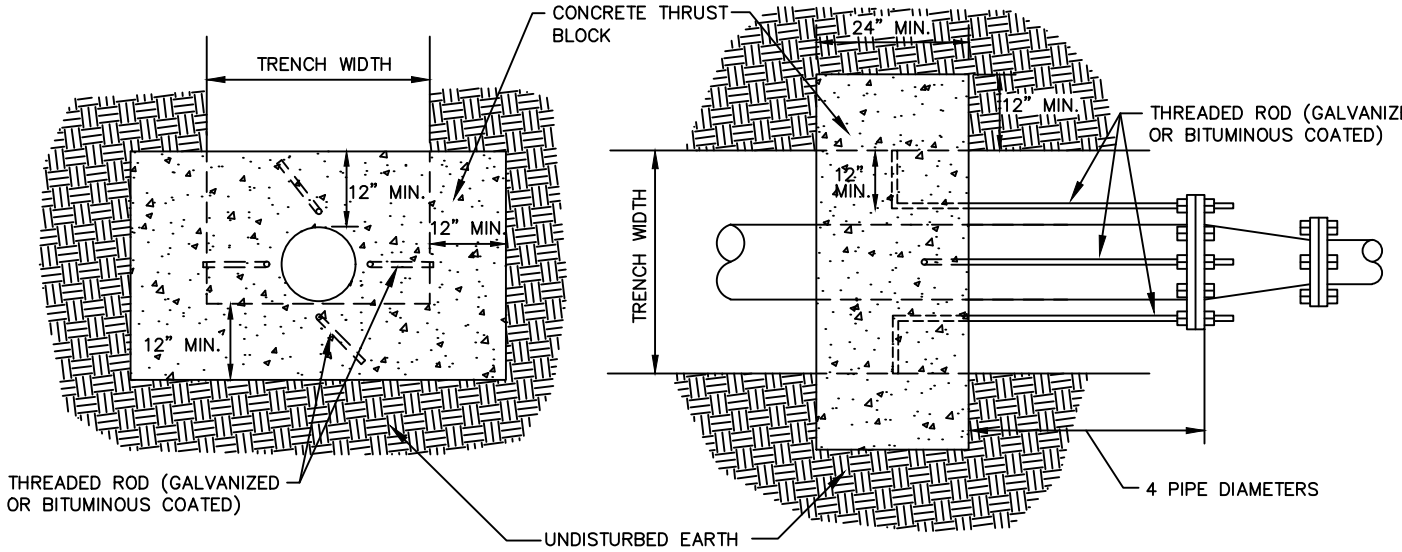
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD-WW-06



TYPICAL THRUST BLOCK FOR BENDS



TYPICAL THRUST BLOCK FOR REDUCERS

NOTES:
1. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. THE FITTING SHALL BE WRAPPED IN A LAYER OF POLYETHYLENE PLASTIC PRIOR TO POURING THE THRUST BLOCK.
2. ROD AND EYE BOLT DIAMETER SHALL BE A MINIMUM OF 3/4" AND SHALL MATCH THE SIZE OF THE BOLT PROVIDED WITH THE FITTING.
3. CONTRACTOR SHALL REPLACE FITTING BOLTS WITH THREADED ROD FOR 1/2 OF THE BOLTS SUPPLIED WITH EACH FITTING. RODS SHALL BE EQUALLY SPACED.

	TYPE			
SIZE	11-1/4° BEND	22-1/2° BEND	45° BEND	90° BEND
2-6	12	12	12	16
8	12	12	16	22
10	12	14	20	28
12	12	18	24	32
14	14	20	28	38
16	16	22	32	42
18	18	26	36	48
20	20	28	40	52
24	24	34	46	64
30	30	42	58	78
36	36	50	70	94
42	40	58	80	108
48	46	66	90	124

THRUST BLOCK DIMENSION "A"

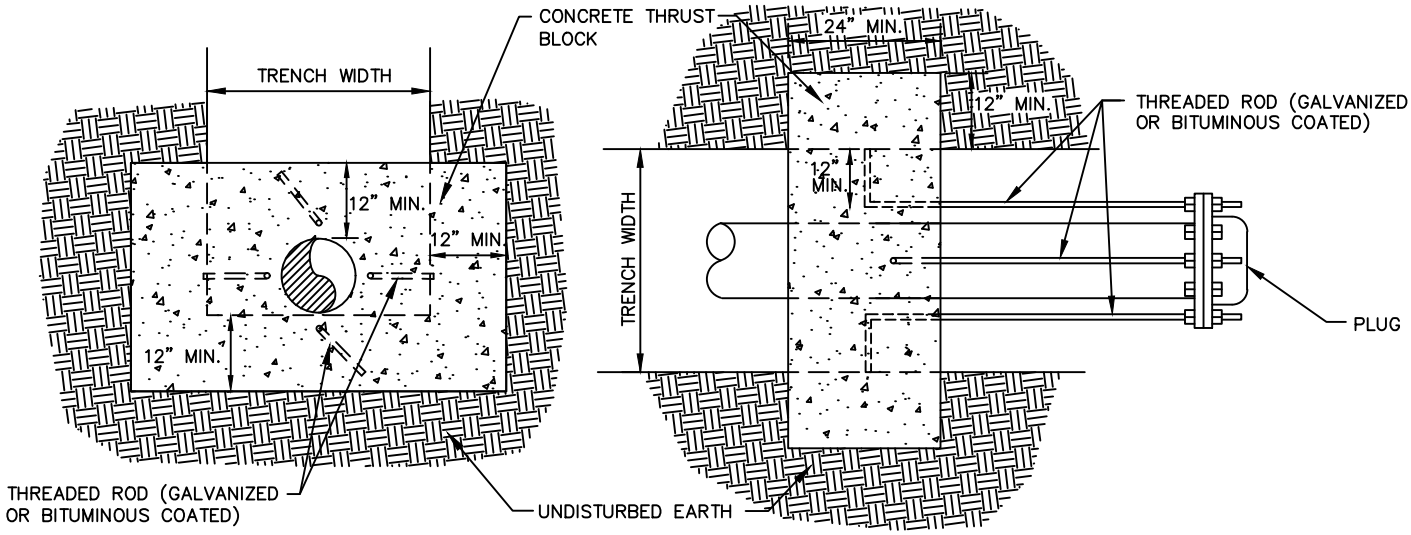
NOT TO SCALE

CITY OF WHITE HOUSE

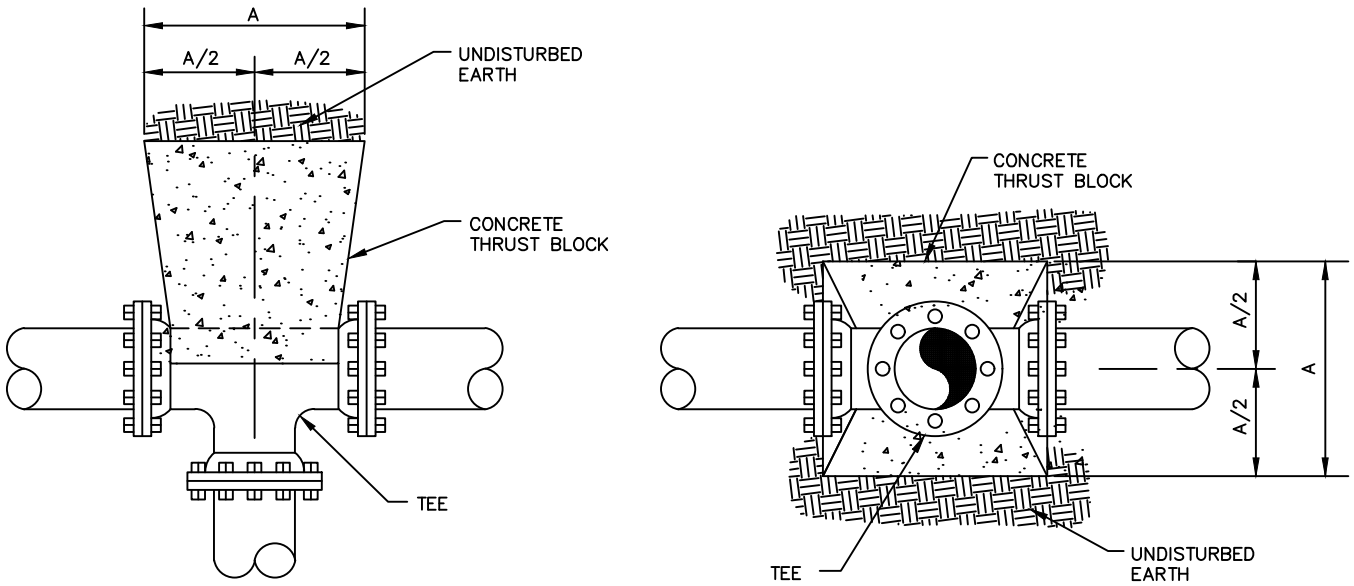
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD-WW-07



TYPICAL THRUST BLOCKS FOR PLUGS



TYPICAL THRUST BLOCKS FOR TEES

NOTES:
1. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. THE FITTING SHALL BE WRAPPED IN A LAYER OF POLYETHYLENE PLASTIC PRIOR TO POURING THE THRUST BLOCK.
2. ROD AND EYE BOLT DIAMETER SHALL BE A MINIMUM OF 3/4" AND SHALL MATCH THE SIZE OF THE BOLT PROVIDED WITH THE FITTING.
3. CONTRACTOR SHALL REPLACE FITTING BOLTS WITH THREADED ROD FOR 1/2 OF THE BOLTS SUPPLIED WITH EACH FITTING. RODS SHALL BE EQUALLY SPACED.

SIZE	TEE	PLUG
2-6	16	14
8	22	18
10	28	22
12	32	28
14	38	32
16	42	36
18	48	40
20	52	44
24	64	54
30	78	66
36	94	80
42	108	92
48	124	104

THRUST BLOCK DIMENSION "A"

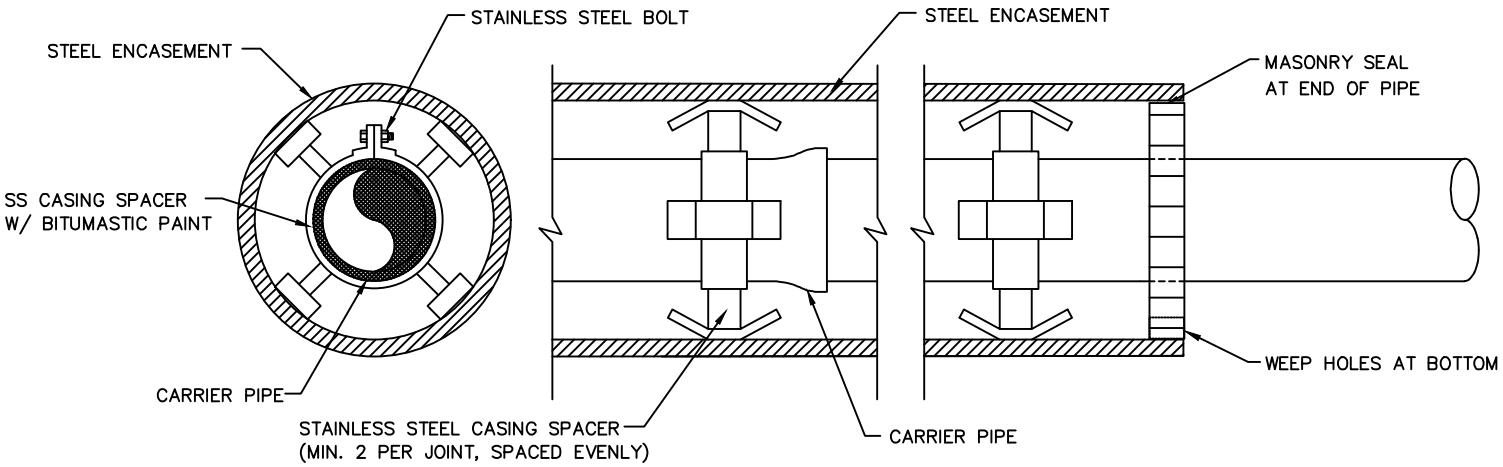
NOT TO SCALE

CITY OF WHITE HOUSE

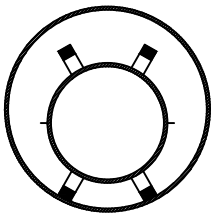
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

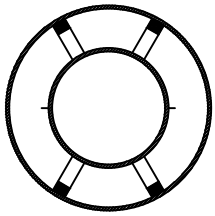
STD-WW-08



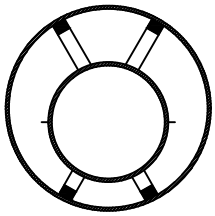
POSITIONING



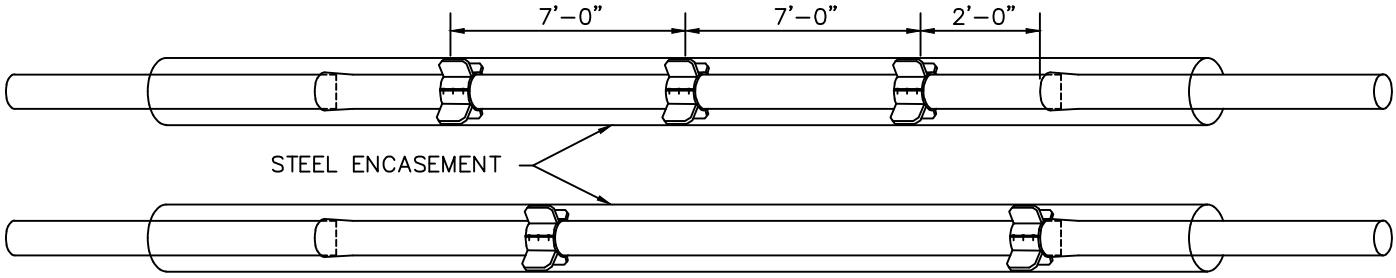
STANDARD: CARRIER LAYS ON CASING BOTTOM. TOP RUNNERS MAINTAIN SPACED IN EVENT OF ROLLOVER



CENTERED: POSITIONS IN CENTER OF CASING, STABLE WITH MOST ANNULAR SPACE AVAILABLE FOR OTHER USES



RESTRAINED: KEEPS CARRIER FROM FLOATING OR BUCKLING UNDER SUDDEN PRESSURE SURGES



NOTE: STANDARD POSITIONING TO BE USED UNLESS OTHERWISE NOTED
ALL BELLS INSIDE CASING SHALL BE INSTALLED WITH A LOCKING GASKET
CASING SPACERS FOR GRAVITY SEWERS SHALL MAINTAIN SEWER LINE GRADE

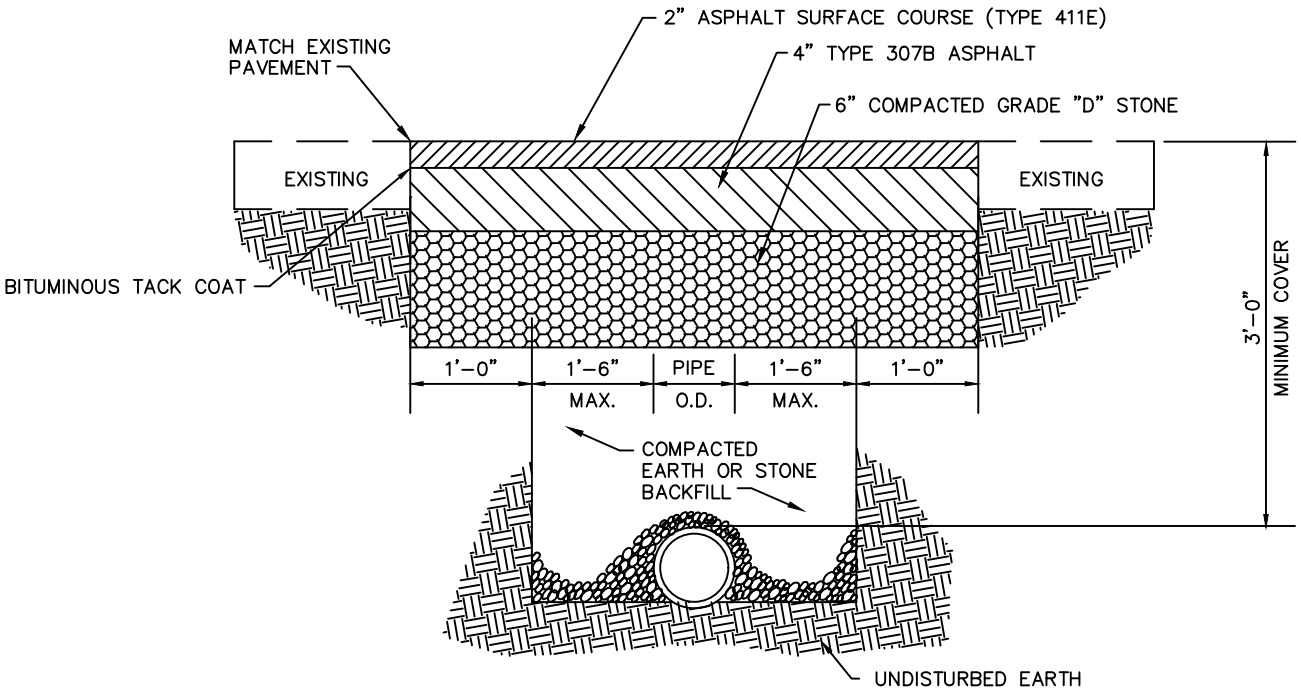
CARRIER PIPE IN STEEL ENCASEMENT DETAIL

NOT TO SCALE

CITY OF WHITE HOUSE
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD–WW–09



NOTES:

1. EDGE TO BE SAWED WITH A CONCRETE SAW TO A NEAT SQUARED EDGE. BROOMED CLEAN OF DUST BEFORE TACK COAT IS APPLIED.
2. EDGES TO BE TACKED WITH CRS-I OR CRS-II.
3. CONTRACTOR RESPONSIBLE FOR REPLACEMENT OF ANY PAVEMENT MARKINGS DISTURBED OR COVERED BY OVERLAY.

TYPICAL PAVEMENT REPAIRS

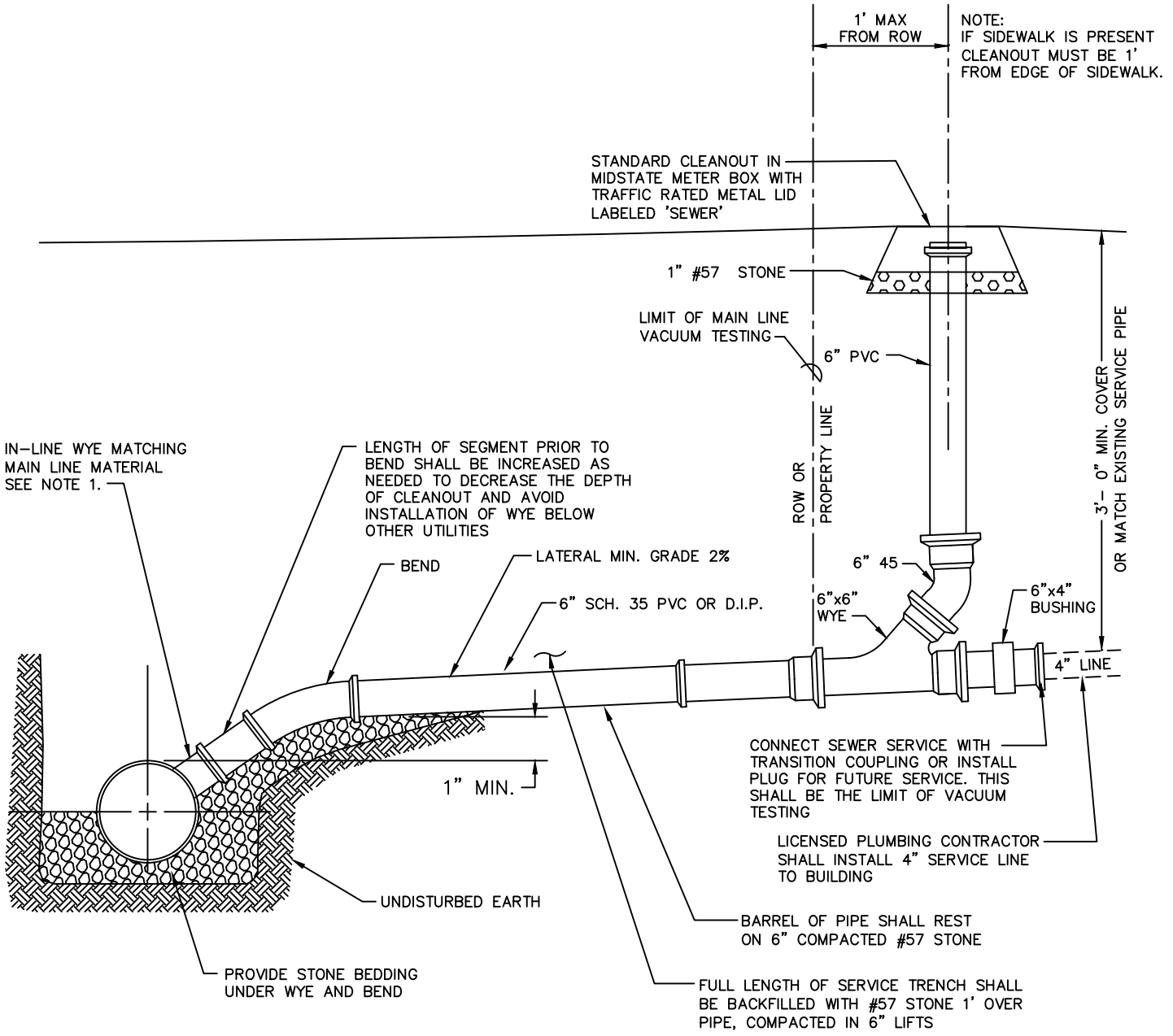
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD-WW-10



SANITARY SEWER SINGLE WYE CONNECTION AND TYPICAL CLEANOUT

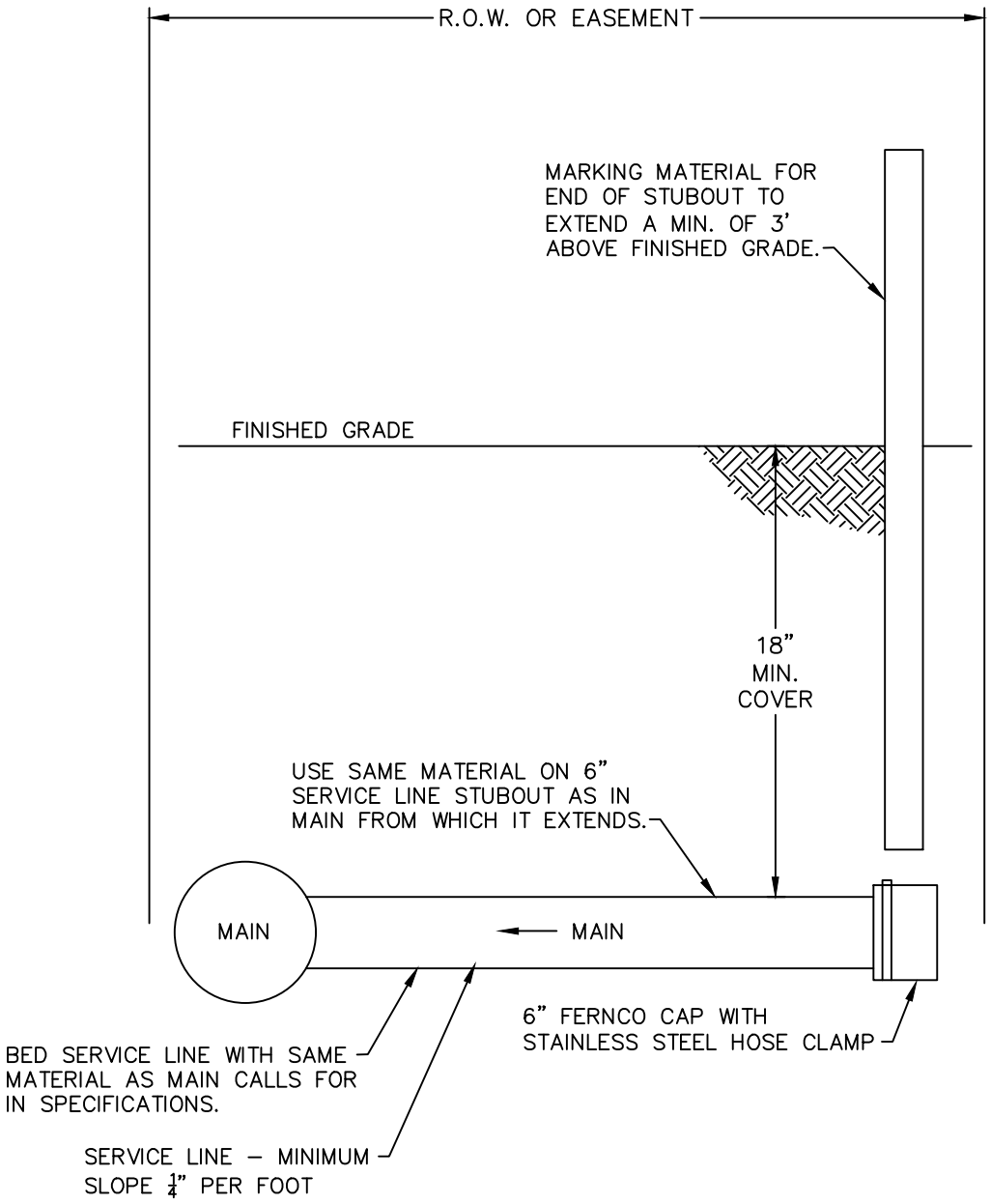
NOT TO SCALE

NOTE:
1. TAPPING SADDLES ARE APPROVED FOR CONNECTIONS TO EXISTING SEWER LINES ONLY
2. INTERMEDIATE CLEANOUTS SHALL BE INSTALLED EVERY 75 LINEAR FEET OF CUSTOMER'S SEWER SERVICE LATERTAL AND AT CHANGES IN DIRECTION.

CITY OF WHITE HOUSE
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD-WW-11



SHORT TAP GRAVITY SERVICE LATERAL STUBOUT NEW CONSTRUCTION

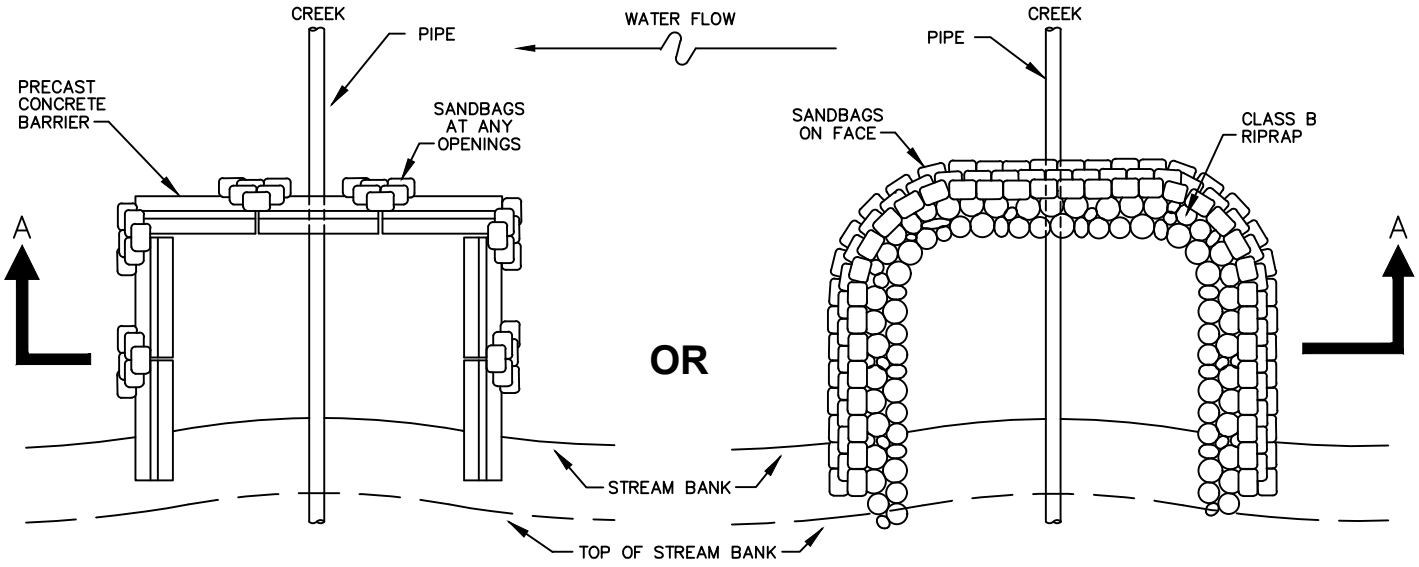
NOT TO SCALE

CITY OF WHITE HOUSE

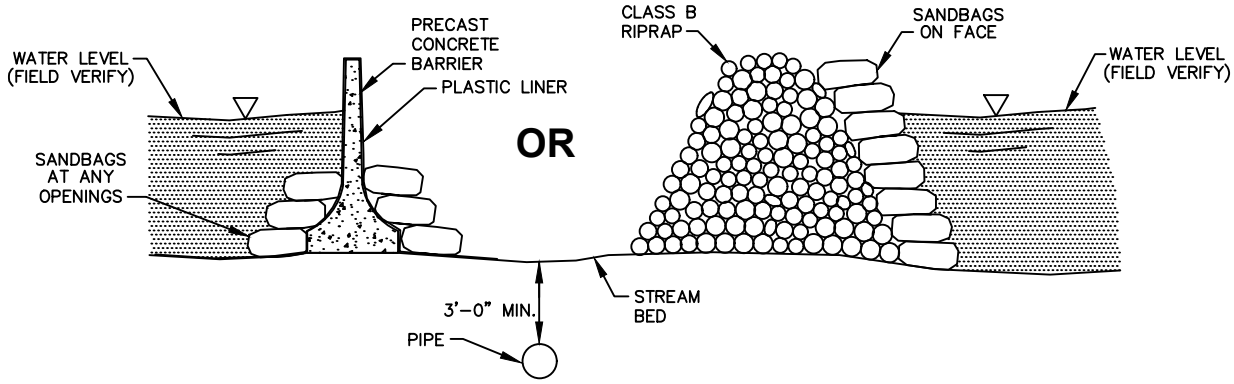
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD–WW–12



PLAN



SECTION A–A

NOTES:

1. COFFER DAM WILL BE BUILT SO THAT APPROXIMATELY ONE–HALF (1/2) OF THE STREAM CHANNEL IS OPEN AT ALL TIMES.
2. MATERIAL FROM THE STREAM BED SHALL NOT BE USED FOR COFFER DAM.
3. NO EARTHEN MATERIAL SHALL BE USED FOR COFFER DAM OR PLACED IN STREAM FOR ANY REASON.
4. STREAM BED SHALL BE DISTURBED THE MINIMUM REQUIRED FOR CONSTRUCTION OF PIPE LINE AND WILL BE RESTORED TO ORIGINAL CONTOURS WHEN WORK IS COMPLETE.
5. ALTERNATIVE COFFER DAM MATERIAL IS ACCEPTABLE BUT SHALL BE APPROVED BY THE ENGINEER.

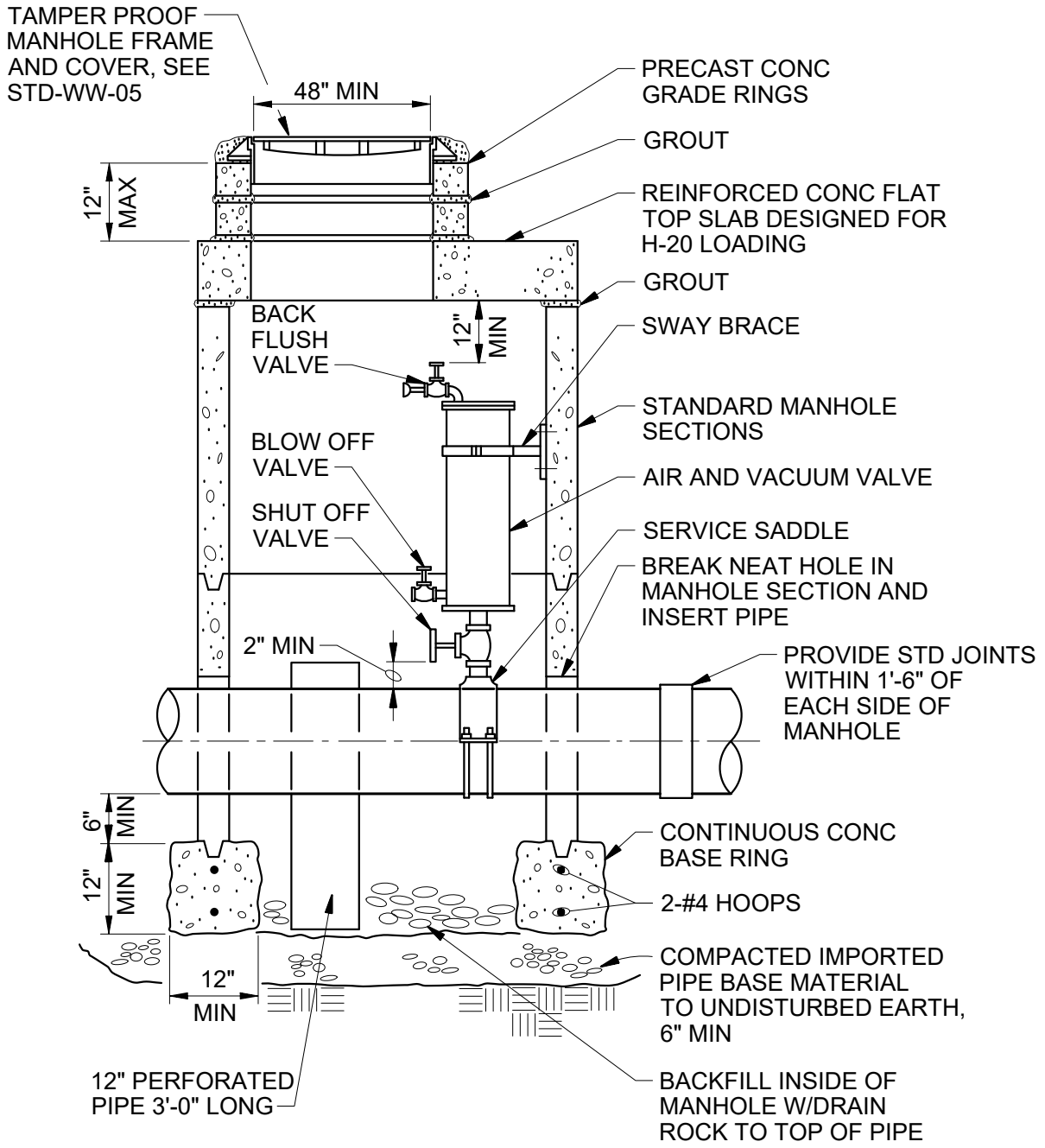
CREEK OR RIVER CROSSING

(LARGE CREEKS AND RIVERS)
NOT TO SCALE

CITY OF WHITE HOUSE
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD–WW–13



NOTES:

1. COMBINATION AIR VALVE TO BE INSTALLED AT ACTUAL HIGH POINT OF LINE. CONTRACTOR SHALL COORDINATE LOCATION WITH INSPECTOR.
2. VALVE SIZE AS SHOWN ON DRAWINGS OR DETAILED IN THE SPECIFICATIONS.
3. ALL PIPING FOR COMBINATION AIR VALVE SHALL BE BRASS OR STAINLESS STEEL.
4. CONTRACTOR SHALL ADJUST THE DEPTH OF THE FORCE MAIN AT ALL HIGH POINTS TO ACCOMODATE THE INSTALLATION OF THE COMBINATION AIR VALVE.

SEWAGE FORCE MAIN COMBINATION AIR VALVE

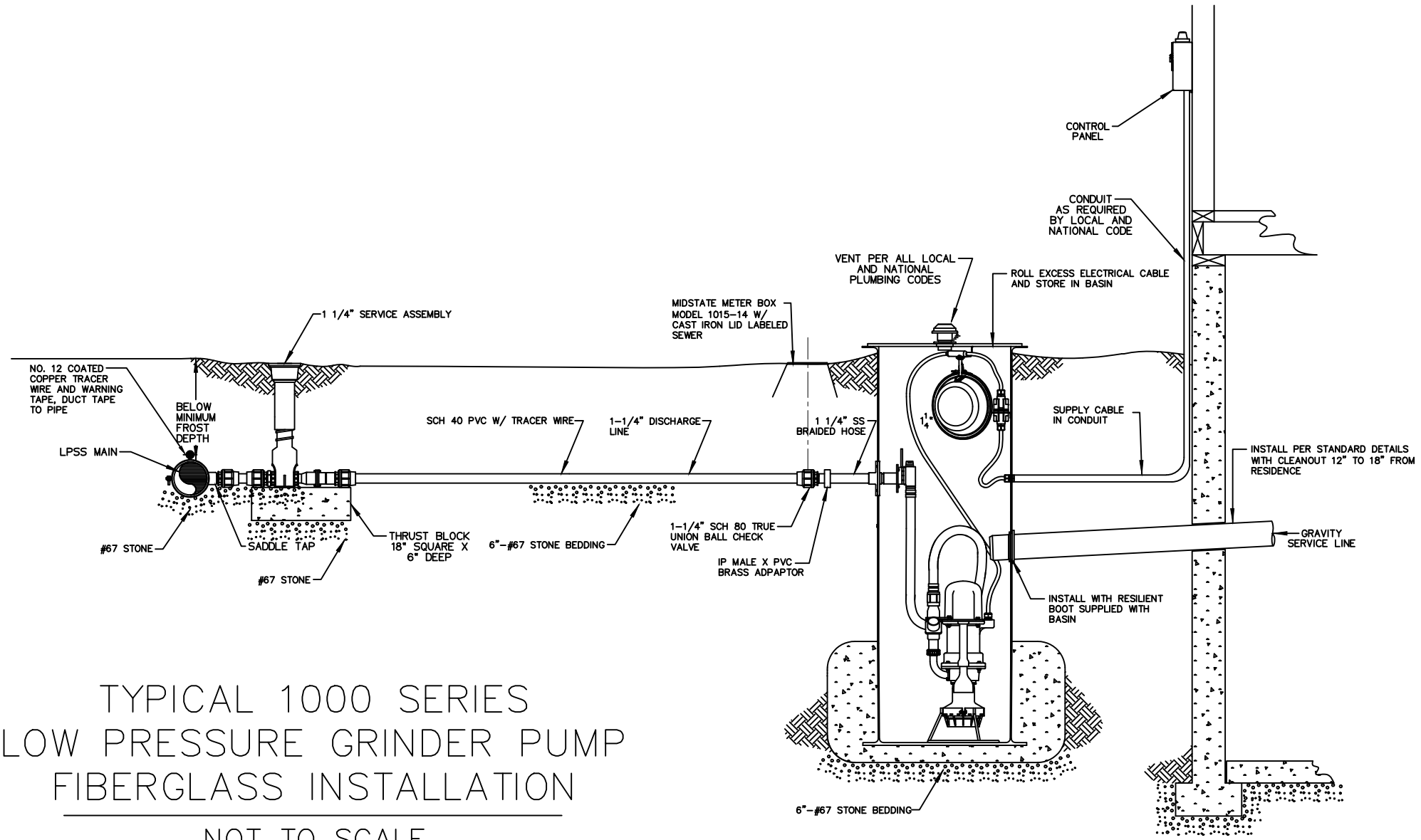
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD–WW–14



TYPICAL 1000 SERIES LOW PRESSURE GRINDER PUMP FIBERGLASS INSTALLATION

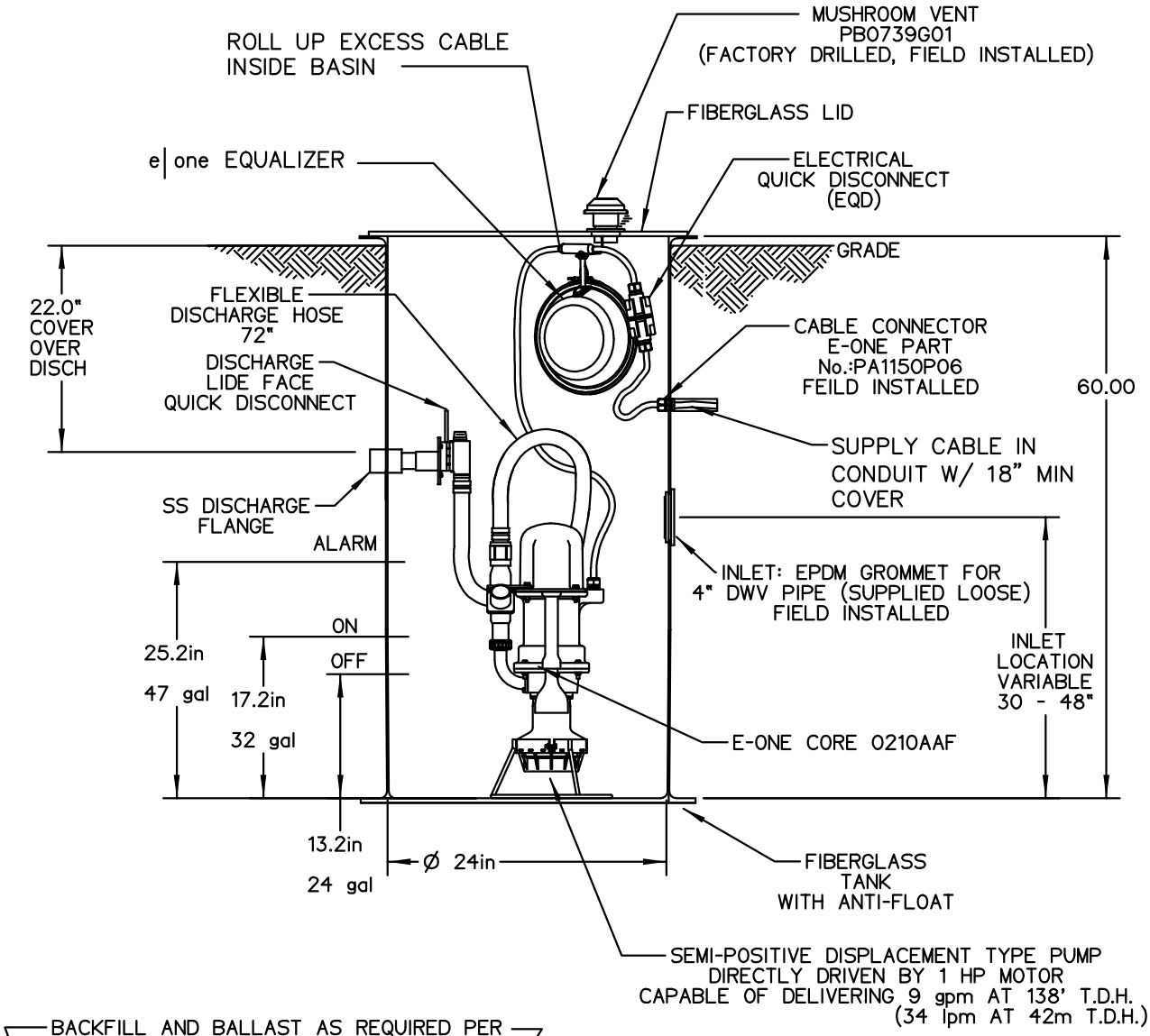
NOT TO SCALE

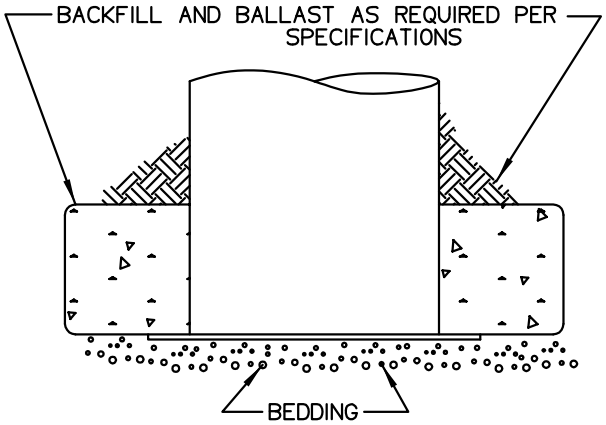
CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD-LP-01





TANK BASE DETAIL

AMGP SIMPLEX GRINDER PUMP, W/ 24 X 60 FIBERGLASS STATION

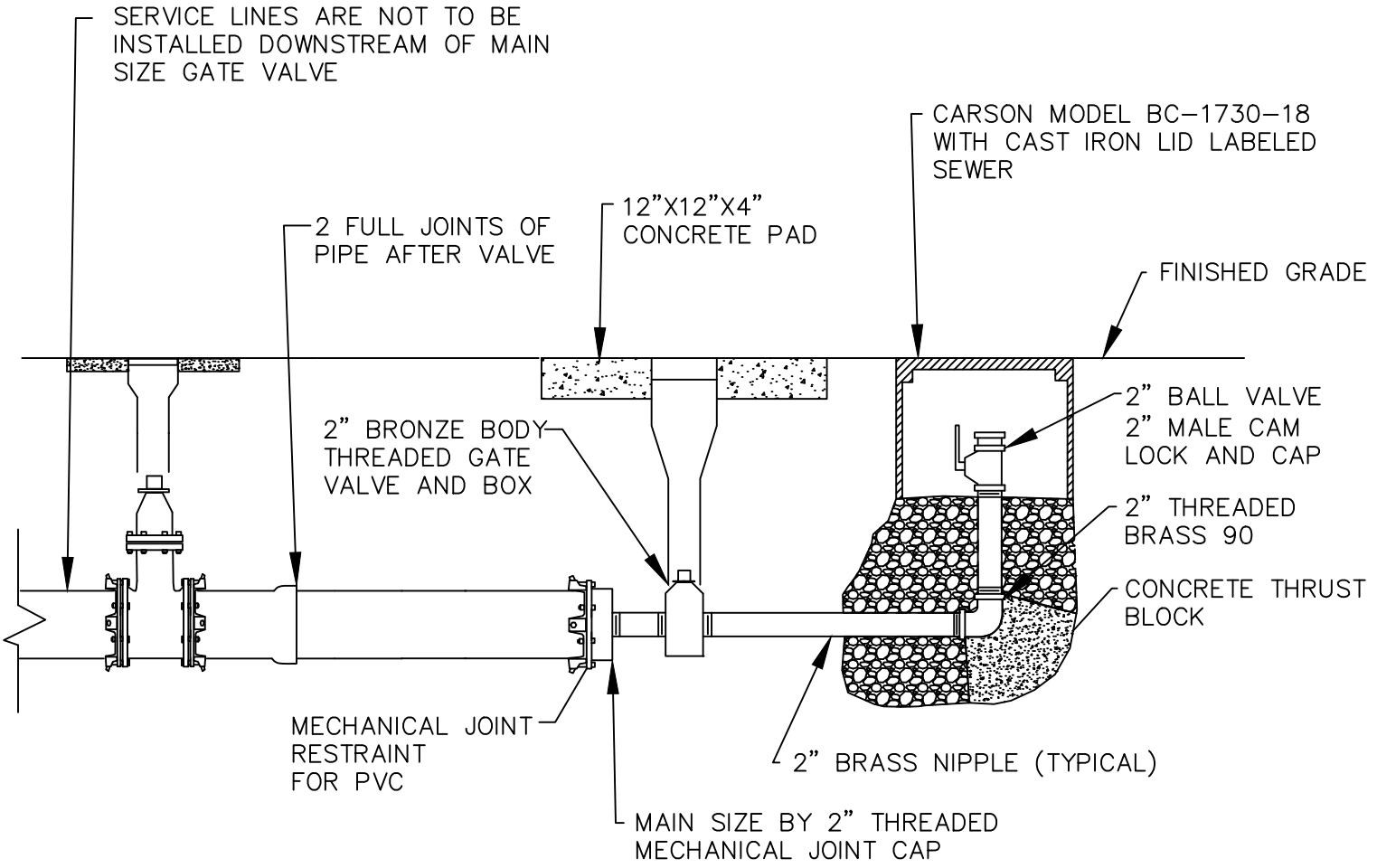
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: OCTOBER 2006

STD-LP-02



NOTE: ALL BRASS NIPPLES MUST BE 12" MIN. IN LENGTH

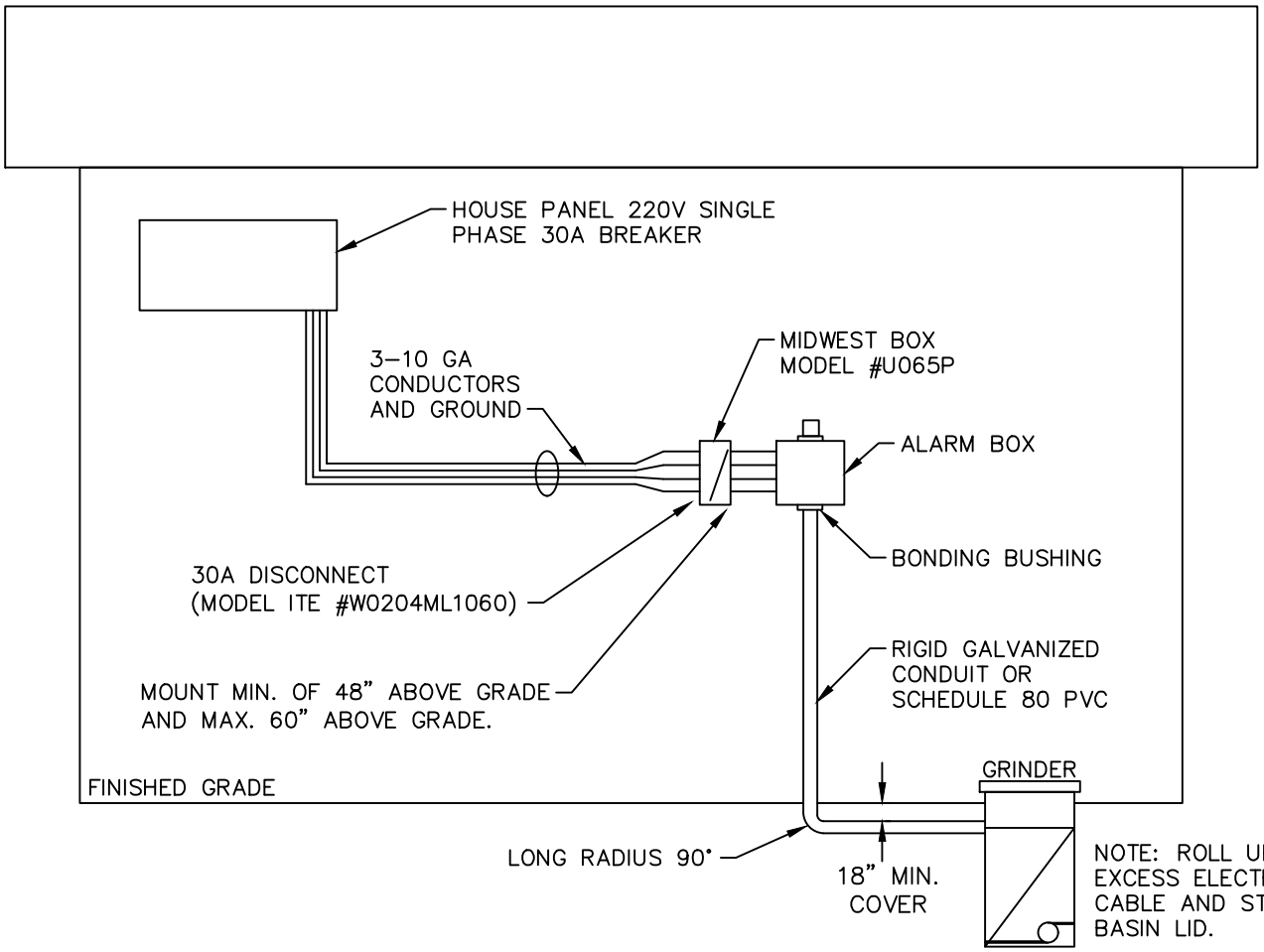
FORCE MAIN DEAD END ASSEMBLY
MAINS 4" AND LARGER

NOT TO SCALE

CITY OF WHITE HOUSE
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD-LP-03



NOTE: VERIFY MOTOR AMPERAGE AND ALL NAMEPLATE REQUIREMENTS PRIOR TO INSTALLATION. ALL CONNECTIONS SHALL BE IN ACCORDANCE WITH LOCAL CODES AND NEC.

ELECTRICAL INSTALLATION FOR SIMPLEX GRINDER PUMPS

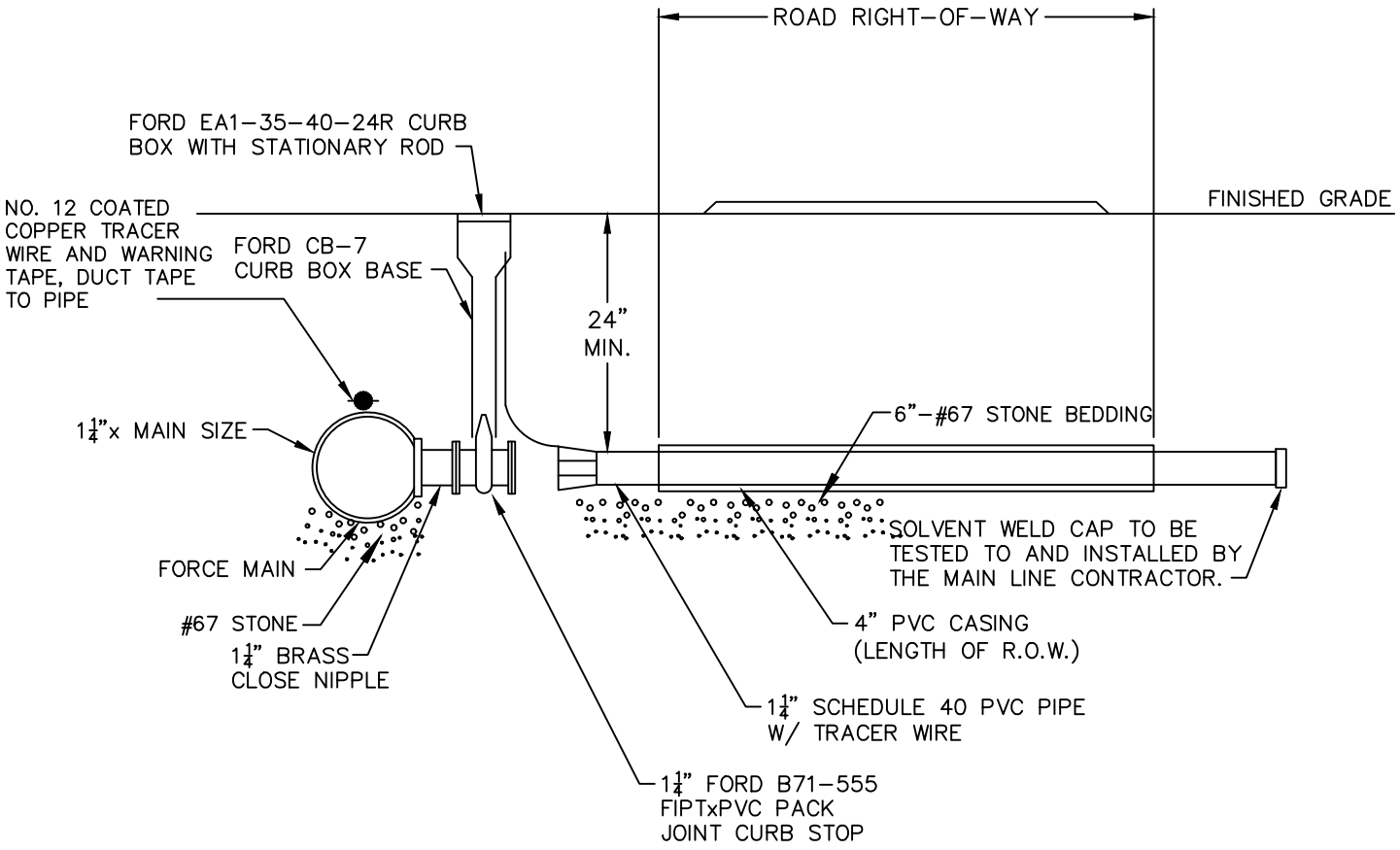
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD–LP–04



INSTALLATION OF SIIMPLEX GRINDER PUMP AT ROAD CROSSING

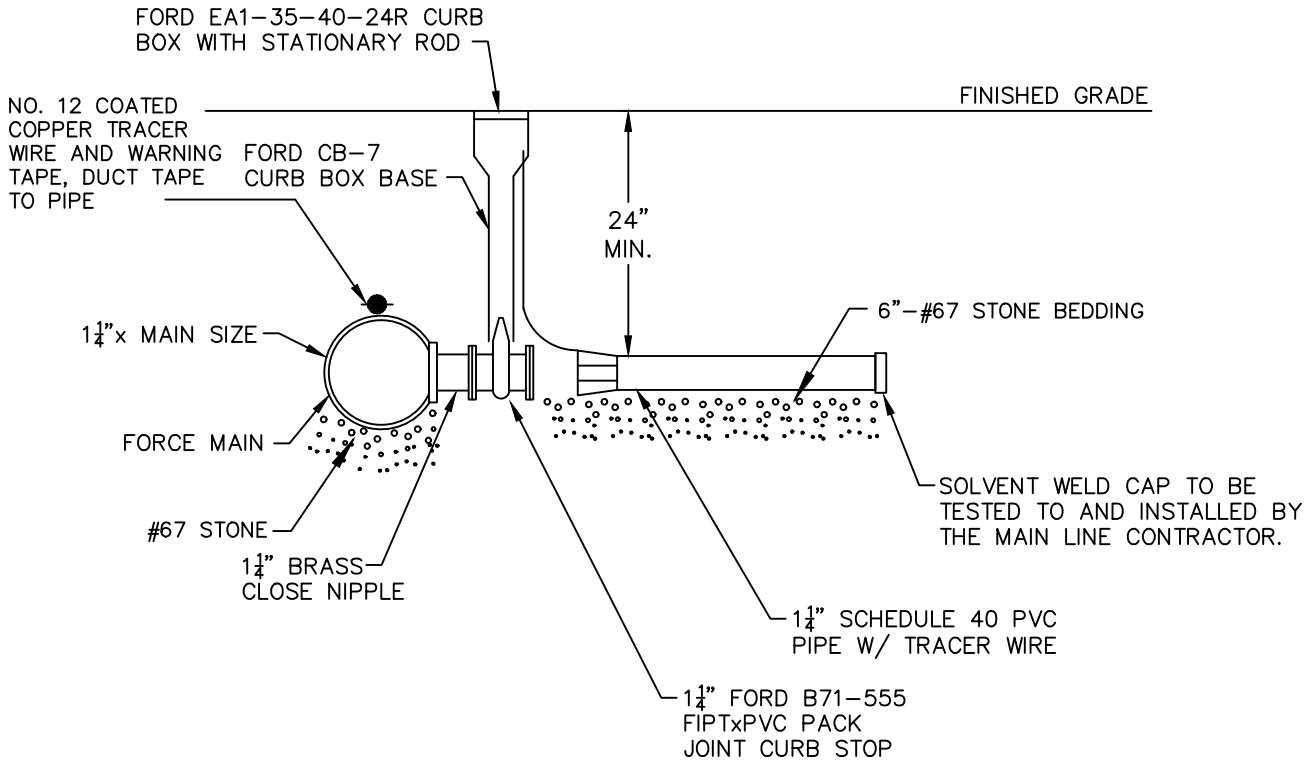
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

STD-LP-05



INSTALLATION OF SIIMPLEX GRINDER PUMP AT ROAD CROSSING

NOT TO SCALE

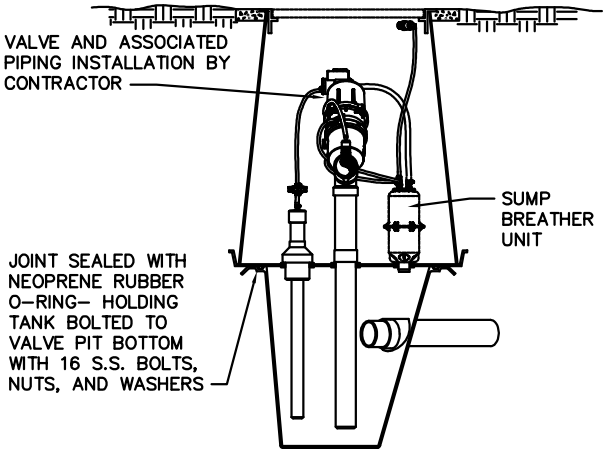
CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: APRIL 2021

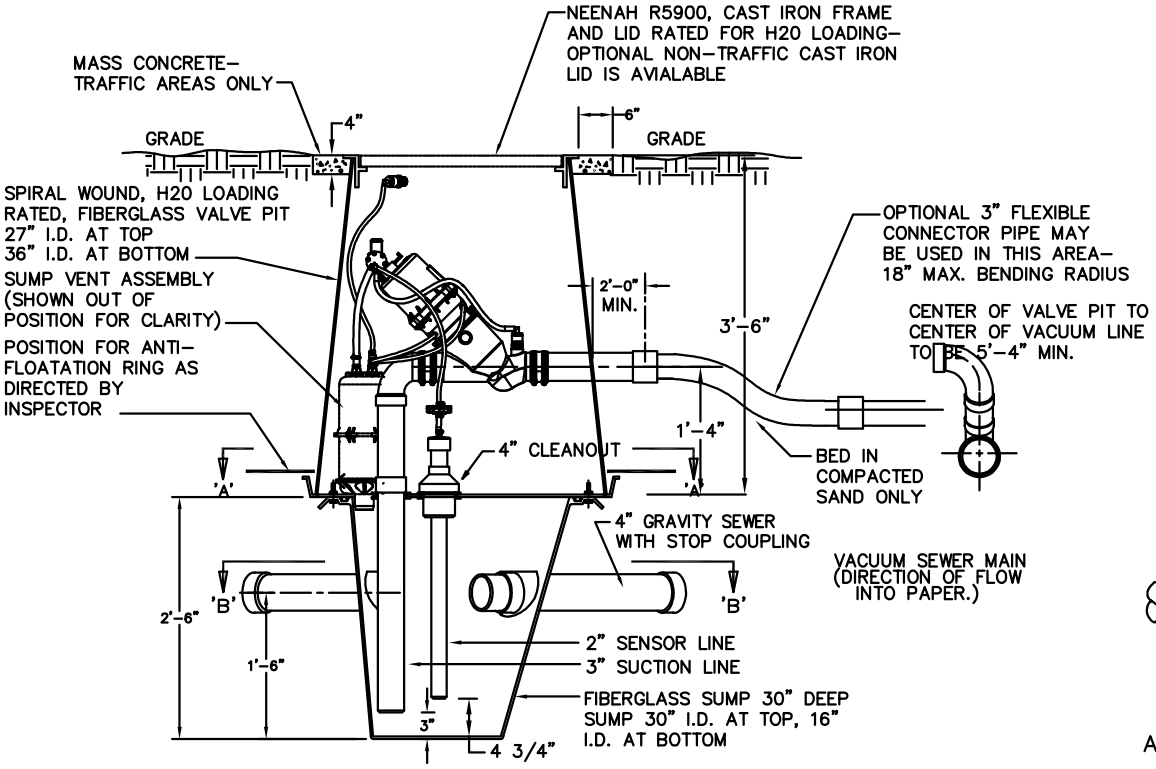
STD-LP-06

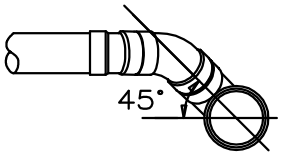
NOTE:
DO NOT INSTALL VACUUM VALVE
UNTIL SUMP VENT VALVE IS IN PLACE



VALVE PIT TUBING DIAGRAM

FOR BEST RESULTS, REFER TO FIGURE 65-3
OF THE INSTALLATION, OPERATION. AND
MAINTENANCE HANDBOOK.





ALTERNATE CONNECTION

OVERALL DEPTH 6'-0"
DEPTH TO CENTERLINE GRAVITY 4'-6"

TYPICAL VALVE PIT INSTALLATIOIN

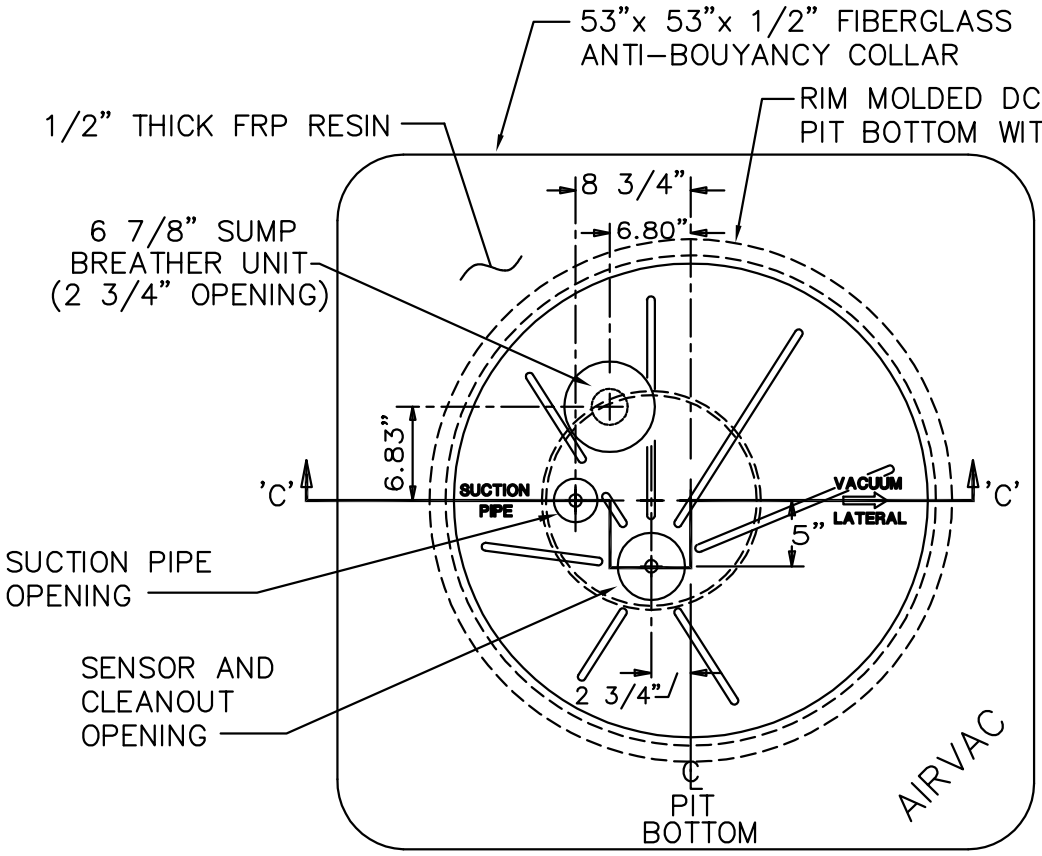
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

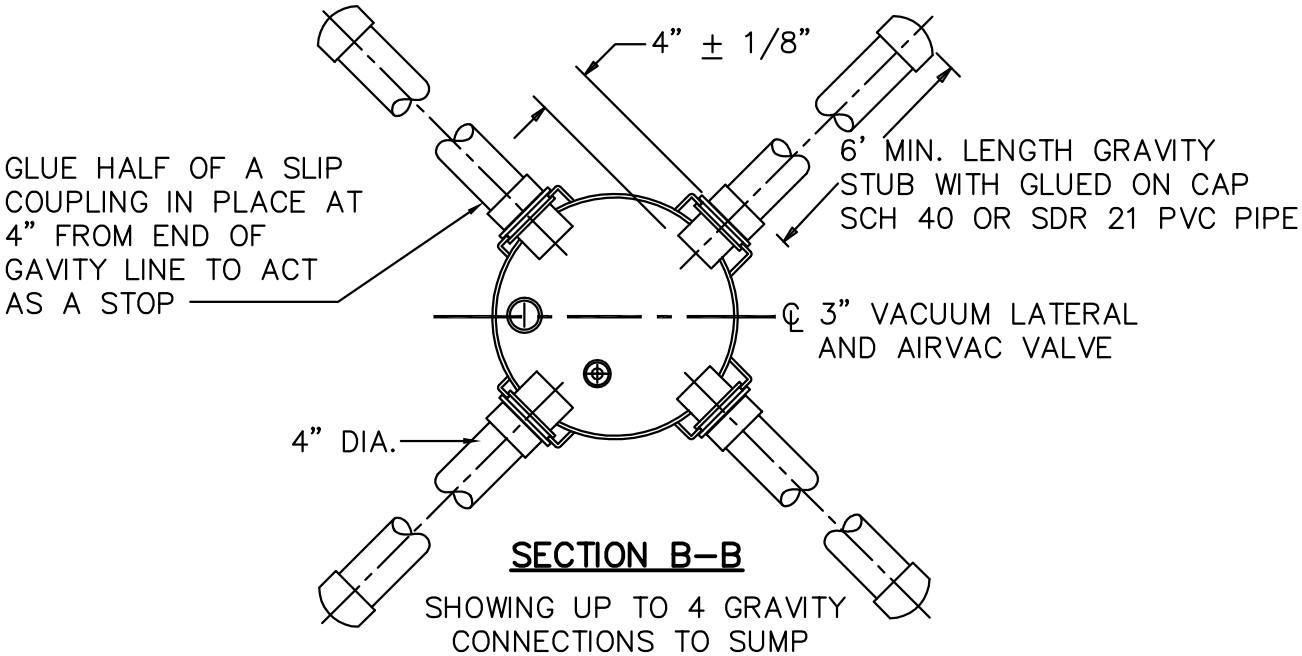
REVISION NO: 1
DATE: AUGUST 2006

STD-VS-01



NOTE:
WHEN INSTALLING ANY PIPE THROUGH A GROMMET USE ONLY WATER OR MILD DETERGENT AS A LUBRICANT. NEVER USE PIPE JOINT GREASE.

SECTION A-A



SECTION B-B

SHOWING UP TO 4 GRAVITY CONNECTIONS TO SUMP

TYPICAL VALVE PIT SECTION VIEWS

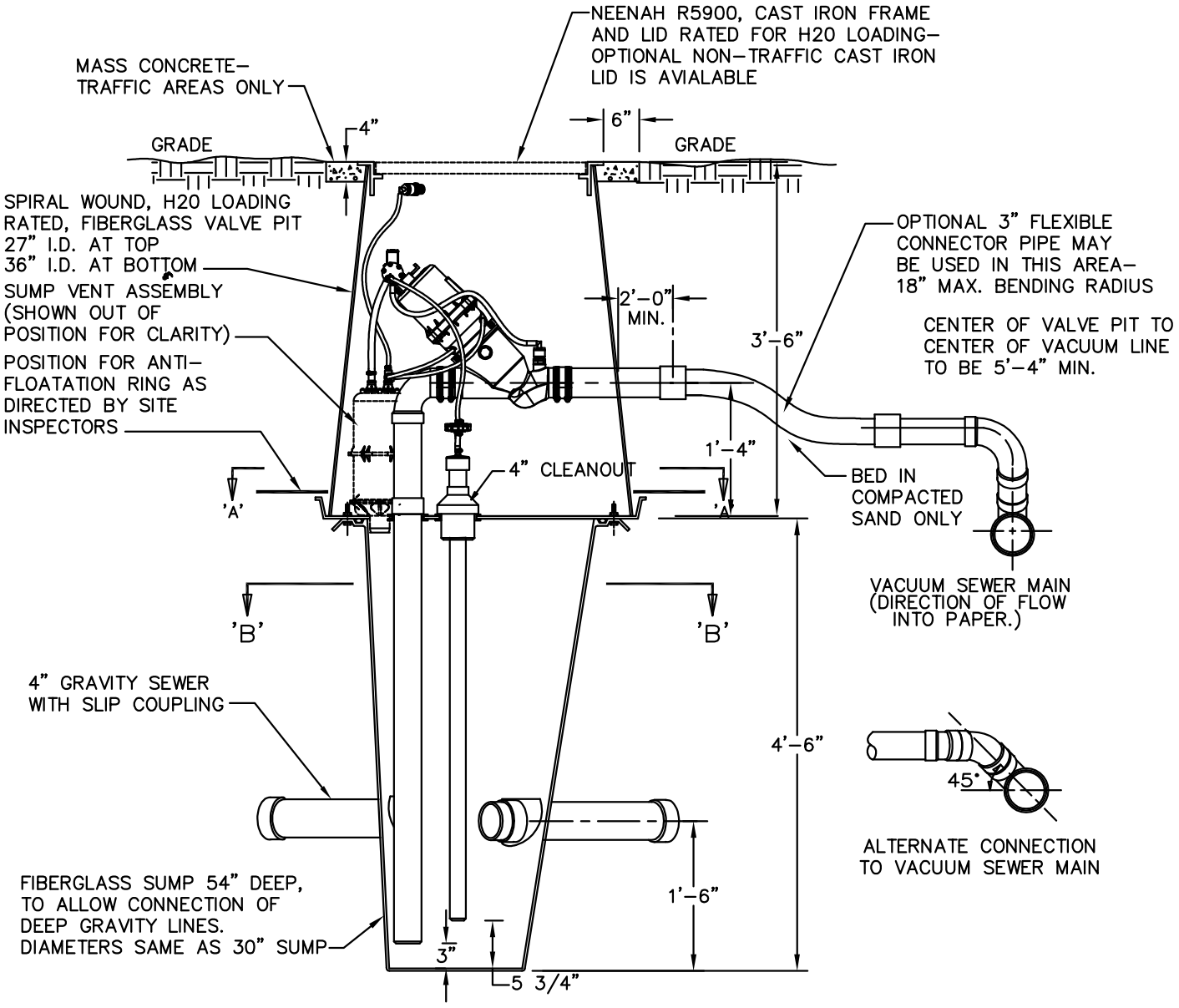
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-02



DEEP VALVE PIT INSTALLATION

NOT TO SCALE

OVERALL DEPTH 8'–0"
DEPTH TO CENTERLINE GRAVITY 6'–6"

CITY OF WHITE HOUSE

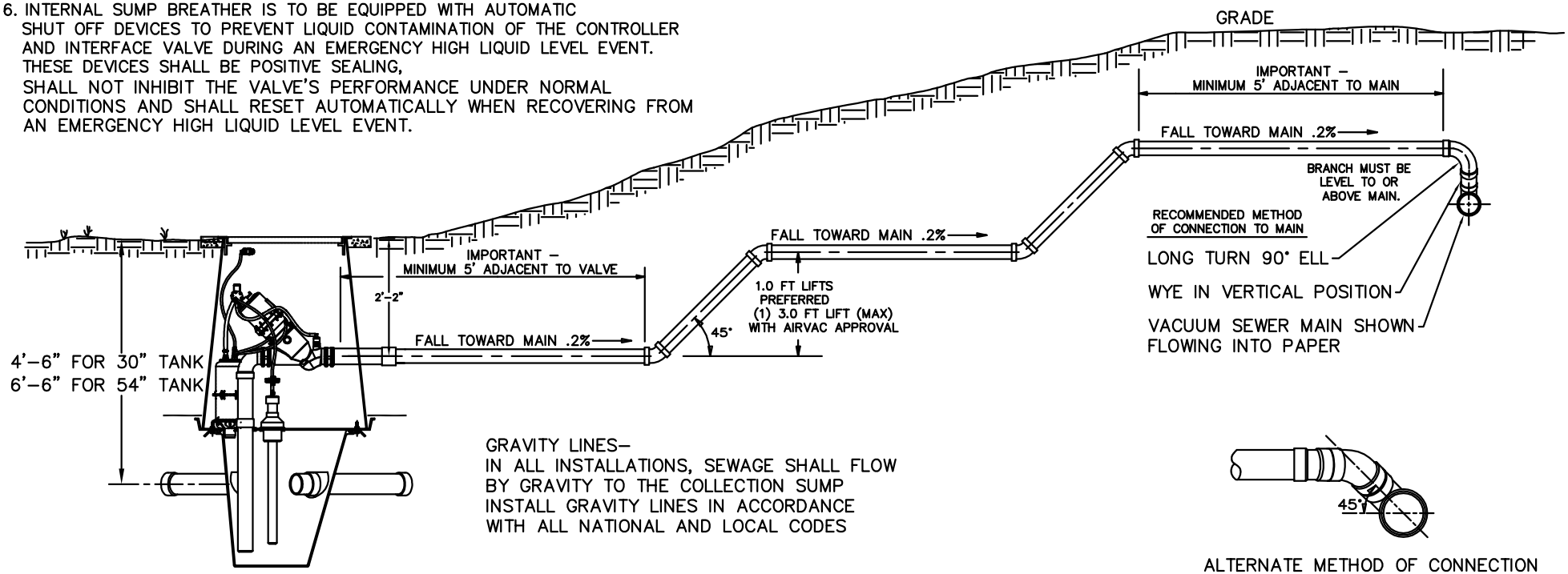
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–03

NOTES:

1. ALL GROMMETS FOR VALVE PIT AND SUMP SUPPLIED BY AIRVAC.
2. ALL HOLES IN VALVE PIT AND PIT BOTTOM ARE FACTORY CUT.
   ALL GRAVITY LINE CONNECTION OPENING IN THE SUMP ARE FIELD CUT.
3. ONLY HOMES OR APARTMENTS WHOSE LOWER FLOOR ELEVATIONS ARE THE SAME SHOULD BE CONNECTED TO A COMMON VACUUM VALVE PIT INSTALLATION. SOME LOCAL CODES MAY REQUIRE THE INSTALLATION OF A BACKFLOW PREVENTER IN THE HOME OWNERS GRAVITY LINES. WITH MULTIPLE FLOOR APARTMENTS, EACH FLOOR LEVEL SHOULD BE SERVICED BY ITS OWN VACUUM VALVE PIT PKG.
4. WHEN INSTALLING ANY PIPE THROUGH A GROMMET, USE ONLY WATER OR MILD DETERGENT AS A LUBRICANT, NEVER USE PIPE JOINT GREASE.
5. DO NOT INSTALL VACUUM VALVE UNTIL HOME GRAVITY LINE IS NEAR COMPLETION AND AIR INTAKE PIPING IS IN PLACE.
6. INTERNAL SUMP BREATHER IS TO BE EQUIPPED WITH AUTOMATIC SHUT OFF DEVICES TO PREVENT LIQUID CONTAMINATION OF THE CONTROLLER AND INTERFACE VALVE DURING AN EMERGENCY HIGH LIQUID LEVEL EVENT. THESE DEVICES SHALL BE POSITIVE SEALING, SHALL NOT INHIBIT THE VALVE'S PERFORMANCE UNDER NORMAL CONDITIONS AND SHALL RESET AUTOMATICALLY WHEN RECOVERING FROM AN EMERGENCY HIGH LIQUID LEVEL EVENT.



GRAVITY LINES–
IN ALL INSTALLATIONS, SEWAGE SHALL FLOW BY GRAVITY TO THE COLLECTION SUMP INSTALL GRAVITY LINES IN ACCORDANCE WITH ALL NATIONAL AND LOCAL CODES

ALTERNATE METHOD OF CONNECTION TO MAIN. WYE IS ROLLED AT 45° USE 45° OR 22 1/2° ELLS TO OBTAIN CORRECT ANGLE BETWEEN BRANCH AND MAIN

LIFT DETAILS FOR 3" SERVICE LATERALS

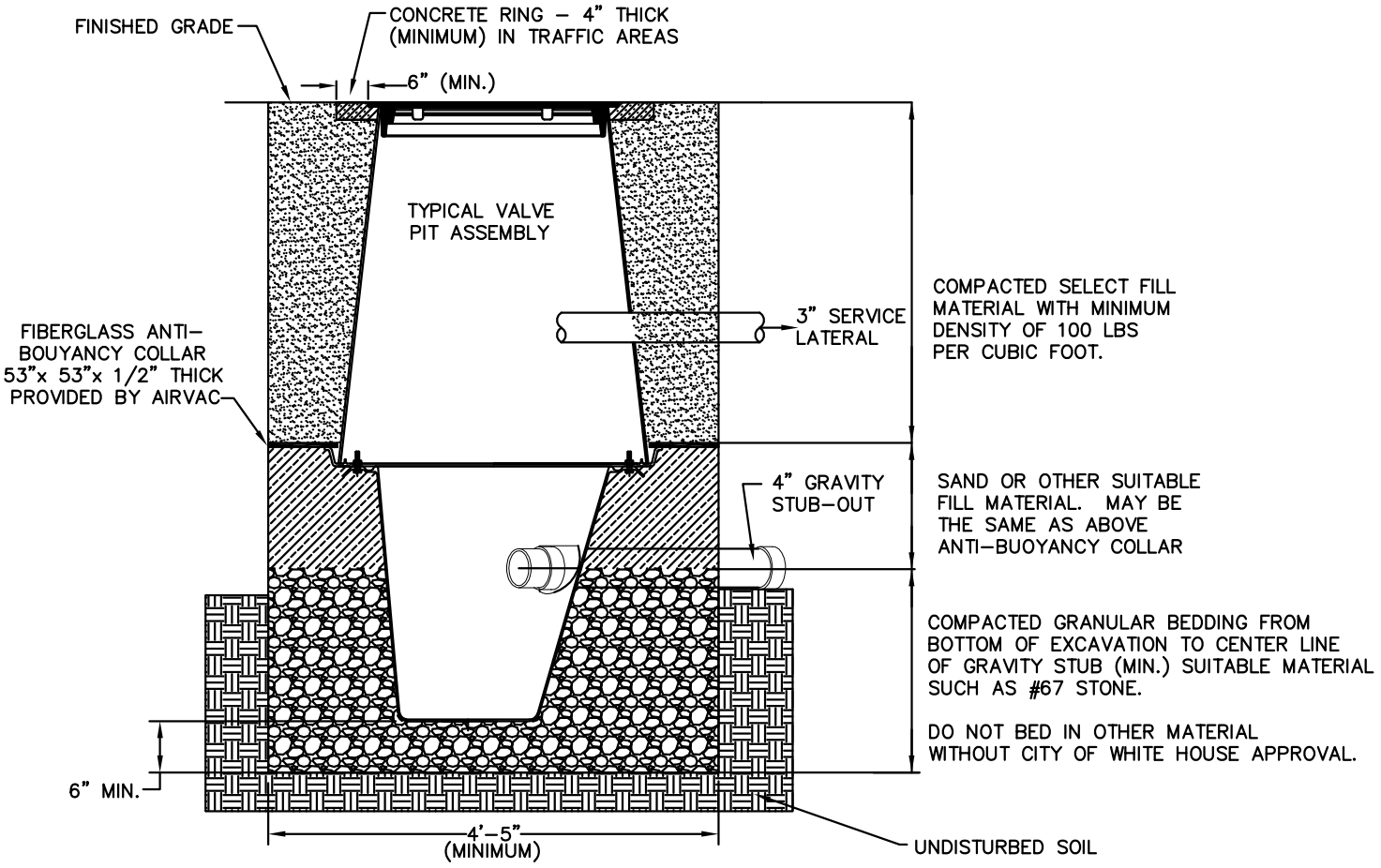
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–04



VALVE PIT BEDDING AND BACK FILL WITH OPTIONAL FIBERGLASS COLLAR SHOWN

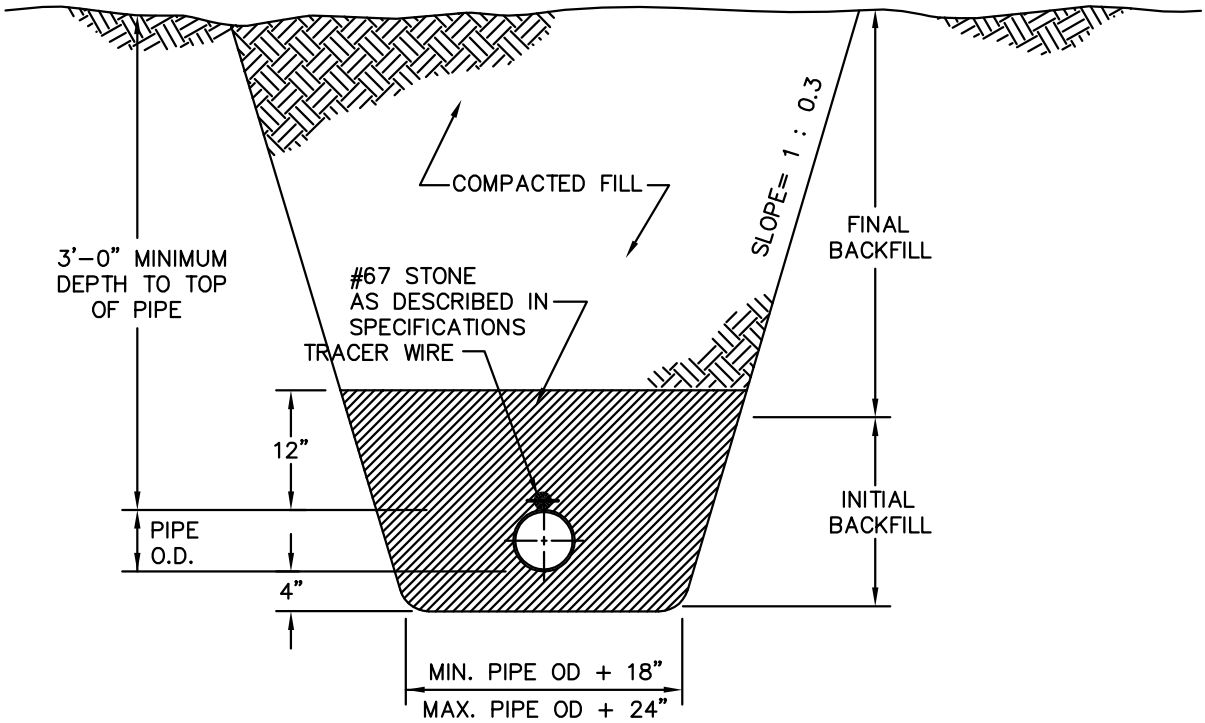
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–05



TYPICAL VACUUM SEWER TRENCH SECTION

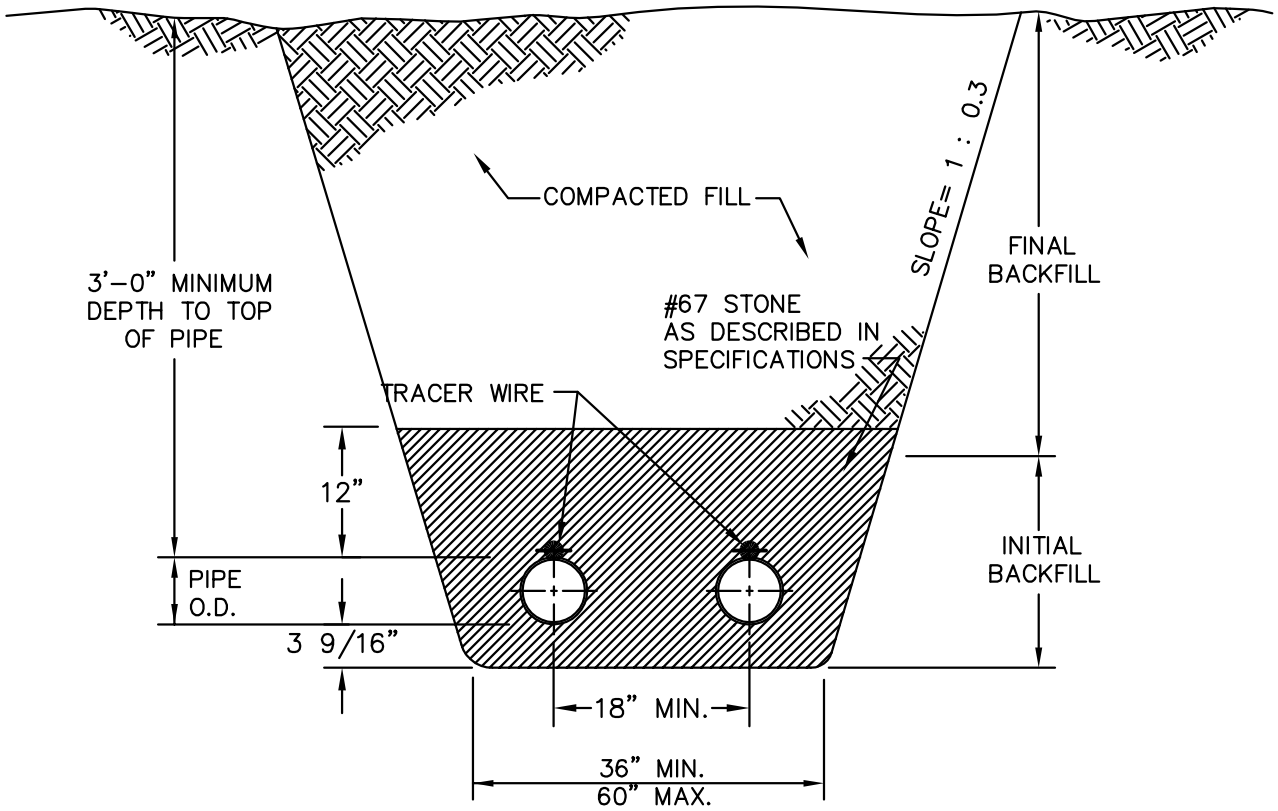
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-06



TYPICAL VACUUM SEWER TRENCH SECTION (2 LINE)

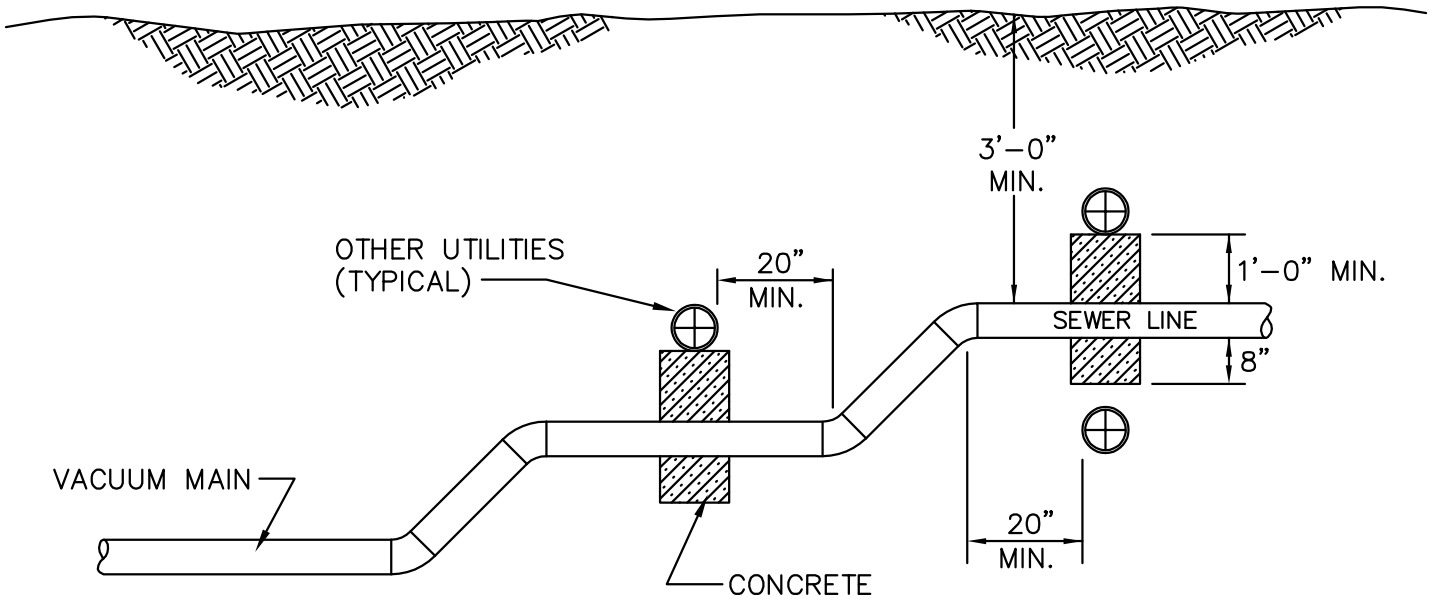
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–07



TYPICAL UTILITY CROSSING

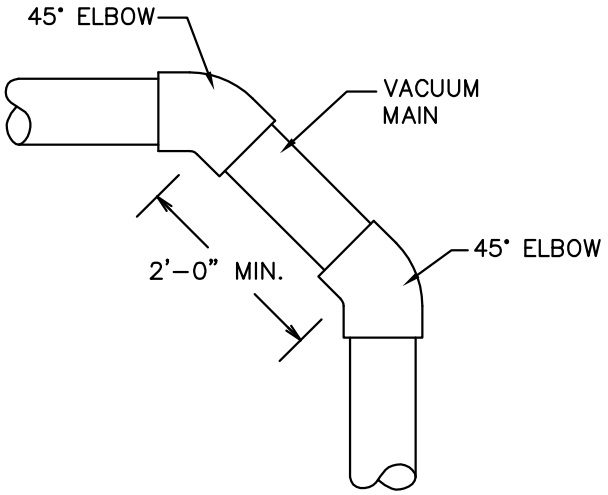
NOT TO SCALE

CITY OF WHITE HOUSE

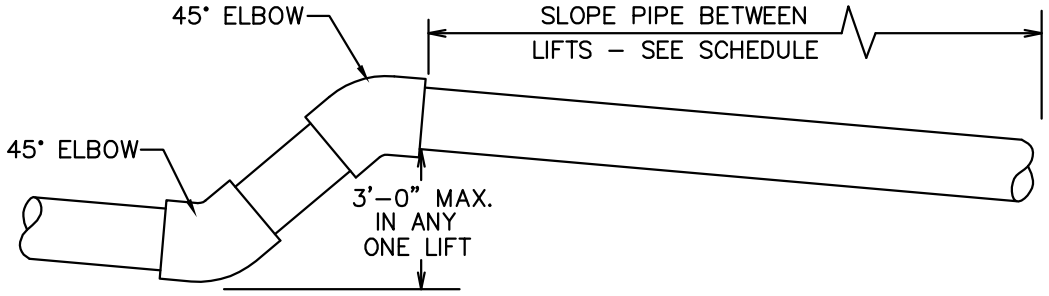
WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–08



CHANGE IN DIRECTION



SLOPE SCHEDULE		
PIPE DIAMETER	MINIMUM FALL	0.2% OF DISTANCE
3"	0.20 FT	0.2% 100 FT ▲
4"	0.25 FT	0.2% 125 FT ▲
6"	0.25 FT	0.2% 125 FT ▲
8"	0.25 FT	0.2% 125 FT ▲
10"	0.25 FT	0.2% 125 FT ▲

USE WHICHEVER SLOPE IS GREATER BETWEEN LIFTS. ABOVE THIS LENGTH ▲ IN DISTANCE, THE 0.2% SLOPE IS GREATER. ANYTHING SHORTER THAN THIS DISTANCE SHOULD USE MINIMUM FALL INDICATED. WHEN NOT BETWEEN TWO LIFTS, USE 0.2% SLOPE.

LIFT DETAIL AND SLOPE SCHEDULE

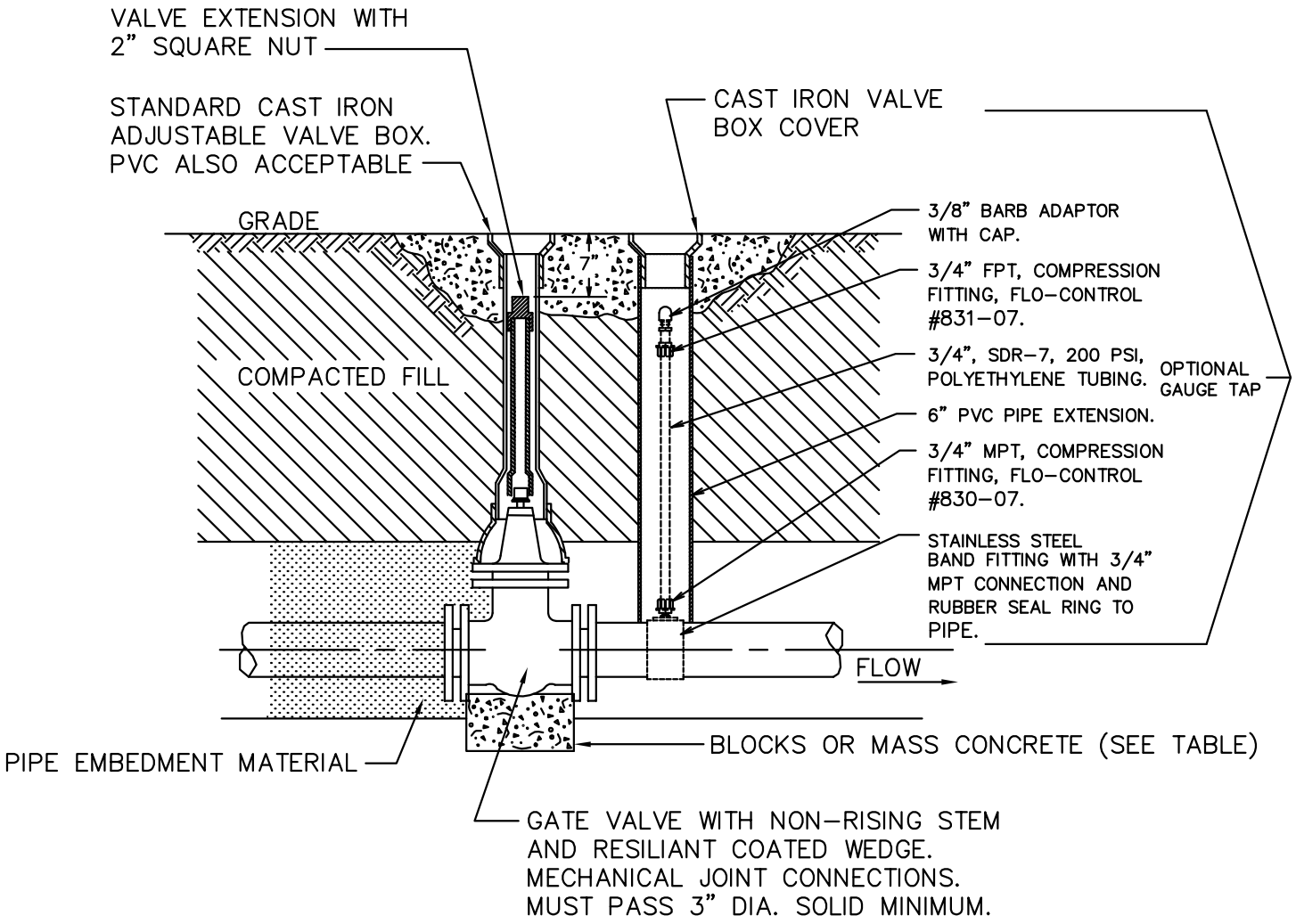
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–09



DIVISION VALVE SUPPORT INFORMATION

VALVE SIZE	SUPPORT SIZE
4"	1" THICK X 1.75' SQUARE
6"	1" THICK X 2.25' SQUARE
8"	1" THICK X 3.00' SQUARE
10"	1" THICK X 3.50' SQUARE

VACUUM MAIN DIVISION VALVE AND OPTIONAL GAUGE TAP

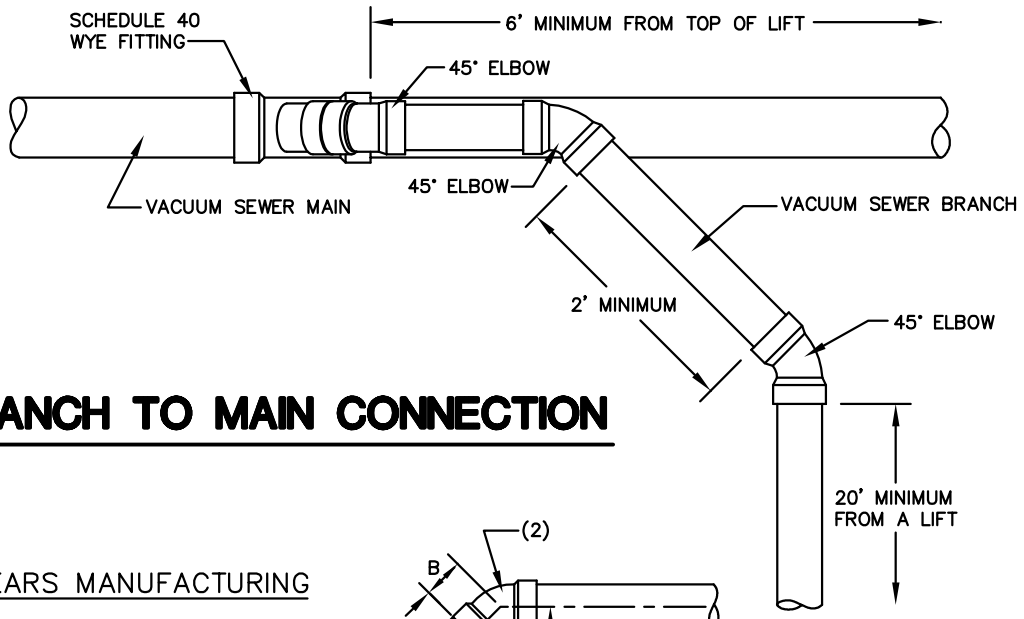
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-10

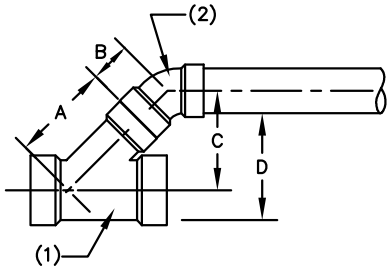


VACUUM BRANCH TO MAIN CONNECTION

DIMENSIONS BASED ON SPEARS MANUFACTURING

(1) 45 DEG WYE, SOCKET x SOCKET x SOCKET

(2) 45 DEG ELL, SOCKET x SOCKET



WYE SIZE	A	B	C	D– INVERT
4 x 4 x 4	8 1/4"	3 3/32"	8.02"	0.67'
4 x 4 x 3	9 1/4"	2 7/8"	8.71"	0.73'
6 x 6 x 6	11 21/32"	5 7/32"	11.93"	0.99'
6 x 6 x 4	12"	3 3/32"	10.67"	0.89'
6 x 6 x 3	12 3/8"	2 7/8"	9.82"	0.82'
8 x 8 x 8	15 1/4"	6 7/16"	15.34"	1.28'
8 x 8 x 6	16 1/8"	5 7/32"	15.09"	1.26'
8 x 8 x 4	14 1/4"	3 3/32"	12.26"	1.02'
8 x 8 x 3	13"	2 7/8"	11.22"	0.94'
10 x 10 x 10	18 31/32	8 1/8"	19.16"	1.60'
10 x 10 x 8	16 25/32	6 7/16"	16.42"	1.37'
10 x 10 x 6	15 7/8"	5 7/32"	14.92"	1.24'
10 x 10 x 4	15 1/2"	3 3/32"	13.15"	1.10'
10 x 10 x 3	14 5/8"	2 7/8"	12.37"	1.03'

VACUUM BRANCH TO MAIN LINE CONNECTION

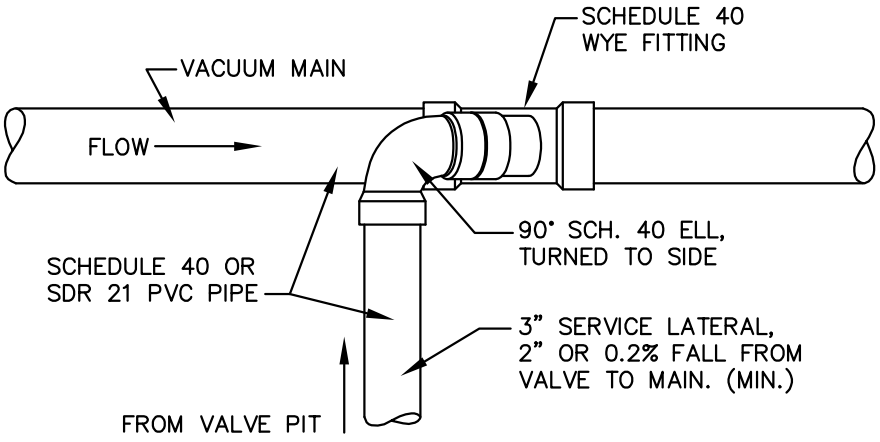
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–11



VALVE PIT TO MAIN CONNECTIONS

NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

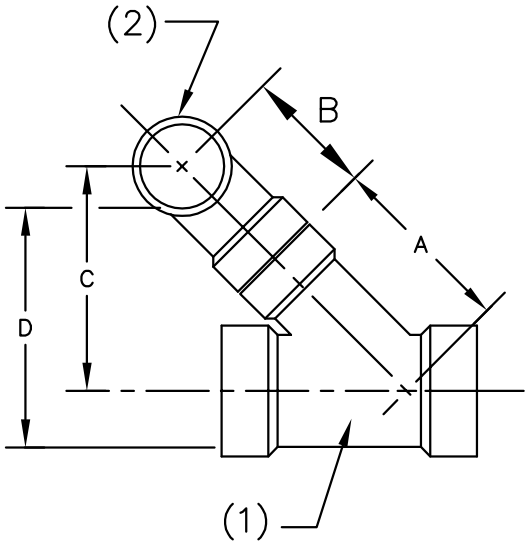
REVISION NO: 1
DATE: AUGUST 2006

STD–VS–12

DIMENSIONS BASED ON SPEARS MANUFACTURING

(1) 45 DEG WYE, SOCKET x SOCKET x SOCKET

(2) 90 DEG ELL, SOCKET x SOCKET



WYE SIZE	A	B	C	D– INVERT
4 x 4 x 3	9 1/4"	3 23/32"	9.17"	0.76'
6 x 6 x 3	12 3/8"	3 23/32"	11.38"	.95
8 x 8 x 3	13"	3 23/32"	11.82"	0.99'
10 x 10 x 3	14 5/8"	3 23/32"	12.97"	1.08

VACUUM SERVICE LATERAL TO MAIN OR BRANCH CONNECTION

NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

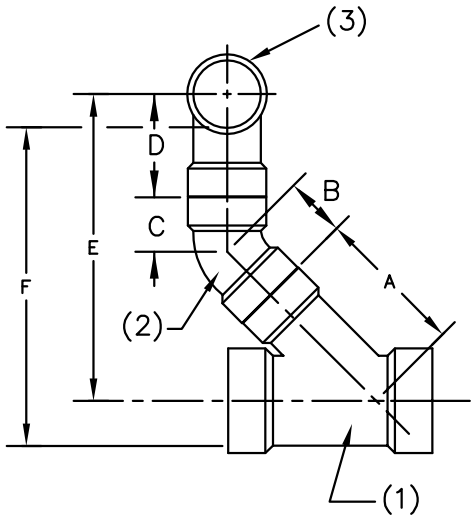
STD–VS–13

DIMENSIONS BASED ON SPEARS MANUFACTURING

(1) 45 DEG WYE, SOCKET x SOCKET x SOCKET

(2) 45 DEG ELL, SOCKET x SOCKET

(3) 90 DEG ELL, SOCKET x SOCKET



WYE SIZE	A	B	C	D	E	F–INVERT
4 x 4 x 3	9 1/4"	2 7/8"	2 7/8"	3 23/32"	15.17"	1.26'
6 x 6 x 3	12 3/8"	2 7/8"	2 7/8"	3 23/32"	17.38"	1.45'
8 x 8 x 3	13"	2 7/8"	2 7/8"	3 23/32"	17.82"	1.48'
10 x 10 x 3	14 5/8"	2 7/8"	2 7/8"	3 23/32"	18.97"	1.58'

VACUUM VALVE PIT SERVICE CONNECTIONS

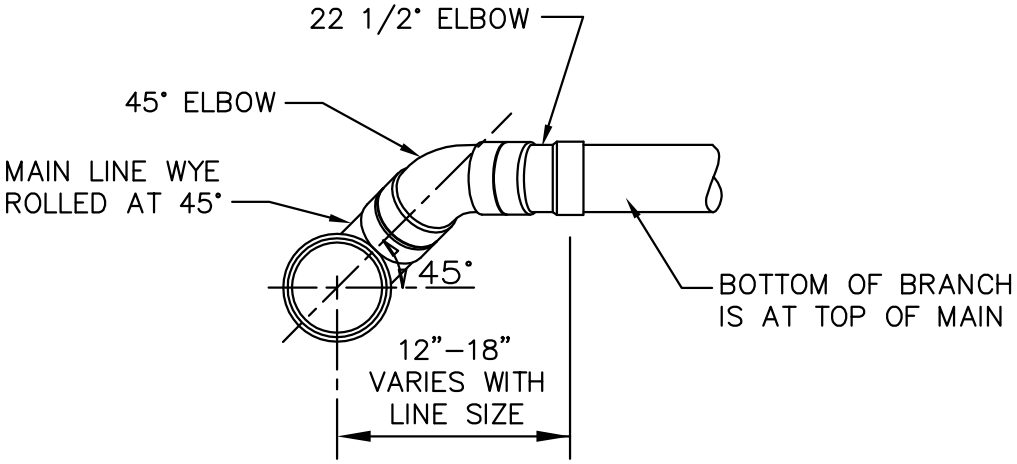
NOT TO SCALE

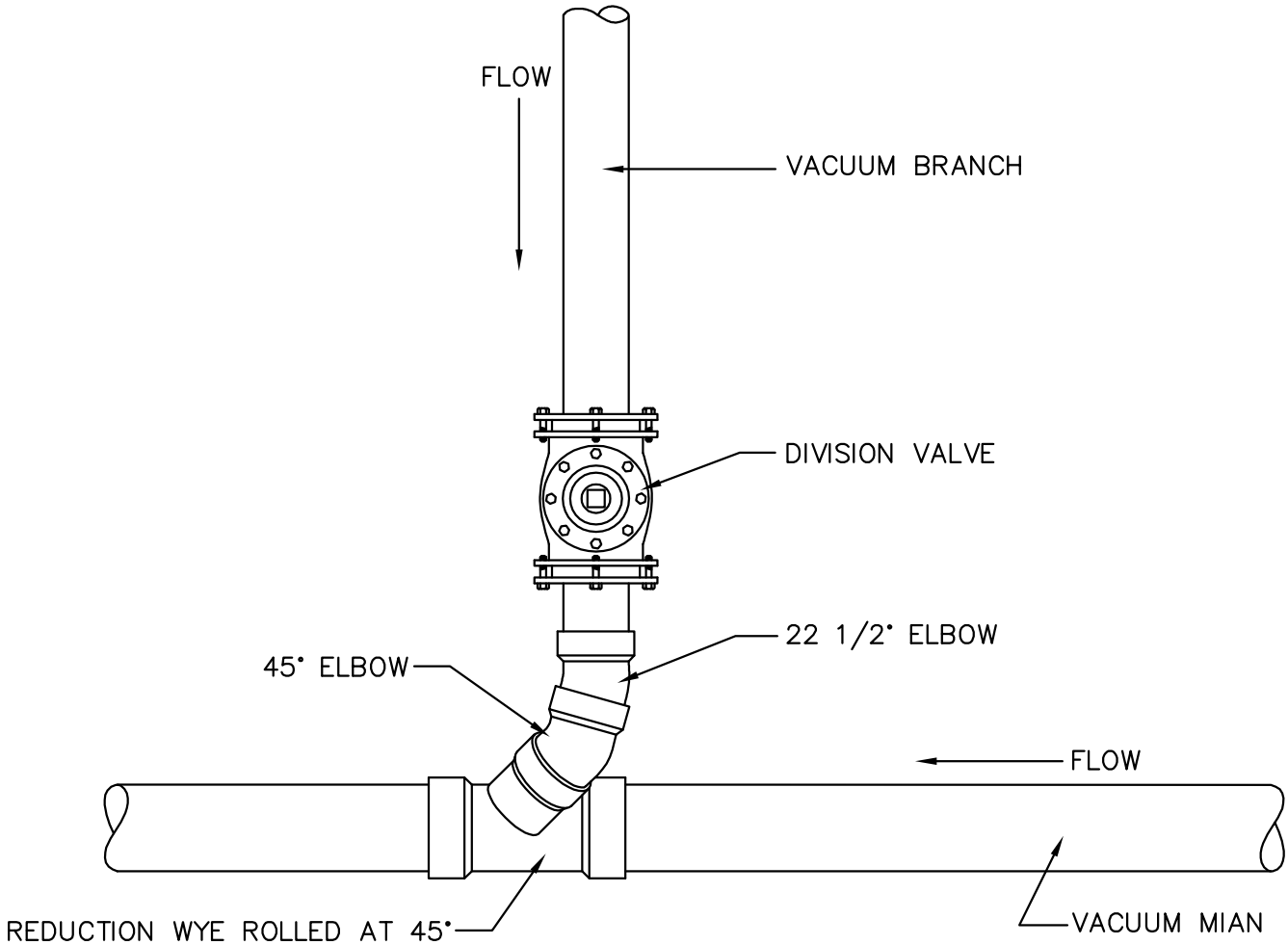
CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–14





ALTERNATE VACUUM BRANCH TO MAIN LINE CONNECTION

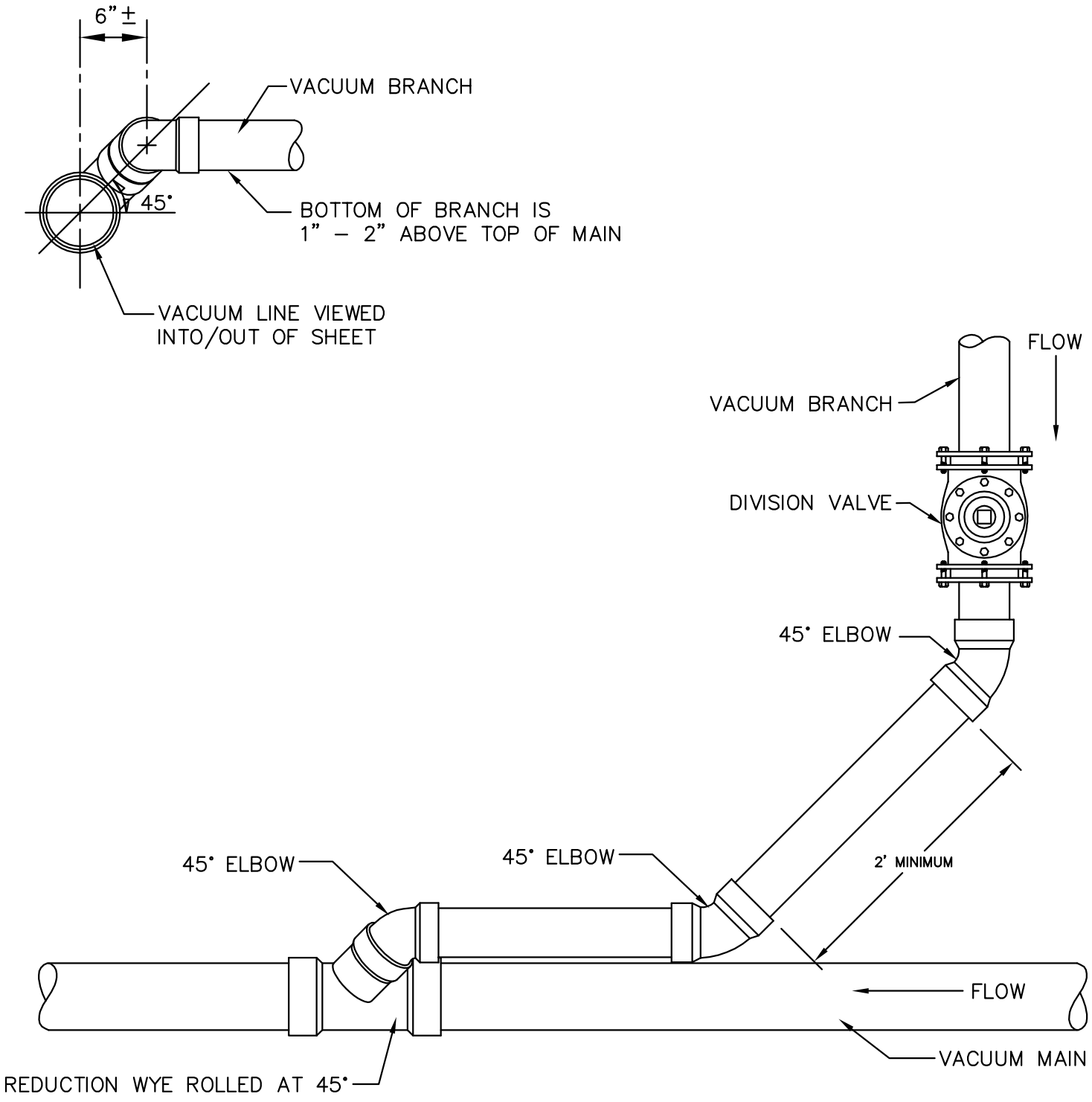
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–15



ALTERNATE VACUUM BRANCH TO MAIN LINE CONNECTION

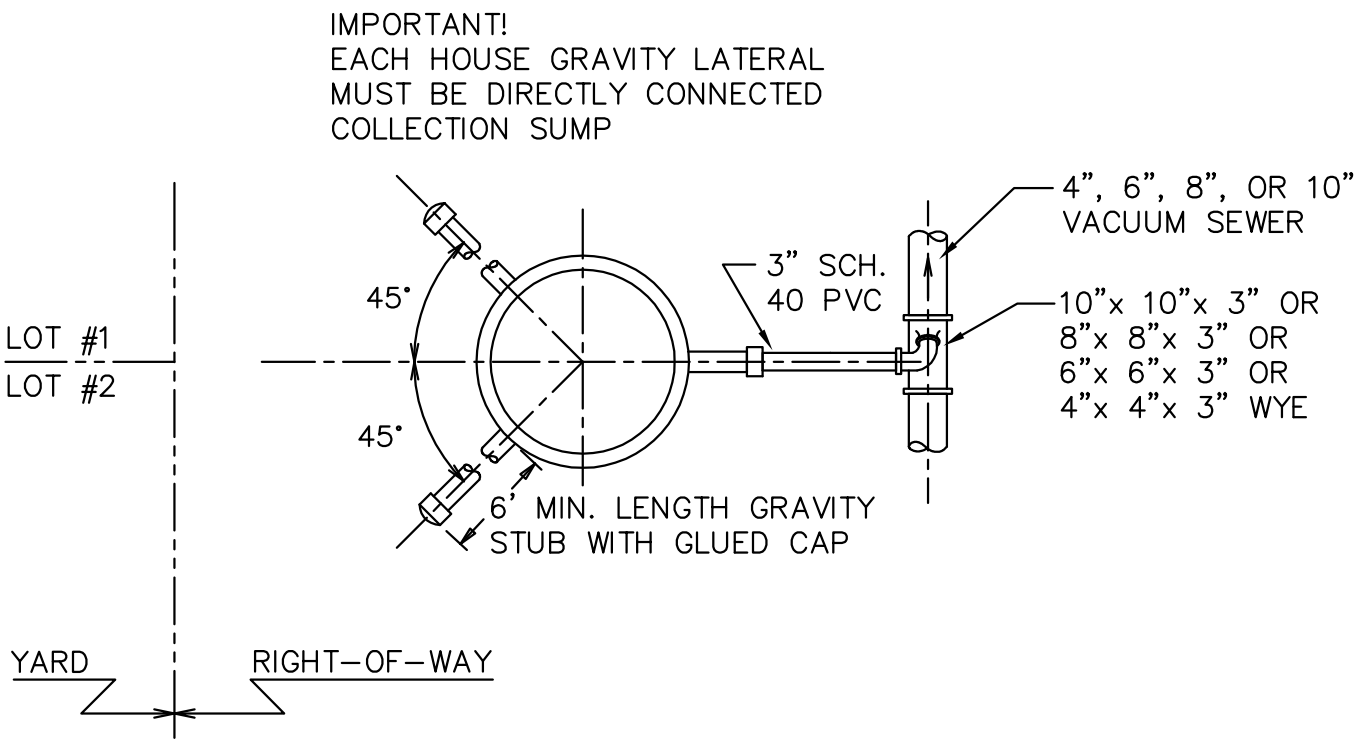
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–16



VALVE PIT WITH 2 CONNECTIONS

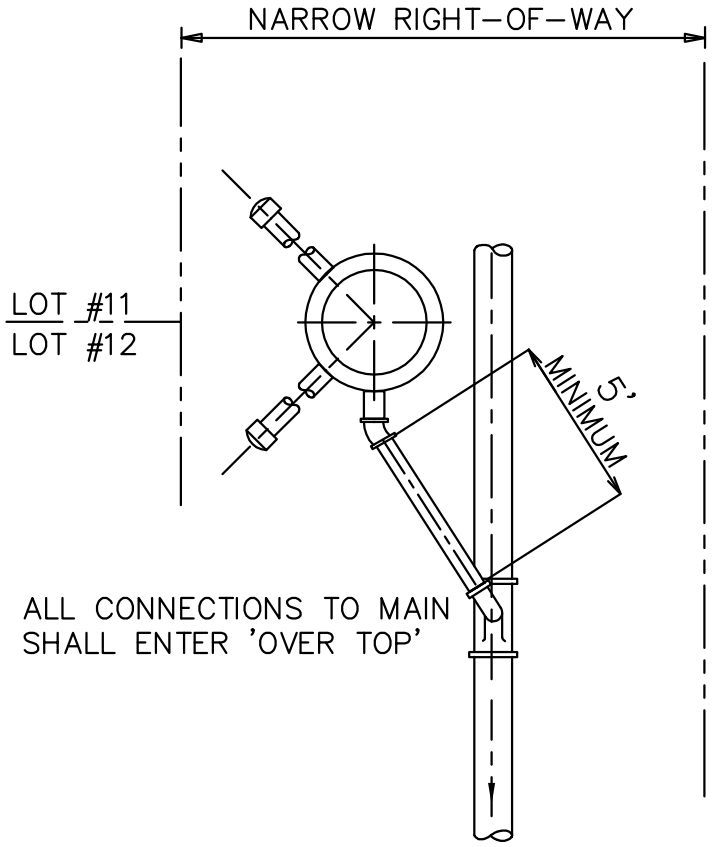
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-17



VALVE PIT IN NARROW RIGHT-OF-WAY

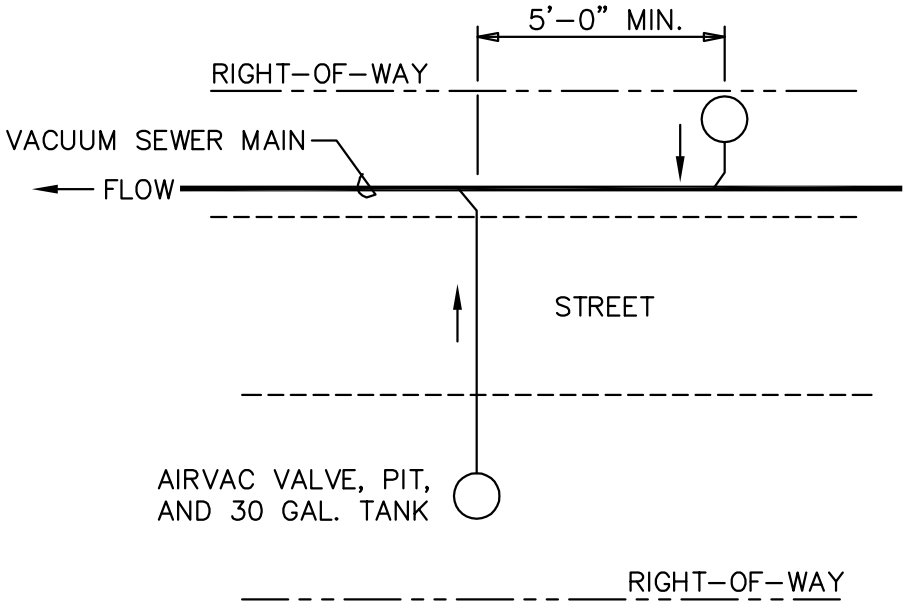
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-18



MINIMUM SPACING BETWEEN CONNECTIONS

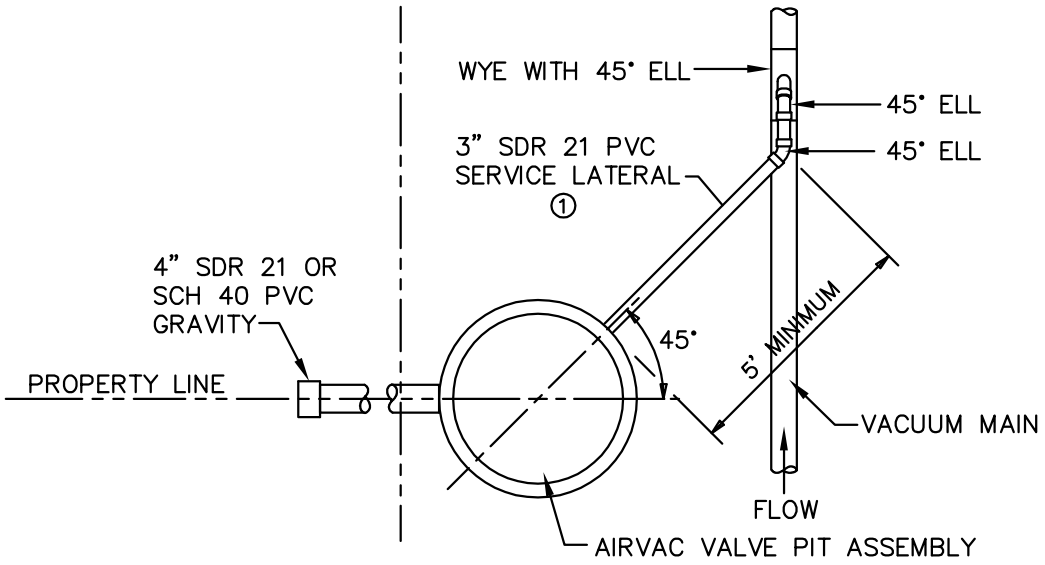
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–19



VALVE PIT WITH SINGLE CONNECTION

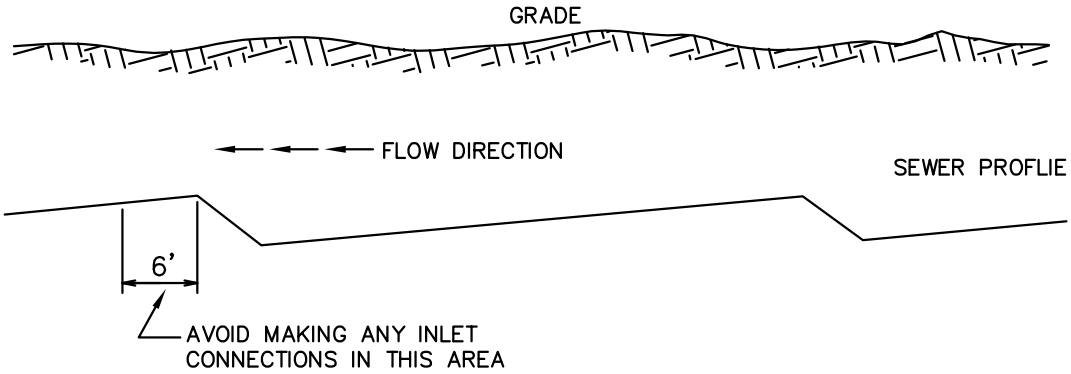
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–20



CONNECTION LOCATIONS TO AVOID

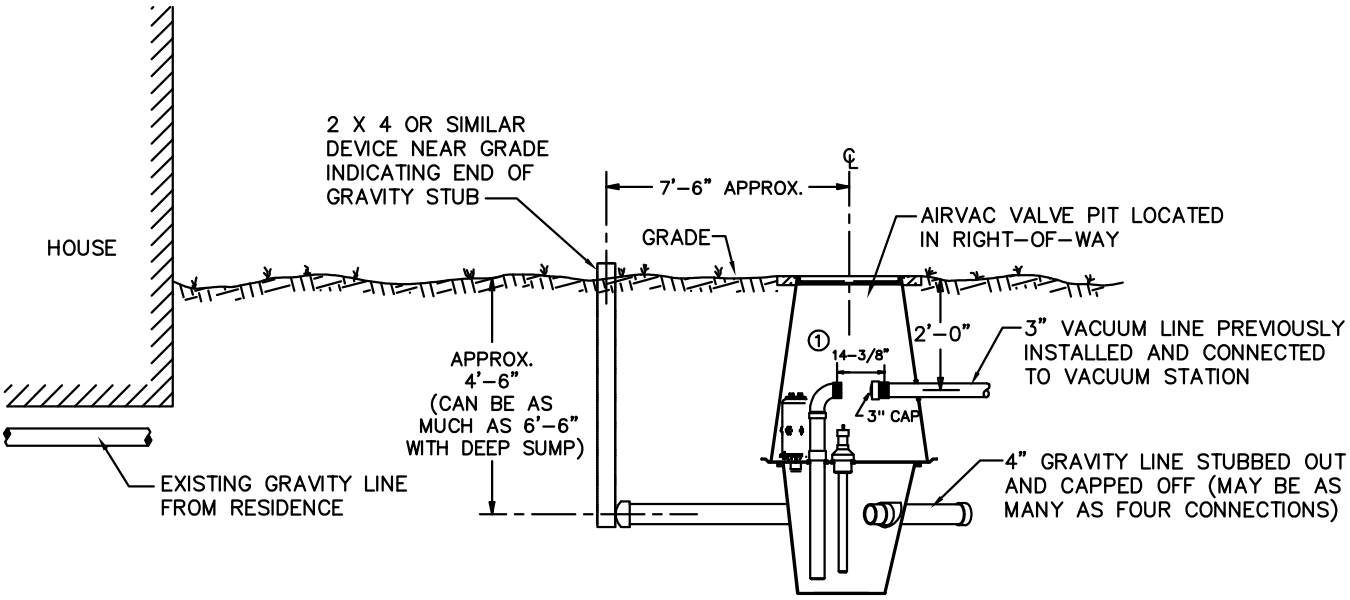
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-21



VALVE PIT PRIOR TO HOOK-UP

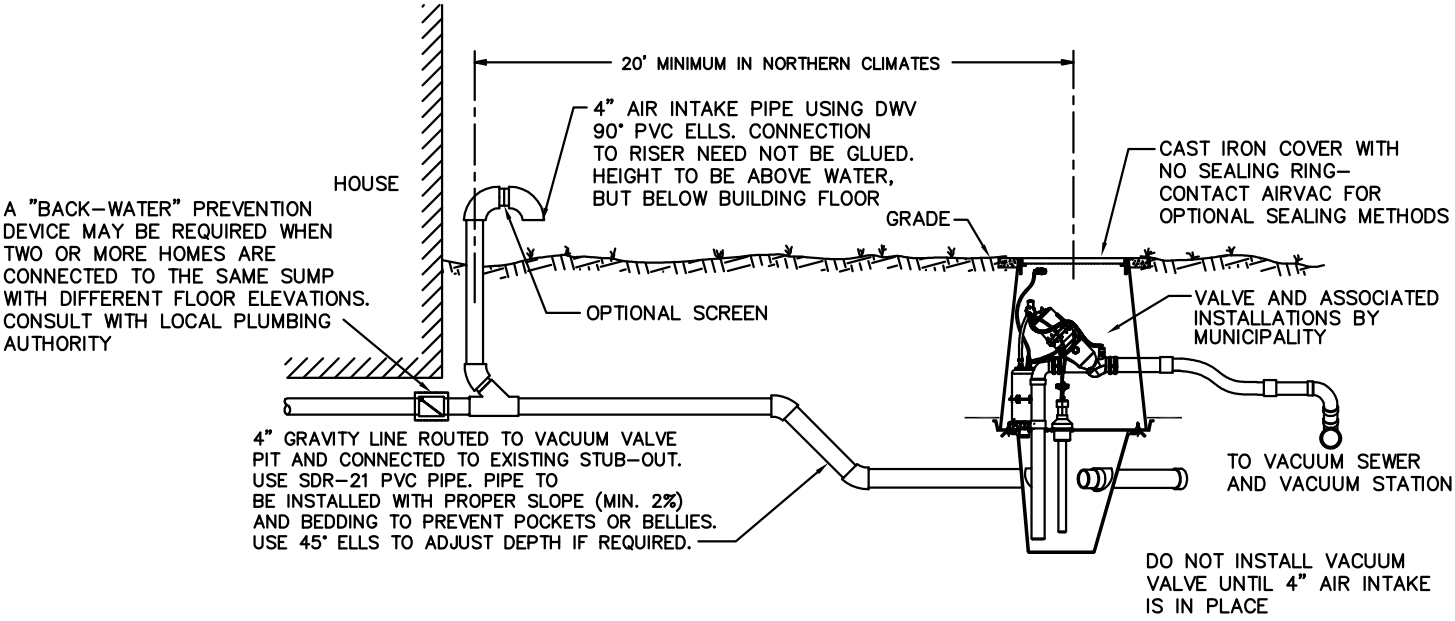
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-22



VALVE PIT AFTER HOME HOOK-UP

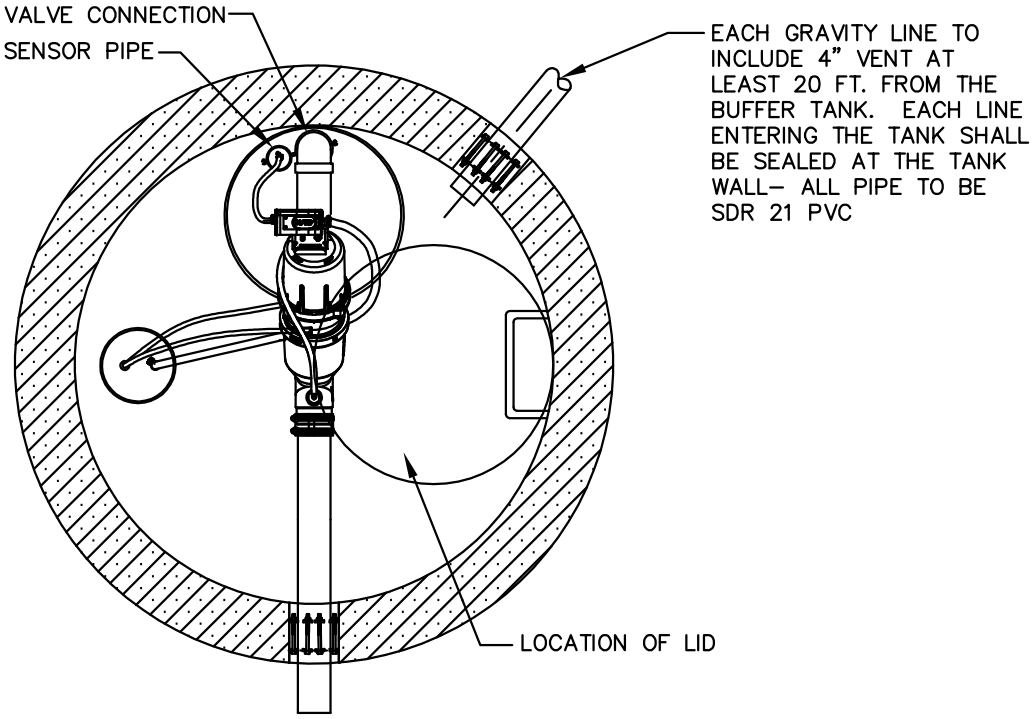
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–23



NOTE:
IF MANHOLE IS MORE THAN 6'–0" DEEP, A SERVICE PLATFORM MAY BE REQURED FOR VALVE MAINTENANCE.

SINGLE BUFFER TANK PLAN

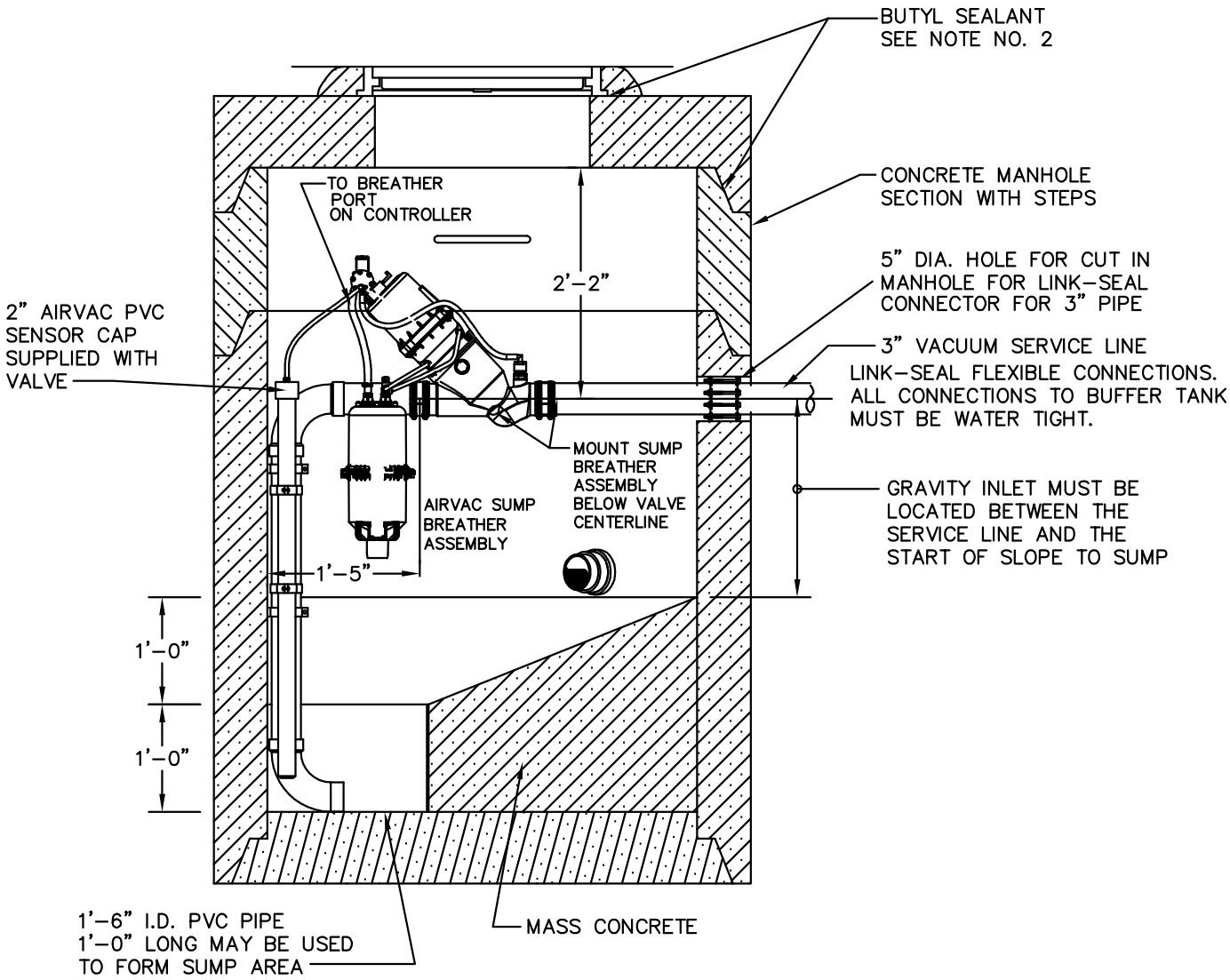
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–24



NOTE:
ANY LIFT EXCEEDING 6'-0" MUST BE ADDED TO HEAD LOSSES ON VACUUM MAIN AND SERVICE LINE TO DETERMINE IF SUFFICIENT VACUUM HEAD IS AVAILABLE.

SINGLE BUFFER TANK SECTION 1

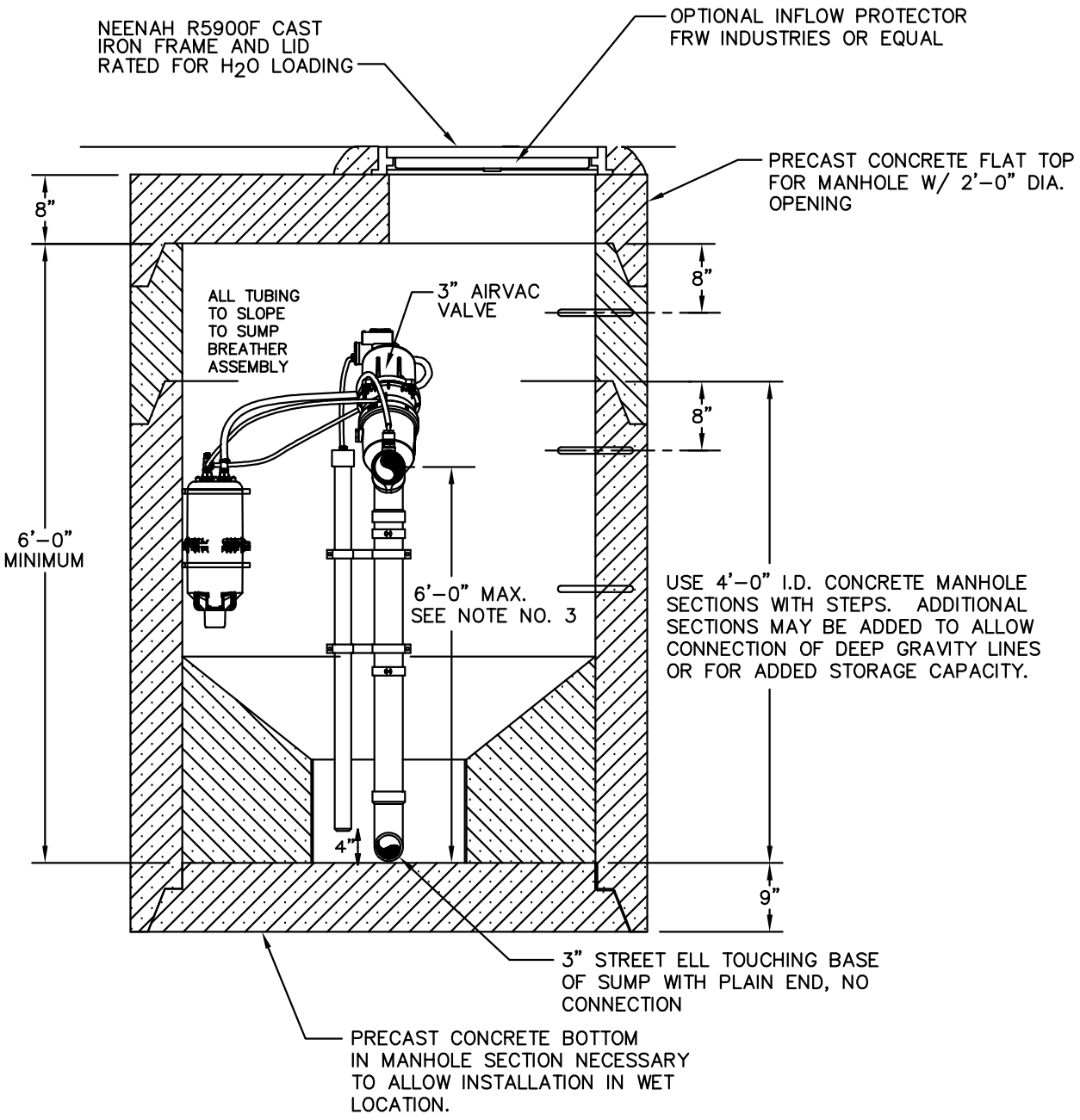
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-25



NOTE:
BUFFER TANK UNIT MUST BE WATERTIGHT. SEAL ALL JOINTS WITH BUTYL SEALANT. TEST FOR LEAKS PER AIRVAC SPECIFICATIONS IN INSTALLATION MANUAL.

SINGLE BUFFER TANK SECTION 2

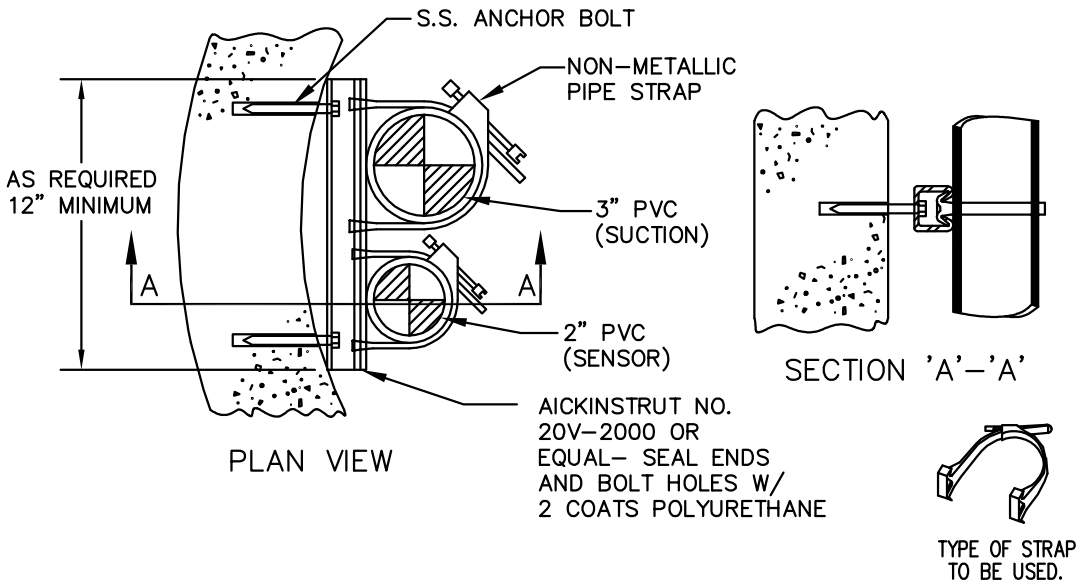
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-26



SINGLE BUFFER TANK PIPE ANCHOR

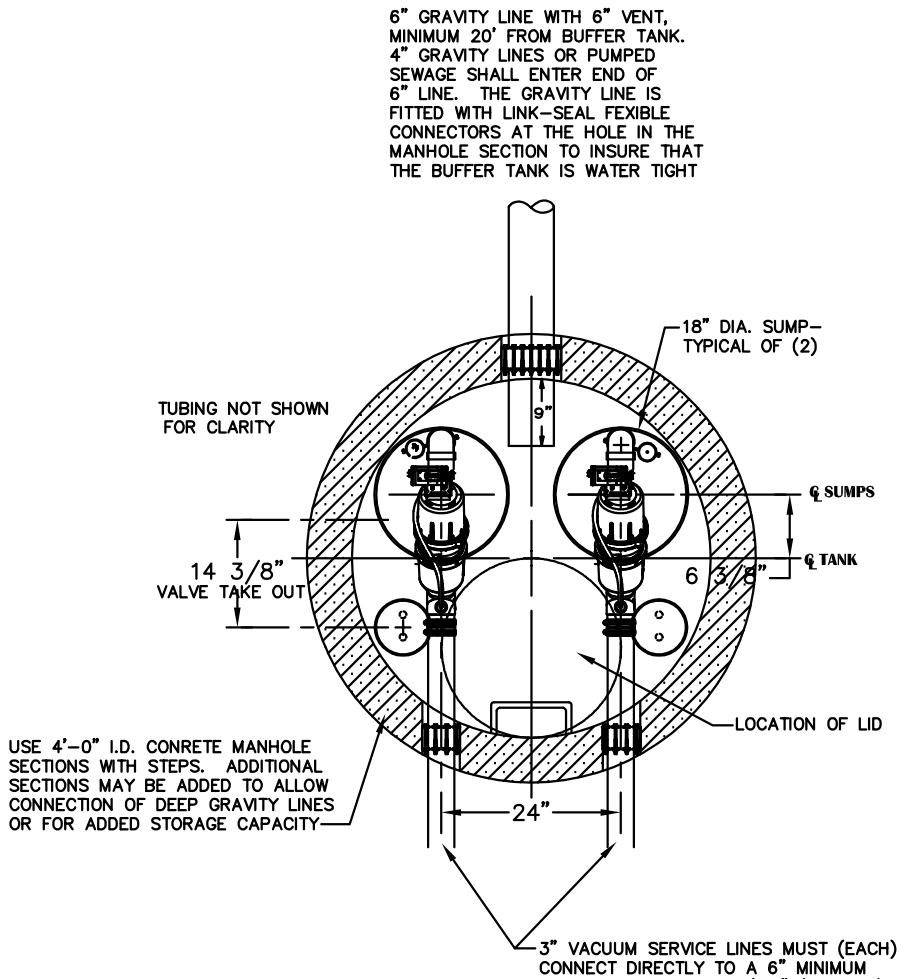
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD–VS–27



NOTE:
IF MANHOLE IS MORE THAN 6'-0" DEEP, A SERVICE PLATFORM MAY BE REQUIRED FOR VALVE MAINTENANCE.

DUAL BUFFER TANK PLAN

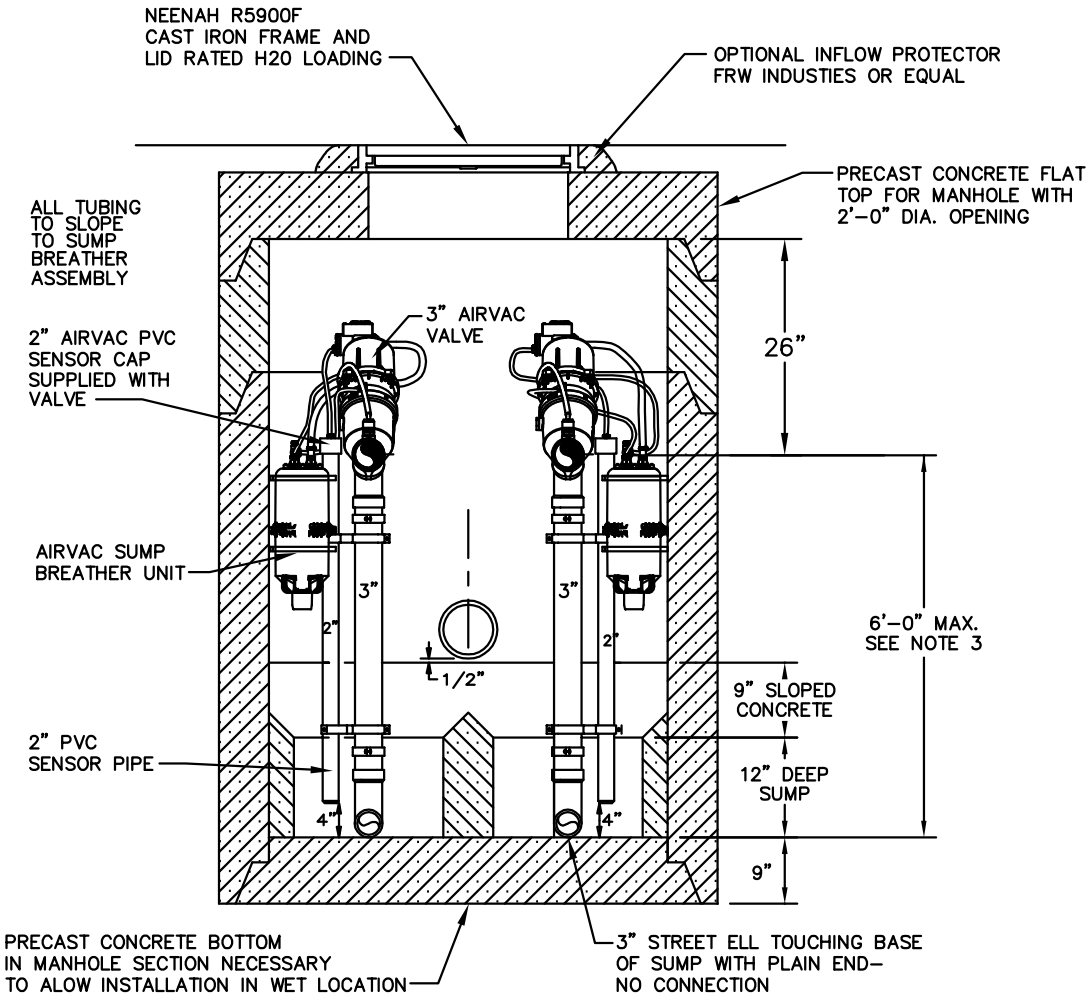
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-28



NOTE:
ANY LIFT EXCEEDING 6'-0" MUST BE ADDED TO HEAD LOSSES ON VACUUM MAIN AND SERVICE LINE TO DETERMINE IF SUFFICIENT VACUUM HEAD IS AVAILABLE.

DUAL BUFFER TANK SECTION 1

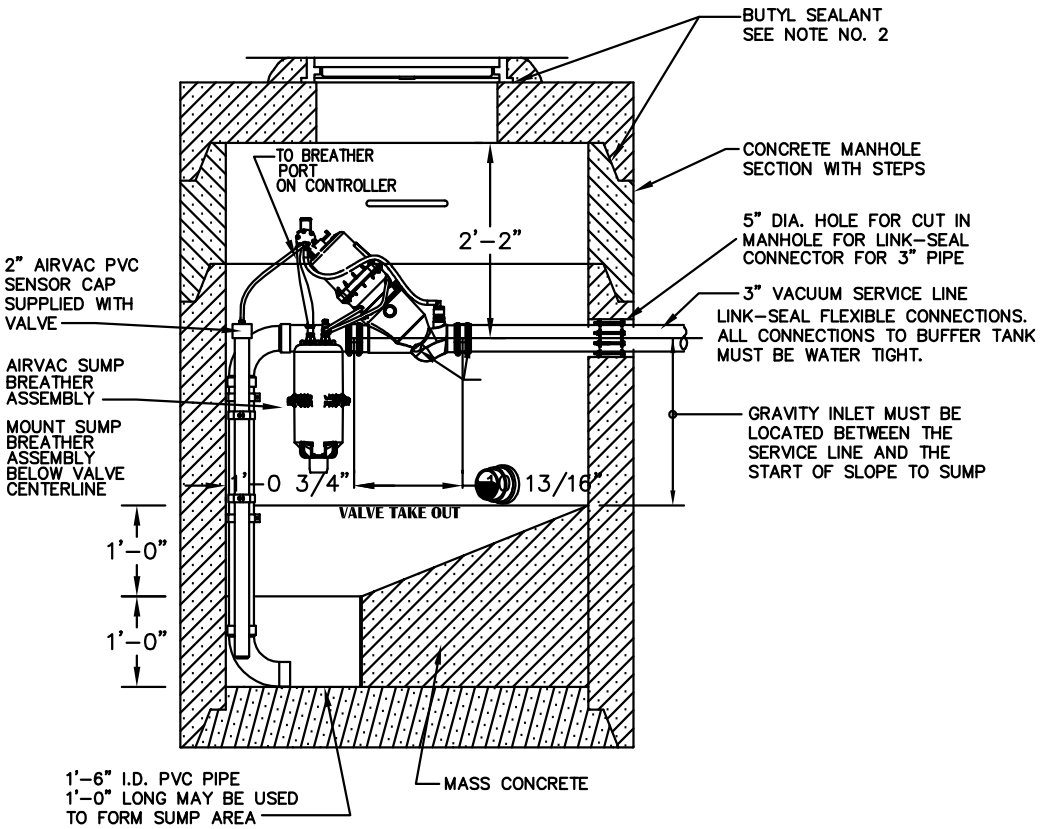
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-29



NOTE:
BUFFER TANK UNIT MUST BE WATERTIGHT.
SEAL ALL JOINTS WITH BUTYL SEALANT.
TEST FOR LEAKS PER AIRVAC
SPECIFICATIONS IN INSTALLATION MANUAL.

DUAL BUFFER TANK SECTION 2

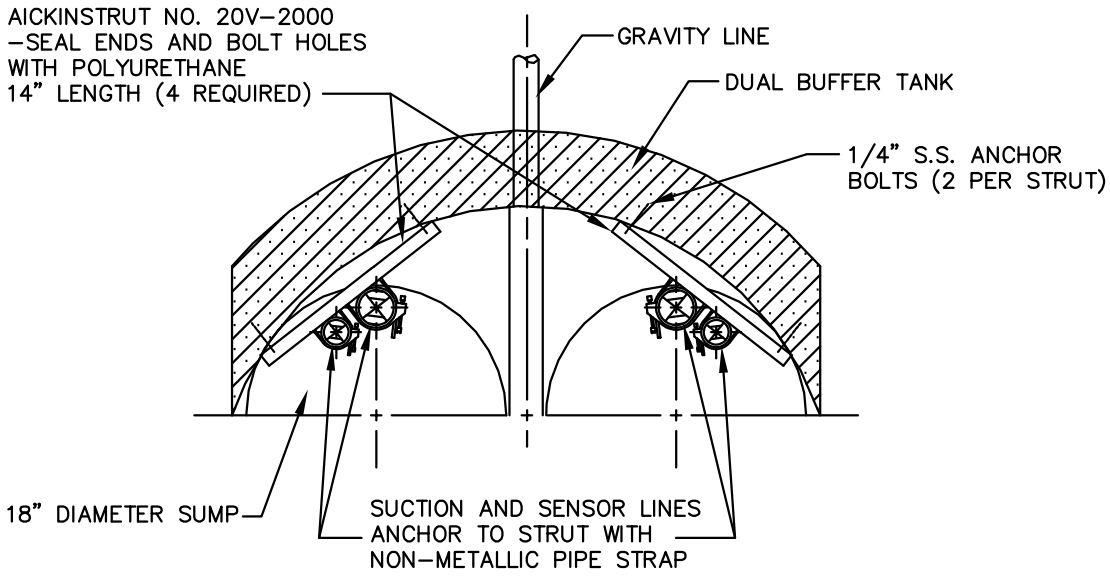
NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-30



DUAL BUFFER TANK PIPE ANCHOR

NOT TO SCALE

CITY OF WHITE HOUSE

WASTEWATER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: AUGUST 2006

STD-VS-31

GENERAL NOTES:

LIFTS:

1. MINIMUM SLOPE BETWEEN LIFTS 0.20% X LENGTH OR 0.25 FT. FALL, WHICHEVER IS GREATER (FOR 4" AND LARGER VACUUM LINES).

2. FOR 3" SERVICE LATERALS, MINIMUM SLOPE BETWEEN LIFTS = 0.2% X LENGTH OR 0.20 FEET FALL, WHICHEVER IS GREATER.

3. MINIMUM SPACING BETWEEN LIFTS – 20'–0".

4. MAXIMUM ELEVATIONS IN ANY ONE LIFT – 3'–0".

SERVICE LINES

1. MINIMUM LENGTH OF PIPING FROM MAIN TO VALVE PIT = 5'–0".

2. SLOPE FROM VALVE PIT TO MAIN––2" OR 0.20% FALL (WHICHEVER IS GREATER).

3. MINIMUM DISTANCE FROM VALVE PIT TO LIFT IN SERVICE LINE –5'–0".

4. MINIMUM DISTANCE FROM LIFT IN SERVICE LINE TO CROSSOVER CONNECTION–5'–0".

CROSSOVER CONNECTIONS (SERVICE LINE OR BRANCH CONNECTION TO MAIN)

1. MINIMUM SPACING BETWEEN ANY TWO CROSSOVER CONNECTIONS – 5'–0".
2. MINIMUM DISTANCE FROM TOP OF LIFT TO ANY CROSSOVER CONNECTION–– 6'–0".
3. ALL CROSSOVER CONNECTIONS MUST ENGER OVER TOP OF THE MAIN (WYE IN VERTICAL POSITION OR 45 DEGREE ALTERNATE ALIGNMENT.
4. LONG TURN 90° PERMITTED AS PART OF CROSSOVER TO MAIN CONNECTION AT MAIN LINE ONLY.

CITY OF WHITE HOUSE
WASTEWATER
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