STANDARD SPECIFICATIONS & DETAILS

City of Portland, Tennessee

January 26, 2023

WPN 22.0728

APPROVED FOR CONSTRUCTION

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

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION

DIVISION OF WATER RESOURCES

AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

Adnan Bahou

01/27/2023

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

APPROVAL EXPIRES FIVE YEARS FROM ABOVE DATE

BRYAN SAMUEL PRICE
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 127899
STATE OF TENNESSEE

1/26/2023

Prepared by:
City of Portland
100 S Russell St.
Portland, Tennessee 37148

DW20221326

APPROVED WATER SPECIFICATIONS

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TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION

DIVISION OF WATER RESOURCES

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01/27/2023

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APPENDIX A: STANDARD WATER DETAILS

APPENDIX B: STANDARD SEWER DETAILS

PART 1. GENERAL

1.01 CITY FUNDED PROJECTS:

All city of portland utility department (PUD) projects shall include the engineer joint contract document council (EJCDC) general conditions. Supplementary conditions shall be provided to the engineer of record.

1.02 DEVELOPER PROJECTS:

Projects for development shall conform to all PUD Standard Specifications and Details. The PUD recommends all Engineers, Developers and Contractors review and understand all acceptance requirements prior to construction.

1.03 PRECONSTRUCTION CONFERENCE

All projects requiring acceptance by PUD shall participate in a preconstruction conference. Scheduling preconstruction conference shall be coordinated by the PUD and shall be attended by the Engineer, Owner/Developer (when applicable), Contractor, PUD personel, and City of Portland Stormwater personnel.

PART 2. PRODUCTS – NOT USED

PART 3. EXECUTION – NOT USED

END OF SECTION

PART 1. GENERAL

1.01 EXTENSIONS OF CONTRACT TIME

A. If the basis exists for an extension of time in accordance with paragraph 8.3 of the Conditions, an extension of time on the basis of weather may be granted only for the number of Weather Delay Days in excess of the number of days listed as the Standard Baseline for that month.

1.02 STANDARD BASELINE FOR AVERAGE CLIMATIC RANGE

A. The Owner has reviewed weather data available from the National Oceanic and Atmospheric Administration and determined a Standard Baseline of average climatic range for the State of Tennessee.

B. Standard Baseline shall be regarded as the normal and anticipatable number of calendar days for each month during which construction activity shall be expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.

C. Standard Baseline is as follows:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
12	11	8	7	7	6	7	5	4	5	6	11

1.03 ADVERSE WEATHER AND WEATHER DELAY DAYS

A. Adverse Weather is defined as the occurrence of one or more of the following conditions which prevents exterior construction activity or access to the site within twenty-four (24) hours of:
   1 Precipitation (rain, snow, or ice) in excess of one-tenth inch;
   2 Temperature which do not rise above 32 degrees F by 10:00 a.m.
   3 Temperatures which do not rise above that specified for the day's construction activity (ie. Concrete or Paving) by 10:00 a.m.;
   4 Sustained win in excess of twenty-five (25) m.p.h.;
   5 Standing snow in excess of one inch (1.00").

B. Adverse Weather may include, if appropriate, "dry-out" or "mud" days:
   1 For rain days above the standard baseline;

2 Only if there is a hindrance to site access or sitework, such as excavation, backfill, and footings; and

3 At a rate no greater than 1 make-up day for each day or consecutive days of rain beyond the standard baseline that total 1.0 inch or more liquid measure, unless specifically recommended otherwise by the Engineer.

C. A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the contractor's scheduled work day, including a weekend day or holiday if Contractor has been permitted to schedule construction activity on that day.

1.04 DOCUMENTATION AND SUBMITTALS

A. Contractor shall maintain, and record results from, a rain gauge on site.

B. Contractor may use NOAA monthly data as documentation of recorded precipitation.

C. Any delay claim requested on the basis of Adverse Weather shall be submitted with the monthly pay request. Failure to request a delay in the monthly pay request will result in denial.

1.05 DECISION AND CONTRACT CHANGE

A. The Engineer/CEI shall issue a response to the claim within ten (10) business days.

B. If additional time is warranted, a field directive and/or change order will be issued. To avoid multiple time only change orders, any warranted time change order shall be incorporated in the final adjusting change order or when appropriate.

PART 2. PRODUCTS – NOT USED

PART 3. EXECUTION – NOT USED

END OF SECTION

PART 1. GENERAL

1.01 SUBMITTALS

A. Submittals shall be remit through the City of Portland IDT portal, delivery or mail. See below for selected method:

PORTAL WEB ADDRESS: https://cityofportlandtn.idtplans.com/secure/

CITY OF PORTLAND
100 South Russell St.
Portland, TN 37148

Attention: City Engineer

B. Within fifteen (15) days of notification of selection, submit:

C. Complete list of proposed subcontractors

D. Complete list of materials suppliers, including brand names (to be furnished as outlined in Instructions to Bidders)

E. Before beginning any on-site construction, submit insurance certificates.

F. Within twenty (20) days after execution of contract, submit:

1 Complete construction progress schedule

2 Schedule of shop drawing submittals

3 Bid unit price breakdown (schedule of values)

G. Submit shop drawings to meet the schedule of shop drawing submittals. When submitting by delivery or mail submit three copies in addition to the number of copies to be returned by the A/E after approval.

1.02 FINAL PAYMENT SUBMITTALS

A. Before issuance of Certificate of Payment for Final Payment, deliver to the A/E:

1 Waivers of lien

2 Written guarantees and warranties

3 Operation and maintenance manuals

4 As-Built Submittal Form

5 Marked-up record set of drawings showing every alteration or change from the original drawings and specifications, including mechanical and electrical changes.

END OF SECTION

PART 1. GENERAL

1.01 REQUIREMENTS INCLUDED

A. Applicability of Reference Standards.

B. Provision of Reference Standards at site.

C. Acronyms used in Contract Documents for Reference Standards. Source of Reference Standards.

1.02 QUALITY ASSURANCE

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

B. The date of the standard is that in effect as of the Bid date, except when a specific date is specified.

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

1.03 SCHEDULE OF REFERENCES

AASHTO American Association of State Highway and Transportation Officials
444 North Capitol Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
P.O. Box 19150
Reford Station
Detroit, MI 48219

AGC Associated General Contractors of America
1957 E. Street, N.W.
Washington, DC 20006

AI Asphalt Institute
Asphalt Institute Building
College Park, MD 20740

AISC American Institute of Steel Construction
400 North Michigan Avenue
Eighth Floor
Chicago, IL 60611

AISI American Iron and Steel Institute
1000 16th Street, N.W.
Washington, DC 20036

ANSI American National Standards Institute
1430 Broadway
New York, NY 10018

ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
1791 Tullie Circle, N.E.
Atlanta, GA 30329

ASME American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

AWPA American Wood-Preservers Association
7735 Old Georgetown Road
Bethesda, MD 20014

AWS American Welding Society
550 LeJeune Road
Miami, FL 33135

CLFMI Chain Link Fence Manufacturers Institute
1101 Connecticut Avenue, N.W.
Washington, DC 20036

CRSI Concrete Reinforcing Steel Institute
933 Plum Grove Road
Schaumburg, IL 60195

EJCDC Engineers Joint Contract Documents Committee
American Consulting Engineers Council
1050 15th Street, N.W.
Washington, DC 20005

EJMA Expansion Joint Manufacturers Association
707 Westchester Avenue
White Plains, NY 10604

FM Factory Mutual System
1151 Boston-Providence Turnpike
Norwood, MA 02062

FS Federal Specification
General Services Administration
Specifications and Consumer Information
Distribution Section (WFSIS)
Washington Navy Yard, Bldg. 197
Washington, DC 20407

GA Gypsum Association
1603 Orrington Avenue
Evanston, IL 60201

IEEE Institute of Electrical and Electronics Engineers
345 East 47th Street
New York, NY 10017
IMI International Masonry Institute
815 15th Street, N.W.
Washington, DC 20005

MIL Military Specification
Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120

ML/SFA Metal Lath/Steel Framing Association
221 North LaSalle Street
Chicago, IL 60601

NAAMM National Association of Architectural Metal
Manufacturers
221 North LaSalle Street
Chicago, IL 60601

NEBB National Environmental Balancing Bureau
8224 Old Courthouse Road
Vienna, VA 22180

NEMA National Electrical Manufacturers Association
2101 L Street, N.W.
Washington, DC 20037

NFPA National Forest Products Association
1619 Massachusetts Avenue, N.W.
Washington, DC 20036

NSWMA National Solid Waste Management Association
1120 Connecticut Avenue, N.W.
Washington, DC 20036

NTMA National Terrazzo and Mosiac Association
3166 Des Plaines Avenue
Des Plaines, IL 60018

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

PCI Prestressed Concrete Institute
201 North Wacker Drive
Chicago, IL 60606

PS Product Standard
U. S. Department of Commerce
Washington, DC 20203

SDI Steel Deck Institute
P.O. Box 3812
St. Louis, MO 63122

SIGMA Sealed Insulating Glass Manufacturers Association
111 East Wacker Drive
Chicago, IL 60601

SJI Steel Joist Institute
1703 Parham Road
Suite 204
Richmond, VA 23229

SMACNA Sheet Metal and Air Conditioning National Association
8224 Old Court House Road
Vienna, VA 22180

SSPC Steel Structures Painting Council
4400 Fifth Avenue
Pittsburgh, PA 15213

TAS Technical Aid Series
Construction Specifications Institute
601 North Madison Street
Alexandria, VA 22314

TCA Tile Council of America, Inc.
P.O. Box 326
Princeton, NJ 08540

UL Underwriters Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

PART 2. PRODUCTS -NOT USED

PART 3. EXECUTION – NOT USED

END OF SECTION

PART 1. GENERAL

1.01 REQUIREMENTS INCLUDED

A. General Quality Control.

B. Workmanship.

C. Manufacturers' Instructions.

D. Manufacturers' Certificates.

E. Mockups.

F. Manufacturers' Field Services.

G. Testing Laboratory Services.

1.02 QUALITY CONTROL, GENERAL

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

1.03 WORKMANSHIP

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

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

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.04 MANUFACTURERS' INSTRUCTIONS

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

1.05 MANUFACTURERS' CERTIFICATES

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

1.06 MOCKUPS

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

1.07 MANUFACTURER'S FIELD SERVICES

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

B. Representative shall submit written report to the Portland Utility Department Inspector (or Engineer) listing observations and recommendations.

1.08 TESTING LABORATORY SERVICES

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

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

C. Reports will be submitted to Portland Utility Department Inspector (or Engineer) in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards and with Contract Documents.

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

1 Notify Portland Utility Department Inspector (or Engineer) and Testing Laboratory at least 48 hours prior to the expected time for operations requiring testing services.

2 Make arrangements with Testing Laboratory and pay for additional samples and tests for Contractors' convenience.

PART 2. PRODUCTS – NOT USED

PART 3. EXECUTION – NOT USED

END OF SECTION

PART 1. GENERAL

1.01 DESCRIPTION

A. Temporary facilities and the necessary controls for the project including utilities, telephone, sanitary facilities, field office, storage sheds and building, safety requirements, first aid equipment, fire protection, security measures, protection of the work and property, access roads, and parking, environmental controls, disposal of trash, debris, and excavated material, pest and rodent control, water runoff and erosion control.

1.02 UNIT PRICES

A. No separate payment for work under this section. Include the costs for performing the work in project costs.

1.03 UNIT PRICES

A. The facilities and controls specified in this section are considered minimum for the Project. The Contractor may provide additional facilities and controls for the proper execution of the work and to meet Contractor's responsibilities for protection of persons and property.

B. Comply with applicable requirements specified in other sections of the Specifications.

1 Maintain and operate temporary facilities and systems to assure continuous service.

2 Modify and extend systems as work progress requires.

3 Completely remove temporary materials and equipment when their use is no longer required.

4 Restore existing facilities used for temporary services to specified or original condition.

1.04 TEMPORARY UTILITIES

A. Obtaining Temporary Service

1 Make arrangements with utility service companies for temporary services.

2 Abide by rules and regulations of the utility service companies or having jurisdiction

3 Be responsible for utility service costs until the work is substantially complete. Included are fuel, power, light, heat, and other utility services necessary for execution, completion, testing, and initial operation of the work.

B. Water

1 Provide water required for and in connection with work to be performed and for specified tests of piping, equipment, devices, or for other use as required for proper completion of the work.

2 Contractor shall not operate any fire hydrants without first having a meter from the City of Portland and having placed the meter on the hydrant. The Contractor shall operate fire hydrant(s) only with an approved hydrant wrench.

3 Provide and maintain an adequate supply of potable water for domestic consumption by Contractor personnel.

C. Electricity and Lighting

1 Provide power for lighting, operation of the Contractor's equipment, or for any other use by Contractor.

2 Electric power service includes temporary power service or generator to maintain plant operations during any scheduled shutdown.

3 Minimum lighting level shall be 5 foot-candles for open areas; 10 foot-candles for stairs and shops.

D. Temporary Heat and Ventilation

1 Provide temporary heat as necessary for protection or completion of the work

2 Provide temporary heat and ventilation to assure safe working conditions; maintain enclosed areas at a minimum of 50° F.

E. Telephone

1 Provide emergency telephone service at the Contractor's field office, or by mobile telephone, for use by Contractor personnel and others performing work or furnishing services at the site.

F. Sanitary Facilities

1 Provide and maintain sanitary facilities for persons on the job site; comply with the regulations of State and Local departments of health.

2 Enforce the use of sanitary facilities by construction personnel at the job site. Such facilities shall be enclosed. Pit-type toilets will not be permitted. No discharge will be allowed from these facilities. Collect and store sewage and waste so as not to cause a nuisance or health problem; have sewage and waste hauled off-site and properly disposed in accordance with local regulations.

3 Locate toilets near the work site and secluded from view insofar as possible. Keep toilets clean and supplied throughout the course of the work.

1.05 FIELD OFFICE

A. Provision of a field office is not required unless specified in the conditions of the contract. If the Contractor chooses to provide one, locate it in a place approved by the Owner Representative.

1.06 PROJECT TRASH, LITTER AND CONSTRUCTION DEBRIS

A. Contractor shall maintain the construction site and all work areas clean of trash, litter and construction debris. All trash and litter shall be properly disposed of in trash receptacles that are emptied regularly. Contractor shall not dump trash and litter into the trench or any other subsurface opening as a means of disposal.

B. Construction debris shall be hauled to an approved site for disposal. Disposal of construction debris in active public waste or disposal areas will not be permitted without prior written approval by the City.

C. Contractor shall not burn grubbed materials on site without prior written permission from the City.

1.07 STORAGE OF MATERIALS

A. Provide adequately ventilated, watertight storage facilities with floor above aground level for materials and equipment susceptible to weather damage.

B. Storage of materials not susceptible to weather damage may be on blocks off the ground.

C. Store materials in a neat and orderly manner. Place materials and equipment to permit easy access for identification, inspection and inventory.

D. Contractor is responsible for materials and equipment stored on and off site.

1.08 SAFETY REQUIREMENTS

A. Conduct operations in a strict accord with applicable Federal, State and Local safety codes and statutes and with good construction practice. The Contractor is fully responsible and obligated to establish and maintain procedures for safety of all work, personnel and equipment involved in the Project.

B. Observance of and compliance with the regulations shall be solely and without qualification the responsibility of the Contractor without reliance or superintendence of the or direction by the Owner Representative. Immediately advise the Owner Representative of investigation or inspection by Federal Safety and Health inspectors of the Contractor of subcontractor's work or place of work on the job site under this Contract, and after such investigation or inspection, advise the Owner Representative of the results. Submit one copy of accidents reports to Owner Representative within 10 business days of occurrence.

C. Protect areas occupied by workmen using the best available devices for detection of lethal and combustible gases. Test such devices frequently to assure their functional capability. Constantly observe infiltration of liquids into the work area for visual or odor evidences of contamination, immediate take appropriate steps to seal off entry of contaminated liquids to the work area.

D. Safety measures, including but not limited to safety personnel, first-aid equipment, ventilating equipment and safety equipment, in the specifications and shown on the Drawings are obligations of the Contractor.

E. Maintain required coordination with the Local Police and Fire Departments during the entire period covered by the Contract.

F. Include project safety analysis in safety plan. Itemize major tasks and potential safe hazards. Plan to eliminate hazards or protect workers and public from each hazard.

1.09 FIRST AID EQUIPMENT

A. Provide a first aid kit throughout the construction period. List telephone numbers for physicians, hospitals, and ambulance services in each first aid kit.

B. Have at least one person thoroughly trained in first aid procedures present on the site whenever work is in progress. Contract to conform to protocols and requirements for training and protection against "blood borne pathogens."

1.10 FIRE PROTECTION

A. Fire Protection Standards

B. Conform to specified fire protection and prevention requirements as well as those which may be established by Federal, State, or Local governmental agencies.

C. Comply with all applicable provisions of NFPA Standard No. 241, Safeguarding Building Construction and Demolition Operations.

1 Provide portable fire extinguishers, rated not less than 2AA or 5B in accordance with NFPA Standard No. 10, Portable Fire Extinguishers, for each temporary building, and every 3,000 square feet of floor area of facilities under construction.

2 Locate portable fire extinguishers with 50 feet maximum from any point in the Project area in which work is performed.

D. Fire Prevention and Safety Measures

1 Prohibit smoking in hazardous areas. Post suitable warning signs in area which are continuously or intermittently hazardous.

2 Use metal safety containers for storage and handling of flammable and combustible liquids.

3 Do not store flammable or combustible liquids in or near stairways or exits.

4 Maintain clear exits from all points within a structure.

1.11 SECURITY MEASURES

A. Protect all work materials, equipment, and property from loss, theft, damage, and vandalism. Contractor's duty to protect property includes Owner's property.

1.12 PROTECTION OF PUBLIC UTILITIES

A. Contractor shall notify Tennessee 811 for underground utility location. No excavation shall occur until all utilities have been cleared through Tennessee 811.

B. Prevent damage to existing public utilities during construction. These utilities are shown on the Drawings at their approximate locations, but all lines may not be shown. Contractor is responsible for damages caused by failure to locate and preserve these underground utilities. Any temporary relocation of utilities, if necessary to accommodate construction, will not be paid for

separately. Bypassing of sanitary waste to storm drainage facilities is not allowed. Utility service lines are not shown on Drawings. Anticipate that such service lines exist and repair them if damaged due to any construction activity. No separate payment will be made for this repair work.

C. Prior to abandonment of utility, make appropriate arrangements with City and/or owner of utility to terminate service, remove meters, transformers, and poles as may be required by site conditions.

D. When excavating near pipelines and prior to start of excavation, request a representative of pipeline company to come to construction site(s) to meet representatives of Contractor and Owner Representative to discuss actual procedures that will be used. Request pipeline company's representative to probe and locate the pipelines in at least three locations: one at each side of proposed excavation and one at centerline of proposed utility. The Contractor may be required to locate the pipeline as directed by the pipeline company at no cost to the project. The Contractor my be required to locate the pipeline as directed by the pipeline company at no cost to the project. Representative of pipeline company and Owner Representative must be present to observe activities of Contractor at all times when excavation is being conducted within 15 feet of pipeline company's pipeline.

1.13 PROTECTION OF THE WORK AND PROPERTY

A. Preventive Actions

1 Take precautions, provide programs, and take actions necessary to protect the work and public and private property from damage.

2 Take action to prevent damage, injury or loss, including, but not limited to the following:

a. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with progress of the work or the work of any other contractor, any utility service company, or the Owner's operations.

b. Provide suitable storage for materials which are subject to damage by exposure to weather, theft, breakage, or otherwise.

c. Place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work.

d. Frequently clean up refuse, rubbish, scrap materials, and debris caused by construction operations, keeping the project site safe and orderly.

e. Provide safe barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways, and other hazardous areas.

3 Obtain written consent from proper parties before entering or occupying with workers, tools, materials or equipment, privately-owned land except on easements provided for construction.

4 Assume full responsibility for the preservation of public and private property on or adjacent to the site. If any direct or indirect damage is done by or on account of any act, omission, neglect, or misconduct in excavation of the work by the Contractor, it shall be restored by the Contractor to a condition equal to or better than that existing before the damage was done.

B. Barricades and Warning Signals

1 Where work is performed on or adjacent to any roadway, right-of-way, or public place; furnish and erect barricades, fences, lights, warning signs, and danger signals; provide watchmen; and take other precautionary measures for the protection of persons or property and protection of the work. Barricades shall be painted to be visible at night. From sunset to sunrise, furnish and maintain at least one light at each barricade. Erect sufficient barricades to keep vehicles from being driven and pedestrians from walking on or into work under construction. Furnish watchmen in sufficient numbers to protect the work. Responsibility of maintenance of barricades, signs, lights, and for providing watchmen shall continue until the project is accepted by the Owner. All signage, barricades, and other traffic control devices shall conform with the Manual on Uniform Traffic Control Devices (MUTCD).

C. Tree and Plant Protection. Trees not intended to be removed during clearing and grubbing shall be adequately protected to ensure construction activities are not in the drip line of the tree and root system is not undermined.

D. Protection of Existing Structures

1 Underground structures:

a. Underground structures are defined to include, but not be limited to, sewer, water, gas, and other piping, manholes, chambers, electrical and signal conduits, tunnels, and other existing subsurface installations located with or adjacent to the limits of the work.

b. Known underground structures, including water, sewer, electric, gas, and telephone services are shown on the

drawings in accordance with the best information available, but are not guaranteed to be correct of complete.

c. Explore ahead of trenching and excavation work and uncover obstructing underground structures sufficiently to determine their location, to prevent damage to them and to prevent interruption of utility services. Restore to original condition damages to underground structure at no additional cost to the Owner.

d. Necessary changes in location of the work may be made by the Owner Representative to avoid unanticipated underground structures.

e. If permanent relocation of an underground structure or other subsurface installations is required and not otherwise provided for in the Contract Documents, the Owner Representative will direct Contractor in writing to perform the work, which shall be paid for under the provisions for changes in the Contract Price as described in the General Conditions.

2 Surface Structures:

a. Surface structures are defined as existing buildings, structures and other constructed installations above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, cubs, walks, guard cables, fencing, and other facilities that are visible above the ground surface.

3 Protection of Underground and Surface Structures:

a. Support in place and protect from direct or indirect injury to underground and surface structures located within or adjacent to the limits of the work. Install such supports carefully and as required by the party owning or controlling such structure. Before installing structure supports, Contractor shall satisfy the Owner Representative that the methods and procedures to be used have been approved by the owner of the structure.

b. Avoid moving or in any way changing the property of public utilities or private service corporations without prior written consent of a responsible official of that service or public utility. Representatives of these utilities reserve the right to enter within the limits of this project for the purpose of maintaining

their properties, that may be considered necessary by performance of this Contract.

c. Notify the owners and/or operators of utilities and pipelines of the nature of construction operations to be performed and the date or daters on which those operations will be performed. When construction operations are required in the immediate vicinity of existing structures, pipelines, or utilities, give a minimum of 5 working days advance notice. Probe and flag the location of underground utilities prior to commencement of excavation of the utility.

d. Assume risks attending the presence or proximity of underground and surface structures within or adjacent to the limits to the work including but not limited to damage and expense for direct or indirect injury caused by the work to any structure. Immediately repair damage caused, to the satisfaction of the owner of the damaged structure

E. Employ a structural engineer to ensure protection measures are adequate for the safety and integrity of structures and facilities.

F. Protection of Installed Products

1 Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of work.

2 Control traffic to prevent damage to equipment, materials, and surfaces.

1.14 ROADS AND PARKING

A. Prevent interference with traffic and Owner operations on existing roads.

B. Designate temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by Owner.

C. Minimize use by construction traffic of existing residential streets and driveways.

D. Do not all heavy vehicles or construction equipment in existing parking areas.

1.15 ENVIRONMENTAL CONTROLS

A. Provide and maintain methods, equipment, and temporary construction as necessary for controls over environmental conditions at the construction site and adjacent areas.

B. Comply with statutes, regulations, and ordinances which relate to the proposed work for the prevention of environmental pollution and preservation of natural resources including by not limited to the National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514.

C. Recognize and adhere to the environmental requirements of the project. Disturbed areas shall be strictly limited to boundaries established by the Contract Documents. Particularly avoid pollution of “on-site” streams, sewers, wells, or other water sources. The City recognizes that the project area has considerable natural value and that construction of projects should be completed with a minimum of impact to the surrounding environment. Attention is directed to this concept. Adopt construction procedures that do not cause unnecessary excavation and filling of the terrain, indiscriminate, destruction of vegetation, air or stream pollution, nor the harassment or destruction of wildlife.

D. Burning of rubbish, debris or waste materials may be conducted with appropriate permissions and permits. Requests for burning rubbish, debris or waste materials shall be submitted to the City or Owners Representative in writing prior to requesting a burn permit.

1.16 POLLUTION CONTROL

A. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by discharge of noxious substances from construction operations.

B. Provide equipment and personnel to perform emergency measures required to contain any spillage, and to remove contaminated soils or liquids. Excavate and dispose of any contaminated earth off-site in accordance with laws and regulations, and replace with suitable compacted fill and topsoil.

C. Take special measures to prevent harmful substances form entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.

D. Provide systems for control of atmospheric pollutants.

1 Prevent toxic concentrations of chemicals.

2 Prevent harmful dispersal of pollutants into the environment.

E. Use equipment during construction that conforms to current Federal, State, and Local laws and regulations.

1.17 PEST AND RODENT CONTROL

A. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.

B. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties

1.18 NOISE CONTROL

A. Provide vehicles, equipment, and construction activities that minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and City Ordinances and in no case will noise levels be permitted which create a nuisance in the surrounding neighborhoods.

B. Conduct construction operations during City business hours except as approved by Owner Representative.

1.19 DUST CONTROL

A. Control objectionable dust caused by operation of vehicles and equipment. Apply water or use other methods, subject to approval of the Owner Representative, which will control the amount of dust generated.

PART 2. PRODUCTS – NOT USED.
PART 3. EXECUTION – NOT USED.

END OF SECTION

PART 1. GENERAL

1.01. DESCRIPTION

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

B. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features, to ensure economical, effective, and continuous erosion control throughout the construction and post-construction period.

C. A Stormwater Pollution Prevention Plan (SWPPP) shall be submitted to the Tennessee Department of Environment and Conservation (TDEC) for any disturbed area equal to or greater than 1 acre. The Notice of Coverage (NOC) shall be obtained and SWPPP implemented prior to any land disturbance.

PART 2. PRODUCTS

2.01. TEMPORARY BERMS

A. A temporary berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes or transverse to centerline on fills.

B. These berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.

2.02. TEMPORARY SLOPE DRAINS: A temporary slope drain is a facility consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half round pipe, metal pipe, plastic pipe, sod, or other material that may be used to carry water down slopes to reduce erosion.

2.03. SEDIMENT STRUCTURES: Sediment basins, ponds, and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect properties and stream channels below the construction areas from excessive siltation.

2.04. CHECK DAMS: Check dams are barriers composed of large stones, sand bags, or other non-erodible materials placed across or partially crossing a natural or constructed drain way.

2.05. TEMPORARY SEEDING AND MULCHING: Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes including waste sites and borrow pits shall be seeded when and where necessary to eliminate erosion.

2.06. STAKED BALED HAY OR STRAW CHECKS

A. Staked baled hay or straw erosion checks are temporary measures to control erosion and prevent siltation. Bales shall be either hay or straw containing 5 cubic feet or more of material and staked in place as to prevent movement during water flow.

B. Baled hay or straw checks shall be used where the existing ground slopes toward or away from the embankment along the toe of slopes, in ditches, or other areas where siltation erosion or water runoff is a problem.

2.07. TEMPORARY SILT FENCES: Silt fences are temporary measures utilizing woven wire or other approved material attached to posts with filter cloth composed of burlap, plastic filter fabric, etc., attached to the upstream side of the fence to retain the suspended silt particles in the runoff water.

PART 3. EXECUTION

3.01. The project drawings show the minimum erosion and siltation control measures required for this job. It is the responsibility of the contractor to install any and all erosion measures necessary to prevent erosion and sediment runoff.

3.02. The contractor shall take special care in installing and maintaining erosion control devices adjacent to creek crossings.

3.03. CONSTRUCTION REQUIREMENTS

A. The A/E has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface of erodible earth material exposed by excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other water impoundment. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats seeding or other control devices or methods as necessary to control erosion. Cut and fill slopes shall be seeded and mulched as the excavation proceeds to the extent directed by the A/E.

B. The Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the preconstruction stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

C. Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise erosion control measures may be required between successive construction stages. Under no conditions shall the surface area of erodible earth material exposed at one time by clearing and grubbing, exceed 750,000 square feet.

D. The A/E may decrease the amount of surface area or erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow and fill operations as determined by his analysis of project conditions.

E. In the event of conflict between these requirements and pollution control laws, rules or regulations, or other Federal, State, or Local agencies, the more restrictive laws, rules, or regulations shall apply.

3.04. CONSTRUCTION OF STRUCTURES

A. Check Dams

1 Check dams shall be utilized to retard stream flow or restrict stream flow within the channel. Materials utilized to construct check dams are varied and should be clearly illustrated or explained in the Contractor's erosion control plan.

2 All check dams shall be keyed into the sides and bottom of the channel. A design is not needed for check dams.

B. Temporary Seeding and Mulching: Seeding and mulching shall be performed in accordance with the Section 02485 Seeding.

C. Baled Hay or Straw Erosion Checks: Hay or straw erosion checks shall be embedded in the ground four (4) to six (6) inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales can remain in place until they rot, or be removed after they have served their purpose, as determined by the A/E. The Contractor shall keep the checks in good

condition by replacing broken or damaged bales immediately after damage occurs. Normal debris cleanout will be considered routine maintenance.

D. Temporary Silt Fences

1 Temporary silt fences shall be placed on the natural ground, at the bottom of fill slopes, in ditches, or other areas where siltation is a problem. Silt fences are constructed of wire mesh fence with a covering of burlap or some other suitable material on the upper grade side of the fence and anchored into the soil.

2 The Contractor shall be required to maintain the silt fence in a satisfactory condition for the duration of the project or until its removal is requested by the A/E. The silt accumulation at the fence may be left in place and seeded, removed, etc., as directed by the A/E. The silt fence becomes the property of the Contractor whenever the fence is removed.

E. Under no circumstances will spent oil wastes be discharged anywhere on the site.

3.05. MAINTENANCE

A. The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor.

3.06. EROSION CONTROL OUTSIDE PROJECT AREA: Temporary pollution control shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads, and equipment storage sites.

END OF SECTION

PART 1. GENERAL – NOT USED

PART 2. PRODUCTS – NOT USED

PART 3. EXECUTION

3.01 UNLOADING

A. Trucks should be parked on level ground for unloading.

B. Before release of chains, cables, or strapping, an inspection should be made to ensure that chock blocks are securely in place on both ends of every support timber.

C. Where chock blocks are missing or inadequately fastened, corrections should be made. Under no circumstances should chocks be removed while there is any possibility of pipe rolling out of control and causing damage or injury.

D. Personnel should never remain on, in front of, or alongside a load of pipe after the restraints have been removed.

E. Steel banding should be cut with a long-handled bolt or strap cutter. Straps should not be cut with an axe, chisel, or other tool likely to damage the pipe or its lining, or cause personal injury.

F. Workmen and any other personnel in the area should wear and use appropriate safety equipment.

G. Pipe should never be rolled off the carrier or dropped on old tires or other cushions.

H. A forklift or crane should be used for unloading.

I. Precautions should be taken to prevent the pipe from rolling or shifting during unloading.

J. Personnel not directly involved in the unloading operation should stand clear.

K. When not unloaded by forklift, pipe is usually lifted from railcars using a cable arrangement with a large padded hook for each end of the pipe or by pipe tongs.

L. If the pipe is shipped on wood spacers, loop slings can be used for unloading, so that the loops can be placed easily around the center of the pipe.

M. A crane may be used to lift the pipe from the railcar to trucks for delivery to the trench site or stockpile.

N. Crane operators should use care not to strike the pipe against the side of the car or against another pipe.

O. When pipe is transported from the railhead to the trench site by truck, the pipe should be safely reloaded, secured, and handled as previously described.

3.02 PIPE STORAGE AND PROTECTION

A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

B. Stored materials shall be kept safe from damage.

C. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times.

D. Pipe stacked in tiers shall:

1. Not be stacked higher than the limits recommended by the manufacturer.

2. Have the bottom tier kept off the ground on timbers, rails, or concrete.

3. Pipe on succeeding tiers should be alternated bell end to plain end

4. Have at least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.

5. For safety and convenience, each size should be stacked separately.

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

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

G. Any material damaged during transporting, unloading, handling, or storing shall not be used and will be rejected by PDU.

3.03 FITTINGS

A. All fittings shall remain in manufacturer's packaging until time of installation.

B. Storage shall be in compliance with the manufacturer's recommendations.

C. Mechanical-joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

3.04 VALVES AND HYDRANTS

A. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

B. Storage shall be in compliance with the manufacturer's recommendations.

C. Any material damaged during transporting, unloading, handling, or storing shall not be used and will be rejected by PDU.

3.05 GASKETS

A. Stored mechanical and push-on joint gaskets shall be placed in a cool location, out of direct sunlight.

B. Gaskets shall not come in contact with petroleum products.

C. Gaskets shall be used on a first-in, first-out basis.

D. Gaskets shall be checked for any cracking or deterioration prior to installation.

3.06 POLYVINYLCHLORIDE (PVC)

A. Thermoplastic pipe may be stored indoors or outside in yards.

B. If stored outdoors, pipe should be protected from direct sunlight.

C. Pipe should be properly supported in storage to prevent sagging or bending.

D. Pipe should be stored at the job site on level ground in the unit packages/skids provided by the factory. Caution must be exercised to avoid compression, damage, or deformation.

E. When unit packages are stacked, care must be used to ensure that the weight of the upper units does not cause deformation to pipe in the lower units.

F. Package units should not be stacked more than 8 feet high. Not be stacked higher than the limits recommended by the manufacturer.

G. Care must be used to ensure that the height of the stack does not result in instability, which can cause collapse, pipe damage, or personal injury.

H. Unit packages should be supported by wooden racks or other suitable means, and spaced properly to prevent damage.

I. Any material damaged during transporting, unloading, handling, or storing shall not be used and will be rejected by PDU.

3.07 HIGH DENSITY POLYETHYLENE

A. Pipe shall be placed on planking or other form of support. The pipe shall be supported evenly spaced along the pipe length.

B. Colored products shall not be stored outdoors for more than two years.

C. Pipe stored for an extended period of time should not be stacked higher than indicated in the following table:

SUGGESTED MAXIMUM ALLOWABLE STAKING HEIGHTS FOR HDPE

Nominal HDPE Size	Stacking Height in Rows by Pipe Size	
	Above DR 17	DR 17 & Below
4	15	12
6	10	8
8	8	6
10	6	5
12	5	4
18	4	3
24	3	2

3.08 MANHOLES

A. Manholes shall be stored on an even surface, above and away from drainage or stormwater confluences to avoid damage during storage.

B. Stacking manholes in storage is prohibited.

3.09 INSPECTION

A. All fittings, pipe, and precast concrete structures shall be inspected by the City at time of delivery to the construction storage site and again at the

installation location, prior to installation. Materials shall be free of any cracks, deformation, or defect.

END OF SECTION

PART 1. GENERAL

1.01 SCOPE

A. This Section provides instruction for project record documents to facilitate closeout and acceptance by the City of Portland Department of Utilities (PUD).

B. Contractor/Developer is responsible for providing Record Documents as prescribed herein.

1.02 SUBMITTALS

A. Engineer of record shall certify with Professional Engineer's Seal that Record Drawings have be installed and comply with the Design, are in accordance with the Tennessee Department of Environment and Conservation design standards, and comply with T.C.A. Title 7 as it relates to all Municipal Utilities.

B. Record Drawing Requirements Form shall be included with the record drawings.

C. Record Drawings shall be survey grade with NAD 83TN State Plane Zone, US Foot.

D. Record Drawings shall be submitted electronically in CAD (dwg file) format. They may be submitted through the City's IDT online submittal system.

E. Record Drawings shall be submitted and approved prior to PDU acceptance.

F. All testing data and start up sheets shall be submitted prior to PDU acceptance. They may be submitted through the City's IDT online submittal system.

PART 2. MATERIALS – NOT USED

PART 3. EXECUTION – NOT USED

PART 1. GENERAL

1.01 REQUIREMENTS INCLUDED

A. Reinforcing steel bars and welded steel wire fabric for cast-in-place concrete complete with tie wire.

B. Support chairs, bolsters, bar supports and spacers for reinforcing.

1.02 QUALITY ASSURANCE

A. Perform concrete reinforcing work in accordance with CRSI 63 and 65 unless specified otherwise.

1.03 SOURCE QUALITY CONTROL

A. Submit certified copies of mill test report of supplied concrete reinforcing, indicating physical and chemical analysis in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1.04 SHOP DRAWINGS

A. Submit Shop Drawings in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

B. All reinforcing steel shall be detailed in accordance with ACI 315, Details and Detailing of Concrete Reinforcement.

C. Indicate bar sizes, spacing, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules and supporting and spacing devices.

PART 2. PRODUCTS

2.01 REINFORCING MATERIALS

A. Reinforcing steel: 60 KSI yield grade billet steel bars, ASTM A615, plain finish, conforming to supplemental requirements S1.

B. Welded steel wire fabric: Plain type, ASTM A185, in coiled rolls.

2.02 ACCESSORY MATERIALS

A. Tie wire: Minimum 16 gage annealed type.

B. Bar supports: All surfaces exposed to weather or liquid or which can be seen in service condition shall have plastic tipped bar supports conforming to Class C, D or E as defined in Chapter 9 of CRSI, Placing Reinforcing

Bars, 1976 Edition. Where no protection is required, Class A supports may be used.

C. Other supports: Concrete brick may be used to support reinforcement to obtain proper clearance from earth and rigidity of reinforcement under concreting operations.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI Manual of Standard Practice, Latest Edition.

B. Locate reinforcing splices, not indicated on the Drawings, at points of minimum stress. Location of splices is to be indicated on Shop Drawings. Unless otherwise indicated, all splices shall be class C.

C. Weld reinforcing bars in accordance with AWS D1.4.

PART 3. EXECUTION

3.01 PLACEMENT OF REINFORCING STEEL

A. Maintain reinforcement surfaces free of rust scale and other coatings which might impair concrete bond as described in Section 7.4 of ACI 318, 1989 edition.

B. Handle, place and tie reinforcement steel in accordance with Building Code Requirements for Reinforcing Concrete, ACI 318 and CRSI Placing Reinforcing Bars, 1976 Edition.

C. All reinforcement bars shall be supported and secured as directed in ACI 315 and CRSI Manual of Standard Practice, 1990 edition.

D. Provide class C tension splices unless indicated otherwise. Do no splicing of reinforcement steel except as authorized by the Architect.

E. Accomplish welding in accordance with AWS D1.4 Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction.

F. Bend bars cold. Do not field bend bars partially embedded in concrete except as specifically approved by the A/E. Do not heat or cut bars with a torch.

3.02 INSTALLING WELDED WIRE FABRIC

A. After vapor barrier or underfloor waterproofing has been placed, install welded wire fabric.

B. Locate welded wire fabric in center third of slab

C. Lap side one full mesh plus 2". Lap ends 2 full meshes. Offset end laps in adjacent width to prevent continuous laps.

3.03 CONCRETE PROTECTION FOR REINFORCEMENT

A. Protect reinforcing by thickness of concrete indicated.

B. Where not indicated, thickness of concrete over reinforcing shall be as follows:

1. Where concrete is deposited against the ground without the use of forms - 3".

2. Where concrete is exposed to weather or to ground but placed in forms - 2" for bars larger than no. 5 and 1-1/2" for no. 5 bars and smaller.

3. In slabs and walls not exposed to the ground or to weather - 3/4".

4. In beams, girders and columns not exposed to the ground or to the weather - 1-1/2".

C. Variation from clear cover shall conform to Section 7.5 of ACI 318, 1989 edition.

END OF SECTION

PART 1. GENERAL

1.01 REQUIREMENTS INCLUDED

A. Cast-in-place concrete as detailed on the Drawings.

B. Floor slabs on grade, footings, grout fill, utility structures, lintel beams and pads.

C. Vapor barrier under slabs on grade.

D. Poured-in-place equipment pads.

E. Surface finish on exposed slabs.

F. Preparation of slabs to receive toppings.

G. Utility kickers and encasement.

1.02 QUALITY ASSURANCE

A. Perform cast-in-place concrete work in accordance with ACI 318, unless specified otherwise.

1.03 SHOP DRAWINGS

A. Submit Shop Drawings in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

B. Submit copies of the concrete mix designs with supporting data to show compliance with ACI 318, Chapter 4 and 5. Indicate types and quantities of materials used, the fresh unit weight, compressive strength, slump, air content and aggregate analysis in mix design.

C. Submit certification showing that the aggregate, cement and all admixtures conform to these specifications.

D. Submit copies of each laboratory test report indicating type of concrete furnished, compressive strength, slump, air content and water added to concrete after batching.

E. Retain ready-mix delivery tickets at the job site for inspection.

1.04 TESTING LABORATORY SERVICES

A. The Contractor shall employ a Testing Laboratory approved by the A/E to perform concrete tests including taking, handling, protecting and storing of test specimens, and the accurate reporting of compressive strength, weight of cylinders, contents of concrete, slump, air contents, and location of concrete. If concrete fails to meet any part of the specifications, immediately

notify the A/E for instructions. Additional testing will be at Contractor's expense.

B. Testing Laboratory shall perform test as follows:

1 Obtain samples: ASTM C31.

2 Compression: ASTM C91.

3 Air content: ASTM C138 (gravimetric method) or ASTM C231 (pressure method).

4 Slump: ASTM C143.

5 Cylinders: One set (6 specimens) for each 150 cubic yards, or fraction thereof, for each 5000 square foot of surface area for slabs, whichever is smaller, of each class of concrete placed each day; test 2 cylinders at 7 days for information and 2 at 28 days for acceptance. If 28 day cylinders do not indicate proper strength, the third set will be tested as directed by the A/E.

C. The strength level shall be considered satisfactory so long as the averages of all sets of three (3) consecutive strength test results equal or exceed the specified strength and no individual test result falls below the specified strength by more than 500 PSI.

D. Additional tests may be required if evidence of faulty workmanship, failure of test or questionable concrete exists. These tests shall be at Contractor's expense.

1.05 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Concrete strength will be evaluated in accordance with ACI 318, section 5.6. Should evidence of low-strength concrete exist, or if test results indicate non-conformance with these specifications, additional testing, as outlined in section 5.6.4 may be directed with the Contractor bearing all costs.

B. If, after additional testing, evidence of low-strength concrete still exists, load tests in accordance with ACI 318, chapter 20, may be ordered. In the event the concrete is determined to be inadequate, the Contractor will be required to remove it from the project and replace it with concrete conforming to these specifications. All such remedial work shall be at the Contractor's expense.

C. The Contractor shall be fully responsible for ensuring that all concrete and placement meets project requirements. Failure of A/E or Testing Laboratory to detect defective work, workmanship or materials shall in no way prevent

rejection and the Contractor being required to take corrective action when such defects are discovered.

D. Contractor shall provide assistance to Testing Laboratory necessary to gather and store sample cylinders. On site storage and protection shall be provided as required.

1.06 CONCRETE QUALITY DESIGN

A. All concrete mix designs shall be proportioned in accordance with ACI 318, section 5.3 (Field Experience and/or Trial Mixtures). Submit mix design for each class of class of concrete based on a standard deviation analysis or trial mixtures. If a standard deviation analysis is used, the concrete shall achieve an average strength in accordance ACI 318, table 5.3.2.2. Refer to figure 5.3 of ACI 318 Commentary on Building Code Requirements for Reinforced Concrete for outlining this procedure. Submittals made that do not conform to ACI 318, section 5.3 will be rejected.

PART 2. PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: Normal-type I Portland, ASTM C150. Use only one brand throughout job.

B. Fine and coarse aggregates: ASTM C33. Size coarse aggregate in accordance with ACI 318, chapter 3, paragraph 3.3.2.

C. Water: Clean and free from injurious amounts of oil, alkali, organic matter or other deleterious material.

2.02 ADMIXTURES

A. Water reducing admixtures: Euclid Eucon WR-75, Master Builders Pozzolith 200N, or equal conforming to ASTM C494, type A, and not containing more chloride ions than municipal drinking water.

B. Water reducing, retarding admixtures: Euclid Eucon Retarder-75, Master Builders Pozzolith 100XR, or equal conforming to ASTM C494, type D, and not containing more chloride ions than municipal drinking water.

C. High range water reducing admixture (Superplasticizer): Euclid Eucon 37, Master Builders RHEOBUILD 1000, or equal conforming to ASTM C494, type F or G and not containing more chloride ions than municipal drinking water.

D. Non-chloride accelerator: Euclid Accelguard 80, Master Builders HC 534, or equal conforming to ASTM C494, type C or E and not containing more chloride ions than municipal drinking water.

E. Air entraining admixture: Conforming to ASTM C260.

F. Calcium chloride: No more than 0.05 percent chloride ions are permitted.

G. Certification: From manufacturer certifying to stated requirements.

2.03 FLY ASH

A. Conforming to ASTM C618, class F.

2.04 READY-MIX CONCRETE

A. In Accordance with ASTM C94, alternate no. 2.

B. Strength (f'c):

1	Interior slabs-on-grade:	4000 psi
2	Structural slabs-on-grade:	4000 psi
3	Columns:	4000 psi
4	Beams and lintels:	4000 psi
5	Walls:	4000 psi
6	Prestressed:	5000 psi
7	Footings:	4000 psi
8	Exterior:	4000 psi
9	Utility structures:	4000 psi
10	Utility kickers and encasements:	4000 psi

C. Contents: In accordance with ACI 302.1R, table 5.2.7a within specified tolerances. All interior slabs subject to abrasion shall have a maximum air content of 3%. All exterior concrete to have a average content of 4% to 6%.

D. Water-cement ratio: All concrete exposed to freezing and thawing shall have a maximum water-cement ratio of 0.50. All concrete subjected to deicers and/or required to be watertight shall have a maximum water-cement ratio of 0.45.

E. Slump: All concrete containing the high range water reducing admixture (superplasticizer) shall have a maximum slump of 8" unless otherwise

approved by the Engineer. The concrete shall arrive at the job site at a slump of 2" to 3", be verified, then the high range water reducing admixture added to increase the slump to the appropriate level.

F. All other concrete shall have a maximum slump of 3" for slabs and 4" for other members.

G. Admixtures: All concrete shall contain the specified water reducing admixture or high range water reducing admixture (superplasticizer). At the Contractors option, both water reducing admixtures may be included in the concrete mix. All concrete slabs placed at air temperatures below 50 degrees F shall contain the specified non-chloride accelerator. All concrete required to be air entrained shall contain the approved air entraining admixture.

H. Water soluble chloride ion concentrations: Maximum concentrations in hardened concrete at an age of 28 days contributed from the ingredients including water, aggregates, cementitious materials and admixtures shall not exceed the limits established in ACI 318, table 4.4.1, unless noted elsewhere in this specification.

2.05 VAPOR BARRIER

A. 6 mil polyethylene sheeting conforming to ASTM E154.

2.06 BOND BREAKER

A. 30 and 90 pound asphalt saturated roofing felt.

2.07 CURING AND SEALING COMPOUND

A. Euclid Super Floor Coat or Super Pliocure, Master Builders Masterseal Dayton J-23 Acrylic Cure or equal conforming to ASTM C309 with minimum 30 percent solids and test data from an independent laboratory indicating a maximum moisture loss of 0.055 grams per sq. cm. in 72 hours when applied at a coverage rate in conformance with the manufacturer's recommendations. Manufacturer's certification required.

2.08 SHEET MATERIAL FOR CURING CONCRETE

A. Waterproof paper or polyethylene film meeting requirements of ASTM C171.

2.09 BONDING COMPOUND

A. Euclid Euco Weld, Larsen Weldcrete, L and M Everbond or approved equal.

2.10 EPOXY ADHESIVE

A. Euclid Euco Epoxy 463 or 615, L and M Epobond, Sika Sikadur Hi-Mod, Adhesive Engineering Concresive 1001-LPL or approved equal. The compound shall be 2 component, 100% solids, 100% reactive suitable for user on dry or damp surfaces.

2.11 NON-SHRINK GROUT

A. Euclid Firmix (metallic) and Euco NS (non-metallic), Master Builders Embeco 636 (metallic) and Masterflow 713 (non-metallic), or approved equal. The grout shall conform to CRD-C-612, "Corps of Engineers Specification for Non-Shrink Grout".

PART 3. EXECUTION

3.01 CONDITION OF SURFACES

A. Notify Testing Laboratory at least 48 hours before starting concrete placement. Do not start concrete placing until Testing Laboratory has approved surfaces, reinforcement placement and embedded items.

B. Place no concrete until reinforcement and embedded items are positioned and secured.

C. Forms, surfaces and trenches shall be free from water, mud, ice, frost and debris when concrete is placed.

D. Wet surfaces before placing concrete.

3.02 VAPOR BARRIER

A. Place vapor barrier over all crushed stone below slabs-on-grade. Place smoothly, without wrinkles and trapped air. Lap sides and end joints at least 6" and weight down. Turn up 4" at vertical surfaces. Keep unnecessary traffic off vapor barrier.

3.03 BOND BREAKER

A. Where separation from a vertical surface is desired, place 12" wide strips of 30 pound felt, creased at right angle in the long direction, at all vertical surfaces, except where fiber board is to be installed. Turn up on vertical surfaces for full thickness of concrete.

B. Where floor slabs bear on tops of foundations, place a 90-pound strip of felt, full width of bearing surfaces.

3.04 PRODUCTION OF CONCRETE

A. Produce all ready-mix concrete in accordance with ACI 301, chapter 7.

3.05 PLACING CONCRETE

a. Prepare place of deposit and equipment. Convey and place concrete in accordance with ACI 301, paragraphs 8.1-8.3. Modifications that follow shall take precedence.

A. Deposit concrete within 1 hour after water is added to dry batching or use retarding admixture.

B. Convey concrete promptly to point of use in a manner to prevent separation of ingredients and loss of water. Deposit concrete near its final position to avoid re-handling.

C. Consolidate concrete, including floor slabs, in accordance with ACI 309 - Guide for Consolidation of Concrete. All concrete shall be vibrated. Maintain at least 1 vibrator on stand-by. Lower frequency vibrators may be used with flowing concrete.

D. Do not use vibrators to cause concrete to flow.

E. Concrete column pours shall not extend more than 3/4" into the concrete slab. Chip off any concrete that exceeds this dimension.

3.06 CONSTRUCTION JOINTS AND EMBEDDED ITEMS

A. Construction joints and embedded items shall conform to ACI 301, chapter 6. Locations of all construction joints shall be as shown on the Drawings or approved by the Engineer.

3.07 FINISHING

A. After placing concrete, screed to levels and slopes indicated. Do not use tamping tools to force aggregate away from the surface.

B. When the water sheen has disappeared, use a wood float to bring concrete to a true level or slope as indicated. Depressions between high spots shall not exceed 5/16" under a 10' straightedge after floating, but before toweling.

C. When trowel finish is required, after concrete has hardened sufficiently to bear a man's weight without imprint, trowel with power and hand tools. Remove small imperfections left by toweling machine and bring to a smooth, dense, polished finish by hand toweling. Continue toweling until a ringing sound is produced as the trowel is moved over the surface.

D. Do not use dry materials, such as sand and cement, on surfaces during finishing.

E. Do not use any procedures, such as the addition of water to the concrete surface that produces a layer of weak material with an increased water-cement ratio at the slab surface.

F. Maximum allowable variation in troweled surfaces shall be such that depressions between high spots shall not exceed 3/16" under a 10' straightedge.

G. Where floors are to be covered with a thin set tile, trowel as specified above and then broom surfaces to form a "tooth".

3.08 CURING

A. As finished work is completed, begin curing. Curing may be accomplished by either of the methods described below, except for items specifically designated for a particular method.

B. For waterproof paper or plastic film curing, cover damp surfaces and lap edges at 4". Apply weights to prevent displacement. Repair tears and punctures as they occur.

C. All interior slabs with resilient tile, carpet or left exposed and all exterior slabs, sidewalks, curbs, etc. shall be cured with the specified clear curing and sealing compound. The compound shall be applied immediately after final finishing operations are completed. Apply uniformly in continuous operation by power sprayer or roller in accordance with manufacturer's directions. Recoat areas which are subjected to heavy rainfall within 3 hours after initial application.

D. Do not use curing and sealing compound on surfaces receiving applied finish other than resilient tile or carpet.

E. Where forms are left in place, keep forms damp by spraying at frequent intervals for 8 days. Do not allow forms to dry out.

3.09 PROTECTION

A. Protect concrete against traffic for at least 48 hours. Erect barriers as necessary to protect uncured areas. Provide wood covers to protect concrete step-ups.

B. Protect concrete from paint, stains and abrasive traffic.

3.10 PATCHING

A. After forms are removed, do not patch or repair, except that fins may be removed back to formed surface, until examined by the Architect. Patch as directed.

B. Cut out honeycombs, rock pockets, voids over 1/4" in any dimension and holes left by tie rods and bolts, down to the concrete, but in no case to a depth of 1". Make edges of cuts perpendicular to the concrete surface. Before placing cement mortar, thoroughly clean, dampen with water and apply the specified bonding compound. The cement mortar shall be placed after the bonding compound has dried.

C. Rub exposed interior finished concrete as specified above. Where form marks and fins detract from appearance or are otherwise objectionable, remove by rubbing.

D. All structural repairs shall be made only with approval of Engineer, as to method and procedure, using the specified epoxy adhesive and/or epoxy mortar.

3.11 GROUTING

A. All column base plates, equipment bases and other locations noted, shall be grouted with the specified non-shrink grout. All exposed grout shall be non-metallic.

B. After steel columns have been erected and shimmed to proper height, grout under column base plates with specified non-shrink grout.

3.12 CLEAN-UP

A. Clean and leave concrete work free from any loose material. Remove any mortar spills from floors or other materials. Leave areas free from any debris.

B. Remove excess material and equipment from site when work is completed.

END OF SECTION

PART 1. GENERAL

1.01 DESCRIPTION

A. Manholes shall be precast with eccentric cones, unless otherwise approved by the Portland Department of Utilities (PDU).

B. Wet wells shall have precast concrete flat tops, with openings as defined on the drawings and as required by pump manufacturer requirements.

C. Section shall also apply to concrete wet wells.

1.02 QUALITY ASSURANCE

A. All precast concrete structures shall conform to ASTM C478, latest revision.

B. Concrete mix for precast concrete structures shall contain admixture, Xypex C-1000 Red or approved equal.

C. All precast reinforced concrete manhole risers and tops specified herein shall be tested and inspected by a commercial testing laboratory, prior to delivery to the site.

D. The commercial testing laboratory shall be engaged and paid for by the Contractor.

E. All materials that fail to conform to these Specifications shall be rejected.

F. After delivery to the site, any materials that have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site.

G. Any material damaged during transporting, unloading, handling, or storing shall not be used and will be rejected by PDU.

1.03 SUBMITTALS

Shop drawings are required to be submitted to PDU for review on all utility materials within a project, in accordance with Section *01 33 00 SUBMITTAL PROCEDURES*.

PART 2. PRODUCTS

2.01 CONCRETE MASONRY

Reinforced concrete shall meet the applicable requirements of Section *03 20 00 CONCRETE REINFORCING*.

2.02 GRADE ADJUSTMENT RINGS

A. Adjustment rings shall be used for casting adjustments in the following manner:

1. Adjust manhole frames and covers found above or below grade and reset loose frames.

2. Combine precast concrete adjustment rings so that the elevation of the installed frame and cover:

a. Extends 6 inches above the natural ground in unpaved areas.

b. Sets flush and smooth in paved areas.

B. Apply an approved sealant between the top adjustment ring and the manhole frame. No less than 2 beads will be applied 1/2-inch wide and 3/4-inch high.

C. The manhole adjustment section (grade rings) shall be a minimum of three inches and shall not exceed 18 inches in height.

D. An approved manhole lining material, no less than 1-inch of lining material will be applied to the inside and outside face of the adjustment rings.

E. Cast Iron solid rings shall conform to ASTM A48, Class 30, material specifications. The ring shall be of a traffic design and no more than 2-inches in height. The extension ring shall be No. 2500 as manufactured by John Bouchard & Sons or approved equal.

F. Reinforced concrete grade rings shall conform to ASTM C478.

G. Manhole concrete grade rings shall have Xypex C-1000 admixture in the concrete.

H. Rings shall be coated with an acid resistant coating.

I. Expanded Polypropylene (EPP) may be used for grade adjustment or to provide a slope across the frame and cover on manholes. EPP shall conform to Cretex Pro-Ring™ or approved equal.

J. Contractor shall minimize the number of grade rings when allowable on rehabilitation projects.

K. Bricks shall not be used to adjust grade.

2.03 MORTAR

A. Mortar shall be prepared by thoroughly mixing one (1) part Portland cement and two (2) parts sand (volumetric measure) in a tight box, with water added gradually and mixed continuously until mortar has attained the proper consistency for use in the work.

B. The mortar shall be prepared only in such quantities as needed for immediate use.

C. Mortar mixed for more than 30 minutes, re-tempered, or previously set shall not be allowed.

2.04 MANHOLES

A. Manholes shall be precast with eccentric cones, unless otherwise approved by the PDU.

B. Manholes shall be installed at the locations shown on the PDU-approved Construction Plans. If a manhole location is needing to be altered, notify PDU prior to placing manhole for approval of changed location.

C. The distance between manholes shall not be greater than 350 feet, unless prior approval is obtained from PDU.

D. Cleanouts shall not be substituted for manholes.

E. Manhole steps shall be within 18 inches of the top of casting and spaced at a maximum of 12 inches on center.

F. Manholes shall have:

1. A minimum inside diameter of 48 inches, where incoming lines are 16 inches or less in diameter.

2. A minimum inside diameter of 60 inches, where depth of manhole exceeds 15 feet.

3. A minimum access diameter of 24 inches shall be provided, as per detail WW-03.

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

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

H. Cement shall meet the requirements of ASTM C150, with Type II Portland cement.

I. All precast manhole sections shall have admixture XYPEX C-100 Red or approved equal in the concrete mix to provide waterproofing and corrosion protection.

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

K. Manholes shall consist of a base, with a monolithically cast bottom barrel section, vertical pipe barrel sections, eccentric top section, grade adjustment rings, and a frame and cover. See Subsection *3.05 Standard Frame and Cover* for manhole frame and cover specifications.

L. Joint contact surfaces shall be formed with mechanical castings, be parallel with two degrees slope, single offset, and nominal 1/16-inch clearance.

M. Gaskets shall conform to ASTM C-443.

N. Flat slab tops for manholes shall not be used, unless approved by PDU. If approved, cast iron manhole covers and assemblies shall be cast into slab tops for access into manholes.

O. Minimum Compressive strength of concrete shall be four thousand (4,000) psi at 28-day test, and the maximum permissible absorption shall be six and one-half percent (6.5%).

P. Trough of manhole may be cast in concrete or built up with mortar.

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

R. Protective coating(s) shall be applied to all interior surfaces of manholes and lift station wet wells when specified by PDU.

S. Risers shall be reinforced with a single cage of steel placed within the center third of the wall.

T. 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.

U. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches for larger sizes.

V. Minimum wall thickness shall be five inches.

W. Precast manhole section shall fit together readily and shall have a self-contained “O”-ring rubber gasket, conforming to ASTM C 443.

X. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by PDU.

2.05 MANHOLE STANDARD FRAME AND COVER

A. Manhole frame and cover shall be designed to withstand an HS20-44 loading defined in the AASHTO Specifications.

B. A heavy-duty cast iron frame and cover shall be used for each manhole.

C. The cover and frame castings shall meet the requirements of ASTM A48 or ASTM A536.

D. Castings shall be stamped with the appropriate utility, “SANITARY SEWER” or “WATER”, and coated with asphalt paint.

E. The frame and cover shall be well-cleaned and free of holes, porosity, hard spots, shrinkage distortion, or other defects.

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

G. Adjusting the frame and cover to proper grade shall conform to Subsection *3.02 Grade Adjustment Rings*.

H. Frame and cover shall be neatly grouted with non-shrink grout.

I. Frames on manhole cones shall be set eccentric, with the precast cone in mastic.

J. 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 water-tight.

K. For off-site manholes, a ring of mortar at least 1-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. For roadway manholes, the mortar shall cover the entire frame casting base and pitch down to the top of the corbel or manhole ring.

L. Standard manhole frames and covers shall be traffic-rated, John Bouchard & Sons 1155, Sigma, or approved equal.

M. Water-tight manhole frames and covers shall be traffic-rated John Bouchard & Sons 1123, Neenah Foundry Company, EJ, or approved equal.

N. Watertight Covers and Frames will each have at least 3 bolts and a gasket to seal cover to frame.

O. Provide manhole inserts, including new dishes, gaskets, and relief valves.

P. Select appropriate water-tight inserts to fit walls and frames of manholes:

1. Install stainless steel manhole inserts at locations shown on the PDU-approved Construction Plans or where directed by PDU Inspector or Engineer.

2. Stainless steel (18 gauge minimum) inserts shall be Southwestern Packing and Seals “Rain Stopper,” or approved equal.

3. Inserts will have a handle of plastic-coated stainless steel installed on the body of the insert dish. The handle will be attached with a #6 high-grade stainless steel rivet. Each dish will have a factory-installed 5-foot-long, 3/16 in. braided stainless steel retaining cable to connect the dish to the manhole frame.

5. Exercise care in selecting the proper insert dish to fit properly with the manhole frame and cover. The insert flange will have an outside diameter 3/16 in. less than the inside diameter of the manhole frame. Once proper fit is established, clean manhole frame surface of all dirt, grit and debris with a wire brush. Fully seal insert on the manhole frame, providing a watertight seal.

6. Securely attach retaining tether to the manhole frame following manufacturer's instructions with a tamper-proof anchoring device.

7. Replace damaged, tight-fitting or missing inserts identified prior to final inspection.

8. For new sanitary sewer manholes, subject to loading or differential movement at manhole frames, and for rehabilitated manholes, install manhole chimney seals to prevent inflow between manhole frames and masonry chimneys.

2.06 FRAME-TO-MANHOLE

A. A watertight flexible boot connection, as manufactured by Kor-N-Seal, Press-Seal Corporation, or approved equal.

B. Install frame-to-manhole butyl rubber sealants to prevent water migration between manhole frames and manhole structures.

1. Butyl rubber sealants shall be Kent Seal No. 2, Concrete Sealants CS202, or approved equal, between adjustments rings and manhole frames.

2. Install seals following manufacturer's installation instructions.

3. Arrange for manufacturer's representative to train Installer's personnel in proper methods of installing seals and for assistance.

C. Surfaces on which the sleeve or extension is to be compressed will be circular, clean, reasonably smooth and free of loose material and excessive voids. If a surface is rough or irregular and would not provide an effective seal, smooth it with an approved microsilica-enhanced grout. Repair flaws in manhole frames, such as cracks, pits or protrusions, by filling with concrete or grinding smooth. This type of surface work will need to be done on manholes that have not been lined; manholes that have been lined should not need any surface work in order to install the seal.

D. If internal surfaces of the chimney or corbel section of the manhole exceed a slope of 1 in 3, do not use a frame-to-manhole seal.

PART 3. EXECUTION – NOT USED

END OF SECTION

PART 1. GENERAL

1.01 DESCRIPTION

A. This work consists of clearing, grubbing, removing, and offsite disposal of all debris and of all vegetation, buildings, and foundations not removed by others that are within designated construction areas, easements, and temporary construction easements except for such objects that the A/E designates to remain. The work shall also include preserving and protecting from injury or defacement all vegetation and objects designated to remain.

B. The PUD Inspector or Engineer will designate all trees, shrubs, plants, and other items that are to remain. Paint required for cut or scarred surfaces of trees or shrubs selected for retention shall be an asphaltum base paint especially for tree surgery and approved by the PUD Inspector or Engineer.

PART 2. PRODUCTS – NOT USED

PART 3. EXECUTION

3.01 Clear the entire construction area of all weeds, brush, briars, bushes, trees, stumps, and other protruding obstructions not designated to remain, except within any areas which the PUD or Engineer may designate to remain undisturbed.

3.02 Perform all clearing and grubbing operations in accordance with the applicable provisions for erosion control as shown on the drawings and as required by local authorities.

3.03 Completely dispose of all materials resulting from clearing and grubbing off the site or at a location approved by the PUD Inspector or Engineer.

END OF SECTION

PART 1. GENERAL

1.01 DESCRIPTION

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

PART 2. PRODUCTS – NOT USED

PART 3. EXECUTION

3.01 PREPARATION OF THE SITE

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

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

C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth, grub the excavated area, and remove all large roots to a depth of not less than two (2) feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the PUD Inspector or Engineer. Fill all holes or cavities created during this work that extend below the subgrade elevation with

suitable material, and compact to the same density as the surrounding material.

D. Trees, cultivated shrubs, etc., that are situated within public rights-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the PUD Inspector or Engineer. Take special precautions to protect and preserve such growth throughout all stages of the construction.

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

3.02 UNSUITABLE MATERIALS

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

3.03 ROCKS AND BOULDERS

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

B. Should rock be encountered in the excavation, remove it by blasting or otherwise. Where blasts are made, cover the excavation with enough excavation material and/or timber or steel matting to prevent danger to life and property. The Contractor shall secure, at his own expense, all permits required by law for blasting operations and the additional hazard insurance required. Observe all applicable laws and ordinances pertaining to blasting operations.

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

3.04 DISPOSAL OF MATERIALS

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the drawings or directed by the PUD Inspector or Engineer shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of by the Contractor as specified below.

B. Waste materials may be deposited in spoil areas at locations approved by the PUD Inspector or Engineer. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain. Seed as specified in Section 02485, Seeding.

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

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

3.05 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

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

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

C. Unless the construction of lines by tunneling, jacking, or boring is called for by the drawings or specifically authorized by the PUD Inspector or Engineer, make excavation for pipelines in open cut and true to the lines and grades shown on the drawings or established by the PUD Inspector or Engineer on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: 4/3d + 15 inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the PUD Inspector or Engineer, the banks of trenches from the ground surface down to a depth not closer than one (1) foot above the top of the pipe may be excavated to non-vertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula 4/3d + 15 inches shall be at the expense of the Contractor and may be cause for the PUD Inspector or Engineer to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. For rigid pipe, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel. For plastic sewer lines, provide a minimum of six (6) inches of No. 67 (TDOT) crushed stone for bedding.

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

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

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

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

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

3.06 SHEETING, SHORING, AND BRACING

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

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

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

D. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement

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

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

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

3.07 THE DEWATERING OF EXCAVATION

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

3.08 BORROW EXCAVATION

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

B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2:1 unless otherwise directed by the PUD Inspector or Engineer Properly clear and grub borrow pits, and remove all objectionable matter from the borrow pit material before placing it in the backfill.

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

3.09 BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the PUD Inspector or Engineer. On each side of the line, from the bottom of barrel to one (1) foot above the top of the pipe, the backfill material shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or other objectionable materials and that has a size of no more than two (2) inches. Place this backfill simultaneously on either side of the pipe in even layers that before compaction are no more than six (6) inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. When shown on the drawings, this backfill shall, at locations beneath or closely adjacent to pavement, consist of No. 67 (TDOT) crushed stone.

B. If plastic sewer pipe is used, install No. 67 (TDOT) crushed stone in a six (6)-inch envelope on all sides of the pipe, then add the remaining backfill up to one (1) foot above the top of the pipe as described in the previous paragraph.

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

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

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

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

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

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

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

J. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the PUD Inspector or Engineer requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

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

3.10 MAINTENANCE

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

B. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and

whenever directed to do so by the PUD Inspector or Engineer. Continue such maintenance until final acceptance of the project, or until the PUD Inspector or Engineer issues a written release.

3.11 SLOPES

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

END OF SECTION

PART 1. GENERAL

1.01 REQUIREMENTS INCLUDED

A. Excavation for buried utility material

B. Provide necessary sheeting, shoring and bracing

C. Prepare trench bottom with appropriate materials

D. De-water excavations as required

E. Place and compact granular beds, as required, and backfill.

1.02 PRECAUTIONS

A. Contractor shall shore and brace all open cut trenches as required by State and Federal Laws and Local Ordinances; conform with recommendations set forth in AGC Manual of Accident Prevention in Construction; protect life, property, or work; and avoid excessively wide cuts in unstable material.

B. Notify utility, when necessary, to disturb existing facilities and abide by their requirements for repairing and replacing

C. Protect all vegetation and other features to remain

D. Protect all benchmarks and survey points.

PART 2. PRODUCTS

2.01 AGGREGATE FOR BEDDING AND BACKFILLING

A. No. 67 stone meeting the requirements of TDOT Section 903.22, Sizes of Course Aggregate

2.02 EXCAVATABLE FLOWABLE FILL

A. Flowable Fill (if applicable to the project) – Meet the requirements of TDOT Section 204.06 for Excavatable Flowable Fill. Load Application of 24 hours maximum with 28-day compressive strength of 30 psi and a 98-day compressive strength of 140 psi.

PART 3. EXECUTION

3.01 PREPARATION

A. Install barriers and other devices to protect areas adjacent to construction.

B. Protect and maintain all benchmarks and other survey points.

3.02 EXCAVATION TRENCHES

A. Perform in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.

B. Maximum width at the crown of the pipe shall be as specified in Sections 33 14 11 Water Mains and Accessories, 33 30 00 Sewer Mains and Accessories, and 33 30 10 Force Mains and Accessories.

C. Cut pavement along neat, straight lines with either a pavement breaker or pavement saw. Avoid castle cuts in pavement edges.

D. Trench depth: To provide minimum cover over the top of the pipe as specified in Sections 33 14 11 Water Mains and Accessories, 33 30 00 Sewer Mains and Accessories, and 33 30 10 Force Mains and Accessories.

E. Align trench as shown on the drawings unless a change is necessary to miss an unforeseen obstruction.

F. When unstable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline and backfill to the proper grade with coarse aggregate AASHTO M-43, Size No. 2 or 3.

G. Remove rock encountered in trench excavation to a depth of six (6) inches below the bottom of the pipe barrel. In no case shall solid roack exist within six (6) inches of the finished pipeline.

3.03 SHEETING, SHORING AND BRACING

A. When necessary, furnish, put in place, and maintain such sheeting, bracing, etc., as may be required to support the sides of the excavation and to prevent movement.

B. Take care to prevent voids outside the sheeting.

C. If voids are formed, immediately fill and compact to the satisfaction of the Engineer.

D. Unless adjacent facilities will be damaged, remove all sheeting, shoring, and bracing after backfill has been placed to a depth of 18 inches over the pipeline.

E. Cut shoring off at the top of the pipe and leave the lower section in the trench.

3.04 USE OF EXPLOSIVES

A. All blasting shall be approved in writing by the City Engineer prior to permitting.

B. Contractor shall obtain all permits required to use explosives.

C. No blasting materials shall remain on the site overnight.

3.05 CLEANUP AND DISPOSAL OF EXCAVATED MATERIAL

A. Dress for final inspection all excavated and graded areas to within reasonably close conformity to the lines, grades and cross-section shown on the drawings:

1. Producing a uniform, satisfactory finish per the City Engineer or his agent.

2. Scale rock cuts of all loose fragments and leave in a neat, safe and workmanlike condition.

3. Clean the entire rights-of-way or easement of all vegetation unless otherwise specified on the drawings.

4. Clear and clean all structures of all objectionable materials and obstructions.

5. Perform final dressing prior to sodding or seeding operations.

B. Dress spoil banks, waste areas, etc., in a satisfactory manner.

C. Dispose of excess material created by trimming slopes, re-sloping, and shaping outside the rights-of-way.

D. Promptly remove cleared debris from site.

E. Obtain permission from applicable regulatory authority for disposal of debris to waste disposal site.

F. Satisfactorily dispose of all excess excavated.

3.06 UNAUTHORIZED EXCAVATION

A. Unauthorized excavation is defined as all excavation outside or below the proposed line and grades shown on the drawings.

B. Backfill areas of unauthorized excavation with the type material necessary (earth, rock, or concrete) to ensure the stability of the structure of construction involved.

C. Unauthorized excavation or backfill to replace same shall not be a pay item.

3.07 REMOVAL OF WATER

A. Keep excavated areas free of water while work is in progress.

B. Well-pointing shall be performed if required.

C. Take particular precautions to prevent the displacement of structures or pipelines as a result of accumulated water.

3.08 OBSTRUCTIONS

A. Obstructions shown on the drawings are for information only and do not guarantee their exact locations nor that other obstruction are not present.

B. When utilities or obstruction are not shown on the drawings but are present off the roadway at the location of the proposed pipeline route, the Contractor may request to relocate the pipeline to avoid disturbing the utility or obstructions.

C. If the relocation is approved, the Contractor shall receive compensation of additional granular backfill and pavement replacement if required.

D. Exercise due care in excavating adjacent to existing obstructions and do not disturb same unless absolutely necessary.

E. In the event obstructions are disturbed, repair or replace as quickly as possible to the condition existing prior to their disturbance. This repair or replacement shall not be a pay item.

F. If desire by the utility, pay for the repair or replacement work performed by the forces of the utility or other appropriate party.

G. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of same from payments to the Contractor.

3.09 INITIAL BACKFILLING/BEDDING

A. Do not begin backfilling before the City Engineer or his representative has inspected the grade and alignment of the pipe, the bedding of the pipe and the joints between the pipe. If backfill material is placed over the pipe before an inspection is made, reopen the trench in order for an inspection to be made.

B. Perform bedding and initial backfilling by hand, together with tamping, until fill has progressed to 12 inches above the top of the pipe.

1. For bedding, deposit NO 67 stone material approximately six (6) inches thick. All bedding material (inside roadways, paved areas, or in earth) shall be No. 67 stone. Bell holes shall be prepared in the bedding zone for the pipe to rest in. Pipe shall not be supported on the pipe bells.

2. For initial backfill (inside roadways, paved areas, or in earth), encapsulate the pipe with No. 67 stone material to a point twelve (12) inches above the top of the pipe.

3. Use tamps and machines of a suitable type which do not crush or otherwise damage the pipe.

3.10 FINAL BACKFILLING

A. After the initial backfill has reached a point 12 inches above the top of the pipe, perform final backfilling depending upon the location of the work and danger from subsequent settlement.

B. Where pipe is located inside local roadways, final backfilling shall be with Grade D crushed stone.

C. Where pipe is located inside State Highways, final backfilling shall be with excavatable flowable fill.

D. Backfilling in Unimproved Areas:

1. Dispose of and replace all soft or yielding material, which is unsuitable for trench backfill with suitable material.

2. Deposit backfill to the surface of the ground by dragline, bulldozer, or other suitable equipment in such a manner so as not to disturb the pipe.

3. Neatly round sufficient surplus excavated material over the trench to compensate for settlement.

4. Dispose of all surplus excavated material.

5. Prior to final acceptance, remove all mounds to the elevation of the surrounding terrain.

3.11 RESTORING TRAFFIC USE IN ROADWAYS

A. All cuts in State Highways shall be covered with steel plates capable of supporting vehicular traffic until final pavement repair is complete. Plates shall be staked in place to prevent movement when crossed by traffic.

B. For all cuts in local roadways, a dense grade aggregate shall be used for the top six (6) inches as a temporary surface to restore traffic. The dense grade aggregate must be maintained in thickness and be kept flush with the existing roadway until final pavement repair is complete.

END OF SECTION

PART 1. GENERAL

1.01 DESCRIPTION

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

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

1 Refer to other sections for work related to that covered by this section.

PART 2. PRODUCTS

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

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

C. CRUSHED STONE CHIPS: Size 6 or Size 7 (Subsection 903.14)

D. DOUBLE BITUMINOUS SURFACE: for both courses, either cutback asphalt, Grade RC-800 or RC-3000, or emulsified asphalt, Grade RS-2 (Subsections 904.02 and 904.03)

E. ASPHALTIC CONCRETE BINDER: Grading B or C, as directed by the A/E (Section 307)

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

G. ASPHALTIC CONCRETE SURFACE: Grading E (Section 411)

H. QUICK DRY TRAFFIC MARKING PAINT (WHITE AND YELLOW): Subsection 910.05.

PART 3. EXECUTION

3.01 SUBGRADE

A. Before any base material is installed, compact the subgrade of the area to be paved to 98% of optimum density as determined by ASTM D698 (Standard Proctor).

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

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

3.02 BASE

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

3.03 SEAL COAT SURFACE

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

3.04 DOUBLE BITUMINOUS SURFACE

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

cover with Size 7 chips at a rate of 20 to 25 pounds per square yard. Then roll the entire area.

B. After the application of the cove aggregate, lightly broom or otherwise maintain the surface for a period of 4 days, or as directed by the A/E. Maintenance of the surface shall include the distribution of cover aggregate over the surface to absorb any free bitumen and cover any areas deficient in aggregate. Sweep excess material from the entire surface with rotary brooms. Sweep the surface at the time determined by the A/E.

3.05 ASPHALTIC CONCRETE BINDER

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

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

3.06 ASPHALTIC CONCRETE SURFACE

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

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

3.07 SMOOTHNESS

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

3.08 SAMPLING AND TESTING

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

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

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

END OF SECTION

PART 1. GENERAL

1.01 DESCRIPTION

A. This work consists of preparing the soil, seeding/sodding, removal of temporary sediment controls, permanent stabilization, landscape planting, and cleanup within designated construction areas, easements, and temporary/ permanent construction easements. All work for this section shall be considered incidental to a project bid item. Some contracts may include an allowance for planting landscaping. Seeding or sod shall not be considered in this context to be landscape planting.

B. Preparation of the soil shall include utilization of a rock hound or similar equipment to remove rocks and gravel from the surface, placement of topsoil, fertilization, finish grading as required by the PUD Inspector or Engineer, and removal of all debris and trash.

C. Temporary Seeding shall be as prescribed on the contract plans and in accordance with the Tennessee Erosion Protection and Sediment Controls Handbook latest edition (TNEPSC Handbook).

PART 2. PRODUCTS

2.01 GRASS SEED: Kentucky 31 Fescue (Festuca elatior) and/or annual rye meeting the requirements of the State Department of Agriculture and furnished in new bags or bags that are sound and not mended; no "below standard" seed will be accepted. Oats shall also be seeded as to establish a vegetative ground cover to prevent erosion.

2.02 SOD:

A. The sod shall consist of a dense, well-rooted growth of permanent and desirable grasses, indigenous to the general locality it is to be placed, that is practicably free from weeds or undesirable grasses. When cutting the sod, the grass should be approximately 2 inches long. If longer, cut the grass to approximately this length and rake the sod free of debris

B. If the sod is in a dry condition such that cutting it causes crumbling or breaking, the contractor shall, at least 12 hours before cutting, apply water to it in sufficient quantities to provide a well-moistened sod throughout the depth it is cut.

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

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

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

2.06 EROSION CONTROL BLANKETS: The materials shall conform to the type specified on the drawings and shall meet or exceed the United States Department of Agriculture: Natural Resources Conservation Service, Material Specification, MS-219.

PART 3. EXECUTION

3.01 SOIL PREPARTION

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

B. Remove all debris and trash from site as work is performed. Removal shall be consistent with all Federal, State, and Local laws and as directed by the Owner.

C. Rock and gravel removal shall be performed after all trench work is complete and settled, but prior to finish grading. A rock hound or similar equipment should be utilized to avoid rocks from resurfacing after rains.

D. Before beginning seeding operations in any area, complete the placing of topsoil and final grading, and have the work approved by the PUD Inspector or Engineer.

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

F. Apply fertilizer and agricultural limestone uniformly over the seedbed, and lightly harrow, rake, or otherwise incorporate them into the soil for a depth of approximately one (1) inch at the following rates:

1. Fertilizer: 15 pounds per 1,000 square feet

2. Agricultural Limestone: 40 pounds per 1,000 square feet

3.02 SEEDING

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

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

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

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

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

3.03 MULCHING

A. Spread straw/mulch material evenly over the seeded areas immediately following the seeding operation.

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

B. The mulch rate may be varied by the PUD Inspector or Engineer, depending on the texture and condition of the mulch material and the characteristics of the area seeded. Cover all portions of the seeded areas with a uniform layer of mulch so that approximately 25% of the ground is visible.

3.04 STABILIZATION MATTING

A. Matting shall be utilized on all slopes greater than 3:1 and any areas subject to channelization to prevent ruts.

B. Installation shall be in compliance with the TNEPSC Handbook and per the project details.

PART 4. QUALITY CONTROLS

4.01 INSPECTIONS

A. The PUD Inspector or Engineer shall inspect the seeding within 60 days after planting to rate new grass stand.

1. Grass stand shall be acceptable at 70% coverage or a mix of 70% grass/with stabilization matting to achieve 70% coverage.

2. Failure to achieve 70% coverage shall result in rework of the ground, re-fertilize, reseeding, and re-mulching. Any area not establishing grass shall be reseeded as directed by the PUD Inspector or Engineer. Areas that are subject to erosion runoff where grass seed cannot be established shall be sodded. No additional payment shall be made for reseeding and re-mulching.

END OF SECTION

PART 1. GENERAL

1.01 SCOPE

A. Perform work needed to make manholes structurally sound, improve flow, prevent entrance of inflow or groundwater, prevent entrance of soil or debris, and provide protection against hydrogen sulfide gas attack.

B. Manufacturer's Product Support: When requested by Portland Department of Utilities (PDU), provide a representative employed by the manufacturer having technical training in admixture and manhole wall liner available for consultation on site upon 48-hours notice.

1.02 SUBMITTALS

A. Installer Qualifications: Submit qualifications to PDU for installers of liners and wall repair systems. Contractor shall be an approved installer as certified and licensed by the manufacturer. Contractor shall submit a list of installer’s personnel who have satisfactorily completed manufacturer’s training in product application within the previous 2 years. Include date of certification for each person.

B. Product Data: Submit product data and include SDS for all products to be installed under this section of the Specifications.

C. Contractor shall submit compete shop drawings of the manhole lining system(s) to demonstrate compliance with these Specifications, materials, and detailed installation procedures. Testing procedures and quality control procedures shall also be submitted. Certifications that the lining system was manufactured in accordance with these Specifications and the applicable ASTM standards shall be submitted with each material shipment.

1.03 PROJECT CONDITIONS

A. Manhole lining shall not be installed until all required mainline sewer rehabilitation and/or manhole work is completed.

B. Manholes Containing Mechanical or Electrical Equipment:

1. Drawings may not show locations of flow monitoring equipment. If a manhole contains any mechanical hardware or electrical flow monitoring equipment, immediately notify a PDU Representative.

2. Reschedule work in such manholes until equipment has been removed and further instructions are given.

3. Do not subject manholes with mechanical hardware or electrical equipment to diversion or bypass pumping.

4. The Contractor will be financially responsible for any damage to equipment due to Contractor's failure to adhere to the instructions stated within this section.

C. Field Location of Manholes, Cleanouts and End of Lines:

1. Contractor is responsible for locating and uncovering all manholes, cleanouts, and ends of lines. If Contractor is unable to locate manholes, cleanouts, or ends of lines, they will need to notify the PDU Sewer Collections Supervisor.

2. Manholes may be located within project limits which are not part of the system being rehabilitated. Properly identify manholes before starting work.

PART 2. PRODUCTS

2.01 WALL CLEANING MATERIALS

A. High Pressure Water: 3,500 psi minimum force.

B. Cleaners: Detergent or muriatic acid capable of removing dirt, grease, oil and other matter which would interfere with bond of sealing material to wall; refer to sealing material manufacturer's recommendations.

2.02 WALL REPAIR MATERIALS

A. Epoxy Resin-Based Linings

1. Epoxy resin-based liners shall be 100% solids by volume, volatile organic compound (VOC) free and shall conform to the minimum physical properties listed in the following table:

Compressive Strength	ASTM D695	10,500PSI
Tensile Strength	ASTM D638	7,000
Flexural Strength	ASTM D790	12,000
Flexural Modulus (initial)	ASTM D790	730,000
Density		971 ± PCF
Bond		Exceed tensile strength of substrate

2. The structures lined with epoxy resin-based liners shall be resistant to corrosion caused by the following:

a. Hydrogen Sulfide

b. 20% Sulfuric Acid
c. 17% Nitric Acid
d. 5% Sodium Hydroxide
e. All common ingredients normally associated with sanitary sewer environments.

3. The finished liner shall have long-term (50-year) flexural modulus of elasticity value of 500,00 psi and shall be certified by independent third-party testing.

4. Epoxy resin-based linings shall be compatible with existing thermal conditions in the manhole.

5. The final product shall not deteriorate, corrode, or lose structural strength in any manner.

6. The system shall be designed to operate at ambient temperatures up to 140 degrees Fahrenheit (°F) with excellent abrasion resistance.

7. Chemical sealants or grouts used to seal active manhole leaks, patch holes or cracks, fill voids, and to otherwise prepare the manhole surface for lining shall be suitable for wastewater system service and chemically resistant to any chemicals or vapors normally associated with domestic wastewater installations.

B. Cementitious Lining Systems

1. The cementitious lining system shall be pumpable Portland-based cement or fused calcium aluminate cement. The lining shall be applied via low-pressure spray or trowel application only. The materials shall be suitable for all specified design conditions. The final product shall not deteriorate, corrode, or lose structural strength in any manner.
2. The cementitious lining shall be installed on manhole benches, inverts, and walls, unless otherwise directed by a PDU Representative.
3. The materials used in the cementitious lining systems shall be mixed on-site, according to the manufacturer’s recommendations. Water shall be added to the materials only during the mixing process and prior to material pumping or spray application. No water shall be added at the nozzle.

4. The cementitious liner, when cured, shall have the following minimum characteristics at 28 days as measured by the applicable ASTM standards referenced in this Specifications:
    a. Minimum compressive strength of 6,000 psi
    b. Minimum bond strength of 130 psi
    c. Shrinkage of less than 0.05%

C. Level B Lining Systems

1. The Level B lining system shall be a cementitious lining system product applied with a minimum 1-inch finished thickness with an epoxy topcoat of a minimum finished thickness of 100 mils. Epoxy topcoat shall be one of the following products or an approved equal:
    a. Raven 405 as manufactured by Raven Lining Systems
    b. Cor-Guard as manufactured by APM, Inc.
    c. Mainstay DS-5 as manufactured by Madewell Products Corp.
    d. Cor-Cote SC as manufactured by Sherwin-Williams
    e. Ecodur 201 by Castagra

D. Level C Lining Systems

1. The Level C lining system shall be an epoxy resin-based lining system applied with a minimum finished thickness, exclusive of any required substrate preparation to enhance structural integrity and/or adhesion of the liner to the substrate as recommended by the lining system manufacturer, of 250 ml (1/4-inch) and shall be one of the following products or approved equal:
    a. Spraywall or Sprayshield as manufactured by Sprayroq, Inc.
    b. S-301 Epoxy Spray System as manufactured by Warren Environmental, Inc.
    c. SprectraShield Liner Systems as installed by Sprectra Tech
    d. Ecodur 201 by Castagra
    e. Mainstay by Madewell Products Corporation

PART 3. EXECUTION

3.01 GENERAL

A. Excavate in accordance with Section 31 23 23 TRENCHING AND BACKFILLING.

B. Perform work in accordance with all applicable OSHA standards. Contractor shall comply with all OSHA trench safety requirements.

3.02 PROTECTION

A. Provide barricades, warning lights, and signs for manhole or cleanout removal excavations. Contractor shall comply with the Manual of Uniform Traffic Control Devices (MUTCD).

B. Do not allow soil, sand, debris, or runoff to enter sewer system.

3.03 DIVERSION PUMPING

A. A PDU Representative shall be notified of the detailed sewage bypassing plan and time to be executed prior to execution.

B. The Contractor shall bypass pump sewage flows around the manhole being rehabilitated while the work is being performed. The Contractor shall be responsible for any equipment associated with bypass pumping and/or removal of effluent.

C. In the event of accidental spill or overflow, the following actions will be executed in the order below:

1. Immediately stop the overflow.

2. Notify the PDU Sewer Collections Supervisor, so the required reporting can be made to TDEC. If needed, take pictures of the overflow for the PDU Sewer Collections Supervisor’s reporting.

3. Clean up the surrounding area.

4. Disinfect spillage and add lime, if needed.

3.04 MANHOLE WALL CLEANING

A. Clean bench/invert floor and interior walls of manholes by removing deleterious material, including dirt, grease, and other debris. If required, use detergent or muriatic acid to remove grease, oil, and other matter that would interfere with bond between existing manhole wall and approved repair materials.

B. Prepare interior surfaces, as recommended by the wall liner material manufacturer. Remove brick steps and cast-iron steps prior to wall lining.

3.05 MANHOLE WALL SEALING

A. Remove loose or defective wall material. Wipe or brush surfaces clean prior to application of hydraulic cements.

B. Seal active leaks in manhole structures, with an appropriate grout compatible with the lining. Injection grouting may be required to seal active leaks, including existing leaks in invert channels and benches. All patch repairs shall be smooth and even with the manhole wall. All voids between sewer pipes and manhole walls, and around existing manhole rungs steps and anchors shall be filled.

C. After active leaks have been stopped, Contractor shall prepare the manhole to receive lining as necessary by reshaping and repairing benches, inverts, and walls where required including smoothing out irregular-shaped corbel and chimney sections prior to any spray application.

D. All interior surfaces shall be prepared as recommended by the lining system manufacturer.

E. Prior to lining, the PDU Inspector or Sewer Collections Supervisor shall inspect and approve the surface preparation work. The Contractor shall notify the PDU Inspector or Sewer Collections Supervisor when the manholes are ready for inspection. The manhole lining shall be performed immediately after the inspection or the manhole may need to be re-cleaned prior to lining application to remove accumulated debris on walls and benches.

F. Appropriate personal protective equipment shall be utilized with supplied air to the spray technician and other personnel in direct contact with the spray environment.

G. Properly apply sealing compound to provide the minimum required uniform coating to the wall surface.

H. Manhole walls and benches shall be monolithically coated to the required thickness by spray-on methods in a single pass or application. Sprayed cementitious linings shall be troweled smooth after application.

I. Covers or plugs shall be placed over all pipe openings to prevent excess material from entering the Wastewater Collections System.

J. The finished invert surfaces shall be smooth, free of ridges and bumps, and will be sloped in the direction of flow. Remove droppings of foreign

and wall sealant materials before they harden on the bottom of the manhole. Special care shall be taken to ensure a smooth transition between the manhole invert and intersecting pipeline inverts for flow to not be impaired.

K. The cured surface shall be smooth, with the minimum required thickness, and continuous with proper sealing connections to any non-rehabilitated areas.

L. Strictly follow product manufacturers' published instructions and recommendations for surface preparation, application, and proportioning.

3.06 MANHOLE REMOVAL AND REPLACEMENT

A. When indicated on the PDU-approved Construction Drawings or instructed by PDU Representative, excavate, properly remove, and dispose of the existing manhole, including base.

B. Employ a trench safety system and keep the excavation dry from sewage flow and surface or ground water.

C. When replacing an existing manhole with a new manhole, the new manhole shall meet all requirements set forth in Section 03 40 00 PRECAST CONCRETE STRUCTURES.

D. Reconstructing drop connections shall be as specified in Section 33 30 00 SEWER MAINS AND ACCESSORIES.

E. Sewer pipe up to 6 feet outside new manholes may be replaced with new sewer pipe, in conjunction with manhole removal and replacement.

3.07 MANHOLE BENCHES/INVERTS

A. Remove obstructions and loose materials from benches prior to shaping inverts. Form smooth, U-shaped inverts having minimum depths of one-half the pipe diameter and channel it across the floor of the manhole using an approved manhole rehabilitation material. Control flow to allow sufficient setting time for material used.

B. Make finished benches and inverts smooth and without defects which would allow accumulation of debris.

3.08 FIELD QUALITY CONTROL

A. Inform PDU Inspector or Engineer immediately if materials being used are not producing required results or need modification. The Engineer has the right to stop the use of any material at any time.

3.09 INSPECTION

A. After manhole wall sealing or manhole rehabilitation is complete, visually inspect manholes in the presence of a PDU Representative. Check for cleanliness and for elimination of active leaks.

B. At the completion of manhole rehabilitation, assist the PDU Representative in verifying installation of minimum coating thickness of concrete liner. Test several points on manhole walls. Repair verification points prior to final acceptance for payment.

3.10 TESTING

A. Perform leakage testing for manholes, refer to Section 33 30 00 SEWER MAINS AND ACCESSORIES.

3.11 BACKFILL.

A. Backfill and compact soil in area of excavation surrounding manholes in accordance with Section 31 23 23 TRENCHING AND BACKFILLING.

B. In unpaved areas, grade surface at a uniform slope of 1 to 5 from the manhole frame to natural grade. Provide at least 4 in. of topsoil as specified in Section 32 90 00 PLANTING SEED OR SOD.

END OF SECTION

PART 1. GENERAL

1.01 DESCRIPTION

A. The work to be performed hereunder shall consist of the installation of a casing pipe for the purpose of installing a sanitary sewer or water line as shown on the drawings or as called for in these specifications. It shall include the excavation of a boring pit, auger boring between the points as specified on the drawings, furnishing and installing of the carrier pipe, and disposing of the excavated materials in the manner herein provided.

PART 2. PRODUCTS

2.01 CASING PIPE

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

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE
FOR E80 LOADING

Pipe Diameter (in)	Casing Pipe Diameter (in)	Nominal Thickness Uncoated (in)
4	8	0.375
6	12	0.375
8	16	0.375
10	20	0.375
12	24	0.500
16	30	0.500
18	36	0.500
24	48	0.500

TABLE OF MINIMUM WALL THICKNESS FOR STEEL CASING PIPE
FOR H-20 LOADING

Pipe Diameter (in)	Casing Pipe Diameter (in)	Nominal Thickness Uncoated (in)
4	8	0.250
6	12	0.282
8	16	0.375
10	20	0.375
12	24	0.375
16	30	0.375
18	36	0.375
24	48	0.375

2.02 CASING SPACERS

A. The casing spacer shall be flanged, bolt-on style, with a two-section T-304 stainless steel of a minimum 14-gauge thickness.

B. Each shell section shall be lined with a 0.090” thick ribbed PVC extrusion, with a retaining section that overlaps the edges of the shell and prevents slippage. PVC liner shall have a hardness of 85-90 durometer.

C. Casing spacers shall be Model C1 or S1 as manufactured by Advance Products and Systems or approved equal.

D. The size, spacing, and quantity of the casing spacers shall be determined by the manufacturer’s recommendation for each size carrier pipe and casing, but the following criteria must be met:

1. The maximum spacing for casing spacers on center shall be 8 feet.

2. Spacers must prevent pipe bell from resting on casing pipe.

3. Casing Spacer shall be located 12 inches on each side of every pipe joint.

2.03 END SEALS

A. End seals shall be Link-Seal Model C modular end seal, with bolt driven force dispersion plates with direct ground burial applications, or approved equal.

PART 3. EXECUTION

3.01 BORING

A. Interpretation of soil investigation reports and data, investigating the site and determination of the soil conditions is the sole responsibility of the Contractor. Any subsurface investigation performed by the Contractor must be approved by the appropriate authority having jurisdiction over the site.

B. Casing construction shall be performed so as not to interfere with, interrupt, or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from casing operations and shall repair and restore all property to its original or better condition.

C. Face Protection: The face of the excavation shall be protected from the collapse of the soil or from debris entering the casing space.

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

3.02 INSTALLATION OF CASING PIPE

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

B. For boring casing pipes, jack the steel casing pipe into place as the boring proceeds. Weld sections of casing pipe together to provide watertight joints.

C. Do not remove unacceptable casing without prior approval from the A/E. If the removal of casing pipe is permitted, make proper provisions to prevent caving in of the earth surrounding the casing.

3.03 INSTALLATION OF CARRIER PIPE

A. Upon acceptance of the casing by the PDU Inspector or appropriate Utility Supervisor, install the carrier pipe in the casing by jacking it through the casing. If necessary to achieve proper line and grade on the carrier pipe,

strap wood or other suitable blocking to the carrier pipe to offset any minor variations in the alignment of the casing.

3.04 LAYOUT OF WORK

A. The Owner will provide the necessary control points required by the Contractor for this construction. The Contractor will provide the detailed layout required to keep the tunnel or bore on grade.

3.05 GUARANTEE OF WORK

A. Guarantee a usable completed casing between the points specified and to the line and grade specified. The allowable tolerance at the downstream end point of the bore shall be such that the invert of the carrier pipe may be positioned within a vertical area limited on the top by an elevation no higher than the elevation shown on the drawings and on the bottom by an elevation no lower than the existing inlet pipe invert. For sewers, the sides shall be a minimum of 8 inches inside the interior face of the manhole at the end of the bore.

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

END OF SECTION

PART 1. GENERAL

1.01 DESCRIPTION

A. This section describes qualifications, materials, and execution of work performed in pipe installation by pipe bursting.

B. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications including the reconnection of lateral service lines and restoration of surfaces.

1.02 QUALIFICATIONS

A. The Contractor shall have:

1. Certification and licensing through the proposed pipe bursting system manufacturer

2. At least 3 years' experience in sewer rehabilitation, including pipe-bursting a minimum of 10,000 linear feet of the same size pipe required for the project or larger

B. Personnel involved with installing pipe shall receive training in proper method for handling and installing.

C. Training for pipe installers shall be performed by pipe manufacturer's certified representative.

1.03 SUBMITTALS

A. Construction Plans

1. Dimensioned layout drawings including size and location of pits and excavations

2. Installation plan showing proposed method of installation, including location of pits, direction, and length of pulls.

3. Bypass pumping plan, including an emergency response plan to be followed in the event of bypass pumping system failure and a backup bypass pump onsite.

B. Shop Drawings

1. Shop drawings are required to be submitted to PDU for review on all utility materials within a project, in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

2. Documents of all the qualifications listed above, in subsection 1.02, will need to be provided to PDU.

PART 2. PRODUCTS

2.01 HDPE PIPE

A. Polyethylene plastic pipe shall be High Density Polyethylene Pipe (HDPE) and meet applicable requirements of ASTM F14.

B. HDPE pipe, fittings, and all additional appurtenances (manholes, tees, gaskets, etc.) will be used in accordance with the material specifications.

C. All pipe installed by pipe bursting will be joined by butt fusion, electrofusion, or full circle repair clamp as detailed in the subsection below, 2.03: Pipe Joining for Terminal Sections of HDPE Pipe.

D. HDPE pipe will be produced from resins, meeting the requirements of: ASTMD1248, designation PE4710, ASTM D3350 cell classification PE345444C, AWWA C901, and AWWA C906.

E. HDPE pipe will meet the minimum stability requirements of ASTM D3350.

F. Pipe will be legibly marked at intervals of no more than five (5) feet with the manufacturer's name, trademark, pipe size, HDPE cell classification, appropriate legend such as SDR 17, ASTMD3035, AWWA C901 or C906, date of manufacture, and point of origin.

G. All pipe shall be made of virgin material. No rework material, except that obtained from the manufacturer’s own production of the same formulation shall be used.

H. The pipe shall be homogeneous throughout and shall be free of visible cracks, holes, foreign material, blisters, or other deleterious faults.

I. Pipe color shall be solid black, unless otherwise specified.

J. HDPE pipe shall be Ductile Iron Pipe Size (DIPS), unless otherwise specified.

K. The HDPE pipe shall be DR 17 or approved equal.

2.02 PIPE JOINING FOR TERMINAL SECTIONS OF HDPE PIPE.

A. The polyethylene pipe shall be assembled and joined at the site using the butt fusion method to provide a leak proof joint. Threaded or solvent cement joints and connections are not permitted. All equipment and procedures used shall be in strict compliance with the manufacturer’s

recommendations. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.

B. Terminal sections may also be joined by Electrofuse Couplings by Georg Fischer, Integrity Fusion Products, or approved equal.

2.03 MATERIALS RELATED TO SEWER SERVICE CONNECTIONS

A. Sewer service connections to the HDPE main shall be made by:

1. Plastic saddles with stainless steel straps manufactured by GPK or approved equal

2. Rubber saddles with stainless steel straps by Romac Industries or approved equal

B. Sewer service connections to the main may also be made with Electrofusion Saddles by Central Plastics, Friatec, or approved equal.

C. Sewer service connections to the main may also be made with Inserta Tees by ADS.

2.04 MATERIALS FOR SEALING MANHOLES

A. The annular space at each manhole may be sealed with Oakum saturated with Avanti 202 or approved equal and covered with a quick setting grout.

B. The annular space at each manhole may also be sealed with a water stop gasket by Fernco Company or approved equal and finished with a quick setting grout.

C. For manholes requiring a full restoration see Section 33 01 30 MANHOLE RESTORATION.

PART 3. EXECUTION

3.01 GENERAL

A. Bypass Pumping shall be accomplished when and where necessary. The Contractor shall provide flow diversion with pumps adequate in size and capacity to handle all flows generated during the pipe burst process. All costs for by pass pumping shall be incidental unless specific pay items for this work are included in the pay schedule.

B. Excavation of insertion pits shall be at locations determined by the Contractor.

C. Insertion pits shall be of sufficient length to allow the bursting head and new HDPE pipe to enter the host pipe at an angle that will maintain the grade of the existing sanitary sewer.

3.02 PREPARATION

A. All sewer service connections shall be located prior to pipe bursting the main by PACP Pre -CCTV Inspection.

B. If the PACP Pre-CCTV inspection reveals obstructions or pipe materials that will prevent the existing pipe from being pipe burst properly and cannot be removed by conventional cleaning equipment, a point repair will be made by the Contractor as in Section 3.06, with approval from the Owner/Engineer. Separate payment for this work will be made and it is not considered incidental to the pipe bursting process.

C. If the PACP Pre-CCTV inspection reveals a sag or hump greater than one-third (1/3) diameter of existing pipe, the sag or hump removal will be made by the Contractor, with approval from the Owner/Engineer. Separate payment for this work will be made and it is not considered incidental to the pipe bursting process.

D. Before any excavation is done for any purposes, the Contractor shall contact Tennessee One Call agency for determining field locations of existing utilities.

3.03 INSERTION OF THE HDPE PIPE

A. The polyethylene pipe shall be assembled and joined at the site using the butt fusion method to provide a leak proof joint. Threaded or solvent cement joints and connections are not permitted. All equipment and procedures used shall be in compliance with the manufacturer's recommendations. Fusing shall be accomplished by personnel certified as fusion technicians by a manufacturer of HDPE pipe and/or fusing equipment.

B. The butt used joint shall be in true alignment and shall have uniform rollback beads resulting from the use of proper temperature and pressure. The joint shall be allowed adequate cooling time before removal of pressure. The fused joint shall be water tight and shall have tensile strength equal to that of the pipe. All defective joints shall be cut out and replaced at the expense of the Contractor.

C. An appropriate relaxation period shall be allowed prior to making service connections and connecting to manholes. The relaxation period shall be appropriate with and dependent upon site conditions, as determined by Contractor.

D. If concrete encasements are encountered, a point repair shall be performed to excavate and break out concrete prior to the bursting operation to allow the steady and free passage of the pipe bursting head, with approval from the Owner/Engineer. Separate payment for this work will be made and itis not considered incidental to the pipe bursting process.

3.04 SERVICE RECONNECTIONS

A. Service connections to the HDPE pipe shall be made with materials submitted and approved in accordance with Paragraph 2.03 Materials Related to Service Connections. Services shall be reconnected so as to minimize disruption of service.

B. After the new HDPE pipe has been installed and tested, the Contractor shall be responsible for reconnecting existing sewer services in the manner described in the bid form. All service lines shall be the size indicated in the plans and specifications.

3.05 CCTV INSPECTIONS

In accordance with *Section 33 30 00 SEWER MAINS AND ACCESSORIES*, subsection 4.13 Close-Circuit Televising (CCTV) Sanitary Sewer Mains.

3.06 POINT REPAIRS

A. Repair pipe where point repairs are identified on Drawings.

B. Work shall include:

1. Verifying location of point repair.
2. Locating interfering utilities.
3. Providing temporary flow bypassing.
4. Providing traffic control.
5. Pipe repair.
6. Backfill and restoration.

3.07 EXISTING MANHOLE:

A. Utilize where practical. Otherwise, excavate predetermined machine and insertion pits.

B. Remove inverts, benches, and channels to permit access for installation equipment.

C. Enlarge input and output pipe openings to accommodate maximum OD size of bursting device.

D. At no time shall bursting device and installation process place undue stress on existing manhole opening surface.

E. Secure pipe to concrete structure or manhole after pipe has been installed.

1. Install waterstop or flange adapter that is fused and seated perpendicular to pipe axis, around pipe exterior, and grouted into structure wall to create watertight seal at manhole wall.

2. Install pipe to extend 12 inches inside manhole opening.

3. Make structure and manhole connections 12 hours, minimum, after pipe insertion.

F. Reconstruct benches and channels after new pipe is installed.

3.08 SEALING MANHOLE:

A. Place electrofusion flex restraints on top (180 degrees) section around newly installed pipe against inner manhole wall and fuse in place. Installation of electrofusion flex restraints shall be carried out in conformance with manufacturer's printed instructions by personnel certified by pipe manufacturer in proper method of installing electrofusion fittings.

B. Seal annular space at manhole. Seal shall extend a minimum of 8 inches into manhole wall in such a manner as to form smooth, uniform, watertight joint.

C. Reshape and smooth manhole invert as specified in Section 33 05 13, Manholes.

D. Use approved manhole rehabilitation materials to form a smooth transition with a reshaped invert and a raised manhole bench to eliminate sharp edges of liner pipe, concrete bench, and channeled invert.

E. Build up and smooth invert of manhole to match flow line of new liner.

F. Repair pipe seals in accordance with *Section 33 30 00 Sewer Mains and Accessories*.

3.09 MANHOLE REPLACEMENT

Where insertion pit or pull pit is excavated adjacent to existing manhole which is not scheduled to be replaced, and when manhole sustains visible damage as a result of excavation or activity in that insertion pit, replace manhole with new manhole conforming to *Section 33 30 00 Sewer Mains and Accessories*.

3.10 TESTING

A. General:

1. Furnish equipment to conduct test.

2. Pressure gauge used shall have minimum divisions of 0.10 psi and accuracy of 2.5 percent.

3. Prior to inspection and acceptance of pipe by Owner or Owner's Representative, flush and clean system to remove accumulated construction debris, rocks, gravel, sand, silt, and other foreign material.

B. After installation of replacement pipe, CCTV inspect sewer line. Correct deficiencies and provide final CCTV inspection accordance with 33 30 00 SEWER MAINS AND ACCESSORIES subsection 4.13 Close-Circuit Televising (CCTV) Sanitary Sewer Mains.

C. Low Pressure Air Testing: Prior to service lines being connected, test manhole to manhole section of sanitary sewer in accordance with ASTM F1417. Conduct as follows:

1. Pressurize test section to 4.0 psi and hold above 3.5 psi for not less than 2 minutes. Add air as necessary to keep pressure above 3.5 psi.

    a. When prevailing groundwater is above sewer being tested, increase test pressure 0.43 psi for each foot water table is above invert of sewer.

    b. If calculated test pressure due to high groundwater is in excess of 9 psi, discuss test procedure with Owner or Owner's Representative.

2. At end of 2-minute stabilization period, note pressure and begin test period. If building service connections have been reinstated before air test, they shall be considered part of pipe to which they are connected and no adjustment of test time shall be allowed.

3. Test Failure:

    a. If pressure drops 0.5 psi in less than time given in table below:

Leakage Rates	
Carrier Pipe Diameter (Inches)	Minimum Elapsed Time (Minutes)
8	4
10	5
12	6
15	7
18	8
21	10
24	13
27	15
30	18

    b. If time for pressure to drop 0.5 psi is 125 percent or less of the time given in table, repressurize line to 3.5 psi and repeat test.

3.11 SEQUENCING AND SCHEDULING

A. Schedule the Work such that each pipe-bursting segment is completed, tested, and restored (including surface restoration) before advancing to next pipe-bursting segment.

B. Schedule the Work such that surface restoration (including affected/replaced manholes) for each pipe-bursting segment is complete no later than 2 weeks after the disturbance.

3.12 WARRANTY

A. Warranty Inspection: Owner will conduct inspection in the 11th month following final acceptance of the Work. Contractor and representative of liner product manufacturer shall participate in inspection. Contractor shall repair deficiencies related to material and workmanship to satisfaction of Owner at no cost to Owner.

PART 1. GENERAL

1.01 SCOPE

A. This Section describes products to be incorporated into the water mains and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

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

1.02 QUALIFICATIONS

If requested by PDU, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 SUBMITTALS

Shop drawings, engineering data, and product data are required to be submitted to PDU for review on all utility materials within a project, in accordance with *Section 01 33 00 SUBMITTAL PROCEDURES*.

1.04 TRANSPORTATION AND HANDLING

A. The Contractor shall provide equipment and facilities for unloading, handling, distributing, and storing pipes, fittings, valves, and accessories.

B. Make equipment available at all times for use in unloading.

C. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

D. Pipe handled on skids shall not be rolled or skidded against the pipe on the ground.

E. Handle pipe, fittings, valves, and accessories carefully to prevent shock or damage.

F. Handle pipe by rolling on skids, forklift, or front-end loader.

G. Do not use material damaged in handling.

H. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior coatings or internal lining of the pipe.

1.05 STORAGE AND PROTECTION

A. See Section *01 66 00: STORAGE AND HANDLING REQUIREMENTS*.

1.06 QUALITY ASSURANCE

A. Product manufacturers shall provide the Engineer with written certification that all products furnished comply with all applicable provisions of these Specifications.

B. If required by PDU, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of 5 days during initial pipe installation.

C. Materials, pipes, and other associated appurtenances that fail to comply with the requirements set forth in these specifications shall be rejected.

PART 2. PRODUCTS

2.01 DUCTILE IRON PIPE (DIP) AND ACCESSORIES

A. Pipes shall be centrifugally cast in metal or sand-lined molds.

B. Pipes shall conform to the specifications of ANSI A21.51/AWWA C151.

C. Pipes shall be new and manufactured in the U.S.A. by American Cast Iron Pipe Company, U.S. Pipe, McWane, or approved equal.

D. Pipes shall be furnished in nominal lengths of 18 or 20 feet. The nominal length shall be marked plainly on each individual piece of pipe.

E. Retainer glands for ductile iron pipe shall be EBAA Iron Megalug Series 1100, Ford Meter Box Company Uni-Flange Series 1400, or approved equal.

F. Pipe and fittings for buried water lines shall be:

1. Lined with cement lining as specified in ANSI A21.4/AWWA C104.

2. A bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick may be applied to the cement lining, in accordance with the pipe manufacturer’s standard practices.

3. The pipe and fittings shall be furnished with a bituminous coating on the outside

G. The pipe manufacturer shall furnish a notarized certificate stating that pipe furnished has been manufactured and tested in accordance with the applicable standards.

H. Any pipe with 24 inches or less of cover shall be Pressure Class 52.

I. All pipe classes shall be as stated in the table below, unless otherwise noted:

Size	Pressure Class [psi]
4” to 12”	350
14” to 24”	250
30” to 64”	200

J. Gaskets shall be:

1. Push-on, single gasket joints shall be Fastite, by American Cast Iron Pipe Company, Tyton, by U.S. Pipe, or approved equal.

2. Restrained joint pipe shall be American Flex-Ring, US Pipe TR Flex, or McWane TR Flex pipe.

3. Gripper-style restraint gaskets shall be Fast-Grip by American Cast Iron Pipe Co, Field-Lok 350 by US Pipe Co, Sure Stop 350 by McWane Pipe Co, or approved equal.

4. The bell of each pipe shall have a tapered angular opening and a cast or machined retaining groove for the gasket.

5. The gasket groove shall have a flared design, so that maximum deflection will be provided.

6. The plain spigot end of the pipe shall be beveled in order to simplify entry and centering within the bell.

7. The gasket shall be of high-quality vulcanized rubber made in the form of a solid ring to exact dimensions.

8. The design of the gasket groove in the bell of the pipe and the design, hardness, and other properties of the gasket shall be liquid-tight at the joint for all pressures from a vacuum to a maximum internal liquid pressure rating of 350 psi.

9. The spigot end of each pipe shall be beveled so that it can be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts.

10. The spigot end shall be striped to indicate the distance into which it is to be inserted into the socket.

11. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75º F.

12. Lubricant shall:

    a. Be used to provide a thin coat on the spigot end and rubber gasket inside the bell of each pipe.

    b. Be nontoxic, impart no taste, or smell to the water.

    c. Have no harmful effect on the rubber gasket.

    d. Have a consistency that will allow it to be easily applied to the pipe in either hot or cold weather.

    e. Be a non-soluble lubricant when the environment of installation is wet or submerged.

K. FITTINGS

1. Fittings shall be ductile iron, in accordance with ANSI/AWWA C153/A21.53, latest revisions.

2. All mechanical joint fittings will require the use of mechanical restraint devices, such as EBAA MegaLug, Sigma One-Lok, Star Pipe Products Star Grip, Ford wedge-type restraint, or approved equal.

3. No additional payment shall be allowed for the installation of mechanical joint restraints, but shall be considered incidental to construction.

2.02 PVC PIPE AND ACCESSORIES

A. All plastic pipe shall be blue C900 DR 14 PVC and made from Class 12454 polyvinyl chloride plastic, as defined by ASTM D1784 and ANSI/AWWA C900.

B. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

C. Potable water main crossings below the gravity sewer should be avoided whenever possible.

D. If the potable water main must cross under a gravity sewer, the crossing shall have a minimum vertical clearance of 18 inches and the water main will be required to be within a casing pipe. See Section 33 05 07 BORE AND JACK INSTALLATIONS for casing pipe information.

E. Gaskets shall be:

1. Push-on joints designed with grooves in which continuous molded rubber ring gaskets can be placed.

2. Made of vulcanized natural or synthetic rubber; no reclaimed rubber shall be allowed.

3. Meet the requirements of ASTM F477.

4. Of the manufacturer's standard design dimensions.

5. Of such size and shape as to provide a positive seal under all combinations of joint and gasket tolerance.

6. The gasket and annular groove shall be designed and shaped so that when the joint is assembled, the gasket will be radially compressed to the pipe and locked in place against displacement, thus forming a positive seal

F. All 2 and 3-inch pipe shall have NSF approval and be manufactured in accordance with ASTM D2241.

G. SDR 21 IPS pipe is only allowed for 2" and 3" pipe. The following tests shall be run for each machine on each size and type of pipe being produced, as specified below:

1. Flattening Test: once per shift in accordance with ASTM D2412. Upon completion of the test, the specimen shall not be split, cracked, or broken.

2. Acetone Test (Extrusion Quality Test)

a. Once per shift, in accordance with ASTM D2152.

b. There shall be no flaking, peeling, cracking, or visible deterioration on the inside or outside surface after completion of the test.

3. Quick Burst Test

   a. Once per 24 hours, in accordance with ASTM D1599:

SDR	Pressure Rating	Minimum Bursting Pressure (psi)
21	200	630

4. Impact Tests

   a. For 6 inches and larger, once per shift in accordance with ASTM D2444.

   b. For 4 inches and smaller, once each two hours, in accordance with ASTM D2444.

5. Wall Thickness and Outside Dimensions Tests:

   a. Once per hour, in accordance with ASTM D2122.

6. Bell Dimension Test

   a. Once per hour, in accordance with ASTM D3139.

7. If any specimen fails to meet any of the above-mentioned tests, all pipes of that size and type manufactured between the test periods must be scrapped and a full set of tests must be done.

H. The Contractor shall provide a certificate from the pipe manufacturer stating:

1. They are fully competent to manufacture PVC pipe of uniform texture and strength, and is in full compliance with these specifications.

2. They have manufactured such pipe and done so in sufficient quantities to be certain that it will meet all normal field conditions.

3. The manufacturer's equipment and quality control facilities are adequate to ensure that each extrusion of pipe is uniform in texture, dimensions, and strength.

4. They certify that the pipe supplied for this project meets the requirements of these specifications.

I. All pipe shall be manufactured in the United States of America.

J. Retainer glands for PVC pipe shall be EBAA Iron Megalug Series 2000 PV, Ford Meter Box Company Uni-Flange Series 1300, or approved equal.

K. The same manufacturer shall make all pipe for any one project, unless otherwise approved by PDU.

L. All PVC pipe shall be furnished in 20-foot lengths.

M. The Contractor's methods of storing and handling the pipe shall abide by Section *01 66 00 STORAGE AND HANDLING REQUIREMENTS*.

N. The practice of stringing pipes out along the proposed water main route is permitted, but shall be at a maximum of one day’s worth of pipe laid out.

O. Each piece of pipe shall have the information below marked on the pipe:

1. Nominal size
2. Type of material
3. SDR or class
4. Manufacturer
5. NSF Seal of Approval

P. The spigot end of each pipe shall be:

1. Beveled to be easily inserted into the gasket joint, which in turn shall be designed so that the spigot end may move in the socket as the pipe expands or contracts.
2. Striped to indicate the distance into which it is to be inserted into the socket.

Q. Each joint shall be able to accommodate the thermal expansions and contractions experienced with a temperature shift of at least 75º F.

R. Lubricant shall be:

1. Approved for being in contact with potable water.

2. Used to provide a thin coat on the spigot end and rubber gasket inside the bell of each pipe

3. Nontoxic, impart no taste, or smell to the water.

4. No harmful effect on the rubber gasket.

5. A consistency that will allow it to be easily applied to the pipe in either hot or cold weather.

6. A non-soluble lubricant when the environment of installation is wet or submerged.

7. Supplied with each order to provide a coat on the spigot end and rubber gasket inside of the bell of each pipe.

8. Not support or promote any bacterial growth.

9. In containers labeled with the manufacturer's name.

10. Supplied by the pipe manufacturer being used.

S. Joints

1. Shall be manufactured in accordance with ASTM D3139, except that the thickness of the bell shall be at a minimum equal to the barrel.

2. All joints for gasket integral bell and ring joints, with rubber compression gaskets, shall be manufactured by the West Lake Pipe & Fittings, Sanderson, National Pipe, Vulcan Plastics, or approved equal.

T. Fittings

1. Standard and special fittings shall be gray iron or ductile iron. Use standard mechanical joint fittings.

2. All fittings shall conform to the specifications of ANSI A21.53/AWWA C153.

3. Wedge-restraints per the previous list are required at all mechanical joint connections.

4. Fittings shall be lined with enameline or a thin cement lining, as specified in ANSI A21.4/AWWA C104.

5. A bituminous seal coat or asphalt emulsion spray coat approximately 1 mil thick shall be applied to the cement lining, in accordance with the pipe manufacturer's standard practices.

6. Fittings shall be in accordance with the standard mechanical joint fittings manufactured by Tyler/Union, Sigma, Star, SIP, or approved equal.

2.03 HDPE PIPE AND ACCESSORIES

A. 4 Inches and Larger

1. HDPE pipe shall meet AWWA C906.

B. Fittings

1. Butt Fusion Fittings shall be PE4710 HDPE, Cell Classification of 445474C as determined by the latest edition of ASTM D3350, and approved for AWWA use.

2. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. 1

3. Molded fittings shall have a pressure rating equal to the pipe unless otherwise specified in the drawings.

4. Fabricated fittings are not permitted. Fabricated fittings are to be manufactured using Data Loggers.

5. Temperature, fusion pressure, and a graphic representation of the fusion cycle shall be part of the quality control records.

6. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one half times the Working Pressure Rating (WPR) of the fitting.

C. Flanged and Mechanical Joint Adapters

1. Flanged and mechanical joint adapters shall be PE 4710 HDPE, Cell Classification of 445474C as determined by the latest edition of ASTM D3350.

2. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3261.

3. Fittings shall have a pressure rating equal to the pipe.

2.04 GATE VALVES

A. Valves larger than 2 inches in diameter shall be resilient wedge, mechanical joint type, conforming to the requirements of ANSI/AWWA C515 rated for 250 psi working pressure.

B. See Section *33 14 17 WATER SERVICE CONNECTIONS* for specifications on valves 2-inch or smaller.

C. Valves shall be manufactured by M&H or approved equal.

D. Valves shall open left, with a 2-inch square wrench nut.

E. Valve ends shall be mechanical joint, restrained, except where flanged are shown. Flanged joints shall meet the requirements of Class 125/150.

F. Valves shall be provided with two O-ring stem seals, with one O-ring located above and one O-ring below the stem collar:

1. The area between the O-rings shall be filled with lubricant to provide lubrication to the thrust collar bearing surfaces each time the valve is operated.

2. At least one anti-friction washer shall be utilized to further minimize operating torque.

3. All seals between valve parts such as body and bonnet, bonnet and bonnet cover, shall be flat gaskets or O-rings.

G. The valve gate shall be made of cast iron having a vulcanized, synthetic rubber coating, or a seat ring attached to the disc with retaining screws:

1. Sliding of the rubber on the seating surfaces to compress the rubber will not be allowed.

2. The design shall be such that compression-set of the rubber shall not affect the ability of the valve to seal when pressure is applied to either side of the gate.

3. The sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

H. All internal ferrous surfaces shall be coated with epoxy to a minimum thickness of 4 mils. The epoxy shall be non-toxic, impart no taste to the water, and shall conform to AWWA C550 and NSF 61 requirements, latest revision.

I. Buried valves shall be equipped with valve boxes. See Subsection 2.06 for specifics on valve boxed.

2.05 BUTTERFLY VALVES

A. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504 for Class 150B.

B. Valve bodies shall be ductile iron conforming to ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron.

C. Shafts shall be ASTM A 276, Type 304 stainless steel, machined and polished.

D. Valve discs shall be ductile iron, ASTM A 536, Grade 65-45-12 or ASTM A 126, Grade B cast iron.

E. The resilient valve seat shall be located either on the valve disc or in the valve body, and shall be fully field adjustable and field replaceable.

F. Valves shall be installed with the valve shafts horizontal.

G. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water.

H. Actuator mounting brackets shall be fully enclosed and shall have gasket seals.

I. Valves shall be equipped with traveling nut, self-locking type actuators designed, manufactured and tested in accordance with AWWA C504.

J. Actuators shall be capable of holding the disc in any position between full open and full closed without any movement or fluttering of the disc.

K. Actuators shall be furnished with fully adjustable mechanical stop-limiting devices.

L. Actuators that utilize the sides of the actuator housing to limit disc travel are unacceptable.

M. Valve actuators shall be capable of withstanding a minimum of 450-foot pounds of input torque in either the open or closed position without damage.

N. Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension, as required.

O. Valve ends shall be mechanical joint restrained type, except where flanged ends are shown.

P. Butterfly valves shall be manufactured by Mueller, M&H, DeZurik, ValMatic, Pratt, or approved equal.

2.06 VALVE BOXES AND EXTENSION STEMS

A. All buried valves shall be equipped with valve boxes.

B. The valve boxes shall consist of 12-in. x 12-in. footing blocks, with a minimum compressive strength of 4,500 psi, and concrete risers for cast iron frame and lid.

C. The cast iron frame and lid for the valve box shall be John Bouchard & Sons 8006 or approved equal, with “WATER” stamped on the lid.

D. Tracer wire shall be connected to valve box frame for accessibility.

E. The lid and top of the frame shall be flush with surrounding grade.

F. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut.

G. Connection to the valve shall be made with a 2” square wrench nut and a set screw to secure to the valve's operating nut.

2.07 AIR VALVES

A. The air release valve shall be APCO 200A or approved equal.

B. The assembly will consist of a 2” gate valve that is blind flange tapped for a 2” nipple, precast concrete meter box, JBS 8370 frame & lid or approved equal.

C. The air/vacuum valve shall operate by means of a non-collapsible stainless steel float which seals an orifice.

D. Combination air valves shall be single body, with combined features of an air release valve and an air/vacuum valve.

E. A combination valve shall have a double orifice.

F. The combination valve shall be ARI Model D-040 as manufactured by A.R.I. Flow Control Accessories.

G. Valve sizes shall be as shown on the PDU-Approved Construction Plans.

H. Where shown on the PDU-approved Construction Plans, provide a surge check valve on the inlet of the air/vacuum valve.

I. The surge check valve shall be normally open, spring-loaded valve consisting of a body, seat, and plug bolted to the inlet of the air/vacuum valve.

J. The surge check orifices must be an adjustable type to suit operating conditions in the field.

K. All air valves and accessories shall be supplied by a single manufacturer.

2.08 TRACER WIRE

A. Tracer detection wire shall be 12-gauge AWG, high-strength, solid copper-clad steel conductor (HS-CCS) locator wire.

B. Tracer wire is only required on water and sewer force mains.

C. Detection wire shall be installed with the pipe and fastened to the crown of the pipe.

D. The ends of the wire shall be brought up through valve boxes within 4 inches from the top.

E. Where required, detection wire shall be buried 4 to 10 inches beneath the ground surface directly over the top of the pipe.

2.09 FIRE HYDRANTS (FH)

A. All fire hydrants shall conform to the requirements of AWWA C502 for 250 psi working pressure, and UL & FM requirements.

B. Hydrants shall be the compression type, closing with line pressure. The valve opening shall not be less than 5-1/4-inches.

C. In the event of a traffic accident, the hydrant barrel shall break away from the standpipe at a point above grade and in a manner which will prevent damage to the barrel and stem, preclude opening of the valve, and permit rapid and inexpensive restoration without digging or cutting off the water.

D. The means for attaching the barrel to the standpipe shall permit facing the hydrant a minimum of eight different directions.

E. Hydrants shall be fully bronze mounted with all working parts of bronze. Valve seat ring shall be bronze and shall screw into a bronze retainer.

F. All working parts, including the seat ring shall be removable through the top without disturbing the barrel of the hydrant.

G. The operating nut shall match those on the existing hydrants. The operating threads shall be totally enclosed in an operating chamber, separated from the hydrant barrel by a rubber O-ring stem seal and lubricated by a grease or oil reservoir.

H. Hydrant shall be a non-freezing design and be provided with a simple, positive, and automatic drain which shall be fully closed whenever the main valve is opened.

I. Hose and pumper connections shall be breech-locked, pinned, or threaded and pinned to seal them into the hydrant barrel. Each hydrant shall have two 2-1/2-inch hose connections and one 4-1/2-inch pumper connection, all with National Standard threads and each equipped with cap and non-kinking chain.

J. Hydrants shall be furnished with a mechanical joint connection to the spigot of the 6-inch hydrant lead.

K. Minimum depth of bury shall be 40 inches. Provide extension section where necessary for proper vertical installation and in accordance with manufacturer's recommendations.

L. All outside surfaces of the barrel above grade shall be painted red. Color to be selected by the Owner.

M. All hydrants shall be traffic models and open left

N. All hydrants shall have a 5-1/4” main valve opening as manufactured by M&H, American Darling, or approved equal.

2.10 BLOWOFF HYDRANTS

Blowoff hydrants shall be a Kupferle Eclipse #2, M&H 2-1/4” MVO Style 33, American Darling B84B-5, with locking caps and 6-inch Alpha base, or approved equal.

2.11 AUTO-FLUSHERS

A. Dead-end lines shall have an auto-flusher hydrant or where required by PDU.

B. The auto-flushing hydrants shall be Kupferle Model #9400A or approved equal.

2.12 MANHOLES AND PRECAST CONCRETE PRODUCTS

See Section 03 40 00 PRECAST CONCRETE STRUCTURES for specifications.

2.13 HYDRANT TEES

Hydrant tees shall be equal to ACIPCO A10180, U.S. Pipe U-592, or approved equal.

2.14 ANCHOR COUPLINGS

A. Lengths and sizes shall be as shown on PDU-approved Construction Plans.

B. Anchor couplings shall be equal to ACIPCO A 10895, U.S. Pipe U-591, or approved equal.

2.15 THRUST BLOCKING

A. Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches.

B. For job mixed concrete, submit the concrete mix design for approval by the Engineer.

C. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94.

D. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.16 PRECAST CONCRETE METER VAULTS

A. The precast concrete vault shall be furnished to the dimensions shown and as specified on the Construction Drawings or Shop Drawings.

B. Vault structural design shall conform to ASTM C-857 and shall be constructed to withstand HS-20 load rating with a 30% impact factor.

C. Precast vaults shall be manufactured by Icast, Old Castle, Jarrett Concrete, or approved equal.

PART 3. EXECUTION

3.01 PIPE LINE LAYOUT & EASEMENT STAKING

A. Prior to commencement of pipe laying, the centerline of the permanent easement shall be staked.

B. Visible evidence of staking shall be placed at a minimum of 50 feet intervals.

C. In the event of loss or damage of the easement staking, these shall be replaced by the Contractor to ensure pipe installation remains within the easement.

D. Contractor shall strictly maintain the horizontal alignment of the pipe as shown on the PDU-approved Construction Plans.

E. Deviation of the alignment shall be done only with the approval of the Head Utility Inspector or PDU Representative.

F. The centerline of the proposed transmission line shall be staked at 50’ intervals with proposed grades marked on each stake.

G. Surveyor shall be licensed in the State of Tennessee.

H. The base lines for locating the principal components of the work and a bench mark adjacent to the work are shown on the PDU-approved Construction Plans.

I. Base lines shall be defined as the line to which the location of the water main is referenced (i.e., edge of pavement, road centerline, property line, right-of-way, or survey line).

J. The Contractor shall be responsible for performing all survey work required for constructing the water main, including the establishment of base lines and any detail surveys needed for construction.

K. This work shall include the staking out of permanent and temporary easements to ensure that the Contractor is not deviating from the designated easements.

L. The level of detail of survey required shall be that which the correct location of the water main can be established for construction and verified by the PDU Inspector or Representative.

M. Where the location of components of the water main (i.e., tunnels, fittings, etc.) are not dimensioned, the establishment on the location of these components shall be based upon the stationing provided on the PDU-

approved Construction Plans or by scaling these locations from the with relation to readily identifiable land marks (i.e., survey reference points, power poles, manholes, etc.).

N. The Contractor shall take all precautions necessary, which includes, but is not limited to installing reference points, in order to protect and preserve the centerline or baseline established by the PDU Inspector or Representative.

O. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way.

P. The location of the reference points shall be recorded in a log, with a copy provided to the PDU Inspector or Representative for use, prior to verifying reference point locations.

Q. Distances between reference points and the manhole centerlines shall be accurately measured to 0.01 foot.

R. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.

S. After the Contractor locates and marks the water main centerline or baseline, the Contractor shall perform clearing and grubbing.

T. Construction shall begin at a connection location and proceed without interruption. Multiple construction sites shall not be permitted without written authorization from the PDU Inspector or Representative for each site.

U. The Contractor shall be responsible for any damage done to reference points, base lines, center lines, and temporary bench marks.

V. The Contractor shall be financially responsible for the cost of re-establishment of reference points, base lines, center lines, and temporary bench marks.

3.02 EXISTING UTILITIES AND OBSTRUCTIONS

A. The PDU-approved Construction Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner.

B. The Contractor shall call the Tennessee One Call System, Inc. (811 or 1-800-351-1111) as required by the Tennessee Law “Underground Utility Damage Prevention Act” (Code Section 65-31-106) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of

the construction work site at least 72 hours (three business days) prior to construction to verify the location of the existing utilities.

C. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Provide the required notice to the utility owners and allow them to locate their facilities according to Tennessee law.

2. Field utility locations are valid for only 10 days after original notice.

3. The Contractor shall ensure, at the time of any excavation that a valid utility location exists at the point of excavation.

4. Expose the facility, for a distance of at least 200 feet in advance of pipeline construction, to verify its true location and grade.

5. Repair any damage to utilities resulting from locating or exposing their true location.

6. Avoid utility damage and interruption by protection with means or methods recommended by the utility owner.

7. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any.

8. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently, if required.

D. Horizontal Conflict with Existing Utilities

1. Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the water main by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility.

2. The Contractor may change the proposed alignment of the water main to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement, complies with regulatory agency requirements and after a written request to and subsequent approval by the Engineer.

3. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

E. Vertical Conflict with Existing Utilities

1. Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed water main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the water main.

2. The Contractor may change the proposed grade of the water main to avoid vertical conflicts if the changed grade maintains adequate cover and complies with regulatory agencies requirements after written request to and subsequent approval by the Engineer.

3. Where such relocation of the water main is denied by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

F. Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.

3.03 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Install pipe lines and appurtenances along highways, streets, and roadways, in accordance with the applicable regulations and permits issued by the City of Portland, Tennessee Department of Transportation (TDOT), Sumner/Robertson County Highway Department (SCHD/RCHD), with reference to construction operations, safety, traffic control, road maintenance, and repair.

B. Traffic Control

1. The Contractor shall provide, erect, and maintain all necessary barricades, suitable and sufficient lights, and other traffic control devices

2. The Contractor shall provide qualified flagmen where necessary to direct traffic.

3. The Contractor shall make all necessary precautions for the protection of the work and the safety of the public.

4. Construction traffic control devices and their installation shall be in accordance with the current Manual on Uniform Traffic Control Devices for Streets and Highways.

5. Placement and removal of construction traffic control devices shall be coordinated with the City of Portland and/or Tennessee

Department of Transportation at a minimum of 48 hours in advance of the activity.

6. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted.

7. Construction traffic control devices shall be removed immediately following their useful purpose.

8. Traffic control devices used intermittently, such as “Flagmen Ahead”, shall be removed and replaced when needed.

9. Existing traffic control devices within the construction work zone shall be protected from damage.

10. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations.

11. Original locations shall be measured from reference points and recorded in a log prior to relocation.

12. Temporary locations shall provide the same visibility to affected traffic as the original location.

13. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.

14. Construction traffic control devices shall be maintained in good repair and shall be clean and visible to affected traffic for daytime and nighttime operation.

15. Traffic control devices affected by the construction work zone shall be inspected daily.

16. Construction warning signs shall be black legend on an orange background.

17. Regulatory signs shall be black legend on a white background.

18. Construction sign panels shall meet the minimum reflective requirements of the Tennessee Department of Transportation, City of Portland, and/or the Sumner/Robertson County Highway Department.

19. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.

20. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual on Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location.

21. Channelization devices shall be patrolled to ensure that they are maintained in the proper position throughout their period of use.

C. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.

2. Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil, and other material suitable for right-of-way restoration.

3. Do not open the trench any further ahead of pipe laying operations than is necessary.

4. Backfill and remove excess material immediately behind laying operations.

5. Complete excavation and backfill for any portion of the trench in the same day.

6. Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations.

7. Replace topsoil, sod, and any other materials removed from shoulders.

8. Construction operations shall be limited to 400 feet along areas, including clean-up and utility exploration.

D. Excavated Materials

1. Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic.

2. Sweep all scattered excavated material off of the pavement in a timely manner.

E. Drainage Structures

1. Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material.

2. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

F. Landscaping Features

1. Landscaping features shall include, but are not limited to fences, property corners, cultivated trees and shrubbery, manmade improvements, subdivision and other signs within the right-of-way and easement.

2. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.

G. Maintaining Highways, Streets, Roadways and Driveways

1. Maintain streets, highways, roadways, and driveways in suitable condition for movement of traffic until completion and final acceptance of the Work.

2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets, and roadways by the use of steel running plates.

3. Running plate edges shall have asphalt placed around their periphery to minimize vehicular impact.

4. Backfill above the pipe shall be compacted as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.

5. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways.

6. The grader or front-end loader shall be available at all times.

7. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the Work.

3.04 PIPE DISTRIBUTION

A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.

B. No street or roadway may be closed for unloading of pipe without first obtaining permission from the City of Portland, TDOT, SCHD, or RCHD.

C. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets, and roadways upon which pipe is distributed.

D. No distributed pipe shall be placed inside drainage ditches.

E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.05 LOCATION AND GRADE

A. Prior to clearing and grubbing, the Engineer will provide a temporary bench mark along the water main route and at all other locations where the alignment of the water main changes significantly.

B. The PDU-approved Construction Plans show the alignment of the water main and the location of valves, hydrants, and other appurtenances.

C. The trenches shall be excavated to the required depth or elevation shown on the PDU-approved Construction Plans:

1. The depth of cover shall not exceed that as shown on the PDU-approved Construction Plans by more than one foot, without approval by the PDU Representative.

2. Excavate trenches to provide a minimum cover not less than three feet.

3. Within the right-of-way of highways, streets, or roadways, excavate to place the top of the pipe a minimum of four feet below the nearest pavement edge or drainage ditch.

4. Increase the depth of cover where specifically shown on the Drawings, and where necessary to avoid interference with underground utilities, drainage ditches and obstructions.

5. Where rock is encountered in trenches for pipelines, excavate to the minimum depth which will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe and valves. Remove boulders and stones to provided a minimum of 6-inches clearance between the rock and any part of the pipe or valve.

3.06 LAYING AND JOINTING PIPE AND ACCESSORIES

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

B. Pipe Installation

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings, valves and hydrants shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to water main materials and protective coatings and linings.

2. Under no circumstances shall water main materials be dropped or dumped into the trench.

3. Unless otherwise indicated by the drawings, all water pipes shall have at least 30 inches of cover. No departure from this policy shall be made except with the approval of the Engineer.

C. All pipe, fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation.

D. Defective materials shall be marked and held for inspection by the PDU Representative, who may prescribe corrective repairs or reject the materials.

E. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe containing dirt shall be laid.

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

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

H. It is mandatory to lay pipe with the bells facing the direction in which work is progressing.

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

J. Whenever pipe laying is not in progress, close the open ends of pipe either with a watertight plug or by other means approved by the Engineer. If there is water in a trench, leave this seal in place until the trench has been pumped completely dry. If crushed stone is used to improve trench

conditions or as backfill for bedding the pipe, its use is considered incidental to the project, and no separate payment will be made for its use.

K. Where a water line crosses over a sanitary sewer, use a full joint of pipe with a standard push-on, restrained or mechanical joint, and centered over the sewer. Where a water line is to be parallel to a sanitary or storm sewer, lay it at least ten (10) feet from the sewer. If it is not practical for the water and sewer lines to be separated as described above, then lay the water line so that the bottom of the water line is at least 18 inches above the top of the sewer. Where the vertical separation cannot be maintained, the sewer shall be constructed of material and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.

L. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves as nearly as practicable.

2. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.

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

M. Excavate, lay the pipe, and backfill as closely together as possible.

N. Do not leave unjointed pipe in the trench overnight.

O. Backfill and compact the trench as soon as possible after laying and jointing is completed.

P. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress.

Q. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the PDU Respresentative.

R. Joint Assembly

1. Push-on, mechanical, flange, and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

2. The Contractor shall inspect each pipe joint within 1,000 feet on either side of main line valves to ensure 100 percent seating of the pipe spigot, except as noted otherwise.

3. Each restrained joint shall be inspected by the Contractor to ensure that it has been “homed” 100 percent.

4. The Contractor shall internally inspect each pipe joint to ensure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.

S. Cutting Pipe

1. Cut ductile iron pipe using an abrasive wheel saw.

2. Cut PVC pipe using a suitable saw.

3. Remove all burrs and smooth the end before jointing.

4. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories, and closure pieces in the correct location.

5. Only push-on or mechanical joint pipe shall be cut.

T. Valve and Fitting Installation

1. Prior to installation, valves shall be inspected for:

a. Direction of opening

b. Number of turns to open

c. Freedom of operation

d. Tightness of pressure-containing bolting and test plugs

e. Cleanliness of valve ports and seating surfaces

2. Defective valves shall be corrected or held for inspection by the PDU Inspector.

3. Valves shall be closed before being installed.

4. Valves, fittings, plugs, and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying, and joining pipe, except for 12-inch valves or larger.

5. 12-inch valves or larger shall be provided with special support, such as treated timbers, crushed stone, concrete pads, or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve.

6. A valve box shall be provided on each underground valve.

7. They shall be carefully set, centered exactly over the operating nut and truly plumbed.

8. The valve box shall not transmit shock or stress to the valve.

9. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe.

10. Extension stems shall be installed where depth of bury places the operating nut in excess of 30-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade.

11. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Engineer.

12. In no case shall valves be used to bring misaligned pipe into alignment during installation.

13. Pipe shall be supported in such a manner as to prevent stress on the valve.

14. A valve marker shall be provided for each underground valve, unless otherwise directed by the PDU Representative or Water Supervisor.

15. Valve markers shall be installed 6-inches inside the right-of-way or easement.

U. Hydrant Installation

1. Prior to installation, inspect all hydrants for:

    a. Direction of opening

    b. Nozzle threading

    c. Operating nut and cap nut dimensions

    d. Tightness of pressure-containing bolting

    e. Cleanliness of inlet elbow

2. Defective hydrants shall be corrected or held for inspection by the PDU Representative.

3. All standard fire hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the roadway, with pumper nozzle facing the roadway.

4. Hydrants having two-hose nozzles, 90 degrees apart, shall be set with each nozzle facing the roadway at an angle of 45 degrees.

5. Hydrants shall be set to the established grade, with the centerline of the lowest nozzle at least 12-inches above the ground or as directed by the PDU Representative.

6. Each standard fire hydrant assemblies shall be connected to the main with a 6-inch branch controlled by an independent 6-inch valve, as per detail W-08.

7. When a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least 6 inches above the drain port opening in the hydrant to a distance of 12 inches around the elbow.

8. When a hydrant is set in clay or other impervious soil, a drainage pit with the dimensions of 2’ x 2’ x 2’ shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant and to a level of 6 inches above the drain port.

9. Hydrants shall be located as shown on the PDU-approved Construction Plans or as directed by the PDU Representative.

10. In the case of hydrants that are intended to fail at the ground-line joint upon vehicle impact, specific care must be taken to provide adequate soil resistance to avoid transmitting shock moment to the lower barrel and inlet connection:

    a. In loose or poor load bearing soil, this may be accomplished by pouring a concrete collar approximately 6 inches thick to a diameter of 24 inches at or near the ground line around the hydrant barrel.

V. Air Valve Vaults

1. Construct the vault or manhole as detailed on the PDU-approved Construction Plans.

2. Air release valves and vaults shall be installed on water lines at all high points and as shown on the PDU-approved Construction Plans.

3. Manholes shall be constructed such that their walls are plumb.

3.07 CONNECTIONS TO WATER MAINS

A. Make connections to existing pipe lines with tapping sleeves and valves or saddle, unless specifically shown otherwise on the Drawings.

B. Location: Before laying pipe, locate the points of connection to existing water mains and uncover as necessary for the Engineer to confirm the nature of the connection to be made.

C. Interruption of Services: Make connections to existing water mains only when system operations permit. Operate existing valves only with the specific authorization and direct supervision of the Owner.

D. Tapping Saddles and Sleeves

1. Holes in the new pipe shall be machine cut, either in the field or at the factory. No torch cutting of holes shall be permitted.

2. Prior to attaching the saddle or sleeve, the pipe shall be thoroughly cleaned, utilizing a brush and rag, as required.

3. Before performing field machine cut, the watertightness of the saddle or sleeve assembly shall be pressure tested. The interior of the assembly shall be filled with water. An air compressor shall be attached, which will induce a test pressure as specified in this Section. No leakage shall be permitted for a period of five minutes.

4. After attaching the saddle or sleeve to an existing main, but prior to making the tap, the interior of the assembly shall be disinfected. All surfaces to be exposed to potable water shall be swabbed or sprayed with a one percent hypochlorite solution.

E. Where connections are shown on the PDU-approved Construction Plans using solid sleeves, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipe line.

F. Where connections are shown on the PDU-approved Construction Plans using couplings, the Contractor shall furnish materials and labor necessary to make the connection to the existing pipe line, including all necessary cutting, plugging, and backfilling.

3.08 THRUST RESTRAINT

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

B. All tees, valves, angles, or bends in the pipe lines shall be satisfactorily restrained and anchored against the tendency for movement with mechanical joint restraints and concrete thrust blocks.

C. Provide retainer glands on fire hydrants, all associated fittings, valves, and related piping, and where shown on the PDU-approved Construction Plans.

D. Retainer glands shall be installed in accordance with the manufacturer's recommendations.

E. The Contractor shall furnish a torque wrench to verify the torque on all set screws, which do not have inherent torque indicators.

F. Harnessing

1. Provide harness rods only where specifically shown on the PDU-approved Construction Plans or directed by the PDU Inspector or Representative.

2. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress of no less than 22,000 psi.

3. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling.

4. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where this is not possible, provide 90-degree bend eye bolts:

    a. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size.

    b. The eye shall be welded closed.

    c. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod.

    d. Eye bolts shall be of the same material and coating as the harness rods.

G. Hydrants shall be attached to the water main by the following method:

1. For all new mains, the isolation valve shall be attached to the main by connecting the valve to the hydrant tee, unless otherwise specified by the PDU Representative.

2. For all existing mains, the isolation valve shall be attached to the main by providing retainer glands between the valve and tapping saddle, unless otherwise specified by the PDU Representative.

3. The isolation valve shall be attached to the hydrant by providing retainer glands between the valve and hydrant.

H. Collars shall be constructed as shown on the PDU-approved Construction Plans.

I. The welded-on collar shall be designed to meet the minimum allowable load shown on the PDU-approved Construction Plans.

J. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

K. Concrete Blocking

1. Provide concrete blocking for all bends, tees, valves, and other points where thrust may develop, except where other exclusive means of thrust restraint are specifically shown on the PDU-approved Construction Plans.

2. Concrete shall be as specified as per detail W-05-01, -02, -03, and -04.

3. Form and pour concrete blocking at fittings as shown on the PDU-approved Construction Plans or as directed by the PDU Representative.

4. Pour blocking against undisturbed earth.

5. Increase dimensions when required by over excavation.

3.09 INSPECTION AND TESTING

A. Pressure and Leakage Test

1. All sections of the water main and service lines subject to internal pressure shall be pressure tested in accordance with AWWA C600.

2. A section of main will be considered ready for testing after completion of all thrust restraint and backfilling.

3. Each segment of water main between main valves shall be tested individually.

4. Test Preparation

    a. Hydrostatic pressure tests shall be made on any valved section of all newly laid main and service pipe in the presence of a PDU representative. Reference specifications, AWWA C600 Section 5.2 and AWWA C605 Section 10.3.

    b. For water mains less than 24 inches in diameter, flush sections thoroughly at flow velocity greater than 2.5 feet per second.

    c. For water mains 24 inches in diameter and larger, the main shall be carefully swept, cleaned, and mopped if directed by the PDU Representative.

    d. Partially open valves and hydrants to flush out seats.

    e. Provide temporary blocking, bulkheads, flanges, and plugs as necessary, to assure all new pipe, valves, and appurtenances will be pressure tested.

    f. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances.

    g. Insert corporation cocks at highpoints to expel air as main is filled with water as necessary to supplement automatic air valves.

    h. Fill pipeline slowly with water.

    i. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure.

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

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

5. Test Pressure

    a. The pipeline shall undergo two tests, the first a defect test for the pipe and the second a leak test.

b. First, the pipeline shall be tested at 200 psi for one hour.

c. Second, the pipeline shall be tested at 150 psi for two hours.

d. The test pressure shall maintain within 0 psi of the specified pressure for the test duration. Should the pressure drop below 200 and 150 psi, respectively, at any time during the test period, the pressure shall be restored to the specified test pressure.

e. The source of the pressure drop shall be identified and repaired.

f. Provide an accurate pressure gauge with graduation not greater than 2 psi.

g. Pressure testing must be performed in the presence of the PDU Inspector or PDU Representative.

6. Leakage

   a. Leakage shall be defined as the sum of the quantity of water that must be pumped into the test section to maintain pressure within 5 psi of the specified test pressure for the test duration, plus, water required to return line to test pressure at the end of the test.

   b. Leakage shall be the total cumulative amount measured on a water meter.

   c. The Owner assumes no responsibility for leakage occurring through existing valves.

7. Test Results: No test section shall be accepted if the leakage exceeds the limits determined by the following formula:

$$L = \frac{SD\,(P)1/2}{148{,}000}$$

Where: L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the leakage test, in pounds per square inch (gauge)

As determined under Section 5 of AWWA C600.

8. If the water main section being tested contains lengths of various pipe diameters, the allowable leakage shall be the sum of the computed leakage for each diameter.

9. The leakage test shall be repeated until the test section is accepted.

10. All visible leaks shall be repaired regardless of leakage test results.

11. After a pipeline section has been accepted, relieve test pressure. Record type, size, and location of all outlets on record drawings/as-builts.

3.10 DISINFECTING PIPELINE AND REQUIRED TESTING

A. All chlorination disinfection and bacteriological procedures shall be in accordance with the latest requirements of the Tennessee Department of Environment and Conservation.

B. After successfully pressure testing each pipeline section, disinfect in accordance with AWWA C651 for the continuous-feed method and these specifications.

C. Disinfection shall be performed by an approved specialty contractor.

D. Before disinfection is performed, the Contractor shall submit a written procedure for approval before being permitted to proceed with the disinfection.

E. This plan shall also include the steps to be taken for the neutralization of the chlorinated water.

F. Chlorination

1. Apply chlorine solution to achieve a concentration of at least 25 milligrams per liter free chlorine in new line.

2. Retain chlorinated water for 24 hours.

3. Chlorine concentration shall be recorded at every outlet along the line at the beginning and end of the 24-hour period.

4. After 24 hours, all samples of water shall contain at least 10 milligrams per liter free chlorine.

5. Re-chlorinate if required results are not obtained on all samples.

G. Disposal of Chlorinated Water

1. Reduce chlorine residual of disinfection water to less than one milligram per liter if discharged directly to a body of water.

2. Reduce chlorine residual of disinfection water to less than two milligrams per liter if discharged onto the ground prior to disposal.

3. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual.

4. Flush all lines until residual is equal to existing system.

H. Bacteriological Testing

1. After final flushing and before the water main is placed in service, the Contractor shall collect samples from the line every 1,200 feet and at the end of every lateral line. Those samples shall be tested for bacteriological quality in accordance with the rules of the Tennessee Department of Environment and Conservation (TDEC).

2. The bacteriological samples shall be analyzed for both coliform and non-coliform growth.

3. Testing shall be performed by a laboratory certified by the State of Tennessee.

4. Two or more successive sets of samples, taken at 24-hour intervals, shall indicate bacteriologically satisfactory water and the results shall be submitted to TDEC.

5. Re-chlorinate lines until required results are obtained.

3.11 PROTECTION AND RESTORATION OF WORK AREA

A. Return all items and all areas disturbed, directly or indirectly by work, under these specifications, to their original condition or better as quickly as possible, after work is started.

B. The Contractor shall plan, coordinate, and execute the work such that disruption to personal property and business is held to a practical minimum:

1. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly.

2. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed.

3. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed, with emphasis placed on completing each individual yard or business frontage.

4. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

5. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris are removed in order to provide a neat and pleasing appearance.

6. The PDU Representative and Inspector shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.

C. Protect all fences, walkways, mail boxes, pipe lines, drain culverts, power lines and cables, telephone lines and cables, property pins, and other improvements that may be encountered in the Work, unless otherwise noted on the PDU-approved Construction Plans or approved by the PDU Representative.

D. Do not disturb cultivated trees or shrubbery, unless otherwise noted on the PDU-approved Construction Plans or approved by the PDU Representative.

E. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

F. Do not cut trees for the performance of the work, except as absolutely necessary.

G. Protect trees that remain in the vicinity of the work from damage from equipment.

H. Do not store spoil from excavation against the trunks.

I. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system.

J. Repair any damaged tree over 3 inches in diameter under the direction of an experienced nurseryman.

K. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor.

L. No stumps, wood piles, or trash piles will be permitted on the work site.

M. Dispose of all materials cleared and grubbed during the construction of the project, in accordance with the applicable codes and rules of the appropriate county, state, and federal regulatory agencies.

N. Swamps and Other Wetlands

1. The Contractor shall not construct permanent roadbeds, berms, drainage structures, or any other structures which alter the original topographic features within the easement, unless otherwise shown on PDU-approved Construction Plans.

2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or wetland.

3. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area.

4. All materials of construction and other non-native materials shall be disposed by the Contractor.

5. The Contractor shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland, or stream which may be temporarily divided by construction.

6. The Contractor shall not spread, discharge, or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.

7. Any construction to be done within a designated wetland shall have an executed and approved ARAP Permit through TDEC, prior to any earthwork.

3.12 FINAL WATER LINE ACCEPTANCE

A. Survey grade as-builts shall be submitted to PDU.

B. Survey shall include all fittings, valves, hydrants, service tees, etc.

C. All surveyed points shall include a description, Lat/Long, and elevations on Tennessee State Plane Coordinates NAD 83.

D. Until water line has received final acceptance for service, all fire hydrant assemblies shall remain covered with plastic bag.

E. Remove bags from hydrants after final water line acceptance.

F. After completing each section of water line, remove all debris and all construction materials from the work site, then grade and smooth over the surface of both sides of the line.

G. Leave the entire area clean and in a condition satisfactory to the City of Portland and PDU.

3.13 ABANDONING EXISTING WATER MAINS

A. Abandon in place all existing water main segments indicated on the PDU-approved Construction Plans to be abandoned.

B. Perform abandonment after the new water main has been placed in service and all water main services have been changed over to the new main.

C. Salvage for PDU existing fire hydrants, valve boxes, valve markers, and other materials indicated on the PDU-approved Construction Plans, unless specified by PDU Representative.

D. Where capping or plugging water main is shown on the PDU-approved Construction Plans or directed by the PDU Representative, disconnect by:

1. Sawing or cutting and removing segment of existing pipe

2. Provide a watertight pipe cap or plug and concrete blocking for restraint to seal off existing mains indicated to remain in service.

3. Seal ends of existing mains to be abandoned with a pipe cap or plug or with a masonry plug and minimum 6-inch cover of concrete on all sides around the end of the pipe.

4. The Contractor shall be responsible for uncovering and verifying the size and material of the existing main to be capped or plugged.

E. Salvage existing fire hydrants, valve boxes, valve markers, and other materials as indicated on the PDU-approved Construction Drawings or as specified by the PDU Representative.

F. Deliver salvaged items in good condition to the PDU storage yard.

G. Coordinate delivery and placement of salvaged materials in advance with the specific Utility Supervisor.

H. Remove existing blow-off piping, located on segments of water mains to be abandoned, to a minimum of two feet below finished grade.

I. Seal the end of remaining piping as specified above.

J. Blow-off piping removed becomes the property of the Contractor.

K. Perform any necessary pavement removal and replacement in accordance with the details on the PDU-approved Constructions Plans, unless otherwise specified by PDU Representative, and in accordance with Section *32 10 13 REMOVING AND REPLACING PAVEMENT*.

END OF SECTION

PART 1. GENERAL

1.01 SCOPE

The work covered by this Section includes furnishing all materials and equipment, providing all required labor, installing water service connections, and all appurtenant work according to these Specifications and/or to the PDU-Approved Construction Plans.

1.02 LOCATIONS

Locations shall be directed by the PDU Inspector or Engineer along the route of the water mains.

1.03 QUALITY CONTROL

All materials installed under this Section shall have the approval of the NSF for water services.

1.04 SUBMITTALS

The contractor shall provide shop drawings, engineering data, and product data to the PDU Representative for review per *Section 01 33 00 SUBMITTAL PROCEDURES.*

PART 2. PRODUCTS

2.01 SERVICE LINES

A. All ¾ to 2-inch services lines shall be Municipex (PEX) tubing.

B. PEX High-Density cross-linked polyethylene tubing shall be manufactured to the requirements of ASTM F876, ASTM F7 CSA B137.5, NSF/ANCI 14, and NSF/AMSI 61.

C. PEX pipe shall meet the standard grade hydrostatic pressure ratings from plastic Pipe Institute in accordance with TR-4/03. The following three standard grade ratings are required:

1. 200 ºF (93 ºC) at 80 psig (551 kPa)

2. 180 ºF (93 ºC) at 100 psig (551 kPa)

3. 73.4 ºF (93 ºC) at 160 psig (551 kPa)

4. Chlorine Testing: According to ASTM F876 shall meet or exceed the following end use condition of 100% at 140 ºF.

5. PEX pipe shall have a co-extruded colored UV Shield made from UV-Resistant polyethylene.

D. For service lines larger than 2 inches, look at Section WATER MAINS AND ACCESSORIES for all other allowable pipe materials.

2.02 SERVICE LINE CASING PIPE

A. 1-½ to 3-inch diameter casing pipe shall be Polyvinyl Chloride Pipe (PVC).

B. All PVC pipe shall have belled ends for push-on type jointing and shall conform to ASTM D 2241.

C. The pipe shall have a Standard Dimension Ratio (SDR) of 21 and shall be capable of withstanding a working pressure of 200 psi.

D. Pipe shall be supplied in minimum lengths of 20 feet.

E. Pipe 3 inches or smaller in diameter:

1. All PVC pipe shall have glued joints, belled ends, and shall conform to ASTM D 1785.

2. All pipe shall be Schedule 40, except where Schedule 80 is specified or shown on the PDU-Approved Construction Plans.

2.03 CONCRETE METER BOXES AND VAULTS

A. Meter vault boxes for ¾- to 1-inch services shall be concrete and have external dimensions of 19¼” x 17”, with JBS 8121 (non-traffic areas) or JBS 8122 (traffic areas) cast-iron frame and cover or approved equal. Meter boxes shall conform to City of Portland Standard Detail W-2.

B. Meter vault boxes for 2” services shall be concrete with external dimensions of 57” x 27”, with a 44” x 20” aluminum hatch or approved equal.

C. Meter vaults for 4” or larger services shall have at a minimum 1 foot of clearance from valves to the inside concrete vault wall.

2.04 METER LINE SETTER

A. ¾-inch and 1-inch meter setters shall be the straight-line type with compression-by-double purpose (FIPT) ends.

B. Setters shall have an inlet ball valve cut-off with lock wings and shall be single check.

C. ¾-inch line setters shall be Ford LSVBHH41-233W-Q-NL or approved equal.

D. 1-inch line setters shall be Ford LSVBHH41-444W-Q-NL or approved equal.

E. The 2-inch setter must be a custom setter type with female threaded inlet and outlet, and 12-inch rise.

F. The 2-inch setter shall have an inlet ball valve and outlet angle check valve, with no bypass.

G. 2-inch custom setters shall be Ford VBH77-12-11-77-NL or approved equal.

H. A minimum of 3-inches crushed stone must be laid under the setter. The valve on the setter shall remain in the closed position after installation.

I. All meter setters shall comply with amended safe Drinking Water Act for lead reduction.

2.05 2-INCH VALVES OR SMALLER

A. Gate valves shall be ductile iron, heavy duty, bronze rising stem, wedge-type, with screwed or union bonnet, and square operating nut.

B. Valve ends shall be threaded.

C. Valves shall have a minimum 250 psi working pressure.

D. Valves shall be made in the U.S.A.

E. Gate valves shall be Mueller, American, M&H, or approved equal.

F. Valves shall open to the left.

G. See Section 33 14 11 WATER MAINS AND ACCESSORIES for gate valves 4-inch and larger.

2.06 CORPORATION STOPS

A. Corporation stops shall be ground-key type and made of bronze conforming to ASTM B61 or B62 and shall be suitable for the working pressure of the system.

B. Outlets shall be suitable for compression type joint.

C. Threaded inlets of corporation stop shall conform to AWWA C800.

D. Corporation stops shall be Ford1000 series or approved equal.

E. ¾ and 1-inch inserts shall be plastic.

F. 2-inch inserts shall be stainless steel.

G. All corporation stops shall comply with amended Safe Drinking Water Act for lead reduction.

H. The corporation stop and gate valve are to be left in the open position after the tap has been made and the setter installed.

2.07 SADDLES

1. Saddles for mains shall be brass, with single straps.

2. Ford models S70 series or approved equal shall be used for ¾ and 1-inch taps.

3. Saddles for C900 mains shall be Ford series S90 brass or approved equal.

4. Saddles for ductile iron pipe mains shall be Ford series F202 or approved equal.

2.08 METERS

A. Domestic Service Meter Assembly

1. ¾, 1-inch, and 2-inch meters shall be furnished by the City of Portland, with applicable fees.

2. 4-inch domestic services shall be Kamstrup 2100, Honeywell EvoQ4, or approved equal, with Itron .

3. See *Section 33 14 11 WATER MAINS AND ACCESSORIES* for specifications on 3-inch meters or larger.

B. Fire Service Meter Assembly

1. All fire meters shall be 4-inch or larger in diameter and shall be an EvoQ4 Electromagnetic Fire Service Meter or approved equal, with a full FM Standard 1044 approval and UL SU327B listing.

2. All fire service meter assemblies shall conform to the requirements of ANSI/AWWA C703, current version.

3. Assembly components shall operate without leakage, damage or malfunction up to a maximum pressure of 175 psi.

4. Meter assembly shall be capable of metering a wide flow range and be equipped to measure both domestic and fire service water usage.

5. Measuring chambers shall consist of a measuring element, calibration device, and register.

6. The register shall be assembled to the measuring chamber in a tamperproof manner, so removal can be made only after the measuring chamber is removed from the main case.

7. Sweep-hand reading and odometer wheel details shall conform to AWWA C701, current version.

8. The meter main case shall be Water Works bronze with internal straightening vanes installed and retained firmly in the inlet portion of the main case to maximize meter performance and accuracy.

9. Flanges for the required size meter assemblies shall be of the Class 125 round type, flat faced, and shall conform to ANSI 16.1 for specified diameter, drilling, and thickness.

10. Each meter assembly shall include a separate FM (Factory Mutual) approved, UL (Underwriters' Laboratories) Listed external fire service strainer, with a minimum net open area of at least 4 times the pipe opening and be V-shaped stainless steel screen for the purpose of maintaining a full unobstructed flow pattern.

11. Strainers shall have a coated ductile iron with steel fasteners capable of maintaining a static pressure of 350 psi.

12. Fire Service Meter Assemblies shall be Sensus Compact Fire Service (CFS) Meter Assembly or approved equal.

2.09 BACKFLOW PREVENTERS

A. Provide reduced pressure backflow preventers where required by PDU.

B. Backflow preventers shall be Watts, Wilkins, or approved equal.

C. Backflow preventers shall be installed with heated and insulated enclosures to provide freeze protection and to allow for proper drainage and testing.

D. Enclosures shall be Hydrocowl Safe-T-Covers or approved equal.

E. Backflow preventers shall be rated for operation with inlet water pressures up to 175 psig and water temperatures up to 180 ºF.

F. Backflow preventers shall be tested and certified in accordance with ASSE 1015 and AWWA C506 and C510.

G. Provide isolation valves on the inlet and outlet of each reduced pressure backflow preventer.

PART 3. EXECUTION

3.01 WATER SERVICE CONNECTIONS

A. Each new ¾ or 1-inch service line shall be tapped into the main through a corporation stop, utilizing a service saddle, and shall comply with Subsection 2.06 and 2.07.

B. 2-inch taps are to be made with valves as per Subsection 2.05.

C. A service line shall be provided to the meter.

D. Connections shall be in full accordance with AWWA requirements.

E. Pressure ratings shall be as required for the installation.

F. ¾-inch to 1-inch short side water services will be on the same side of the road as the water main and as per water detail, W-02.

G. ¾-inch to 1-inch long side water services will be on the opposite side of the road to the water main and as per water detail, W-03.

H. Water service connections installed under roadway shall be pulled through a casing.

I. Installation shall conform to the details for water service connections on the PDU-approved Construction Plans.

J. Contractor shall provide any and all appurtenant work required to provide the intended water service connections.

3.02 CASINGS

A. Casings shall be installed in an open trench or through a bored hole approximately equal in diameter to the external diameter of the casing.

B. Casings shall have 40 inches of minimum cover under roadways.

C. At other locations, minimum cover shall be 24 inches.

3.03 TEMPORARY WATER SERVICES

A. Temporary services shall consist of relocating an existing water meter to just outside the construction limits to clear proposed grading by the DOT Contractor.

B. Temporary services shall include connecting the relocated meter to the existing or new water main as appropriate by means of a new service line, in accordance with Subsection Part 2 and any additional depth service line installation required to clear proposed grading work.

3.04 RELOCATION OF SERVICE LINES

A. Relocate the existing meter to the new right-of-way limits and reconnect to the house service.

B. Existing meters already located at the new right-of-way limits will not need relocating.

C. Before disconnecting the existing meter, the existing corporation in the main shall be closed.

D. All existing meters and meter boxes shall be removed, if not already located at the right-of-way, reinstalled, and reconnected as indicated on the PDU-approved Construction Plans.

E. Existing service lines shall be field-located by the Contractor.

F. The Contractor shall be responsible for locating existing water meters, relocating the meters, and meter boxes as necessary, and determining the existing size service line to reconnect the meters to the new water mains.

G. All service lines installed under existing pavement, including streets, driveways and sidewalks, shall be installed by boring.

H. The Contractor shall be prepared to make emergency repairs to the water system, if necessary, due to damage by others working in the area.

I. The Contractor shall furnish and have available at all times, a tapping machine, for the purpose of making temporary water service taps or emergency repairs to damaged water services.

3.05 TRANSFER OF SERVICE

A. Immediately before connecting to the relocated or existing meter, all service lines shall be flushed to remove any foreign matter.

B. Any special fittings required to reconnect the existing meter to the new copper service line or the existing private service line shall be provided by the Contractor.

C. To minimize out of service time, the Contractor shall determine the connections to be made and have all the required pipe and fittings on hand before shutting off the existing service.

D. After completing the connection, the new corporation stop shall be opened and all visible leaks shall be repaired.

END OF SECTION

PART 1. GENERAL

1.01 SCOPE OF WORK

A. The following specification covers the design, installation, inspection, testing, and acceptance of gravity wastewater systems.

B. Construction consists of furnishing all labor, equipment, tools, appliances, and materials for performing all operations necessary for the construction and installation of gravity wastewater sewers and service lines. This shall include all manholes, casings, and appurtenances to complete the project and for utilities to become ready for operation.

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

D. The Developer/Contractor shall furnish to the City a one (1)-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 of Portland for ownership and operation.

E. Unless otherwise noted, all materials and equipment supplied under this Section shall be new, of good quality, and in good condition.

1.02 QUALIFICATIONS

A. If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

B. Upon request, Contractor shall submit proof of licensing class MU, MU-B, or MU-A.2.

1.03 SUBMITTALS

Shop drawings, engineering data, and product data are required to be submitted to PDU for review on all utility materials within a project, in accordance with *Section 01 33 00 SUBMITTAL PROCEDURES*.

1.04 DESIGN EXCEPTIONS

Submit a request for any design exception prior to installation. Design exceptions are issued by Portland Department of Utilities (PDU). Any deviation from the specifications requires a design exception.

PART 2. PRODUCTS

2.01 GRAVITY MAINS

A. Gravity mains shall be green SDR 26 PVC pipe, Protecto 401 lined Ductile Iron Pipe, or approved equal.

B. No gravity sewer main shall be less than 8 inches in diameter.

C. The depth of cover over all mains shall be not less than 48 inches.

D. 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%

E. 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.

F. Gravity mains shall be meet the following separation criteria:

1. All separation distances shall be measured from outer edge of sewer pipe to closest outer edge of other utility.

2. Separation of at least 10 feet horizontally from any existing or proposed potable water main.

3. Separation of at least 5 feet from any other utilities.

4. If these specified distances cannot be met, the Contractor shall notify PDU for further instructions.

5. The vertical separation between gravity sewer pipe and any other pipelines/utilities shall be 18 inches.

6. 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 minimum vertical clearance of 18 inches and the water main will be required to be within a casing pipe. See *Section 33 05 07 BORE AND JACK INSTALLATIONS* for casing pipe information.

2.02 GRAVITY SERVICES

A. Sewer services shall be a minimum diameter of 4 inches for residential and 6 inches for commercial/industrial services.

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

C. As per detail WW-06, a 6-inch cleanout assembly shall be installed on all sewer services and shall be located 1 foot outside right-of-way, unless otherwise approved by a PDU Representative.

D. The cleanout assembly shall have a concrete cleanout box, and cast iron frame and lid, as per detail WW-08.

E. The sewer service shall be at a minimum 6 inches from the tap at the main to the 6-inch cleanout assembly for all sewer services. A 6” x 4” reducer may be installed after the 6-inch cleanout assembly, as per detail WW-06, for a 4-inch residential sewer service.

F. 4-inch and 6-inch service laterals shall be laid at a minimum slope of 1/4-inch per foot.

G. Residential double sewer service connections are allowed, but the service pipe diameter shall be 6 inches and as per detail WW-07.

H. Service line connections to manholes are permitted as follows:

1. PDU approval required prior to execution.

2. For residential service connections to City manholes, PDU will charge fees associated with coring the manhole and install the service line up to the property line as a stub-out for the property owner to connect.

3. For manholes that have not been accepted as the City’s for residential development shall be cored by the Contractor and will

require inspection and approval from the PDU Inspector or Sewer Collections Supervisor.

4. For all commercial and industrial developments, the Contractor shall be responsible for coring the City's manhole for service connection, but will require inspection and approval from the PDU Inspector or Sewer Collections Supervisor.

2.03 DROP PIPE MANHOLE CONNECTION

A. Shall be provided for any gravity main entering at a vertical distance of 2.0 feet, or more, above the outgoing channel invert.

B. The bottom drop section shall be monolithically cast with the bottom manhole section.

C. Drop manholes shall have a Duran Reliner Bowl, with Force Line Hood, or approved equal.

D. Reliner stainless steel pipe support brackets shall be installed at 4-foot spacings (minimum of 2 per drop).

E. 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.

F. See *Section 03 40 00 Precast Concrete Structures* for structure specifications.

2.04 PVC PIPE AND FITTINGS

A. 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

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

C. 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.

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

E. 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.

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

G. Standard minimum laying lengths shall be 20.0-foot for SDR26 pipe shall be tested in accordance with ASTM D3212.

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

I. Rubber boots shall be installed where PVC enters a manhole to produce a watertight connection.

J. The rubber boots shall be Kor-N-Seal, Press Seal Gasket Corp., or approved equal.

PART 3. INSTALLATION

A. Any field changes to signed approved plans will require approval from PDU 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 to ensure no negative pressure is placed against the joint or connection.

D. It shall be the Contractor’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 PDU 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 *Section 33 05 07 BORE AND JACK INSTALLATIONS*.

G. No pipe shall be laid when the trench conditions or the weather is unsuitable for such work.

H. Trenches must be dry enough for side and bottom of excavations to be stable.

I. PDU reserves the right to determine when trench conditions have become unsuitable.

J. PVC pipe may be damaged by prolonged exposure to direct sunlight.

K. The Contractor shall take necessary precautions during storage and installation to avoid prolonged exposure to sunlight.

L. Pipe shall be stored under cover and sufficient backfill shall be placed to shield it from the sun as the pipe is installed.

M. Pipe cannot be used if the manufacture date that is stamped on the pipe is more than one (1) year prior to installation date.

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

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

3.02 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.

3.03 PRIOR TO CONSTRUCTION

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.

B. For City Contracted projects, the Contractor shall submit these certificates to the PDU prior to installation of the pipe materials.

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

3.04 TRENCH EXCAVATION

A. 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.

B. 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 #57 stone, with a minimum depth of 6” when laying pipe in stable clay-based soils, and a minimum depth of 6” from the bottom of the pipe #57 stone for embedment and 2” to 3” of foundation stone below embedment, as directed by the PDU Representative, when laying pipe in unstable, loose soils.

C. 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, A2, or A-3, as approved by the PDU Inspector or Engineer. Reference TDOT Standard Specifications for Road and Bridge Construction Section 203.04.D.

D. 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.

E. 4.4.5 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 41/2feet above natural grade.

3.05 HANDLING AND CUTTING PIPE

A. 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.

B. 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.

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 PDU, 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. Cutting Pipe: The Contractor shall cut pipe by means of an approved mechanical cutter. The cut shall be perpendicular to the longitudinal axis of the pipe and rough ends or spurs will be satisfactorily removed prior to installation and seating.

3.06 PIPE LAYING

A. Pipe shall be constructed of the materials specified and as 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. 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 PDU 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.

D. 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.

E. 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.

F. 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.

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

H. 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 PDU Department or placed into use.

I. 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 PDU Inspector or Engineer prior to installation.

J. 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.

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

3.07 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 meeting requirements of TDOT Section 903.22, Sizes of Course Aggregate

B. See Section 31 23 23 TRENCHING AND BACKFILLING for backfill and compaction requirements.

C. 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. Riser adjusting rings shall be a minimum of three inches to a maximum of 12-inches in height.

3.08 GRAVITY SERVICES

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

B. Each service/cleanout location shall be marked with an “S” pressed into the face of curb during the installation of the concrete.

C. The cleanout(s) shall be capped and end shall be attached to a green painted wood two-inch by four-inch stake, to avoid damage by equipment during construction. After connection to the building, the lateral cleanout shall be cut down to final grade and a concrete box and cover installed as shown in Standard Detail WW-06, WW-07, and WW-08.

3.09 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 PDU Standard Sewer Detail WW-03 for manhole requirements. All trenches shall be prepared per the requirements of Section 31 23 23 TRENCHING AND BACKFILLING.

B. 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.

C. 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.

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

E. Gravity Mains:

1. In the first stage, the Contractor shall provide adequate compacted fill beneath the haunches of the pipe, using mechanical tampers suitable for this purpose. This compaction applies to the material placed beneath the haunches of the pipe and above any bedding material. Fill compacted by mechanical compactors shall be placed in six-inch layers and thoroughly tamped over the entire surface.

2. 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 one foot 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. Material to be placed in six (6”) inch layers (loose thickness).

3. 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. All gravity mains installed in roadways or 3-feet from the edge of pavement, including new construction, shall have a full stone backfill (#57). 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.

F. Manholes:

1. The Contractor shall provide well-compacted sub-base under the manhole per PDU Standard Sewer Detail WW-03.

2. From the bedding up to grade the Contractor shall backfill around the manhole with #57 stone (nominal size 3/4”- No 4). The width of the backfill and compaction shall be the width of the excavation, or to a width equal to three times the manhole diameter whichever is less.

G. 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 T180 (ASTM D1557 - 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 T180(ASTM D1557 - Modified Proctor) with no tolerance.

H. 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 PDU 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 PDU 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 PDU 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.

3.10 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 PDU 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. Kor-N-Seal 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 PDU 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.

3.11 DECOMMISSIONING EXISTING WASTEWATER SYSTEMS

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 PDU Representative, 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.

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

2. Perform a Mandrel Test, Low Pressure Air Test, and CCTV inspection for all newly installed gravity sanitary sewers. Perform a vacuum test for newly installed sewer manholes and those sewer manholes with a new connection.

3. The PDU Inspector or Engineer of Record 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 deflection and leakage upon completion of installation. It is highly recommended that pavement, sidewalks, and curbs over newly installed PDU utilities not be constructed until the PDU utilities have been tested and have passed inspection.

4. 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 PDU inspector or a responsible person under their charge. Contractor shall notify the PDU seven days in advance of all tests.

5. 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 PDU or PDU Inspector.

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

7. Piping shall be properly backfilled and compacted a minimum of 30 days before testing.

8. Prior to tests, all gravity lines shall be cleaned and flushed with an appropriately sized cleaning ball. Pre-cleaning by high velocity jet or other methods may also be necessary.

9. 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.

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

11. 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 PDU Inspector, or the Engineer of Record. Tests or inspections after correction of defects shall be repeated until the work is

completed to the satisfaction of the PDU Inspector or Engineer of Record.

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

B. Deflection Tests: PVC

1. Pipe Maximum allowable pipe deflection (reduction in vertical inside diameter) shall not exceed 5% as determined using a mandrel. The mandrel shall be pulled through the pipe, not blown.

2. 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.

3. 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.

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

5. The Project Manager, Engineer or PDU 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.

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

7. The Contractor shall furnish the mandrel, labor, materials, and equipment necessary to perform the tests as approved by the Project Manager, Engineer or PDU 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. Percent (%) deflection as previously stated

8. If the mandrel fails to pass any section of pipe, 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.

C. Low Pressure Air Test

1. Low pressure air test for sewer mains less than 36-inch inside diameter shall be tested I accordance with the latest version of ASTM C 828, ASTM C 924, and/or ASTM F1417 as applicable

2. Use testing pneumatic plugs that can remain in place when pressurized to 25 psig with external aids.

3. For pipe less than 36-inch diameter in accordance with the following:

    a. Determine ground water level

    b. Plug both ends of pipe.

    c. Pressurize pipe to 4.0 psig, increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes adjust pressure to 3.5 psig (plus adjustment for groundwater).

d. Measure time for pressure to drop from 3.5 psi to 2.5 psi. The time shall be greater than the specified (or calculated) time.

MINIMUM TEST TIME FOR VARIOUS PIPE SIZES

Nominal Pipe Size (Inches)	Time (Min./foot)	Minimum Test Time
6	0.855	5:40
8	1.512	7:33
10	2.374	9:27
12	3.419	11:20
18	7.693	17:00
24	13.676	22:40
30	21.369	28:20

e. For pipes greater than 36-inch inside diameter and larger air test at each joint. A visual inspection of the line shall be performed immediately after the air test. The minimum time allowable for the pressure to drop from 3.5 psi to 2.5 psi during a joint test, regardless of pipe size, shall be 10 seconds.

f. Sewer mains failing to minimum test time shall be located and remedied by the Contractor. The sewer mains shall be retested until the minimum test time is met and all test procedures are passing.

D. Vacuum Testing Manholes in 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. General: 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.

4. Vacuum test in accordance with ASTM C1244 and as follows:

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

    b. 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.

    c. Determine test duration for manhole from the following table:

Diameter (ft)			
	4	5	6
Depth in (ft)	Time (s)		
8	20*	28*	33*
10	25	33	41
12	30	39	49
14	35	45	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

*Minimum time

    d. 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.

e. When vacuum test fails to meet 1 inch Hg drop in specified time after repair, repair and retest manhole.

3.13 CLOSE-CIRCUIT TELEVISING (CCTV) SANITARY SEWER MAINS

A. The following procedures shall be followed on all sanitary sewer mains which are to be accepted by the PDU.

B. PDU 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 PDU Inspector.

C. 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.

D. 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.

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

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

G. CCTV inspection for the Contractor's own use may be done at any time; however, the City inspector shall be present during all televising for acceptance and the procedures listed herein shall be followed.

H. Mains shall be flushed and cleaned thoroughly prior to CCTV inspection

I. 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.

J. 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 PDU inspector. The City inspector may require pigging of specific sections, if necessary.

K. There shall be no dips in the mains. Any dips which are found shall be reviewed and a decision made by the PDU 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.

L. 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.

M. The PDU inspector will 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.

END OF SECTION

PART 1. GENERAL

1.01 SCOPE

A. This Section describes products to be incorporated into force mains, pressure sewers, pressure sewer services, and individual pressure systems, accessories, and requirements for the installation and use of these items.

B. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.

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

1.02 QUALIFICATIONS

If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 SUBMITTALS

The contractor shall provide shop drawings, engineering data, and product data to the PDU Representative for review per *Section 01 33 00 SUBMITTAL PROCEDURES.*

1.04 STORAGE AND HANDLING

Storage and handling shall comply with *Section 01 66 00 STORAGE AND HANDLING REQUIREMENTS.*

1.05 QUALITY ASSURANCE

A. Product manufacturers shall provide the Engineer with written certification that all products furnished comply with all applicable provisions of these Specifications.

B. If ordered by the Engineer, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe.

C. This service will be furnished for a minimum of five days during initial pipe installation.

PART 2. PRODUCTS

2.01 DUCTILE IRON PIPE (DIP)

A. Ductile iron pipe shall be manufactured in accordance with AWWA C151.

B. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet.

C. Sizes will be as shown on the PDU-Approved Construction Drawings.

D. All pipe shall have a minimum pressure rating, as indicated in the following table, and corresponding minimum wall thickness, unless otherwise approved by PDU:

Pipe Sizes	Pressure Rating (psi)
4” to 12”	350
16” to 24"	250

E. Fittings and Accessories

1. Fittings shall be ductile iron mechanical joint and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53, with a minimum rated working pressure of 250 psi.

2. Thrust collars shall be welded-on ductile iron body type capable of withstanding 250 psi internal pressure on a dead end from either direction on that pipe size.

3. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer.

4. Retainer glands may be used for thrust collars where shown on the PDU-Approved Construction Plans.

5. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi.

6. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the PDU-Approved Construction Drawings.

7. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected.

8. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe, McWane (Clow), or approved equal.

F. Joints

1. Joints for ductile iron pipe and fittings shall be mechanical joint, flanged joint, restrained joint, push-on joint, or as shown on the PDU-Approved Construction Drawings.

2. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.

3. Provide the necessary bolts for connections.

4. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit.

5. All bolts and nuts shall be made in the U.S.A.

6. Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11.

7. Details of the joint design, including the bolts, nuts, and gaskets, shall be in accordance with the manufacturer's standard practice/recommendations.

8. Restrained Joints shall be ACIPCO, U.S. Pipe, or approved equal.

G. Cement Linings

1. Pipe and fittings shall be cement lined in accordance with AWWA C104/ ANSI/AWWA C104/A21.4.

2.02 POLYVINYL CHLORIDE (PVC) PIPE

A. PVC pipe shall have a diameter of 2 inches or greater and shall conform to ASTM D 2241.

B. The pipe shall be green SDR 26 PVC pipe.

C. PVC pressure pipe shall be supplied in 20-foot nominal lengths.

D. Fittings

1. All fittings shall be of ductile iron meeting the requirements of AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53, with a minimum rated working pressure of 250 psi.

2. Fittings shall be cement lined in accordance with AWWA C104/ANSI A21.4.

3. Fittings shall be mechanical joint.

4. Fittings shall be furnished with a bituminous outside coating.

5. Special adapters shall be provided, as recommended by the manufacturer, to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings, or valves.

6. Fittings less than 4 inches in diameter shall be of the same material, strength, and dimension as the pipe to which it connects.

E. Joints

1. Pipe and fittings 2 inches in diameter and greater shall have integral bell and spigot type joints, with elastomeric gaskets having the capability of absorbing expansion and contraction without leakage.

2. Joints shall meet the requirements of ASTM D 3139; gaskets shall meet the requirements of ASTM F 477.

3. Joint system shall be subject to the approval of the PDU Representative.

F. Acceptance will be on the basis of the PDU Inspector or Sewer Collections Supervisor and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

2.03 SCHEDULE 40 PIPE

A. Schedule 40 pipe shall be used on pipe less than 2 inches in diameter that is approved by PDU.

B. Schedule 40 pipe shall be in accordance with ASTM D 1785.

C. Fittings shall be solvent weld socket type, same schedule as piping, ASTM D 2466 or D 2467.

D. Solvent cement shall be in accordance with ASTM D 2564.

2.04 C900 PIPE

A. Where shown on the PDU-Approved Construction Drawings, PVC pipe shall have belled ends for push-on type jointing and shall conform to AWWA C900, ductile iron pipe equivalent outside diameters.

B. The pipe shall have a Dimension Ratio (DR) of 14 and shall be capable of withstanding a working pressure of 200 psi.

C. Pipe shall be supplied in minimum lengths of 20 feet.

D. Fittings shall be of cast or ductile iron meeting the requirements of AWWA C110 or AWWA C153, with a minimum rated working pressure of 250 psi.

E. Fittings shall be cement lined in accordance with AWWA C104.

F. Fittings shall be furnished with a bituminous outside coating.

G. Special adapters shall be provided, as recommended by the manufacturer, to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings, or valves.

H. Fittings shall be lined with ceramic epoxy as specified in Section 33 30 00.

2.05 MANHOLES AND PRECAST CONCRETE PRODUCTS

Precast manholes, concrete cleanout boxes, and all other concrete products shall conform to section 33 30 00 SEWER MAINS AND ACCESSORIES

2.06 TRACER WIRE

A. Tracer detection wire shall be 12-gauge AWG, high-strength, solid copper-clad steel conductor (HS-CCS) locator wire.

B. Tracer wire is only required on water and sewer force mains.

C. Detection wire shall be installed with the pipe and fastened to the crown of the pipe.

D. The ends of the wire shall be brought up through valve boxes within 4 inches from the top.

E. Where required, detection wire shall be buried 4 to 10 inches beneath the ground surface directly over the top of the pipe.

2.07 RETAINER GLANDS

A. Retainer glands for ductile iron pipe shall be Megalug, Series 1100, as manufactured by EBBA Iron Sales, Inc, or Uni-Flange Series 1400, as manufactured by Ford Meter Box Company.

B. Retainer glands for PVC pipe shall be Megalug Series 2000 PV, as manufactured by EBAA Iron Sales, Inc, or Uni-Flange Series 1300, as manufactured by Ford Meter Box Company.

2.08 ANCHOR COUPLING

Anchor Couplings shall be Tyler Union or approved equal.

2.09 METER BOX

A. Meter vault boxes for components of force main being 1-inch in diameter or less shall be concrete and have external dimensions of 19¼" x 17", with JBS 8121 (non-traffic areas) or JBS 8122 (traffic areas) cast-iron frame and cover or approved equal. With "SEWER' stamped on the casting lid.

B. Meter vault boxes for components of force main being 2-inch in diameter shall be concrete with external dimensions of 57" x 27", with a 44" x 20" aluminum hatch or approved equal.

C. Meter vaults for 4-inch in diameter or greater shall have at a minimum 1 foot of clearance from valves to the inside concrete vault wall.

2.10 CONCRETE

A. Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches.

B. For job mixed concrete, submit the concrete mix design for approval by the Engineer.

C. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94.

D. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.11 PLUG VALVES (PV)

A. Valves shall be 90-degree turn, non-lubricated, eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement.

Valves shall be suitable for throttling service and service where valve operation is infrequent.

B. Valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B16.1. Valves shall be rated at a minimum of 150 psi.

C. Valves shall have a port area equal to at least 80 percent of the full pipe area.

D. Bodies shall be cast-iron, conforming to ASTM A 126, Class B (carbon steel for 2-inch valves).

E. Valve ends shall be a mechanical joint type, except where flanged or restrained joint ends are shown on the Drawings. Mechanical joint valves shall have bell ends conforming to applicable requirements of AWWA C111/ANSI A21.11. Flanged joints shall meet the requirements of ANSI B16.1, Class 125. Flanged valves with flange-to-MJ adapters shall not be acceptable in lieu of MJ valves.

F. Valve seats shall be a raised, welded-in overlay of not less than 90 percent pure nickel, machined to mate with the resilient faced plug. Overlay shall be minimum of 1/8-inch thick.

G. The plug shall be of semi-steel, conforming to ASTM A 126, Class B. The plug facing shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug. Facing material shall be abrasion resistant and suitable for service in sewage and sludge applications.

H. Valves shall be furnished with replaceable, sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C507. Bearing materials shall have a proven record of service of not less than five years.

I. The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C504.

J. Actuators

    1. Valves for exposed service, 3 through 8-inches in diameter, shall be lever operated. Hand levers shall be steel with a non-metallic grip.

2. Actuators for buried service and valves 10-inches and larger, shall be equipped with manual operated geared actuators. Geared actuators shall be totally enclosed, oil lubricated, worm and gear type. Shaft seals shall be provided to prevent entry of dirt and water into the actuator. All shaft bearings shall be permanently lubricated bronze bushings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Construction of actuator housing shall be semi-steel. Gear actuators shall comply with requirements of AWWA C504.

3. Gear actuators for buried valves 10-inches and larger in diameter shall be mounted above ground on an extended bonnet.

4. Motorized actuators shall be provided where shown on the Drawings and as specified in this Section.

5. Valves and operators for submerged or buried service shall have seals on all shafts and gaskets on valve operator covers to prevent the entry of water. Operator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals.

K. Operators

1. Valves for non-buried service, six feet or more above the operating floor shall be furnished with a chainwheel operator and chain for operation from floor level. All other valves shall be equipped with a handwheel operator.

2. Valves, 3 through 8-inches, for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension required to bring the operation nut within 6-inches of finished grade. Valve boxes and extension stems shall be as specified in this Section.

L. All exposed bolts, nuts, and washers for buried or submerged valves shall be stainless steel. All exposed nuts, bolts, springs, washers, and miscellaneous hardware shall be zinc coated in accordance with ASTM A 153 unless specified otherwise.

M. The exterior of all buried valves shall have a factory applied, two coat coal tar epoxy coating system. The coal tar epoxy shall be Tnemec Tneme-Tar 46-413, Indurall Ruffstuff 2100 Coal Tar Epoxy or Kop-Coat Bitumastic No. 300-M. Each coating shall have a minimum dry film thickness of 8-10 mils.

N. All ferrous metal interior surfaces of plug valves shall be provided with a factory applied epoxy interior coating conforming to the requirements of

AWWA C550. The coating shall be either TNEMEC Series 20 Pota Pox, Valspar Series 78 or Kopcoat Hi Gard Epoxy. Each coating shall have a minimum dry film thickness of 4 to 6 mils.

O. Acceptable Manufacturers: All plug valves shall be products of a single manufacturer who must submit evidence of five years satisfactory service in sewage applications of the same design and of the sizes required. Valves shall be manufactured by DeZurik or Keystone.

2.12 VALVES FOR SERVICE CONNECTIONS

A. Check Valves: The valve shall be suitable for PVC threaded construction. The valve shall be gravity-operated, flapper-type check valve. This valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6inchesof water at maximum rated flow. Working parts shall be made of 300 series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back pressure. The valve body shall be a high gloss injection molded part made of PVC Type I-II. Check valves shall be furnished with each individual pump station.

B. PVC Ball Valves (PBLV) Ball valves shall be non-shock thermoplastic of Type 1, Grade 1 PVC with O-ring stem seal and Teflon ball seat. O-ring seals shall be EPDM. Valves shall withstand 150 psi pressure. Valves shall have union connections at each end. Valves shall be Hayward "Safe Block", or Chemtrol TU Series, or Spears (True Union 2000 Industrial).

C. Ball Valves (BLV-BZ)

1. Ball valves shall have a single piece, bronze body construction. Valves shall have threaded ends and lever operator. Ball shall be 316 stainless steel with TFE seats and packing. Valves shall be pressure rated for 400 psi at 68 degrees F.

2. Valves shall be Apollo Series 70-100, Neles-Jamesbury Series 300, Watts No. B-6400, or Nibco T580.

2.13 AIR VALVES FOR SEWER SERVICE

A. Air Release Valves: Valves shall be automatic air release valves designed to allow escape of air under pressure and close water-tight when liquid enters the valve. Valve shall have a 2-inch NPT inlet. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be

equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve.

B. Air/Vacuum Valves: Valves shall be automatic air and vacuum valves designed to allow escape of air, close water-tight when liquid enters the valve, and allow air to enter in the event of a vacuum. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve.

C. Combination air valve shall consist of an air release valve tapped into the body of an air and vacuum valve.

D. Single Body Valve: In lieu of C. above, a single body, double orifice, sewage combination valve may be used. Materials of construction, orifice size, venting capacity and accessories shall meet the requirements of A. and B. above.

E. Valves shall be recommended by the manufacturer for wastewater service and shall be equal to APCO Valve Corporation. A.R.I. Flow Control Accessories, or Val-Matic.

2.14 VALVE BOXES AND EXTENSION STEMS

A. Valve Boxes

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

2. 2. Valve boxes shall be manufactured by Bouchard.

B. Extension Stems: Extension stems shall be provided if depth of bury places the operating nut in excess of 60-inches beneath finished grade, so as to set the top of the operating nut 30-inches below finished grade.

Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller 26441.

2.15 SERVICE CONNECTIONS

Tap, Saddle and Gate Valve Assembly shall be utilized for all individual simplex grinder pump station installations. All other connections shall be designed and submitted for approval by an Engineer.

2.16 SIMPLEX GRINDER PUMP STATION

A. The simplex grinder pump station shall include a fiberglass-reinforced polyester tank which shall house a displacement grinder pump, level controls, piping, anti-siphon valve, check valve, wiring, and other miscellaneous appurtenances. The alarm/disconnect panel and 6 conductor, 12 gauge, type SJOW power and alarm cable shall also be supplied as part of the pump station.

B. Alarm/Disconnect Panel

1. The alarm/disconnect panel shall be NEMA 3R, UL listed, thermoplastic enclosure with a hinged, padlockable cover and secured dead front and component knockouts. A visual alarm lamp enclosed within a red fluted lens at least 2-5/8-inches in diameter and 1-11/16-inches in height shall be mounted on top of the panel in such a manner as to maintain a NEMA 3R rating. An audible alarm, capable of being deactivated by depressing a push-type switch, encapsulated in a weatherproof silicone boot, shall be mounted on the bottom of the enclosure.

2. The panel shall contain one 15 amp, double pole circuit breaker for the power circuit and one 15 amp single pole circuit breaker for the alarm circuit. The panel shall contain terminal blocks, integral power bus, and a complete alarm feature.

3. Additional features shall include an audible and visual alarm, push-to-run switch, and high level (redundant) pump starting control.

4. Alarm Sequence

a. Wastewater in wet well rising above alarm level triggers a visual and audio alarm. The contacts on the alarm switch will close. The redundant pump starting system will be energized.

b. The audible alarm may be silenced by means of the externally-mounted push-to-silence button.

c. Visual alarm remains illuminated until the wastewater level in the wet well drops below the "off" setting of the alarm pressure switch.

C. The pump shall be by Barnes or approved equal and as shown on the Drawings.

PART 3. Execution

3.01 EXISTING UTILITIES AND OBSTRUCTIONS

A. The Drawings indicate utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Tennessee One Call System, Inc. (1-800-351-1111) as required by the Tennessee Law "Underground Utility Damage Prevention Act" (Code Section 65-31-106) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site at least 72 hours (three business days) prior to construction to verify the location of the existing utilities.

B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.

1. Provide the required notice to the utility owners and allow them to locate their facilities according to Tennessee law. Field utility locations are valid for only ten days after original notice. The Contractor shall ensure, at the time of any excavation that a valid utility location exists at the point of excavation.

2. Expose the facility to verify its true location and grade for a distance of at least 200 feet in advance of pipeline construction to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.

3. Avoid utility damage and interruption by protecting it with means or methods recommended by the utility owner.

4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently if required.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed pressure main does not permit safe installation of the pressure main by the use of sheeting, shoring, tie-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the pressure main to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement and complies with regulatory agency requirements after a written request to and subsequent approval by the Engineer. If, in the opinion of the Engineer, the pressure main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the Owner will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.

2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed pressure main does not permit the crossing without immediate or potential future damage to the utility, main, service, or the pressure main. The Contractor may change the proposed grade of the pressure main to avoid vertical conflicts if the changed grade provides minimum required capacity, maintains adequate cover and complies with regulatory agencies requirements, after written request to and subsequent approval by the Engineer. If, in the opinion of the Engineer, the pressure main's proposed location cannot be adjusted, thus requiring the relocation of an existing utility, the Owner will direct the Contractor to relocate the utility as part of the Contract with the costs of such relocation being paid for as part of a change order.

D. Water and Sewer Separation

1. 1. Water mains should maintain a minimum 10-foot edge-to-edge separation from sewer lines, whether gravity or pressure. If the main cannot be installed in the prescribed easement or right-of-way and provide the 10-foot separation, the separation may be reduced, provided the bottom of the water main is a minimum of 18-inches above the top of the sewer. Should neither of these two separation criteria be possible, the water main shall be installed below the sewer with a minimum vertical separation of 18-inches.

2. The water main, when installed below the sewer, shall be encased in concrete with a minimum 6-inch concrete depth to the first joint in each direction. Where water mains cross the sewer, the pipe joint adjacent to the pipe crossing the sewer shall be cut to provide

maximum separation of the pipe joints from the sewer. A minimum of 18-inches of vertical clearance must be maintained at all times.

3. No water main shall pass through, or come in contact with, any part of a sanitary sewer manhole.

E. Miscellaneous Obstructions: The Contractor shall coordinate its work with the individual property owners during the installation of the Individual Pumping Systems. Property owners may have invisible fences, underground sprinkler systems, storm drainage, and other miscellaneous obstructions which must be worked around. The Contractor shall take all necessary measures to minimize disruption or damage to such systems. The Contractor shall restore any damage to personal property as soon as possible.

3.02 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by applicable regulatory agencies with reference to construction operations, safety, traffic control, road maintenance and repair.

B. Traffic Control

1. The Contractor shall: provide, erect and maintain all necessary barricades, suitable and sufficient lights and other traffic control devices; provide qualified flagmen where necessary to direct traffic; take all necessary precautions for the protection of the work and the safety of the public.

2. Construction traffic control devices and their installation shall be in accordance with the current Manual On Uniform Traffic Control Devices (MUTCD) for Streets and Highways.

3. Placement and removal of construction traffic control devices shall be coordinated with the applicable regulatory agencies a minimum of 48 hours in advance of the activity.

4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.

5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring

temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.

6. Construction traffic control devices shall be maintained in good repair, and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.

7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the Department of Transportation and the county. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.

8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual On Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

C. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.

2. Stripping: Where the pipe line is laid along road right-of-way, strip and stockpile all sod, topsoil and other material suitable for right-of-way restoration.

3. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.

4. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.

D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off the pavement in a timely manner.

E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

F. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences; property corners; cultivated trees and shrubbery; manmade improvements; subdivision and other signs within the right-of-way and easement. The Contractor shall take extreme care in moving landscape features and promptly re-establishing these features.

G. Maintaining Highways, Streets, Roadways and Driveways

1. The pressure sewer mains shall be punched under all paved surfaces. After several unsuccessful attempts to punch the pipe, the Engineer may direct the Contractor to trench across the pavement.

2. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the work.

3. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates. The edges of running plates shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted, as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.

4. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. Make the grader or front-end loader available at all times.

5. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the work.

3.03 PIPE DISTRIBUTION

A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.

B. No pipe shall be strung further along the route than 500 feet beyond the area in which the Contractor is actually working without written permission

from the Owner. The Owner reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.

C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.

D. No distributed pipe shall be placed inside drainage ditches.

E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.04 LOCATION AND GRADE

A. Drawings show the alignment of the pressure mains and the position of manholes and other appurtenances. The slope shown on the profile and/or called for in the Specifications is the slope of the invert of the pipe.

B. After the Contractor locates and marks the manhole centerlines or baselines of the sewer, the Contractor shall perform clearing and grubbing.

3.05 LAYING AND JOINTING PIPE AND ACCESSORIES

A. Lay all pipe and fittings to accurately conforming to the lines and grades established in the plans.

B. Pipe Installation:

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

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

3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.

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

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

6. It is common practice to lay pipe with the bells facing the direction in which work is progressing, however, it is not mandatory.

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

8. Provide tracer wire and detection tape for all non-metallic pressure pipe. The tracer wire shall be wrapped around the pipe and shall be looped up to the surface at all valve locations. Detection tape shall be installed on top of all pipe.

9. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the Engineer.

C. C. Alignment and Gradient

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

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

D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or

accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Engineer.

E. Joint Assembly

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

2. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.

F. Cutting Pipe

1. Cut ductile iron pipe using an abrasive wheel saw.

2. Cut PVC pipe using a suitable saw.

3. Remove all burrs and smooth the end before jointing.

4. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

G. Valve and Fitting Installation

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

2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve.

3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or

pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the Engineer.

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

H. Air Valve Manholes

1. Construct the vault or manhole as detailed on the Drawings.

2. The frame and cover shall be cast into the top slab or cone.

3. Where vent pipe are shown on the Drawings, vents shall be of one-piece, welded steel construction. Vent pipes shall equal air valve size, but no less than 4-inches. The vent pipe shall be grouted into a precast hole in the vault. The discharge of the vent pipe shall be provided with a 3/16-inch PVC coated mesh screen.

I. House Connections: Install tees in locations designated by the Engineer for future connection of service lines. Plug the branch of the tee. Record the location of fittings installed on a copy of the Contract Drawings to be submitted as Record Drawings.

3.06 MANHOLE AND PRECAST CONCRETE PRODUCT CONSTRUCTION

Construct manholes as shown on the Drawings and as specified in 33 30 00 SEWER MAINS AND ACCESSORIES.

3.07 THRUST RESTRAINT

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

B. Retainer Glands: Provide retainer glands where shown on the Drawings and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.

C. Harnessing: Provide harness rods only where specifically shown on the Drawings or directed by the Engineer. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling. Where

possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.

D. Concrete Blocking

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

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

E. Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements specified in Article 2.03 of this Section. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

3.08 CONCRETE COLLARS

Construct collars shall be installed per standard detail WW-08.

3.09 DETECTION WIRE AND LOCATION TAPE

A. Provide detection wire for all PVC pipe force mains and pressure sewers. Detection wire shall be installed with the pipe, taped to the pipe, and wrapped once around the pipe on each joint.

B. Detection wire shall be accessible, at a minimum, every 1,000 linear feet and every gate valve location. When a gate valve location or by placement of a concrete pull box. The ends of the wire shall be brought up through the box in either case and attached to the lid

C. Where required, location tape shall be buried 4 to 10 inches beneath the ground surface directly over the top of the pipe.

3.10 INSPECTION AND TESTING

A. A. Pressure and Leakage Test

1. All sections of pipeline subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of line

will be considered ready for testing after completion of all thrust restraint and backfilling. Each segment of pipeline between line valves shall be tested individually.

2. Test Preparation

    a. Flush pipeline section thoroughly at flow velocities adequate to remove debris from pipe and valve seats. Partially operate valves and hydrants to clean out seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.

    b. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.

    c. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Unless permanent air vents are in place, insert temporary corporation stops at highpoints to expel air as line is filled with water.

    d. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure. Differential pressure at valves and hydrants shall equal the maximum possible, but shall not exceed manufacturer's pressure rating.

3. Test Pressure: Test the pipeline such that no point has a pressure less than 1.5 times the future working pressure for at least two hours. The test pressure shall not vary by more than 5 psi for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not less than 5 psi.

4. Leakage: Leakage shall be defined as the quantity of water that must be pumped into the test section equal to the sum of the water, to maintain pressure within 5 psi of the specified test pressure for the test duration plus water required to return line to test pressure at the end of the test. Leakage shall be the total cumulative amount measured on a water meter. The Owner assumes no responsibility for leakage occurring through existing valves.

5. Test Results: No test section shall be accepted if the leakage exceeds the limits determined under Section 4 of AWWA C600. The leakage test shall be repeated until the test section is

accepted. All visible leaks shall be repaired regardless of leakage test results.

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

3.11 PROTECTION AND RESTORATION OF WORK AREA

A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.

2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.

B. Man-Made Improvements: Protect, or remove and replace with the Engineer's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins and other improvements that may be encountered in the work.

C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Engineer. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.

D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be

removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.

E. Disposal of Rubbish: Dispose of all materials cleared and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate county, state and federal regulatory agencies.

F. Swamps and Other Wetlands

1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.

2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the Contractor.

3. The Contractor shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland or stream which may be temporarily divided by construction.

4. The Contractor shall not spread, discharge or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.

3.12 INSTALLATION OF INDIVIDUAL PUMP SYSTEM

A. Sequence of Construction: The installation of the individual pump system shall begin after the pressure sewer mains and service connections have been constructed, approved by the Engineer, and accepted by the Owner. Installation of the individual pump system shall include the following steps:

1. Examine the property with the Engineer and Owner to determine the location for the grinder pump station and the alarm/disconnect panel.

2. Install the grinder pump station and alarm/disconnect panel at the designated location according to specifications.

3. Install pressure service line from the grinder pump station to the service connection.

4. Reroute the gravity service line from the house to the grinder pump station and complete the wiring. Cap or plug the existing gravity service line to the septic tank.

5. Open the ball valve at the service connection and test the system.

6. Clean-up and restore the property to its original condition.

B. Installation of Grinder Pump Station

1. The Contractor shall provide a firm, dry subgrade for the structure, and shall guard against flotation or other damage resulting from general water or flooding. The grinder pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the Engineer.

2. Remove packing material. Users instructions must be given to the Owner. Hardware supplied with the unit, if required, shall be used at installation. The basin shall be supplied with a standard 4-inch inlet grommet (4.5-inch o.d.) for connecting the incoming sewer line. Appropriate inlet piping must be used. The basin shall not be dropped, rolled or laid on its side for any reason.

3. Installation shall be accomplished so that 1 to 4-inches of accessway 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.

4. A minimum 6-inch layer of naturally rounded aggregate, clean and free flowing, with particle size of not less than 1/8-inch nor more than 3/4-inch shall be used as bedding material under each unit. 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 lifting eyes for loading and unloading purposes. 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. 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 8-inch sleeve is required over the inlet prior to the concrete being poured.

5. Backfill of clean, native earth, free of rocks, roots and foreign objects shall be thoroughly compacted in lifts not exceeding 12-inches to a final Proctor Density of 85 percent. Improper backfilling

may result in damaged accessways. The grinder pump station shall be installed at a minimum depth of 30-inches from grade to the top of the 1-1/4-inch discharge line. The finish grade line shall be 1 to 4-inches below the bottom of the lid, and final grade shall slope away from the grinder pump station.

6. All restoration shall be the Contractor's responsibility. Properties shall be restored to their original condition in all respects, including but not limited to, sidewalk replacement, landscaping, loaming and seeding, and restoration of traveled ways, as directed by the Engineer.

7. The electrical enclosure shall be furnished, installed and wired to the grinder pump station by the Contractor.

8. An alarm device is required on every installation. The Contractor shall mount the alarm device in a conspicuous location. The alarm/disconnect panel shall be connected to the grinder pump station by a length of cable as shown on the Drawings supplied by the manufacturer. The power and alarm circuits must be on separate power circuits.

C. Rock Excavation: Any rock encountered during the installation of the individual pump system, including the trenching of the pressure service and the gravity service lines, shall be removed by means other than blasting.

END OF SECTION

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. 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 upflow 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, 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 Flygt, Pumpex, ABS, and Gorman-Rupp, 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 of Portland Utility Department (PUD) 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 PUD. 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 PUD in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

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 runout.

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 deenergize 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 (10100%).

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, inline 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. 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. 9. Magnetic flowmeter systems shall provide zero flow stability by means of automatic zero adjustment of a DC-excited metering circuit.

10. 10. Converters shall be capable of bidirectional flow measurement.

11. 11. Signal converters shall be of the same brand as the magnetic flowmeters.

12. 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. 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 xx xx xx.

2.09 PUMP STATION WETWELL AND VALVE VAULT

A. The pump station wetwell and valve vault shall be constructed of precast concrete.

B. 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.

C. 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.

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. The City shall observe all field tests. Contractor shall give three (3) days' written notice to the City before performing tests.

C. Successful operation shall be demonstrated to the satisfaction of the City.

D. The Contractor shall make, at his expense, all necessary changes, modifications, and/or adjustments required to assure satisfactory and efficient operation.

E. 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.

F. An authorized representative(s) shall be present for start-up of the pumps and controls.

G. 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. 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 PUD.

END OF SECTION

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 aboveground, 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; and emergency diesel engine generator.

B. PERFORMANCE CRITERIA

3. 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. 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.

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 01 33 00, Submittal Procedures.

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 01 33 00, Submittal Procedures.

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 wetwell.

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 wetwell. 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°F, and turned off at 55°F.

3. The blower motor control circuit shall incorporate a thermalmagnetic 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 lockscrew 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. 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.

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. 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 lockwashers. 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.

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. 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

6. 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. Wiring

    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 60o C temperature rating, on circuits of 100 A or less, nor above 75o 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. 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)The PCS equipment shall be constructed in compliance with UL's

2. 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 lowprofileenclosure 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 deenergizethe 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 pipe stand mounting and for operating temperatures of -15° to +125°F and a relative humidity of ten to one hundred percent (10100%).

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. 1. The magnetic flowmeter shall be a completely obstructionless, inline flowmeter with no constrictions in the flow of fluid through the meter.

2. 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 PUMP STATION WETWELL AND VALVE VAULT

A. The pump station wetwell and valve vault shall be constructed of precast concrete.

B. 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.

C. 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. 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 wetwell.

C. 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.

D. 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.

E. 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 wetwell, Contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge

END OF SECTION

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 gas pipe. Contractor shall include all labor, materials, equipment, incidentals, and ancillary components to make 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 REFERENCED DOCUMENTS

The City of Portland Gas Emergency Plan and Operations & Maintenance Manual shall be incorporated by reference to this Standard Specification Section.

1.03 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 regulators, meters, relief valves, and heaters shall be supplied by the Contractor.

1.04 DELIVERY, STORAGE, AND HANDLING

All equipment shall be delivered, stored, and handled in strict accordance with the Manufacturer's recommendations and Section 01 66 00 Storage and Handling Requirements.

PART 2. PRODUCTS

2.01 PIPE

A. Polyethylene (PE) Pipe

1. All PE shall be manufactured from resin qualifying for a Plastic Pipe Institute Material Designation of PE 3408. All PE pipe shall conform the ASTM D2513, ASTM D3350, ASTM D1505.

2. All PE pipe shall have a Dimension Ratio (SDR) 11. The pipe shall be rated for use in 100 psig gas distribution systems unless otherwise stated on the plans.

3. All PE pipe shall be Yellowstripe 8300, PolyPipe GDB50, or as approved equal.

4. PE piping shall have 12-gauge solid copper tracer wire installed over the PE pipe. Larger gauge wire may be required for special installations. This wire shall be installed above the pipe for the full length of all PE pipe installed. Tracer wire shall be within six (6) inches, but no closer than three (3) inches to the pipe at all locations. All PE pipe installations are to be backfilled at a minimum of three (3) inches before the tracer wire is placed in ditch. The tracer wire shall not touch the pipe at any location. Tracer wire shall be wire capped and connected to riser cap at each meter set, but shall not be electrically connected to the riser. Location tap shall be placed in the trench as shown on the typical trench drawings.

5. Design Pressure for all PE pipe shall be 125 psig at 73°F. The minimum pipe wall thickness of steel shall be as follows:

Nominal PE Size, (Inches) IPS	DR	Dimensions		Standard Length (feet)
		Ave. OD (inches)	Min Wall Thickness (inches)	
½	---	0.840	0.090	500
¾	---	1.050	0.095	500
1	9.3	1.315	0.120	500
1¼	11	1.650	0.150	500
1½	11	1.900	0.173	500
2	11	2.375	0.216	250
2	11	2.375	0.216	500
2	11	2.375	0.216	1,500
3	11	3.500	0.318	500
3	11	3.500	0.318	40
4	11	4.500	0.409	40
6	11	6.250	0.602	40
8	11	8.625	0.784	40
10	11	10.750	0.977	40

B. Steel Pipe

1. All steel pipe shall be new steel pipe conforming to American Petroleum Institute (API) Standard Specifications API 5L (latest edition) Grade X-42 or higher, seamless, and shall be ball valves manufactured by BALON.

2. All underground pipe including casing pipe shall be coated with standard thin film fusion bonded epoxy coating.

Nominal PE Size, (Inches) IPS	Yield Strength (psi)	Min Wall Thickness (inches)	Coating Thickness
¾	42,000	0.113 (Sch. 40)	Thin Film Epoxy 14-16 mils Thick
1	42,000	0.133 (Sch. 40)	
2	42,000	0.154 (Sch. 40)	
3	42,000	0.188	
4	42,000	0.188	
6	42,000	0.188	
8	42,000	0.250	
12	52,000	0.312	

3. Steel Pipe shall not be used in construction of new gas mains. Steel pipe shall only be used in rehabilitation projects in replacement of steel mains.

2.02 VALVES

A. Polyethylene (PE) Valves

1. All polyethylene pipe shall be manufactured from resin qualifying for a Plastic Pipe Institute Material Designation of PE 3408. All PE valves shall be approved by Owner, compatible to pipe being installed, and meet the minimum requirements under ASME B16.40 and ASTM D2513 latest edition.

2. All PE valves shall be Rockwell “Polyvalves” or approved equal, butt fusion, ball valves comparable with use in a gas system. All valves shall have a pressure rating adequate for the intended service.

B. Steel Valves

1. Steel Valves shall not be used in construction of new gas mains. Steel Valves shall only be used in rehabilitation projects in replacement of steel mains.

2. All below ground steel valves shall have a two (2) inch square nut adapter with riser per the City of portland Standard Details and be ball type with ¼ turn fully open to closed.

3. All valves shall have a pressure rating adequate for the intended service.

4. All lubricated steel valves shall be greased and turned to ensure that the valve will operate properly. All lubricated steel valves shall have a readily accessible grease connection and an indicator clearly visible showing whether the valve is open or closed.

5. All steel valves for underground installation shall be factory coated wherever possible with a Fusion Bond Epoxy (FBE), Tarset, or equivalent coating.

2.03 FITTINGS

A. Polyethylene (PE) Fittings

1. All PE fittings shall be butt fusion type of fittings unless otherwise noted or called for in the plans.

2. All PE fittings shall be of compatible material to the polyethylene pipe, and be marked in accordance with ASTM F2897. Fittings shall meet the minimum requirements under the latest editions of the following specifications:

PE	ASTM D2513-12ae1
Electrofusion PE	ASTM F1055-98
Plastic PE Mechanical	ASTM F1924-12
Metallic Mechanical	ASTM F1948-12
Anodeless Risers & Transition Fittings	ASTM 1973-13

3. All transition fittings (plastic to steel) shall be factory assembled.

B. Steel Fittings

All steel fittings shall conform to ASME B16.9 and ASTM 234 WPB and be Schedule STD.

2.04 SERVICE CONNECTIONS

A. All service connection lines shall be Polyethylene (PE) pipe.

B. Service tap on PE pipe shall be accomplished with a Frialen DAAI Gas Tapping Tee, ASTM F1055, D2513, or approved equal, with maximum working pressure of 145 psi (gas), suitable for use with PE - SDR 11.

C. Service tap on steel pipe shall be accomplished using a Mueller Autoperf Transition Tee, ASTM F1973., D2513 – CAT 1 with PE stub, or approved equal. The fitting shall be factory assembled.

2.05 CASING VENT PIPE

A. Vent pipe shall be installed in the manner and location as specified as indicated on the drawings.

B. Pipe for vents shall conform to requirements specified herein under Section 2.01.B and Steel Pipe and 2.03.B Steel Fittings.

C. All underground vent pipe shall be coated in accordance with Section 2.01.B.2.

D. All exposed vent pipe shall be painted with epoxy paint and as recommended by the manufacturer.

E. Vent pipe shall be two (2) inches nominal diameter schedule 40 pipe.

F. Vent pipe shall be a two (2) inch diameter schedule 40 with 180° screened return elbow or manufactured vent cap welded four (4) feet above finished grade.

2.06 CASING PIPE

A. Install where indicated using only new steel casing pipe. Casing pipe shall conform with Section 33 05 07 subsection 2.01 CASING PIPE.

B. Gas main shall be insulated from casing pipe with casing spacers per Section 33 05 07 Bore and Jack Installation subsection 2.02 CASING SPACERS. Wood shall not be used to insulate gas pipe from casing pipe.

PART 3. EXECUTION

3.01 INSTALLATION

A. Connections

1. Welded Connections

   a. Welded joints shall be butt type, made with approved acetylene or arc welding equipment.

   b. Use weld fittings at all turns in gas piping. Bending of pipe will not be permitted, except as specifically authorized in writing by the City of Portland Department of Utilities.

   c. No welding shall be done directly on any valves or any other items not having ends designed for welding. Use weld tees at all branch connections.

   d. Bevel all ends of pipes and fittings which are to be welded and cleanly and accurately cut and shape each to the proper contour to fit the surface to which it is to be joined. Align piping properly before welding, and maintain it rigidly in alignment during welding. All welds shall be leak proof and sound throughout, fused thoroughly for full thickness of pipe wall, and free from slag inclusions, gas pockets, surface porosity, overlaps, undercuts, excess convexity and other defects. Weld surfaces shall be free from loose scale, rust slag, or other foreign materials.

   e. Cut out re-weld unsatisfactorily welded joints, or replace the pipe and fittings involved with new materials, as approved.

   f. All welds shall have a minimum of three (3) passes.

   g. Welder shall maintain a copy of weld procedures applicable to the projects on the job site at all times.

2. Fusion Connections

   a. All joints and connections of PE pipe, fittings, and valves shall be made by heat fusion in accordance with the manufacturer's written fusion procedures and comply with ASTM F2620-12.

   b. Contractor shall obtain a copy of applicable PE pipe fusion procedures and maintain these procedures on the job site for the Owner's inspection.

3. Flanged Connections
   No flanged connections shall be performed without prior written permission from the Director of Utilities. Contractor shall submit for approval the procedures for installation and maintain these procedures on the job site for the Owner's inspection.

4. Threaded Connections
   All threaded connections shall be clean cut taper threads. All threaded joints shall be made up with approved pipe joint compound applied to male threads only. Threaded connections shall only be used in above ground applications.

5. Mechanical Connections
   No mechanical joint connections shall be performed without prior written permission from the Director of Utilities. Contractor shall submit for approval the procedures for installation and maintain these procedures on the job site for the Owner's inspection.

6. Compression Connections
   No compression connections shall be performed without prior written permission from the Director of Utilities. Contractor shall submit for approval the procedures for installation and maintain these procedures on the job site for the Owner's inspection.

B. Cathodic Protection

1. Install seventeen (17) pound "Dow Galvomag" or equivalent magnesium anodes where indicated.

   a. Anode shall be installed three (2) feet or more away from the pipe. Anode shall be installed at or below the elevaton of the bottom of the pipe.

   b. Anodes shall be provided with a minimum of ten (10) feet of copper lead wire attached.

   c. Anode lead wire shall be Cadwelded to pipe.

2. Areas of steel pipe to be cathodically protected by magnesium anodes: Install anodes as necessary to create a negative (Cathodic) voltage of at least 1.00 volt (at all points on the steel piping), with reference to a saturated copper-copper sulfate half cell.

C. Internal Cleaning

1. Prior to testing, internally clean all new piping three (3) inch nominal diameter or greater and all two (2) inch piping projects that are 5,000 feet or longer with a suitable "pig" type cleaner forced by air pressure through the pipe two (2) or more times until the line is thoroughly cleaned. Two (2) inch diameter projects shorter than 5,000 feet shall be pigged when requested by Owner.

   a. Steel Pipe

i. The first two cleanings shall be performed with a wire brush type pig.

ii. All subsequent cleanings shall be performed with a polyurethane or polyethylene type pig.

iii. Should water be present during pigging, the pipe shall be dried using a suitable squeegee type pig. Squeegee pig shall be run through the pipe until it comes out dry.

b. Polyethylene Pipe

i. All subsequent cleanings shall be performed with a polyurethane or polyethylene type pig.

ii. Should water be present during pigging, the pipe shall be dried using a suitable squeegee type pig. Squeegee pig shall be run through the pipe until it comes out dry.

2. Provide a suitable barrier in front of the open ends of the pipe to catch the cleaners and prevent injury to personnel.

3. After pigging the line, air shall be forced through the pipe to ensure all smaller particles and dust is removed.

4. The compression used in forcing the pig through the pipe or blowing air through the pipe shall in no way inject any type of oil, lubricant or any foreign matter into the pipe.

5. All pipes that are not pigged shall be purged with air.

D. Painting

1. All above ground piping (including existing piping to remain), valves, regulators, hangers, supports, tanks, meters, control boxes, etc. shall be painted as follows:

a. Remove all pipe coating material, rust, dirt, grease, scale, slag, and foreign matter by sandblasting and/or wire brush cleaning.

b. Surfaces to be painted shall be dry and free from moisture.

c. Apply approved paint.

i. Allow proper drying time between coats.

ii. All valves above ground that operate in the open position (including line valves, relief stack valves, etc.) shall be gray or yellow.

iii. All valves that operate in the closed position (bypass valves) shall be painted red or pink.

iv. All casing vents and meter valve tops shall be painted yellow.

v. All meters, regulators and above ground piping shall be painted meter gray.

vi. All other exposed items shall be painted as specified by the City.

E. Testing

1. Contractor shall furnish approved testing equipment, materials and test medium. Contractor shall give the City ample advance notice of all proposed tests and conduct all tests in the City of Portland Gas Supervisor's presence in an approved manner.

2. Test all distribution piping with a minimum of 100 psig air or inert gas pressure. Test all PE3408 piping with a minimum of 100 psig air or inert gas pressure. Test high-pressure piping, including the high-pressure side of regulator stations, with a minimum of 900 psig air or inert gas.

3. Test gauge shall show no drop in pressure after the source of test pressure has been disconnected from the pipeline involved in the test and the temperature of the test medium has been allowed to equalize. Record test medium, test pressure, and test duration and submit to the City of Portland Gas Department as part of acceptance testing. City of Portland Gas Supervisor or his agent shall be present for testing.

   a. 24-hour test:
      2-inch and smaller – 24-hour test
      Larger than 2-inch - 24-hour test with recording chart

4. Locate and repair all leaks, which may be disclosed by the tests. And repeat the tests as required for approval.

5. All charts used in the tests shall be identified with the test date, section of pipeline involved, and test pressure. All test charts must be signed by Contractor and witnessed by City of Portland Gas

Supervisor or his agent. Chart shall be submitted to the City of Portland Utility Department.

6. All test gauges shall be a minimum of two and one-half (2½) inches in diameter or bigger, depending on the accuracy required for the test.

7. All test shall have a gauge at the point where the air or inert gas I being put into the pipe.

8. Service Piping:

   b. 1” and smaller pipes 0-1,000 feet in length shall be tested for a period of no less than ten (10) minutes at a minimum pressure of 100 psig (PE3408).

   c. Service pipes larger than 1” diameter or longer than 1,000 feet shall be tested as distribution pressure piping as detailed above.

9. Gauges and charts used for 100 and 150 psi tests shall not have a range greater than 0-300 psi.

10. It is strongly recommended that once the pipe has been pressurized to the proper pressure that it sit for a period of time to allow pressure and temperature equalization.

11. Compressors used in pressuring the pipe shall in no way inject any type of oil, lubricant, or any foreign matter into the pipe.

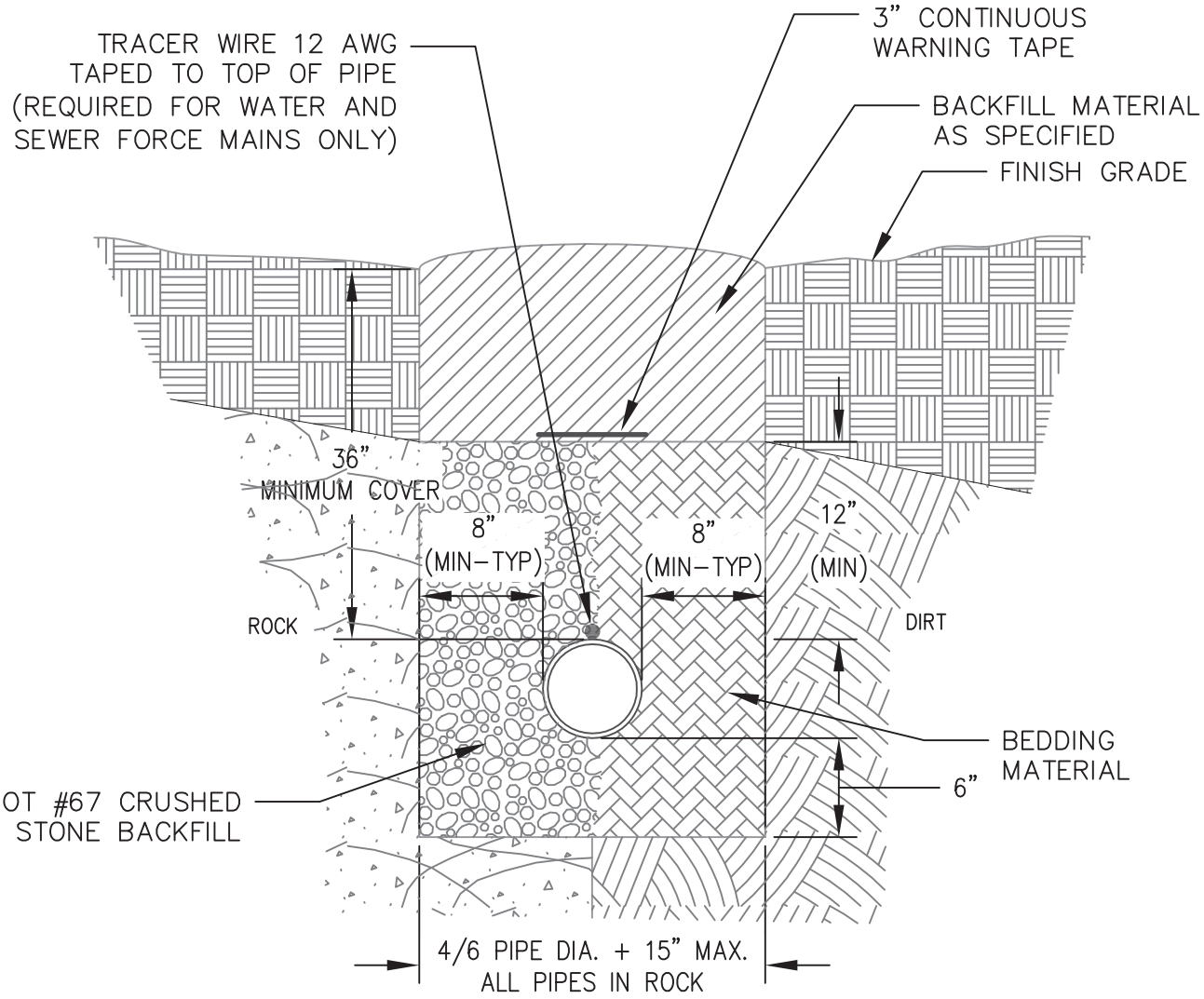
END OF SECTION

APPENDIX A

STANDARD WATER DETAILS

NOTES:

1. 36" MIN COVER FOR ALL MAIN UNLESS OTHERWISE SPECIFIED.
2. BEDDING MATERIAL SHALL BE FINE, LOOSE EARTH FREE FROM CLODS, ORGANIC DECOMPOSABLE MATERIAL, DEBRIS, AND STONE NO LARGER THAN TWO (2) INCHES IN DIAMETER
3. IN ROAD INSTALLATIONS SHALL BE FULL STONE BACKFILL.



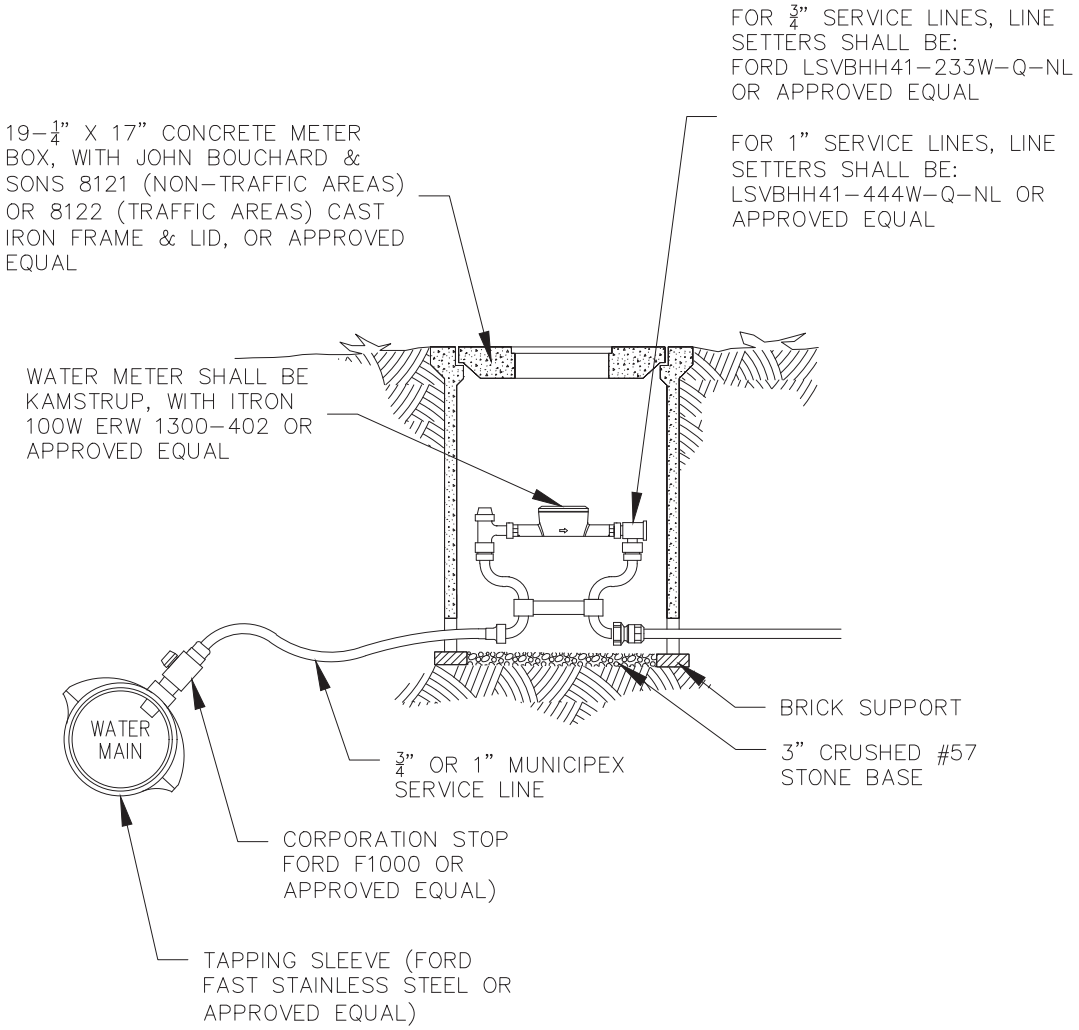
WATER TRENCH DETAIL

N.T.S.

CITY OF PORTLAND, TN	CITY OF PORTLAND DEPARTMENT OF UTILITIES – WATER STANDARD WATER DETAILS	REVISION NO: 1 DATE: 06/01/2021 W–01

GENERAL NOTES:

1. CONTRACTOR SHALL INSTALL EVERYTHING, EXCEPT THE METER.
2. CITY SHALL INSTALL METER ONCE LINE IS APPROVED AND IN SERVICE



3/4" & 1" SERVICE METER ASSEMBLY

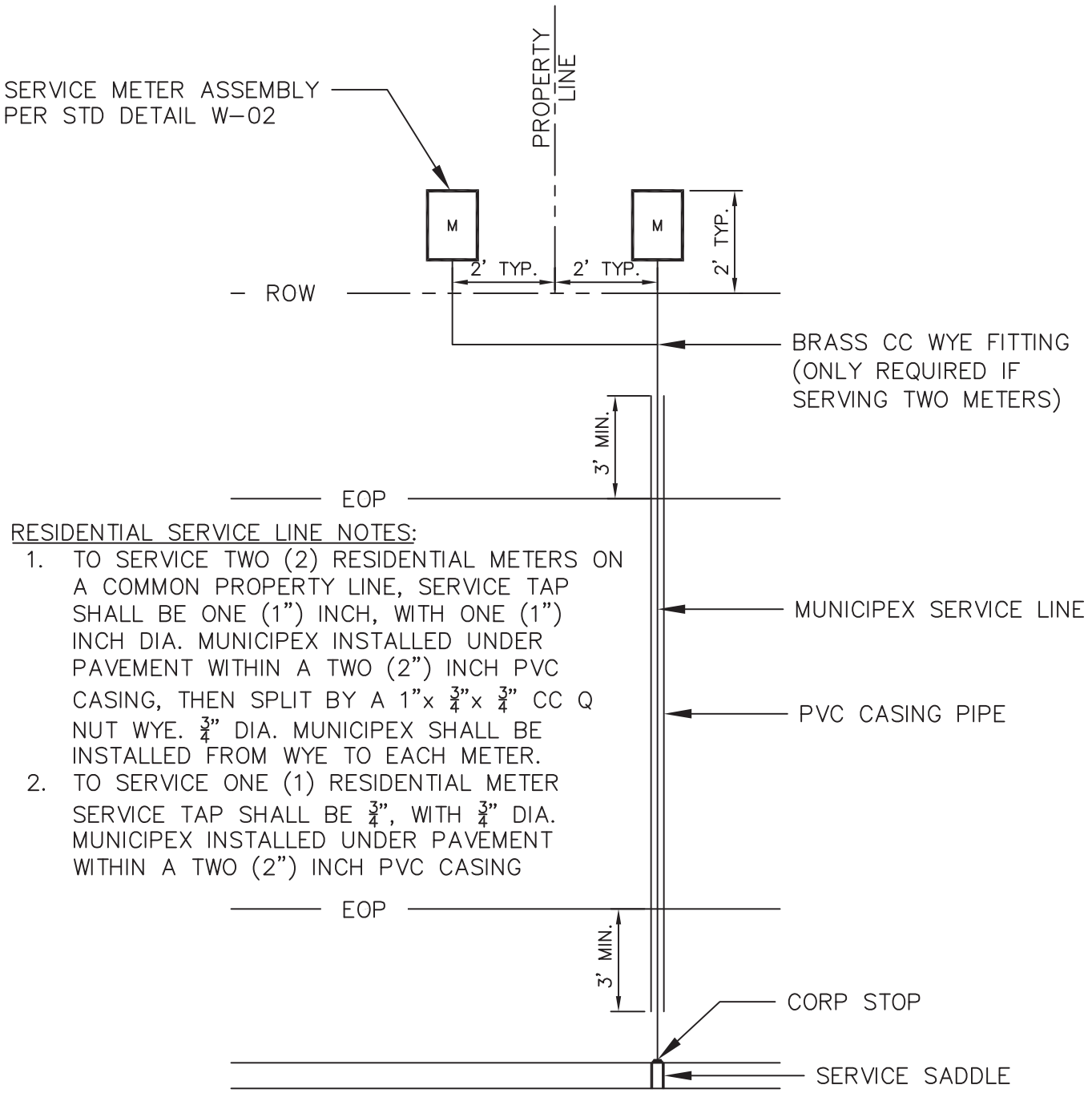
N.T.S.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 2
DATE: 11/10/2022

W–02



RESIDENTIAL SERVICE LINE NOTES:

1. TO SERVICE TWO (2) RESIDENTIAL METERS ON A COMMON PROPERTY LINE, SERVICE TAP SHALL BE ONE (1") INCH, WITH ONE (1") INCH DIA. MUNICIPEX INSTALLED UNDER PAVEMENT WITHIN A TWO (2") INCH PVC CASING, THEN SPLIT BY A 1"x ¾"x ¾" CC Q NUT WYE. ¾" DIA. MUNICIPEX SHALL BE INSTALLED FROM WYE TO EACH METER.
2. TO SERVICE ONE (1) RESIDENTIAL METER SERVICE TAP SHALL BE ¾", WITH ¾" DIA. MUNICIPEX INSTALLED UNDER PAVEMENT WITHIN A TWO (2") INCH PVC CASING

NOTES:

1. ALL LONG SIDE RESIDENTIAL SERVICES SHALL HAVE PVC CASING PIPE EXTENDING 3 FT OUTSIDE THE EDGE-OF-PAVEMENT (EOP). FOR ¾"-1" SERVICE – 2" CASING
2. FOR ALL LONG SIDE 2" SERVICES, CASING PIPE SHALL BE 3" PVC.
3. SERVICE METERS SHALL BE LOCATED WITHIN 2FT OF THE RIGHT-OF-WAY (ROW). AND PROPERTY LINES.

LONG SIDE WATER SERVICE

N.T.S.

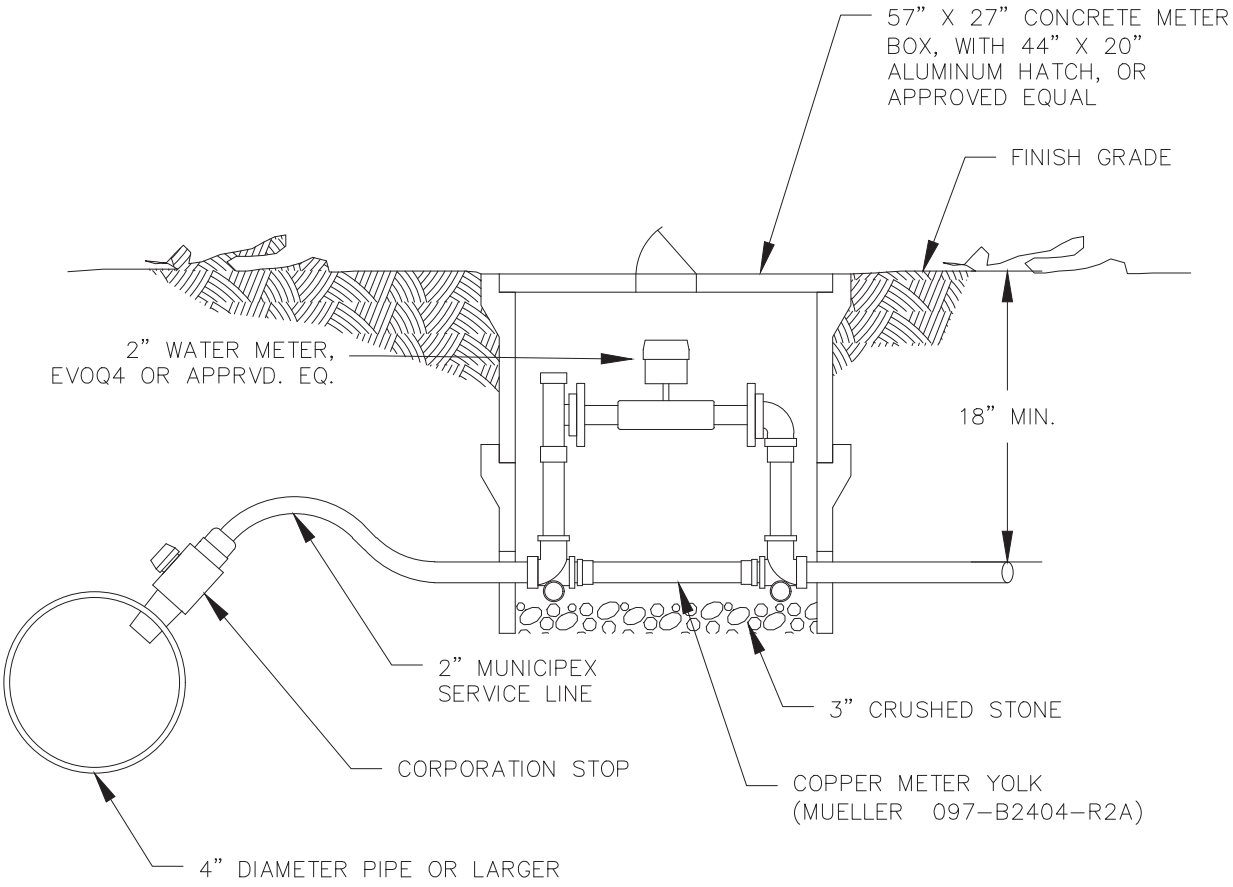
CITY OF PORTLAND, TN
Proud, Progressive Portland
Home of the STRAWBERRY FESTIVAL

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 2
DATE: 09/17/2021

W-03



2" COMMERCIAL TAP ASSEMBLY

N.T.S.

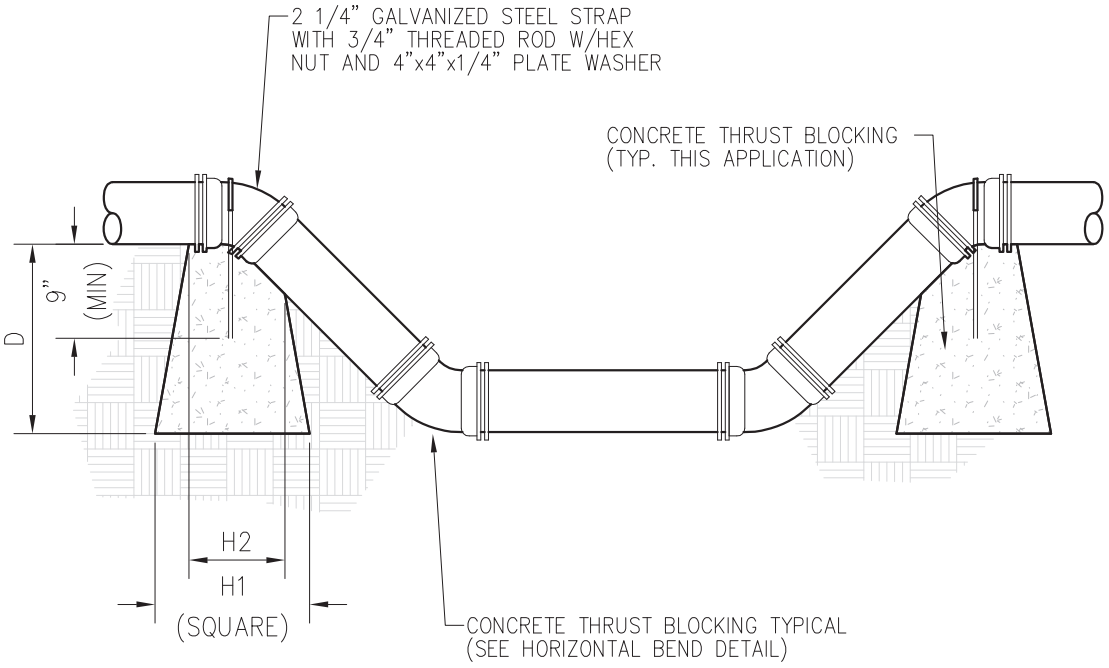
CITY OF PORTLAND, TN
Proud, Progressive Portland
Home of the STRAWBERRY FESTIVAL

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 2
DATE: 11/09/2022

W-04



VERTICAL BENDS

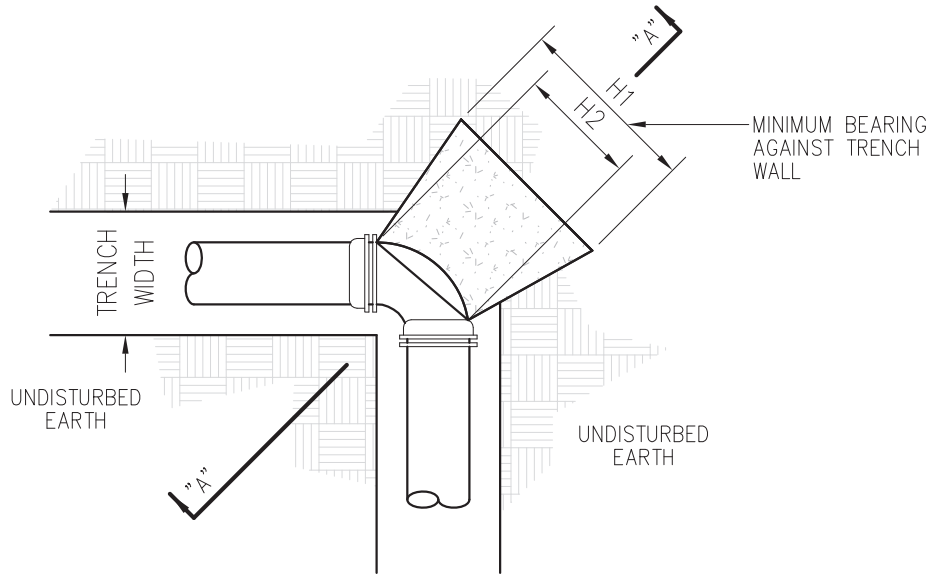
N.T.S.

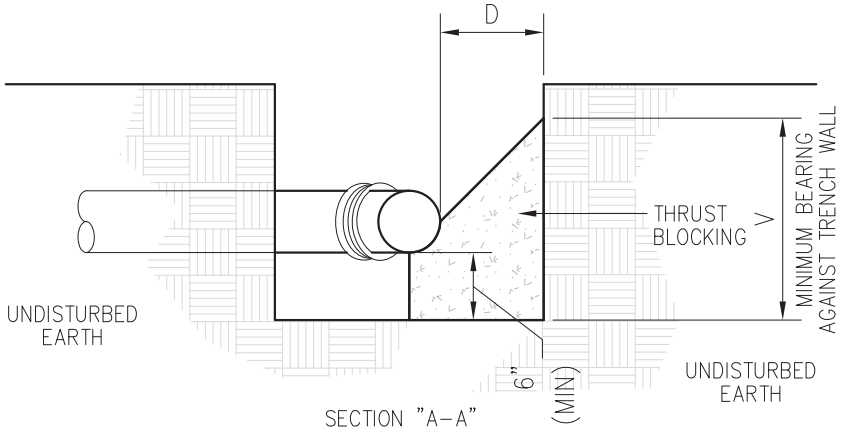
CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 2
DATE: 09/25/2021

W–05
(1 OF 4)





HORIZONTAL BENDS

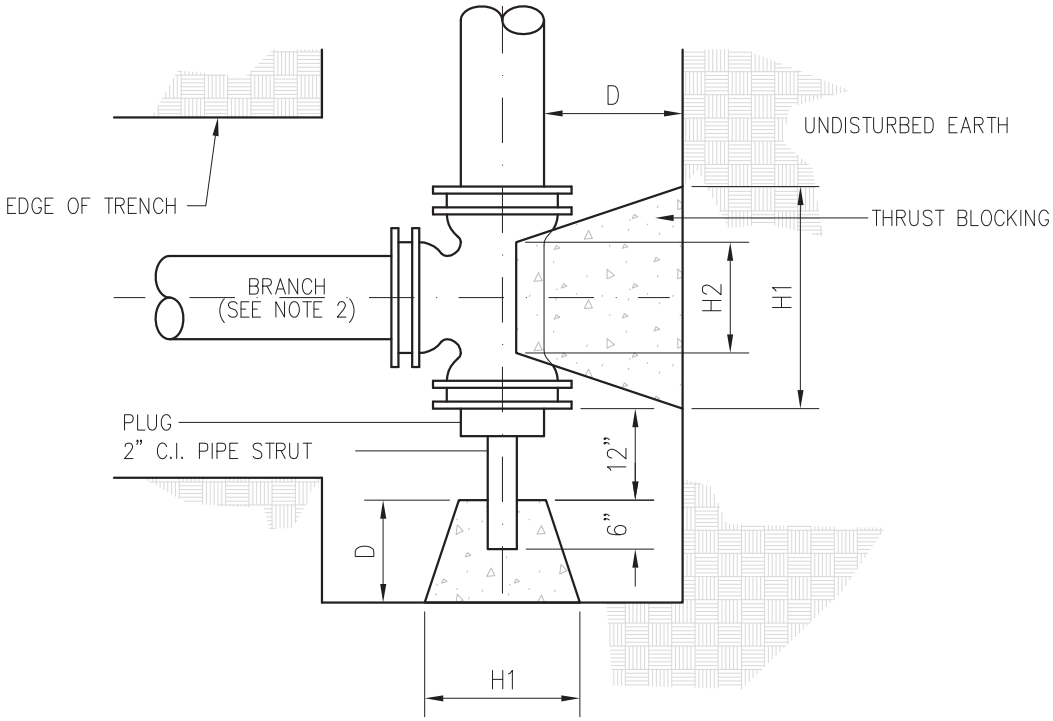
N.T.S.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 2
DATE: 09/25/2021

W-05
(2 OF 4)



NOTES:

1. BLOCKING WILL BE PAID FOR AT THE CONTRACT UNIT PRICE FOR CLASS "B" CONCRETE FOR THE VOLUME SHOWN IN THE ABOVE TABLE FOR EACH FITTING SO BLOCKED ONLY IF A SEPERATE ITEM APPEARS IN THE SCHEDULE OF A PROPOSAL FOR A UNIT PRICE CONTRACT. OTHERWISE, THERE WILL BE NO SEPERATE PAYMENT FOR CONCRETE THRUST BLOCKING.

2. DIMENSIONS ARE CONTROLLED BY DIAMETER OF BRANCH MAIN.

TEES, CROSSES AND PLUGS

N.T.S.

CITY OF PORTLAND, TN
Proud, Progressive Portland
Home of the STRAWBERRY FESTIVAL

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 2
DATE: 09/25/2021

W–05
(3 OF 4)

TEES, CROSSES, AND PLUGS					90° BENDS					45° BENDS					22-1/2° BENDS					11-1/4° BENDS					PIPE SIZE
H1	H2	V	D	Cu.Ft.	H1	H2	V	D	Cu.Ft.	H1	H2	V	D	Cu.Ft.	H1	H2	V	D	Cu.Ft.	H1	H2	V	D	Cu.Ft.	
18"	10"	12"	18"	1.90	18"	10"	12"	18"	1.90	18"	6"	12"	18"	1.50	18"	6"	12"	18"	1.50	18"	6"	12"	18"	1.50	2" - 2."
24"	12"	12"	18"	2.25	24"	12"	12"	18"	2.25	18"	8"	12"	18"	1.60	18"	8"	12"	18"	1.60	18"	8"	12"	18"	1.60	3" - 4"
24"	16"	18"	18"	3.50	30"	16"	18"	18"	4.05	24"	10"	16"	18"	3.20	24"	10"	16"	18"	3.20	24"	10"	16"	18"	3.20	6"
36"	18"	18"	24"	5.05	39"	18"	24"	18"	7.30	30"	12"	18"	18"	3.95	24"	12"	18"	18"	3.45	24"	12"	16"	18"	3.40	8"
48"	24"	18"	24"	7.15	54"	32"	24"	18"	10.25	36"	18"	21"	18"	4.60	24"	18"	21"	18"	4.60	24"	18"	21"	18"	4.60	10"
54"	30"	24"	24"	13.40	54"	32"	36"	24"	18.15	42"	18"	24"	24"	9.60	24"	18"	24"	24"	6.60	24"	18"	21"	24"	6.10	12"
60"	32"	30"	24"	17.90	60"	40"	42"	24"	25.00	44"	24"	30"	24"	13.20	30"	24"	24"	24"	9.20	27"	21"	24"	24"	7.90	14"
66"	34"	36"	24"	22.50	69"	48"	48"	24"	29.00	48"	30"	36"	24"	17.00	36"	30"	27"	24"	11.80	27"	24"	27"	24"	9.10	16"
66"	36"	40"	24"	27.50	69"	48"	48"	24"	33.00	48"	30"	36"	24"	17.00	36"	30"	29"	24"	13.00	27"	30"	29"	24"	11.00	18"
	38"		24"			48"		24"			40"		24"			36"		24"		30"	40"		28"		20"
	42"		24"			60"		24"			48"		24"			42"		24"			42"		32"		24"
	58"		24"			96"		24"			72"		24"			72"		24"			48"		36"		36"

NOTES:

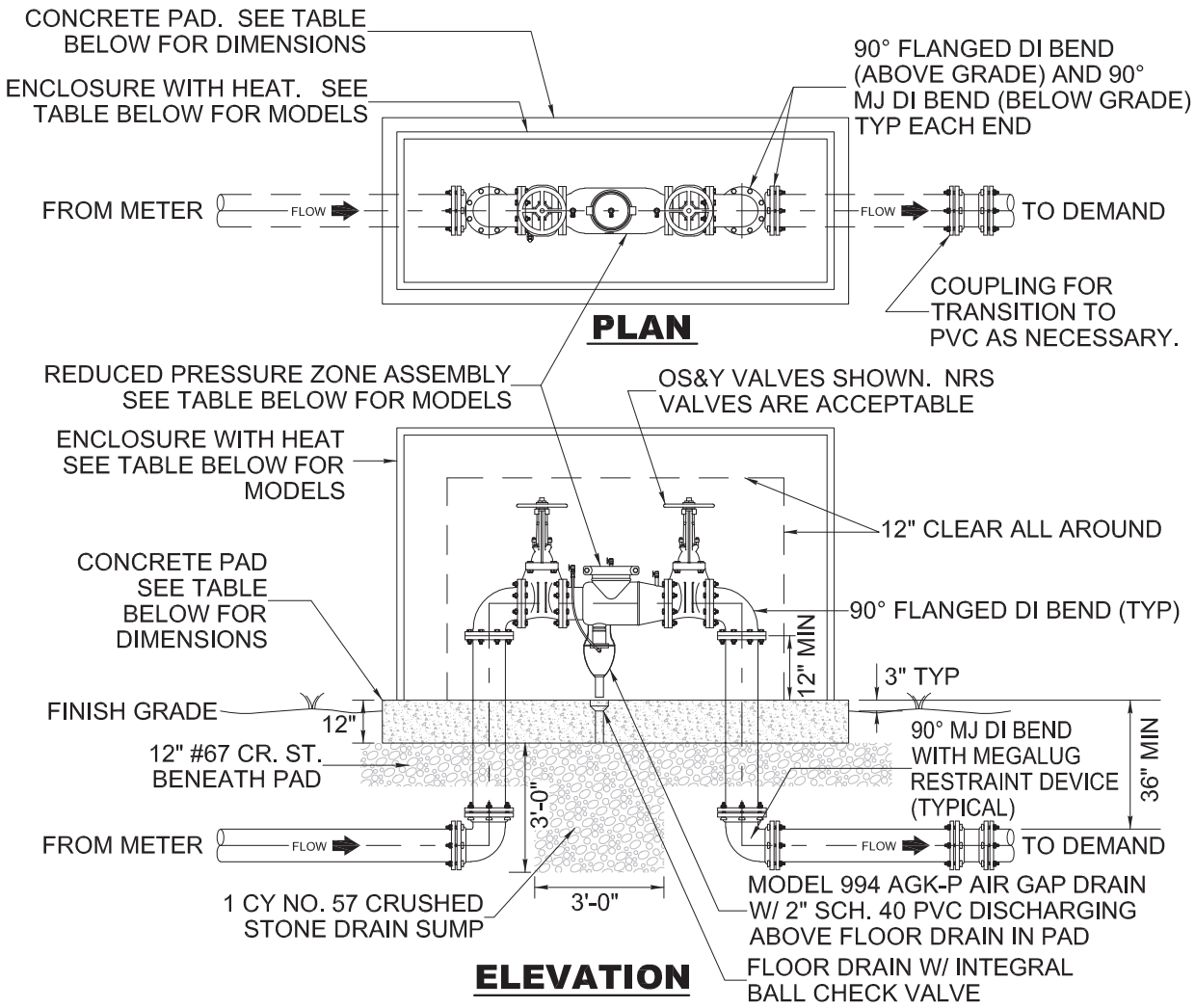
1. BLOCKING WILL BE PAID FOR AT THE CONTRACT UNIT PRICE FOR CLASS "B" CONCRETE FOR THE VOLUME SHOWN IN THE ABOVE TABLE FOR EACH FITTING SO BLOCKED ONLY IF A SEPERATE ITEM APPEARS IN THE SCHEDULE OF A PROPOSAL FOR A UNIT PRICE CONTRACT. OTHERWISE, THERE WILL BE NO SEPERATE PAYMENT FOR CONCRETE THRUST BLOCKING.

2. DIMENSIONS ARE CONTROLLED BY DIAMETER OF BRANCH MAIN.

3. THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE THRUST BLOCKING ON ALL TEES, BENDS, TAPPING SLEEVES AND VALVES, AND ANY OTHER PIPING CONNECTIONS AS SHOWN ON THE STANDARD DETAIL SHEET. THE CONTRACTOR SHALL NOT BE ALLOWED TO USE ANY PRE-MIX CONCRETE SUCH AS SAK-CRETE. ALL THRUST BLOCKING SHALL BE VISUALLY INSPECTED PRIOR TO BACKFILLING BY THE OWNER'S REPRESENTATIVE.

CONCRETE THRUST BLOCKING TABLE

N.T.S.



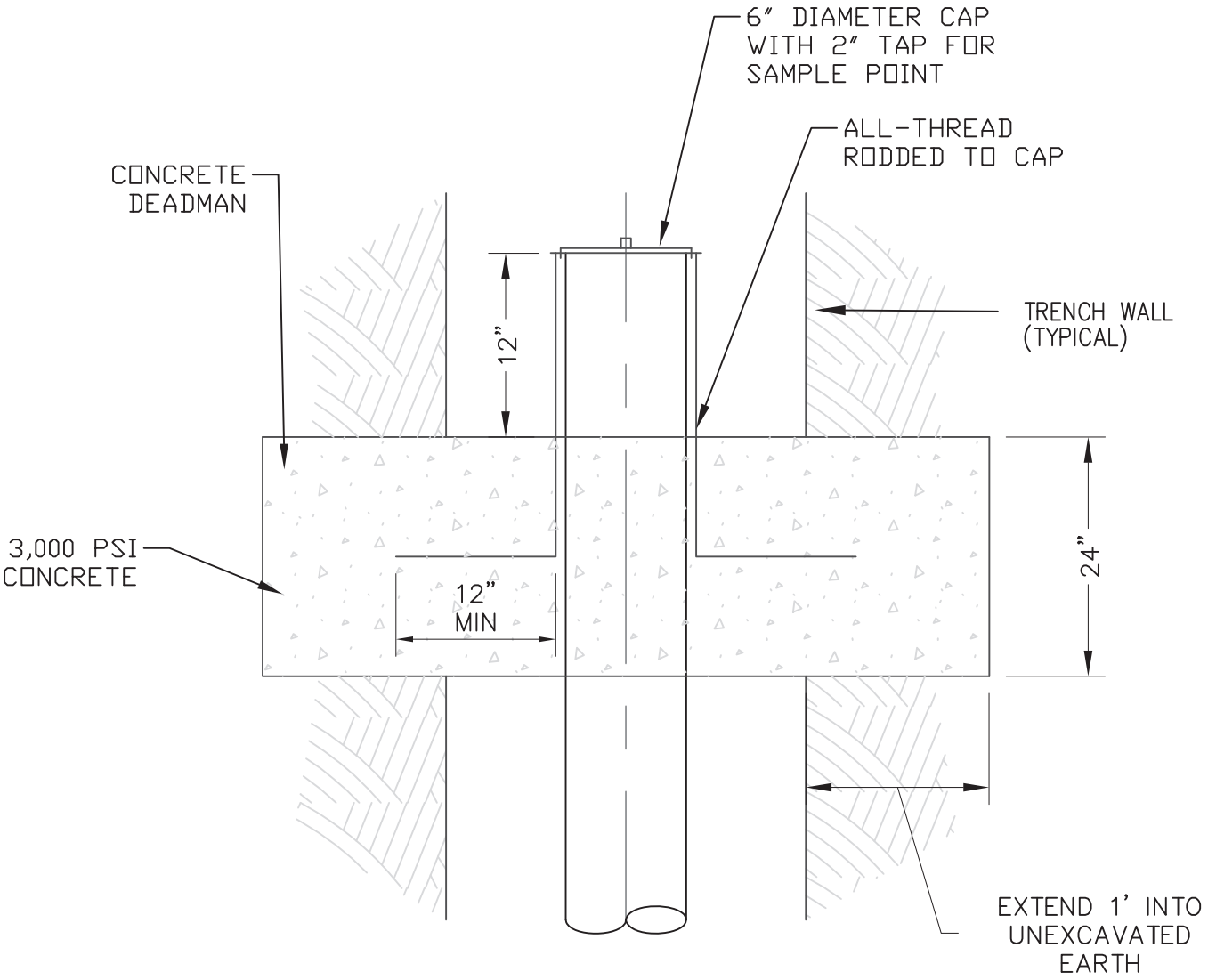
RPZ SIZE	RPZ	ENCLOSURE (NRS)	ENCLOSURE (OSY)	PAD (NRS)	PAD (OSY)
3"	WATTS 994	WATTS WBN3	WATTS WBE3	82" x 38"	82" x 38"
4"	WATTS 994	WATTS WBN3	WATTS WBE3	82" x 38"	82" x 38"
6"	WATTS 994	WATTS WBN4	WATTS WBE6	102" x 44"	117" x 48"
8"	WATTS 994	WATTS WBN6	WATTS WBE8	102" x 44"	130" x 52"

NOTES:

1. RPZ ASSEMBLY MAY BE INSTALLED WITHIN BUILDING OR STRUCTURE HOWEVER NO CONNECTIONS TO THE WATER LINE MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
2. AC POWER WILL BE REQUIRED FOR ENCLOSURE HEAT.
3. TN STATE APPROVED BACKFLOW DEVICES MAY BE SUBMITTED FOR WATTS DEVICES.

3–8 INCH REDUCED PRESSURE BACKFLOW PREVENTER DETAIL

N.T.S.



CONCRETE DEADMAN DETAIL

N.T.S.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

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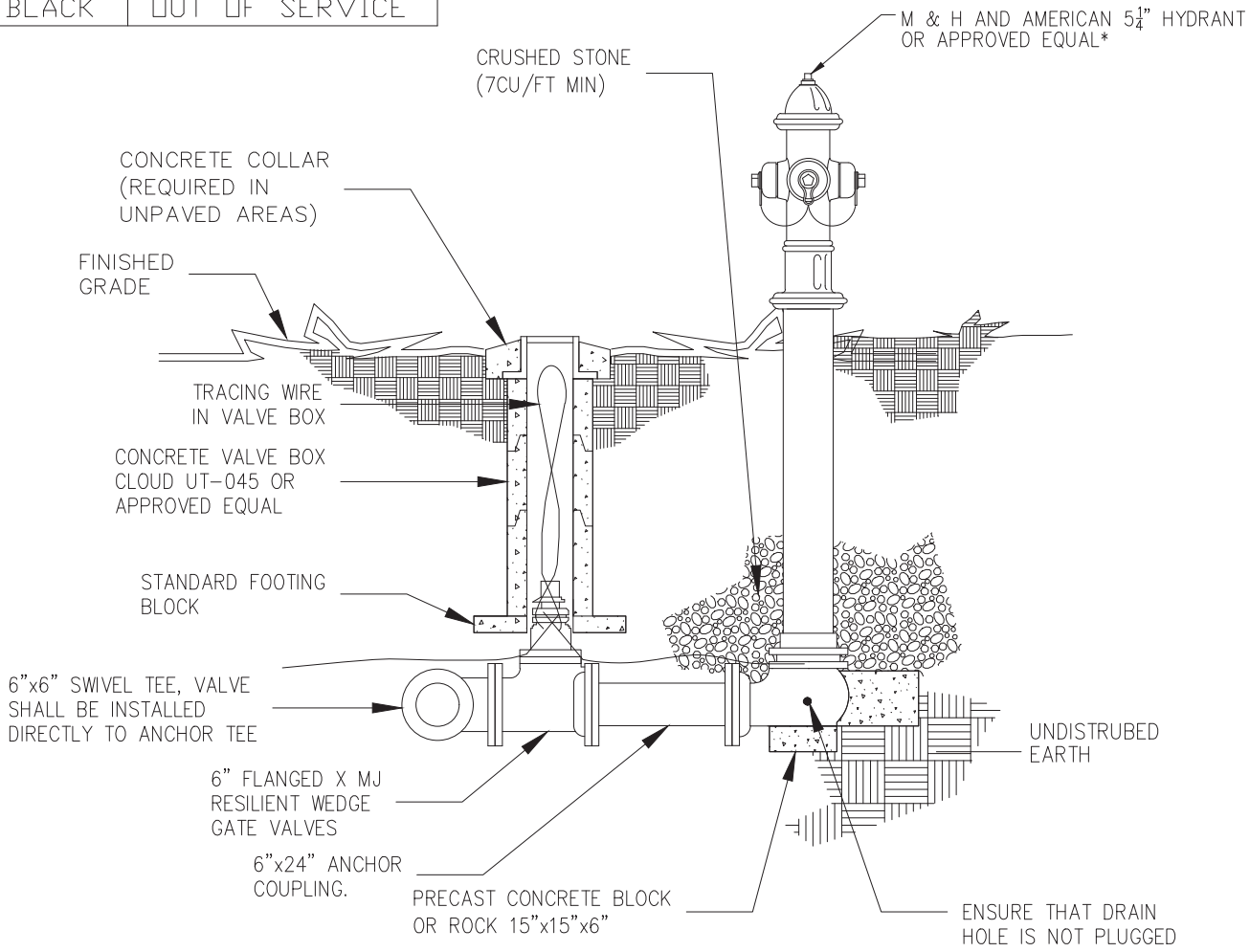
W–07

HYDRANT CAP COLOR	AVAILABLE FLOW (AT 20 PSI RESIDUAL)
BLUE	1,500 GPM OR MORE
GREEN	1,000 - 1,499 GPM
ORANGE	500 - 999 GPM
RED	BELOW 500 GPM
BLACK	OUT OF SERVICE

*AS PER NFPA 291, ALL PUBLIC HYDRANTS ARE TO BE MUNICIPAL GOLD. ALL PRIVATE HYDRANTS SHALL BE SILVER.



FIRE HYDRANT ASSEMBLY

N.T.S.

CITY OF PORTLAND, TN

Proud, Progressive Portland

Home of the STRAWBERRY FESTIVAL

CITY OF PORTLAND

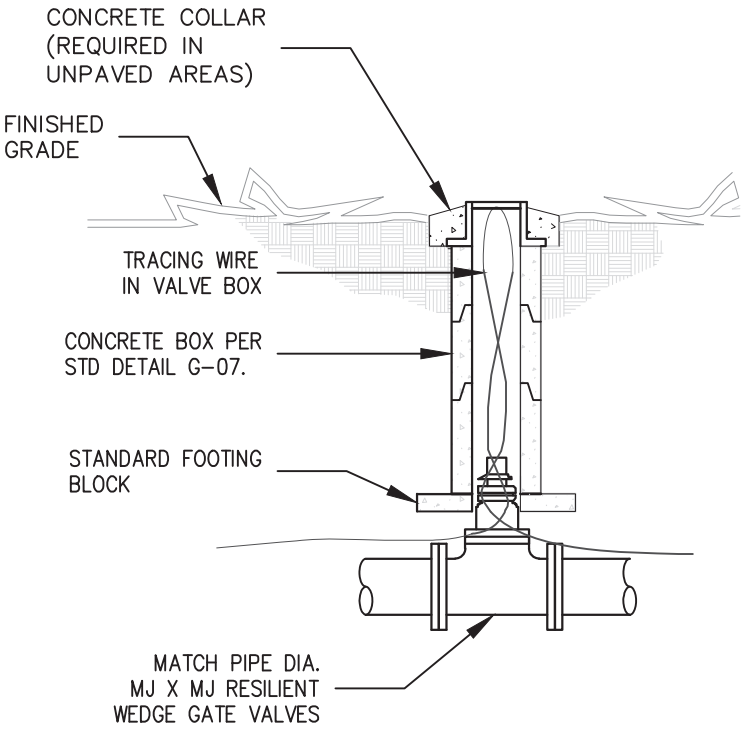
DEPARTMENT OF UTILITIES – WATER

STANDARD WATER DETAILS

REVISION NO: 3

DATE: 12/19/2022

W-08



NOTES:
1. TRACING WIRE SHALL BE CONNECTED TO VALVE BOX FRAME FOR ACCESSIBILITY.

GATE VALVE INSTALLATION

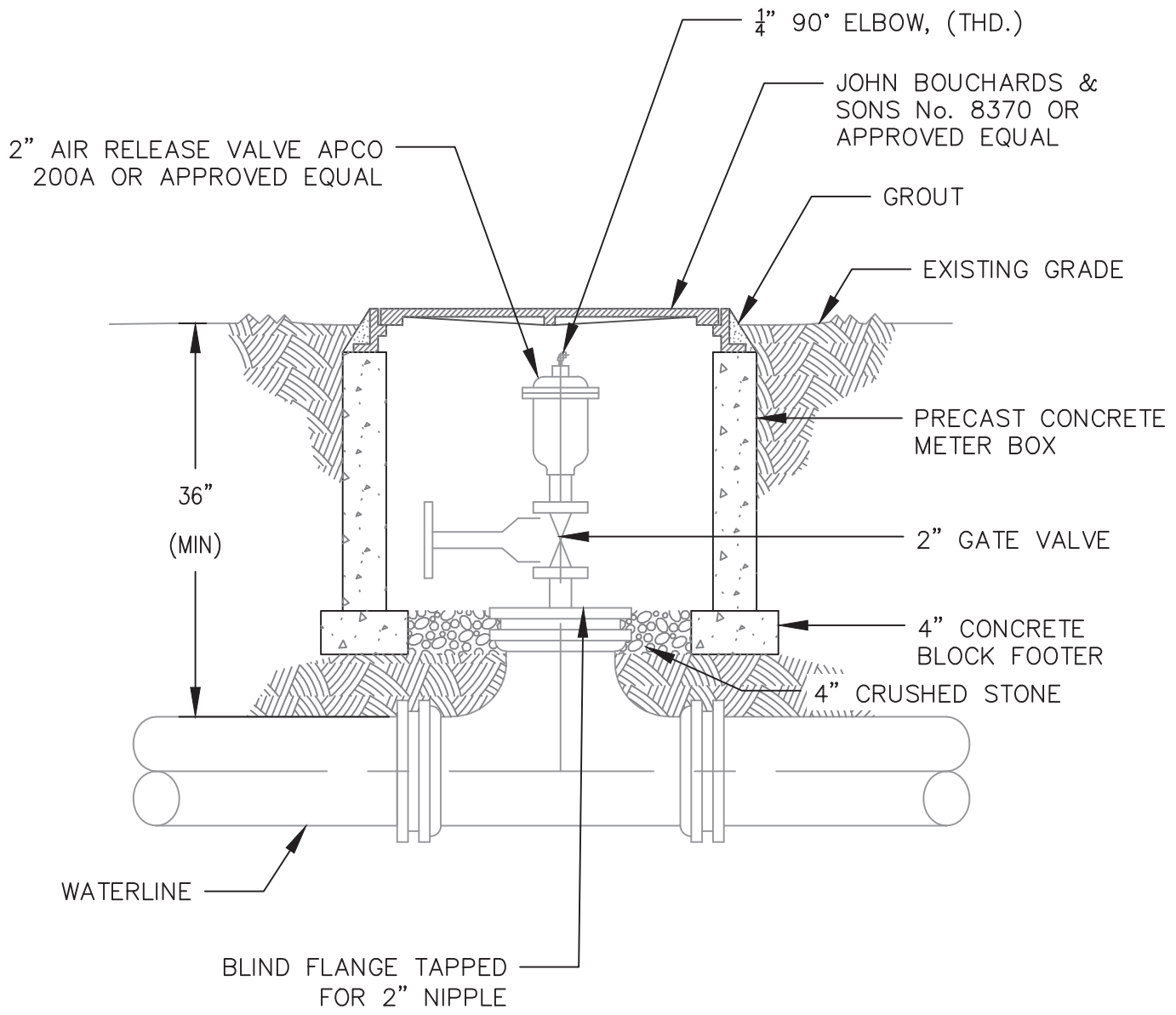
N.T.S.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 1
DATE: 06.01.2021

W-09



2" AIR RELEASE VALVE DETAIL

N.T.S.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

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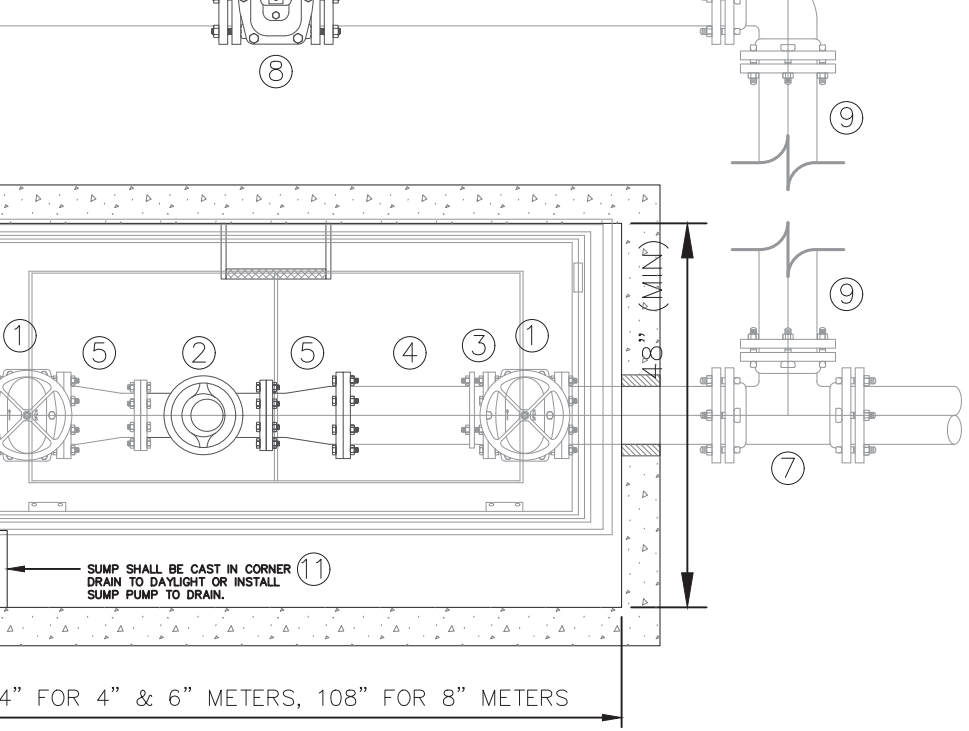
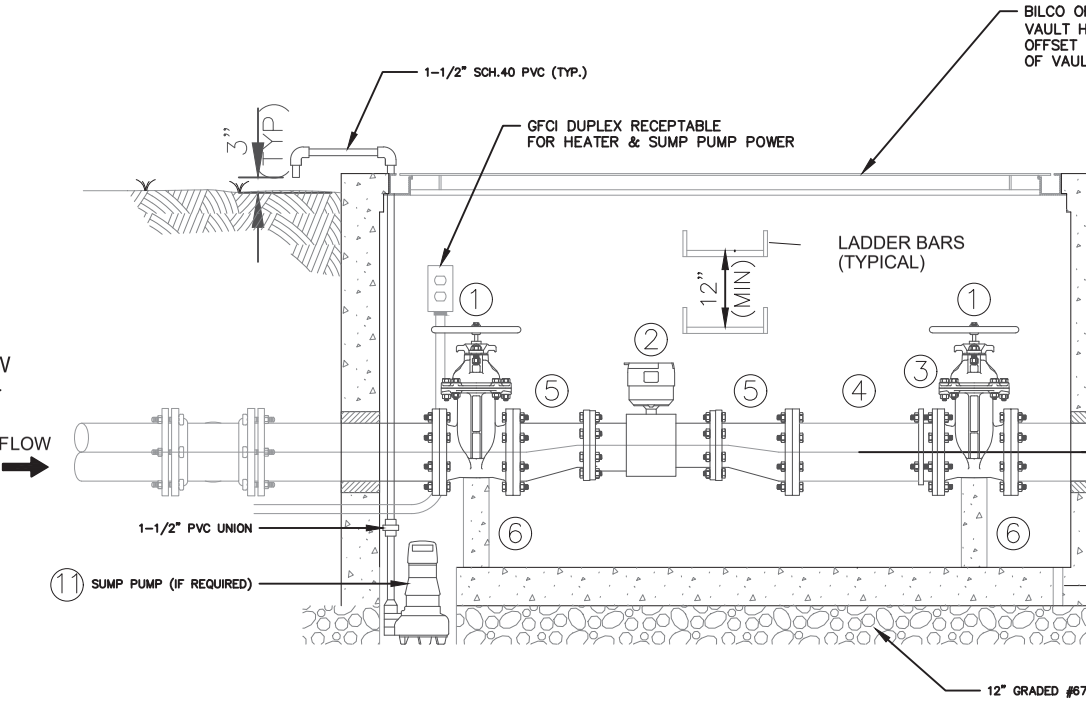
DATE: 06/01/2021

W–10



PLAN



ELEVATION

ULT DESIGN REQUIREMENTS:

: AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES.
R 300 PSF.
SSIVE STRENGTH @ 28 DAYS = 4000 PSI, MIN.
STM A615,GRADE 60
TYL RUBBER, CONSEAL CS-102 (CONTINUOUS @ EACH JOINT).
OP SLAB EXTERIOR
RINGS PER SLAB TOP
HALL BE A MINIMUM 6" THICKNESS
OAD RATED IF VAULT IS INSTALLED IN SIDEWALK AREA.
-0 PVC LINE AND DRAIN TO DAYLIGHT AT APPROXIMATE
RAWINGS. SUMP PUMP SHALL BE INSTALLED ONLY IF
BLE

NOTE:

EDUCED PRESSURE BACKFLOW PREVENTER PER THE CITY OF PORTLAND DEPARTMENT OF UTILITIES (P.D.U.)
OWNSTREAM OF THE METER. BACKFLOW PREVENTERS MAY BE INSTALLED WITHIN BUILDINGS IN A HORIZONTAL
OOR BACKFLOW PREVENTERS MUST BE INSTALLED ABOVE GROUND IN HEATED ENCLOSURES MOUNTED ON
MANUFACTURER'S REQUIREMENTS.

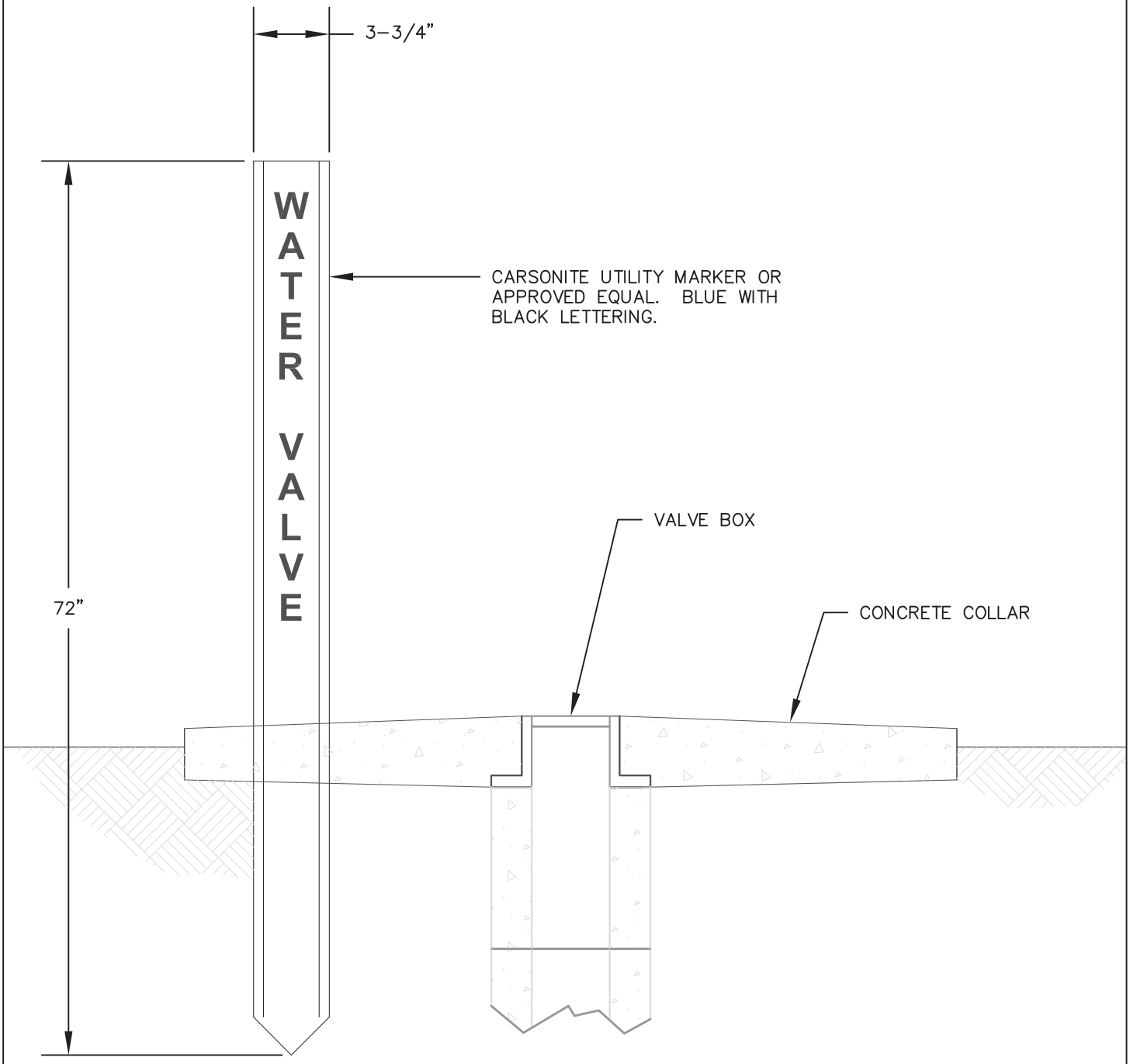
OWED TO PUBLIC WATER LINE BETWEEN THE METER AND THE BACKFLOW PREVENTER.

NUMERED VAULT COMPONENTS:

① 6" NRS WHEEL OPERATED GATE VALVE, F
② 4" EVOQUA ULTRASONIC METER, UL LISTE
③ FORD STYLE FLANGE COUPLING ADAPTER
④ SPOOL BY PLAIN PIECE, MIN. 10"
⑤ 6"x4" DI, ECCENTRIC REDUCER, FL.
⑥ CONCRETE PIPE SUPPORTS (2 REQUIRED).
⑦ 6"x6" DI, MJ TEE
⑧ 6" NRS GATE VALVE, MJ
⑨ CL 350 DUCTILE IRON
⑩ 6" MJ DI 90° ELBOW
⑪ SUMP PUMP IN CORNER – 1-1/2" DISCH

FIRE SERVICE METER VAULT

NOT TO SCALE



WATER UTILITY MARKER

N.T.S.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER

STANDARD WATER DETAILS

REVISION NO: 1

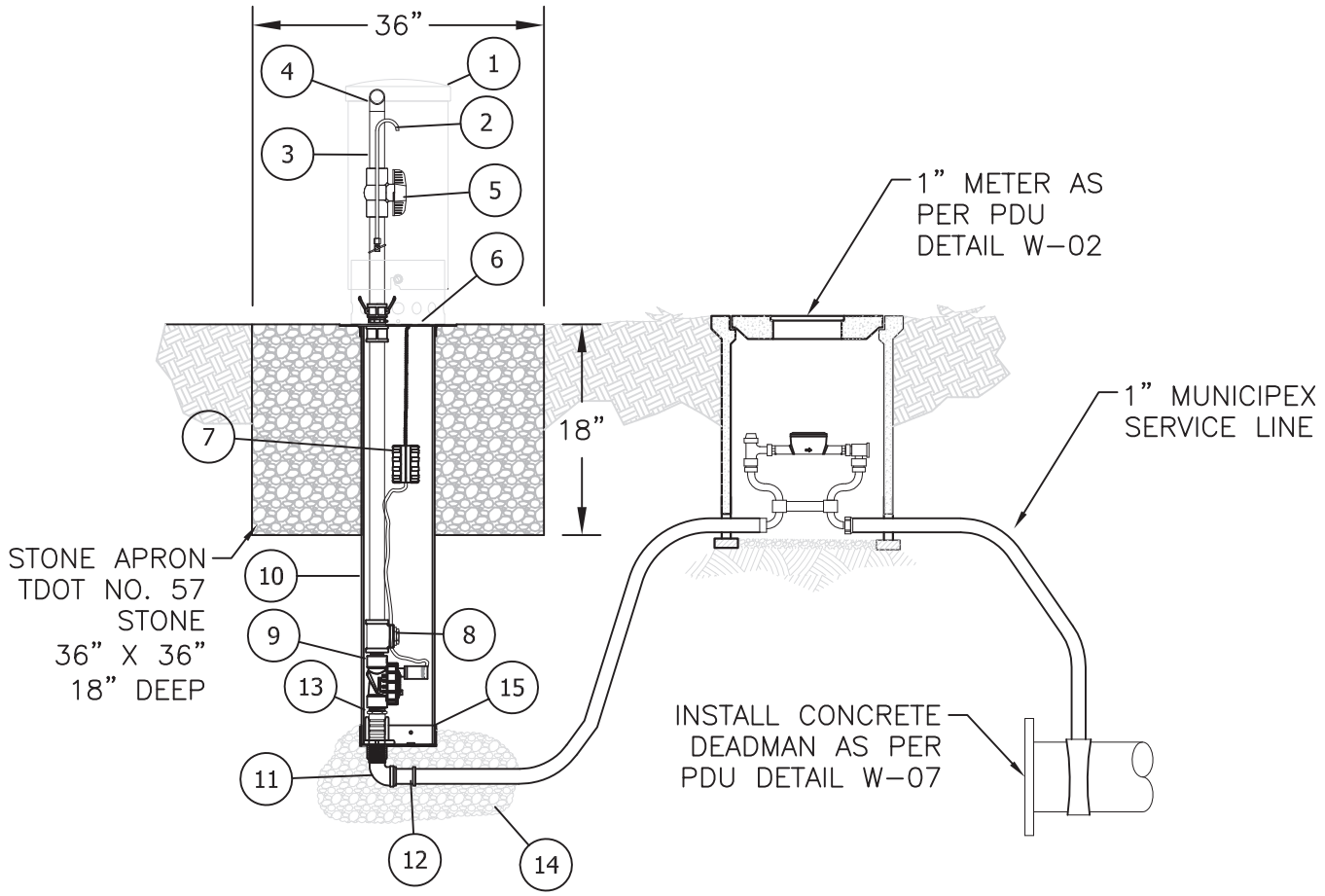
DATE: 06/01/2021

W-12

GENERAL NOTES:

1. CONCRETE DEADMAN AS PER PDU DETAIL W–07 MUST BE INSTALLED AS TEMPORARY FLUSH POINT FOR TESTING AND SAMPLING PRIOR TO INSTALLATION.
2. WATER LINE MUST BE PRESSURE TESTED, SAMPLED, AND APPROVED BY PDU PRIOR TO INSTALLATION.
3. FLUSH WATER LINE FREE OF DEBRIS BEFORE INSTALLATION.
4. FLUSHER MUST BE INSPECTED BY PDU REPRESENTATIVE PRIOR TO INSTALLATION.
5. FLUSHER MUST BE SET–UP IN ACCORDANCE WITH PDU STANDARDS BY A PDU REPRESENTATIVE PRIOR TO ACCEPTANCE OF WATER LINE.

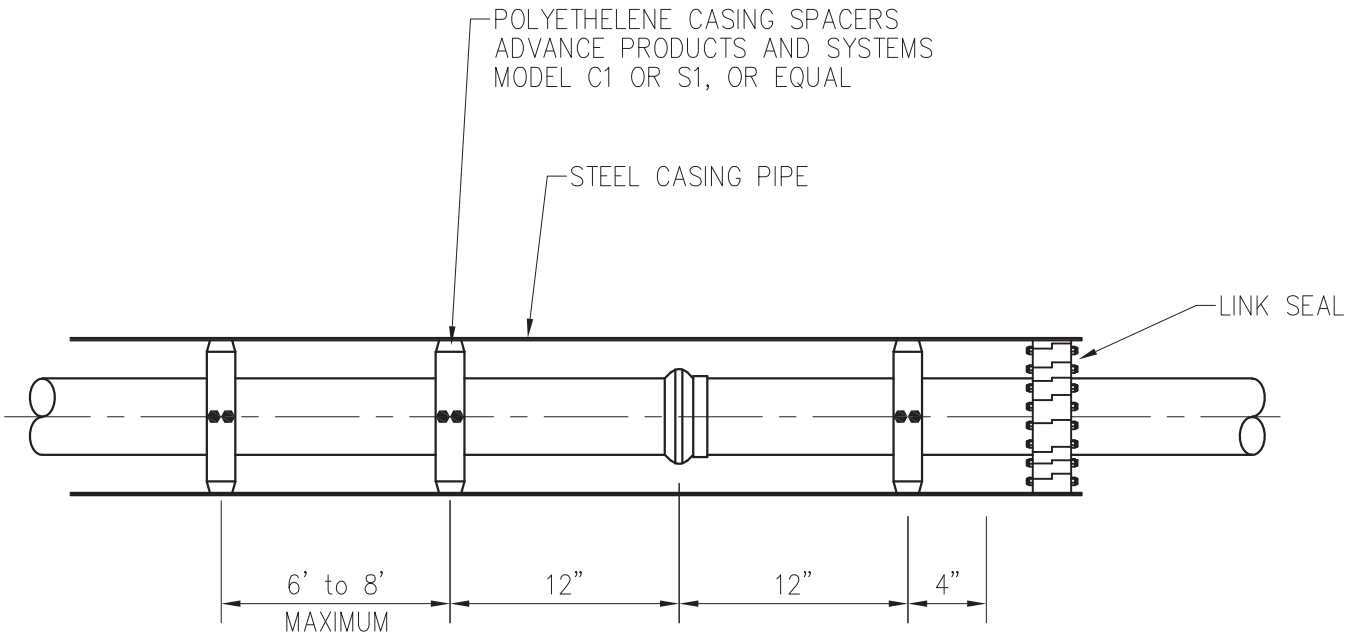
ITEM	ITEM / DESCRIPTION
1	UV RESISTANT LOCKABLE DOME ELNCLOSURE
2	SAMPLING POINT
3	1" PVC PIPE
4	UV RESISTANT LOCKABLE DOME ENCLOSURE
5	1" PVC BALL VALVE
6	REMOVABLE ACCESS PLATE
7	CONTROLLER
8	AUTOMATIC DRAIN
9	1" AUTOMATIC VALVE
10	SDR 35 SEWER PIPE
~~11~~	~~1" S.S. FIP INLET~~
12	1" MIP x COMPRESSION ADAPTER
13	O–RING CONNECTOR
14	TDOT NO. 57 STONE
15	DEBRIS PLATE



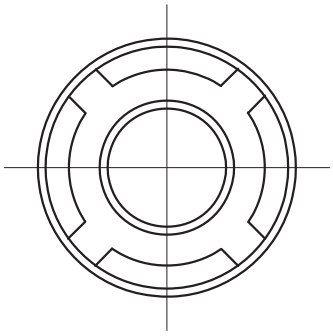
1" AUTOMATIC FLUSHER

N.T.S.

Automatic flushing device shall have a 1" Stainless Steel MIP inlet, that will lead vertically to the bottom into a 1" automatic flushing valve. Automatic solenoid valve shall have a 150 psi rating. Each unit shall be furnished with a stand-alone valve controller. Valve controller will not require a second hand-held device for programming. Controller must have minimum of 12 possible flushing cycles per day. Shall be submersible to 12 feet, operate with a 9 volt battery (compartment holds two batteries) and have resin-seated electrical components. Solenoid shall have no loose parts when removed from valve. Removal of 1" automatic valve shall be possible via an o-ring connector located under the valve after removal of stainless steel access plate. Valve assembly shall be contained within a UV-resistant locking cover, as manufactured by Kupferle Foundry Company. Model #9400A or approved equal.



SECTION VIEW



NOTE:
SPACERS MUST PREVENT
PIPE BELL FROM RESTING
ON CASING PIPE

SECTION VIEW

CASING PIPE & SPACER DETAIL

N.T.S.

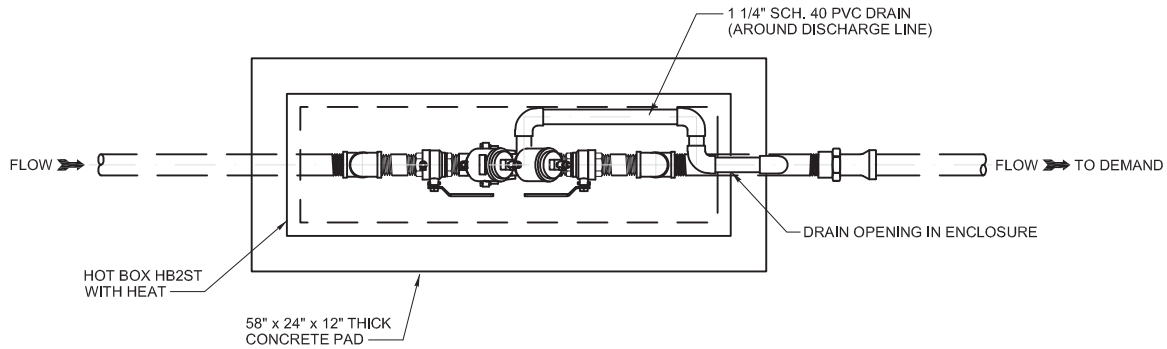
CITY OF PORTLAND, TN
Proud, Progressive Portland
Home of the STRAWBERRY FESTIVAL

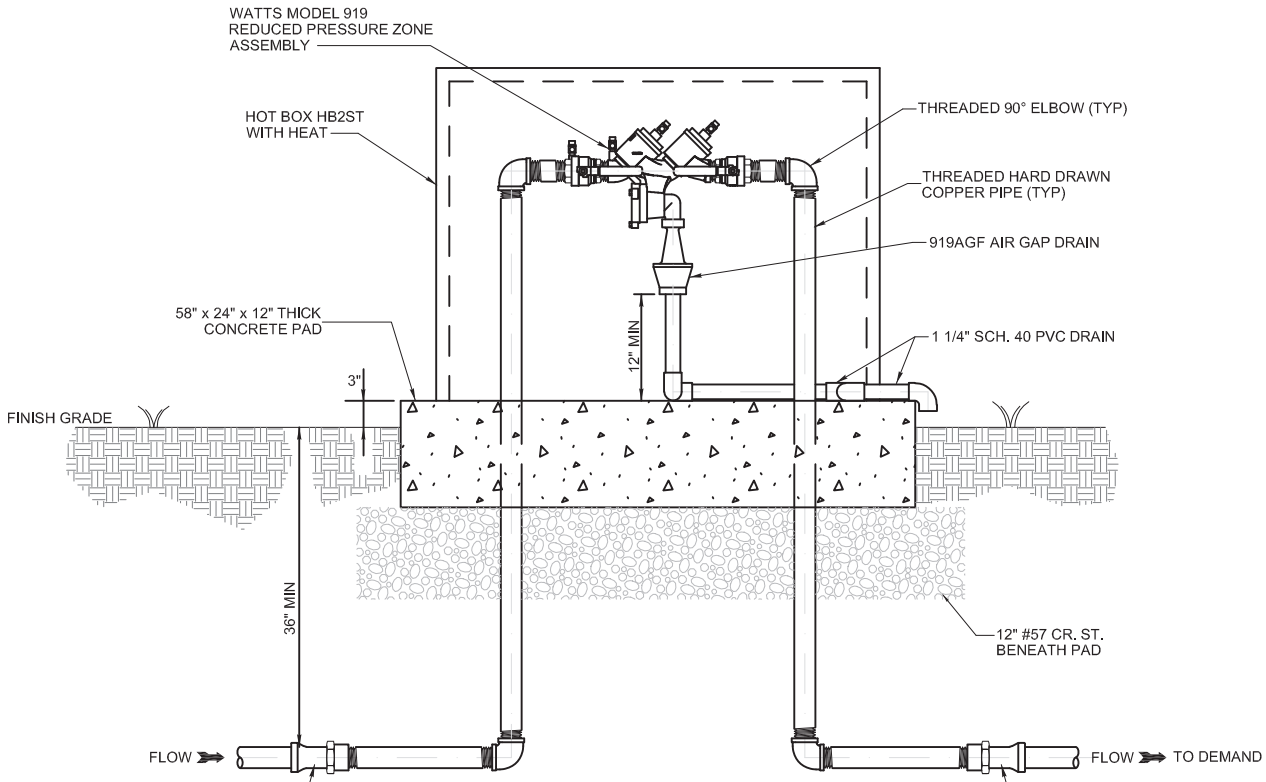
CITY OF PORTLAND

DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 2
DATE: 08.09.2022

W–14





NOTES:

1. BACKFLOW PREVENTION DEVICE TO BE UTILIZED IS BASED ON TYPE OF FACILITY OR STRUCTURE. REFER TO LCWSA POLICIES AND PROCEDURES FOR DETAILS.
2. RPZ ASSEMBLY MAY BE INSTALLED WITHIN BUILDING OR STRUCTURE HOWEVER NO CONNECTIONS TO THE WATER LINE MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
3. AC POWER WILL BE REQUIRED FOR ENCLOSURE HEAT.

1–2 INCH BACKFLOW PREVENTER DETAIL

N.T.S.

CITY OF PORTLAND, TN
Proud, Progressive Portland
Home of the STRAWBERRY FESTIVAL

CITY OF PORTLAND

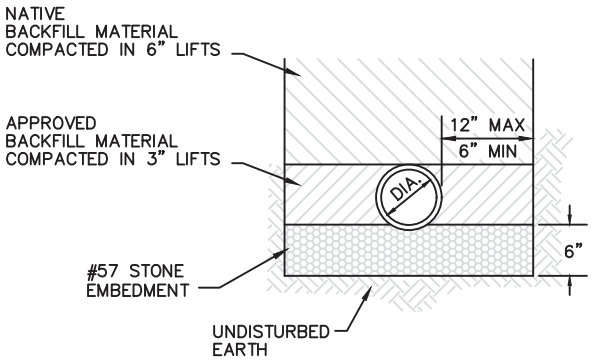
DEPARTMENT OF UTILITIES – WATER
STANDARD WATER DETAILS

REVISION NO: 1
DATE: 03/21/2022

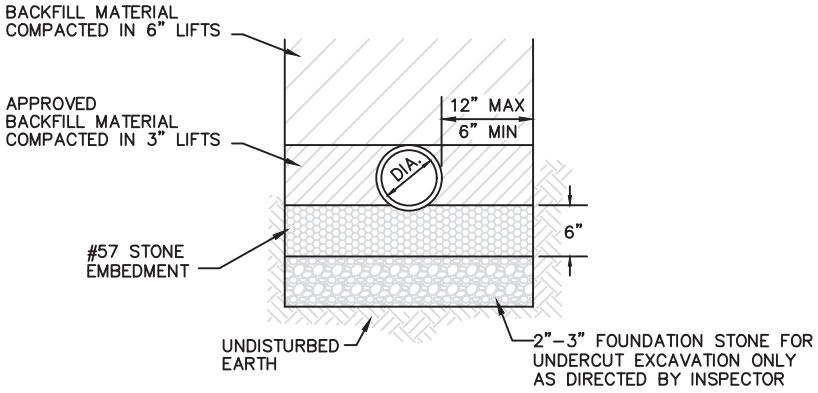
W–17

APPENDIX B

STANDARD SEWER DETAILS

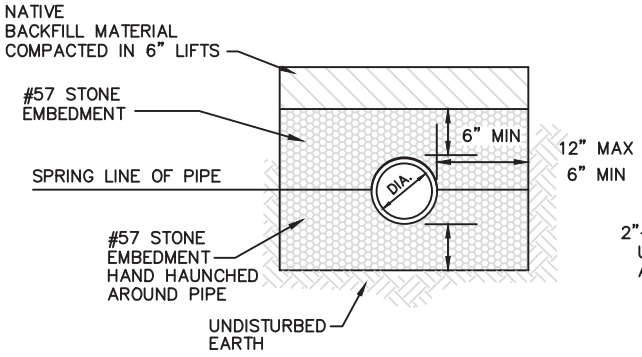


STANDARD EXCAVATION

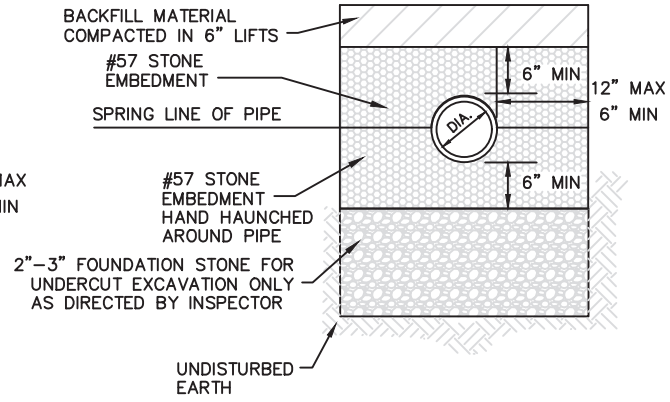


UNDERCUT EXCAVATION
IN UNSTABLE SOILS TYPES

DUCTILE IRON GRAVITY SEWER



STANDARD EXCAVATION



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 PORTLAND

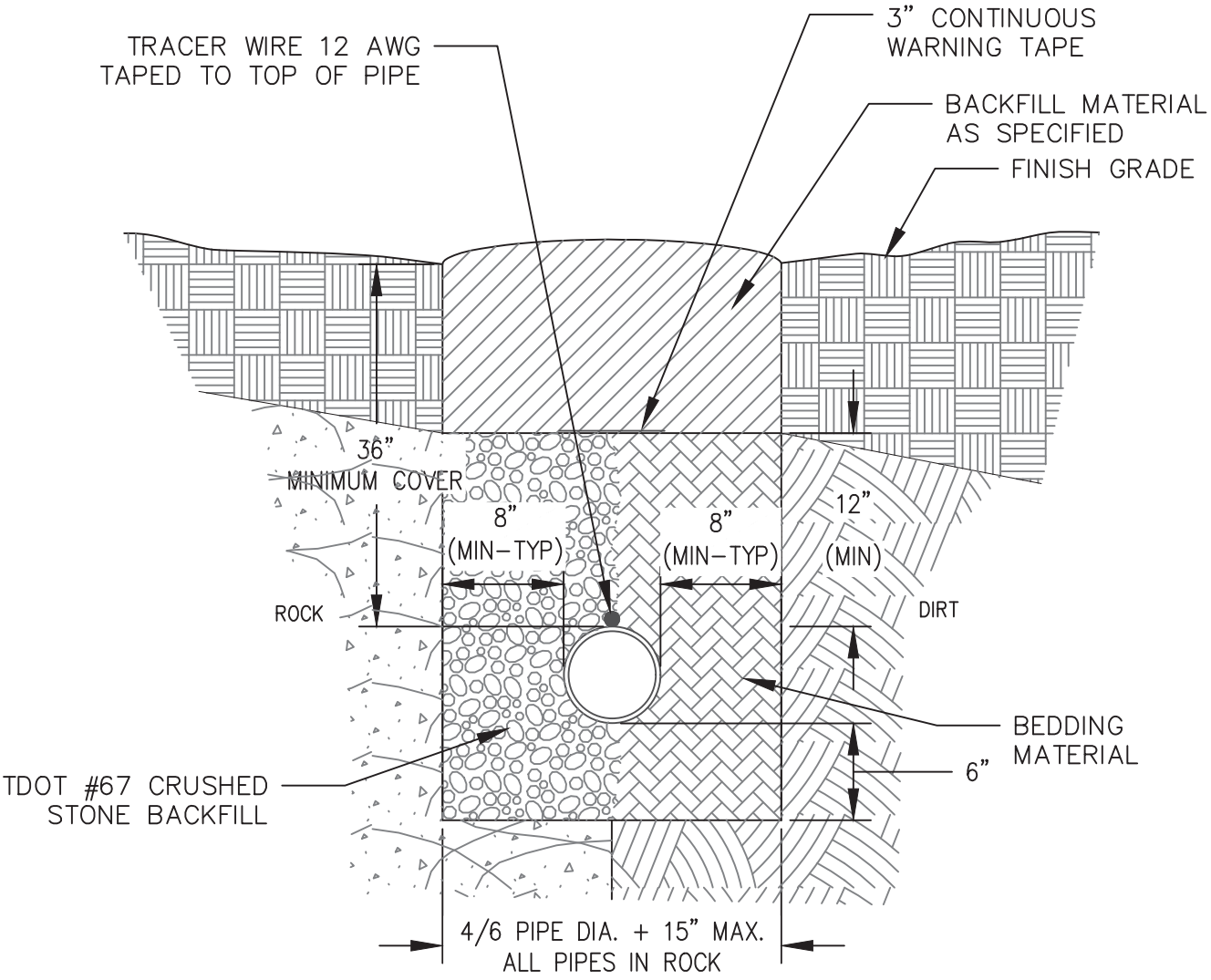
DEPARTMENT OF UTILITIES – SEWER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: 06/01/2021

WW–01

NOTES:

1. 36" MIN COVER FOR ALL MAIN UNLESS OTHERWISE SPECIFIED.
2. BEDDING MATERIAL SHALL BE FINE, LOOSE EARTH FREE FROM CLODS, ORGANIC DECOMPOSABLE MATERIAL, DEBRIS, AND STONE NO LARGER THAN TWO (2) INCHES IN DIAMETER
3. IN ROAD INSTALLATIONS SHALL BE FULL STONE BACKFILL.



SEWER FORCE MAIN TRENCH DETAIL

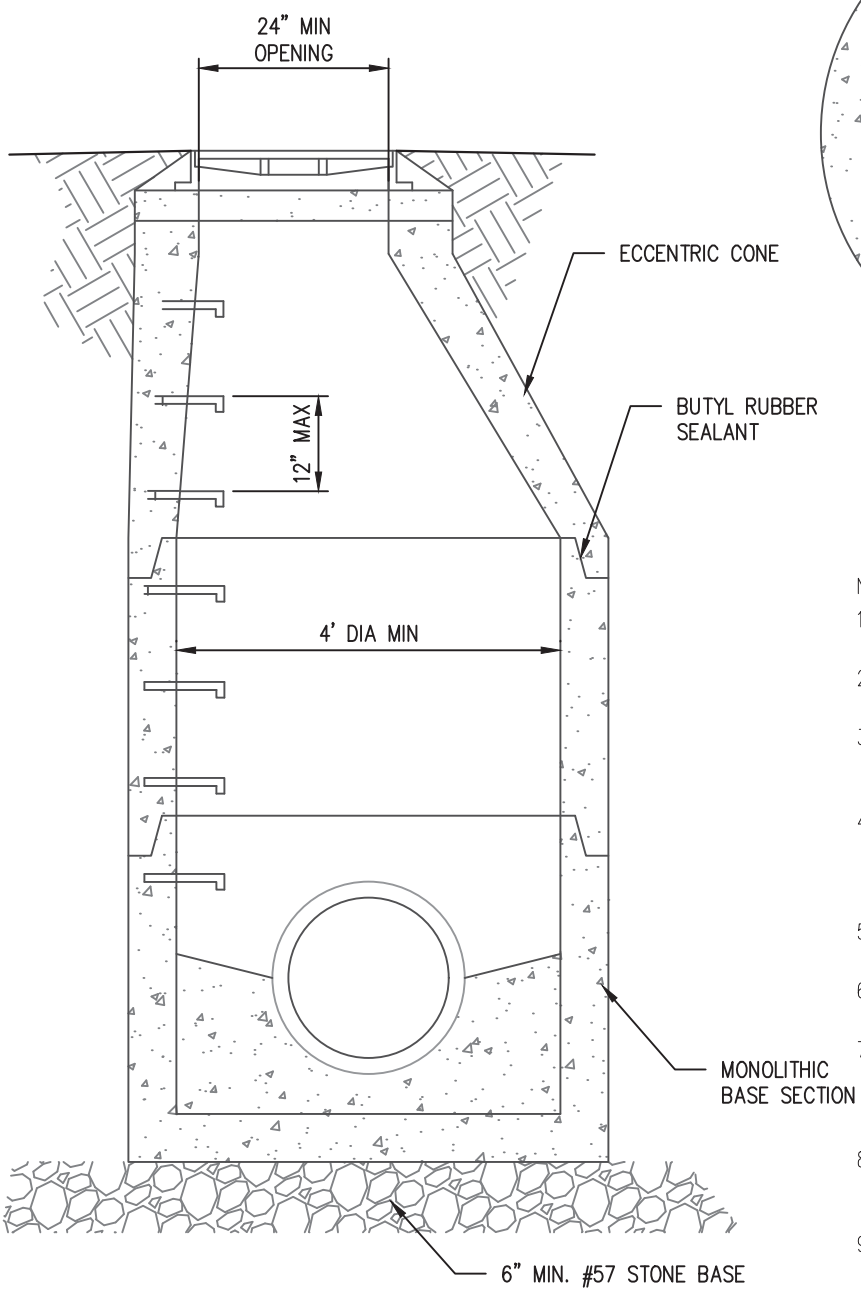
N.T.S.

CITY OF PORTLAND

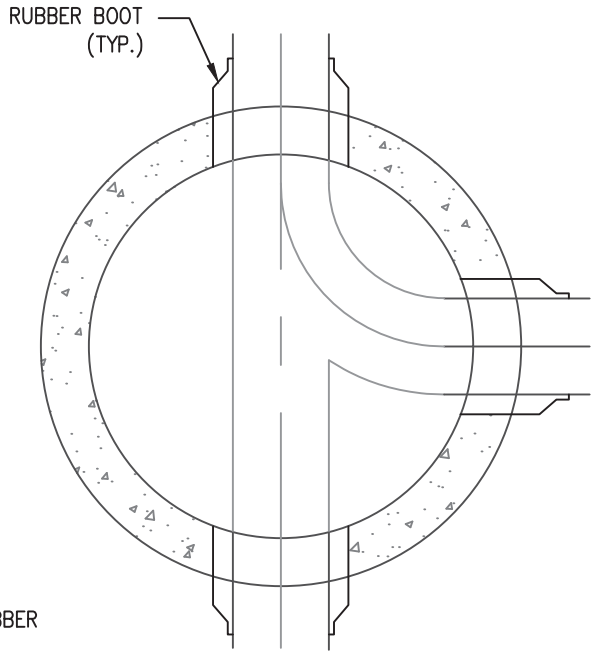
DEPARTMENT OF UTILITIES – SEWER
STANDARD WATER DETAILS

REVISION NO: 1
DATE: 06/01/2021

WW-02



PROFILE VIEW



PLAN VIEW

NOTES:

1. SEE PLANS FOR LOCATION, DIAMETER, ELEVATIONS AND PIPE SIZE.
2. TROUGH OF MANHOLE MAY BE CAST IN CONCRETE OR BUILT UP WITH MORTAR
3. GROUT ANNULAR SPACE BETWEEN WALL AND PIPE WITH NON-SHRINK MORTAR TO INSURE WATERTIGHT SEAL.
4. ALL PRECAST SECTIONS SHALL CONFORM TO ASTM C478 WITH COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAY TEST. CONCRETE MIX SHALL INCLUDE XPEX OR APPROVED EQUAL.
5. BUTYL RUBBER SEALANT SHALL BE KENT SEAL No.2 OR CONCRETE SEALANTS CS202.
6. MANHOLE STEPS SHALL BE WITHIN 18" OF TOP, 12" O.C.
7. MANHOLE COVERS TO HAVE "SANITARY SEWER" EMBOSSED ON THE COVER. FRAMES SHALL BE JOHN BOUCHARD & SONS NO. 1155, 1123, OR APPROVED EQUAL.
8. GRADE RINGS MAY BE REQUIRED TO ADJUST TOP ELEVATION PRIOR TO FINAL PAVING. BRICKS SHALL NOT BE USED FOR ADJUSTMENT.
9. RUBBER BOOTS SHALL BE KOR-N-SEAL OR PRESS SEAL GASKET CORPORATION OR APPROVAL EQUAL.
10. SEE CITY OF PORTLAND SPECIFICATIONS FOR PRODUCT SPECIFICATIONS.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – SEWER
STANDARD SEWER DETAILS

REVISION NO: 1
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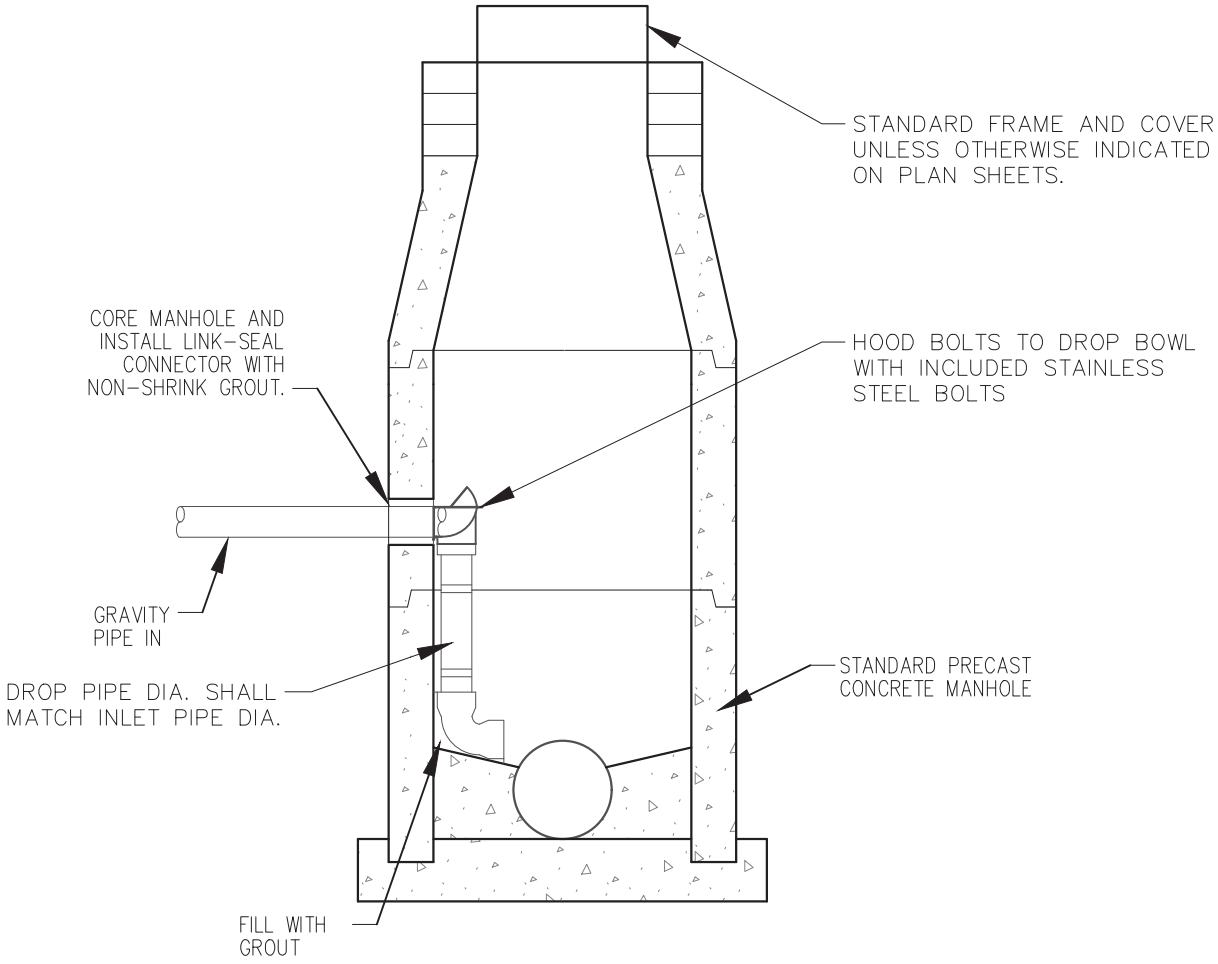
WW-03



NOTES:

1. DROP MANHOLE SHALL BE DURAN RELINER WITH FORCE LINE HOOD OR APPROVED EQUAL.
2. RELINER STAINLESS STEEL PIPE SUPPORT BRACKET SHALL BE INSTALLED @ 4' SPACING (MIN OF 2 PER DROP).
3. DROP MANHOLE SHALL BE A MINIMUM OF 24-INCHES.

INSIDE DROP MANHOLE

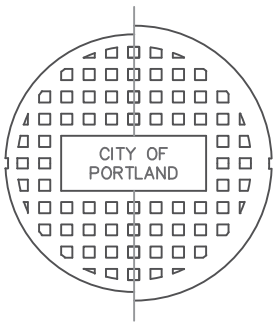
N.T.S.

CITY OF PORTLAND

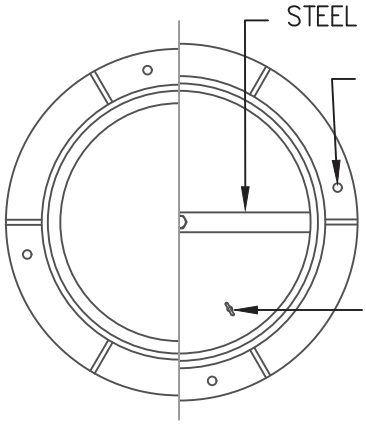
DEPARTMENT OF UTILITIES - SEWER
STANDARD WATER DETAILS

REVISION NO: 1
DATE: 06/01/2021

WW-04



COVER



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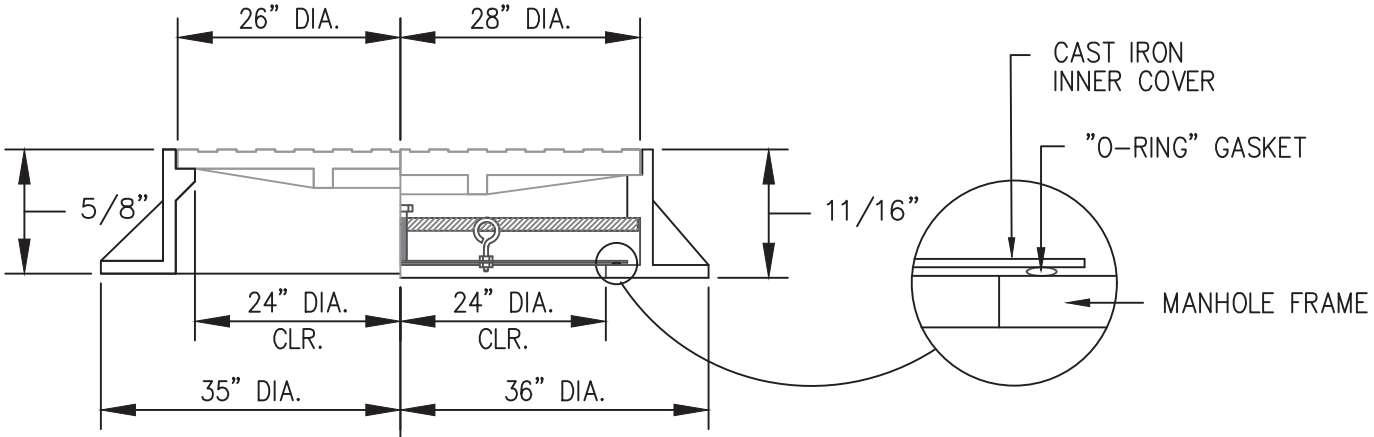


DETAIL "A"

STANDARD	WATER-TIGHT
BOUCHARD & SONS 1155	BOUCHARD & SONS 1123

FRAME AND COVER DETAIL

N.T.S.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES - SEWER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: 06/01/2021

WW-05

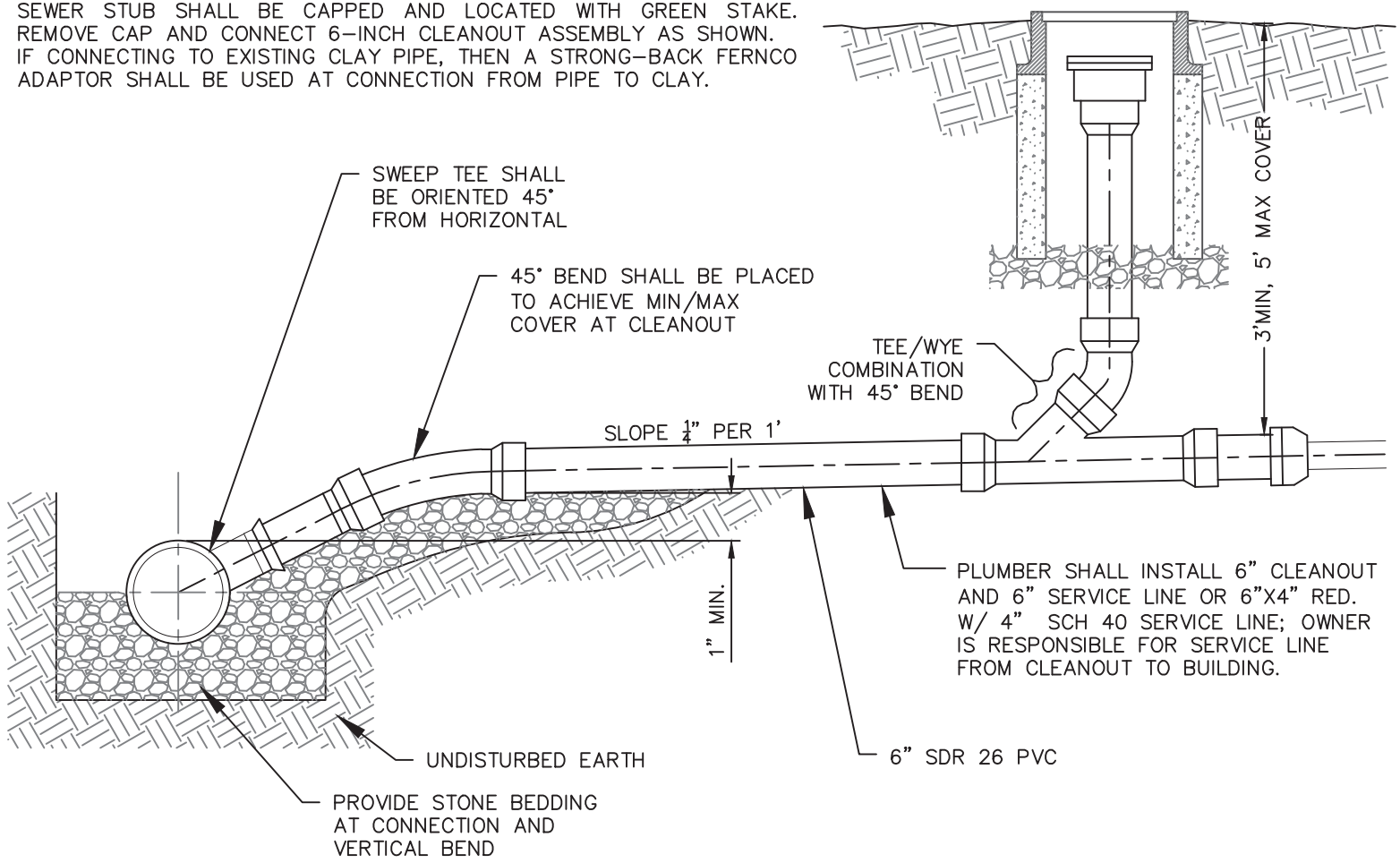
CITY OF PORTLAND

DEPARTMENT OF UTILITIES – SEWER

STANDARD SEWER DETAILS

NOTES:

1. CLEANOUT SHALL BE LOCATED 1' OUTSIDE OF THE ROW, IN THE PUDE OR 1' FROM BACK OF SIDEWALK.
2. CLEANOUT SHALL BE LOCATED IN SOFT SURFACE. CLEANOUTS SHALL NOT BE LOCATED IN ASPHALT OR CONCRETE SURFACES WITHOUT PORTLAND DEPARTMENT OF UTILITY APPROVAL.
3. SIDEWALK SHALL BE STAMPED WITH A 1"X1"–"S" AT BACK OF CURB WHERE CLEANOUT IS PLACED. PLUMBER SHALL INSTALL SERVICE LINE PER UPC.
4. CLEANOUTS SHALL BE INSTALLED AT BENDS AND NO MORE THAN 75 FEET APART. BOXES ARE REQUIRED FOR ALL CLEANOUTS, CONCRETE BOX SHALL BE INSTALLED FOR CLEANOUT AT RIGHT–OF–WAY.
5. SERVICE LINE SHALL BE BEDDED AND BACKFILLED TO TOP OF PIPE WITH #57 STONE.
6. SEWER STUB SHALL BE CAPPED AND LOCATED WITH GREEN STAKE. REMOVE CAP AND CONNECT 6–INCH CLEANOUT ASSEMBLY AS SHOWN.
7. IF CONNECTING TO EXISTING CLAY PIPE, THEN A STRONG–BACK FERNCO ADAPTOR SHALL BE USED AT CONNECTION FROM PIPE TO CLAY.



SEWER SERVICE DETAIL

N.T.S.

WW–06

REVISION NO: 2

DATE: 01.27.2022

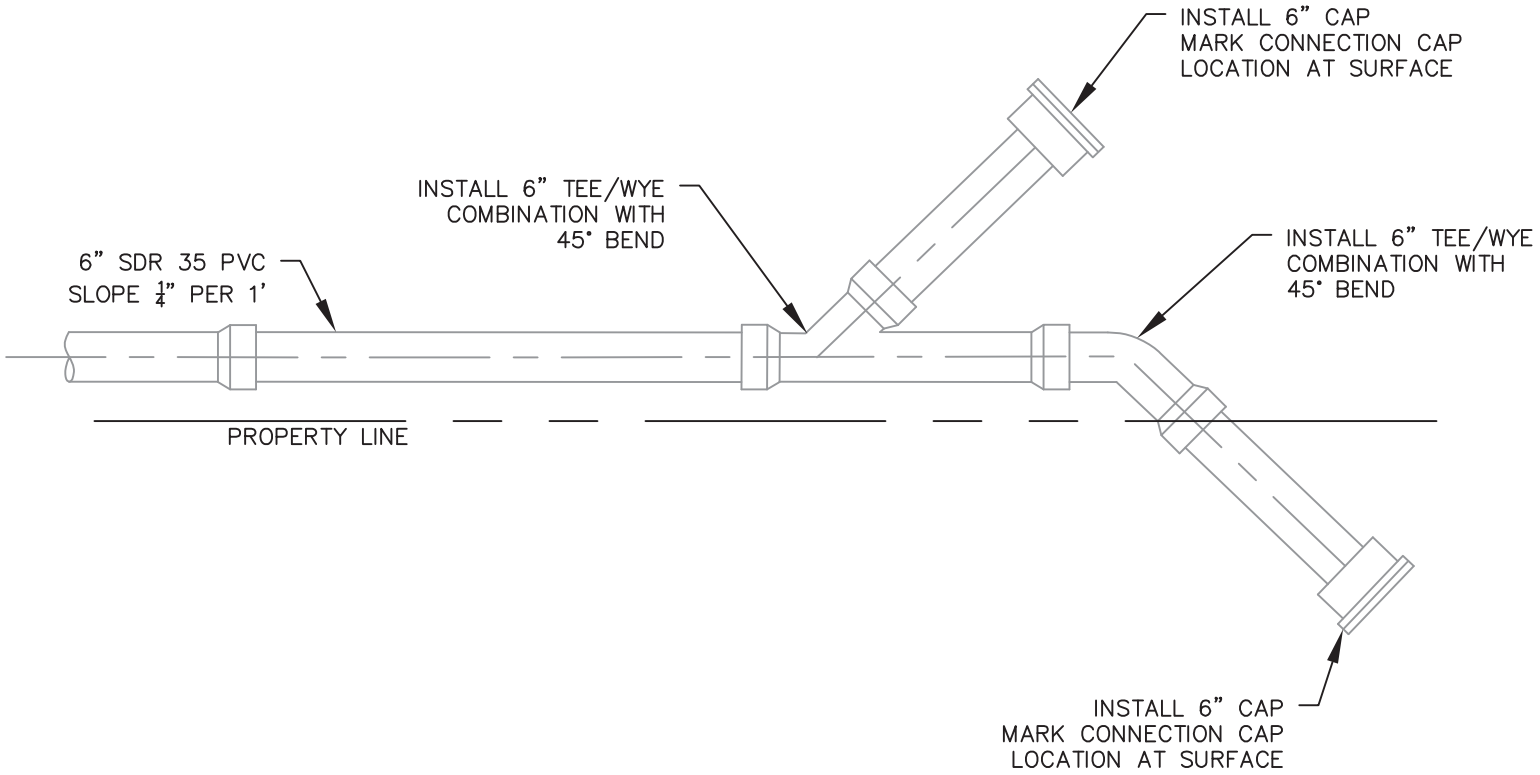
CITY OF PORTLAND

DEPARTMENT OF UTILITIES – SEWER

STANDARD SEWER DETAILS

NOTES:

1. ALL CLEANOUT NOTES FROM WW–06 SHALL APPLY TO THE DOUBLE SEWER SERVICE CONNECTION – LONG SIDE
2. CLEANOUT SHALL BE LOCATED 1' OUTSIDE OF THE ROW (AS CLOSE AS PRACTICABLE) IN THE PUDE OR 1' FROM BACK OF SIDEWALK.
3. PLUMBER SHALL INSTALL 6" CLEANOUT AND 6" SERVICE LINE OR 6"X4" RED. W/4" SCH.40 SERVICE LINE; OWNER IS RESPONSIBLE FOR SERVICE LINE FROM CLEANOUT TO BUILDING.



DOUBLE SEWER SERVICE CONNECTION – LONG SIDE

N.T.S.

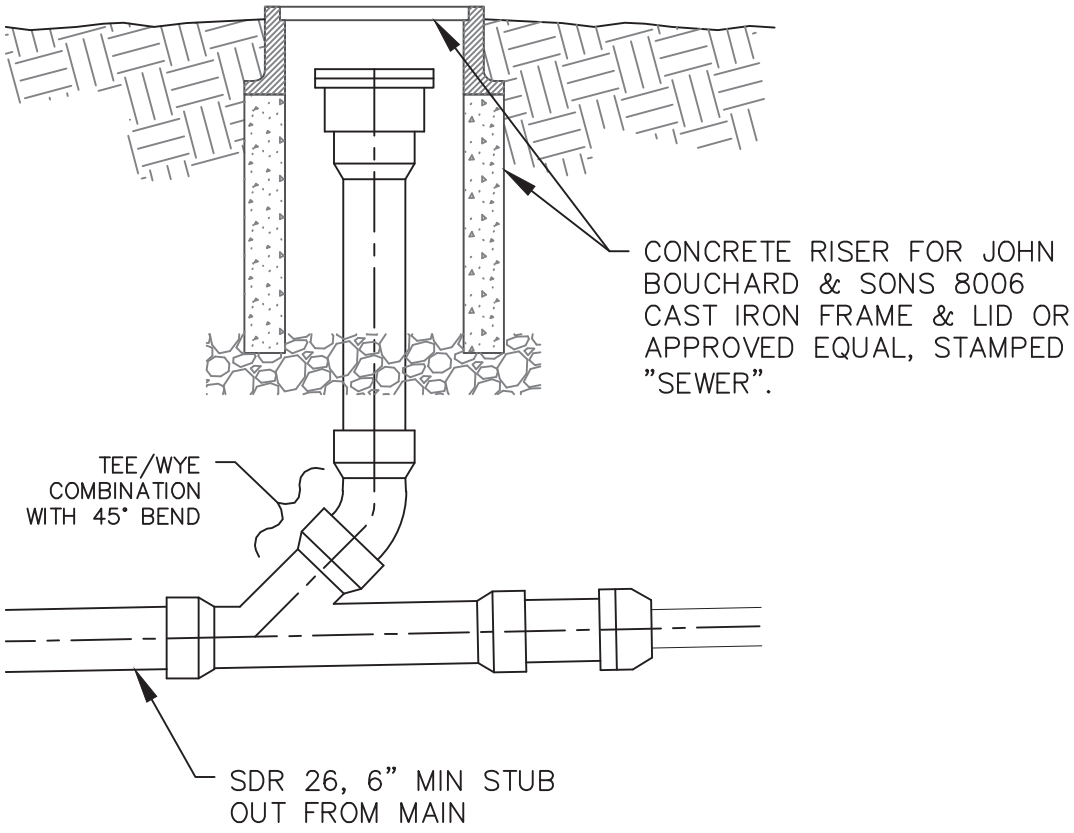
REVISION NO: 1

DATE: 09/08/2021

WW–07

NOTES:

1. CONCRETE RISERS SHALL BE USED FOR ALL CLEANOUTS AT THE RIGHT-OF-WAY.
2. CONCRETE RISERS SHALL BE USED FOR ANY CLEANOUTS INSTALLED UNDER HARD SURFACE (I.E. PAVEMENT, CONCRETE, OR GRAVEL DRIVEWAYS)
3. CONCRETE BOXES SHALL BE INSTALLED ON ALL COMMERCIAL AND INDUSTRIAL LOCATIONS.
4. PLASTIC RISERS MAY BE USED FOR ANY CLEANOUTS ON A RESIDENTIAL CUSTOMER SIDE INSTALLED UNDER SOFT SURFACES (I.E. GRASS) AND AT LEAST THREE (3) FEET AWAY FROM ANY HARD SURFACE (I.E. PAVEMENT, GRAVEL, ETC..)



CLEANOUT BOX

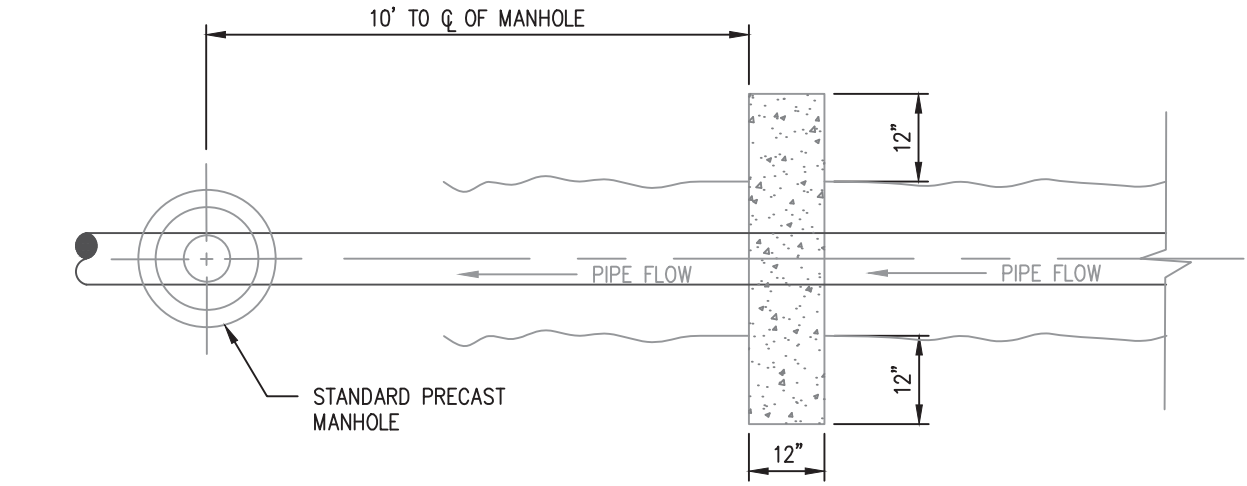
N.T.S.

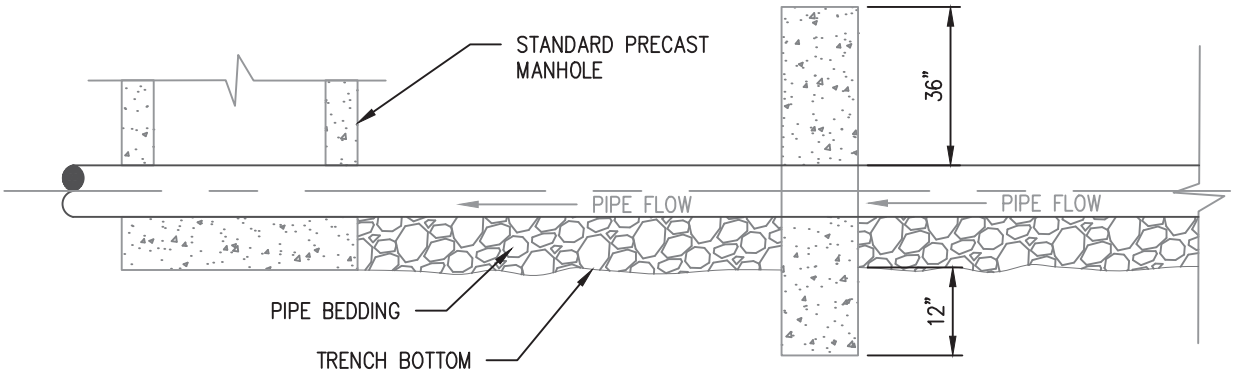
CITY OF PORTLAND

DEPARTMENT OF UTILITIES – SEWER
STANDARD SEWER DETAILS

REVISION NO: 2
DATE: 01.27.2022

WW-08





NOTES:

1. CONCRETE SHALL BE PLACED 10' UPSTREAM FROM EVERY MANHOLE. ADDITIONAL CONCRETE COLLAR LOCATIONS INCLUDE ON EITHER SIDE OF A STREAM/DITCH LINE OR UPON RECOMMENDATIONS OF THE CITY OF PORTLAND UTILITY DEPARTMENT.
2. CONCRETE COLLAR SHALL PERTRUDE INTO NATIVE SOIL A MINIMUM OF 12" ON BOTTOM AND SIDE OF TRENCH AND EXTEND TO A MINIMUM OF 1' BELOW THE SURFACE ELEVATION.

CONCRETE COLLAR

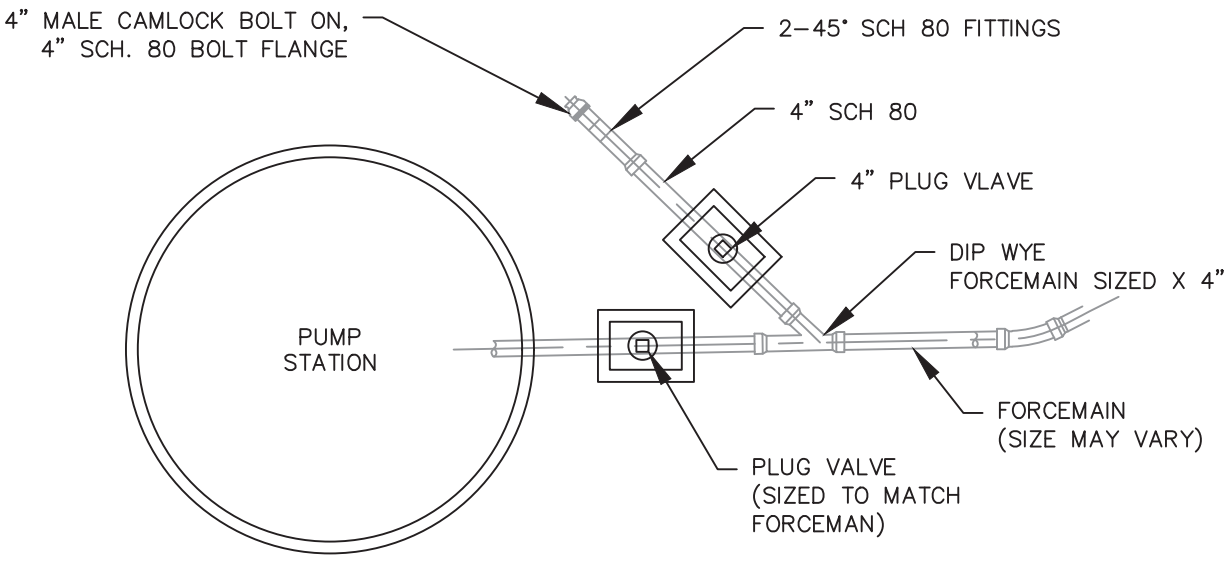
N.T.S.

CITY OF PORTLAND

DEPARTMENT OF UTILITIES – SEWER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: 06/01/2021

WW–09



NOTES:

1. ALL VALVES AND CAMLOCK CONNECTION SHALL BE IN CONCRETE VALVE BOXES WITH CONCRETE FOOTER BOXES AND ADJUSTED TO GRADE.
2. CONNECTION SHALL BE 4" MALE CAMLOCK BOLT ON CONNECTION. CONNECTION SHALL BE WITHIN 4" BELOW GRADE.
3. ALL LINES SHALL BE BEDDED IN 6" MINIMUM DEPTH OF #57 STONE.

PUMP STATION BY-PASS CONNECTION

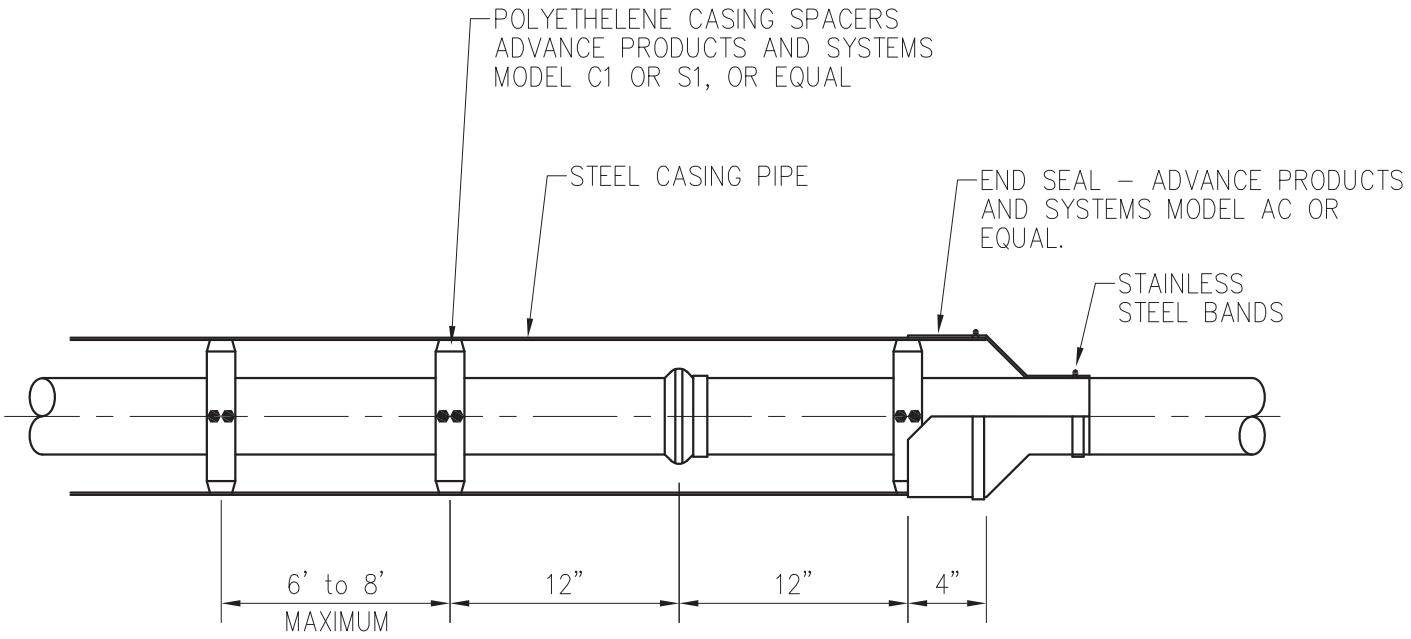
NOT TO SCALE

CITY OF PORTLAND

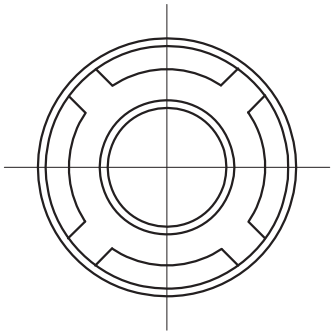
DEPARTMENT OF UTILITIES - SEWER
STANDARD SEWER DETAILS

REVISION NO: 0
DATE: 06/01/2021

WW-10



SECTION VIEW



NOTE:
SPACERS MUST PREVENT
PIPE BELL FROM RESTING
ON CASING PIPE

SECTION VIEW

CASING PIPE & SPACER DETAIL

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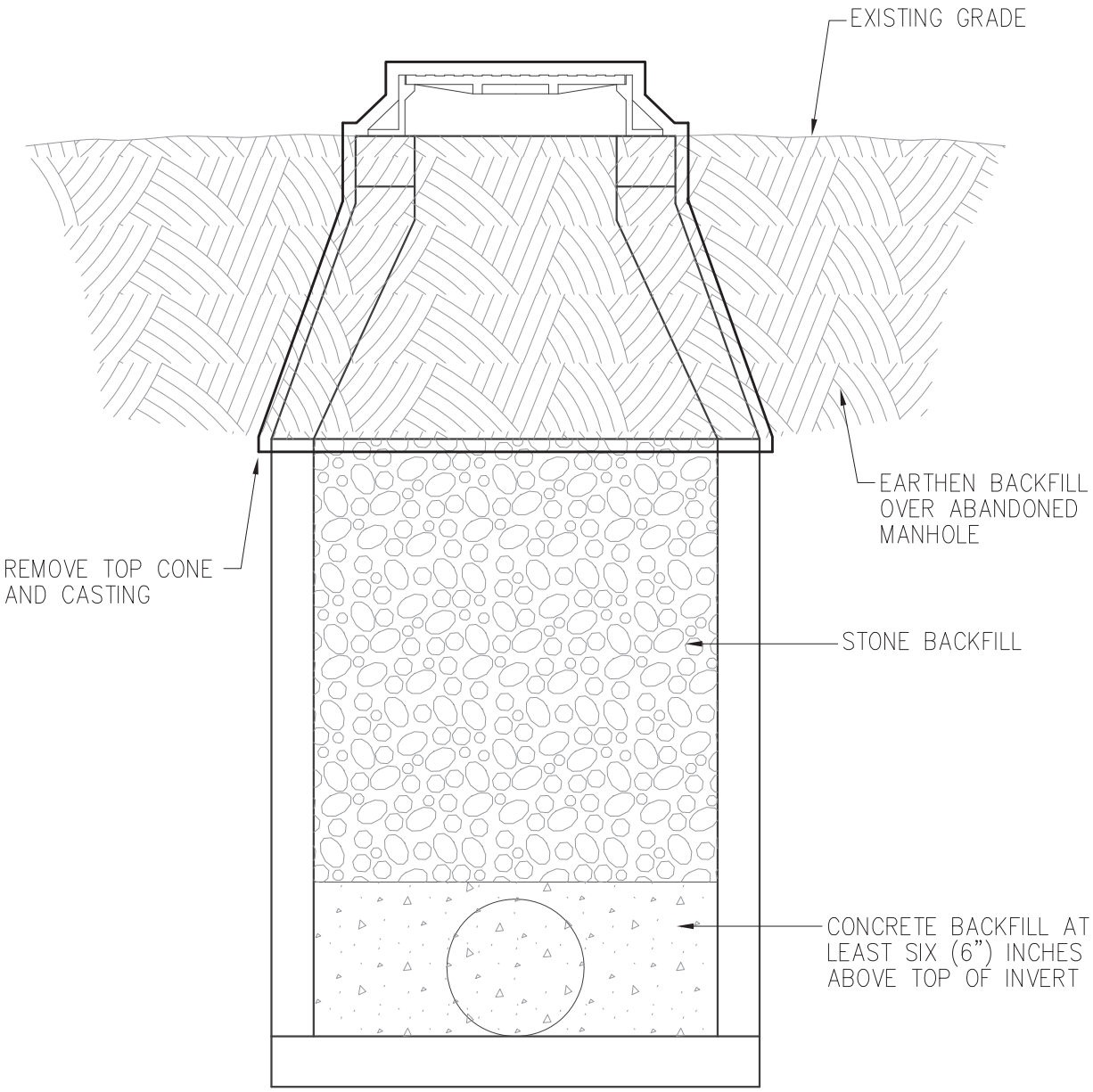
DEPARTMENT OF UTILITIES – SEWER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: 06.23.2021

WW–11



ABANDONED MANHOLE DETAIL

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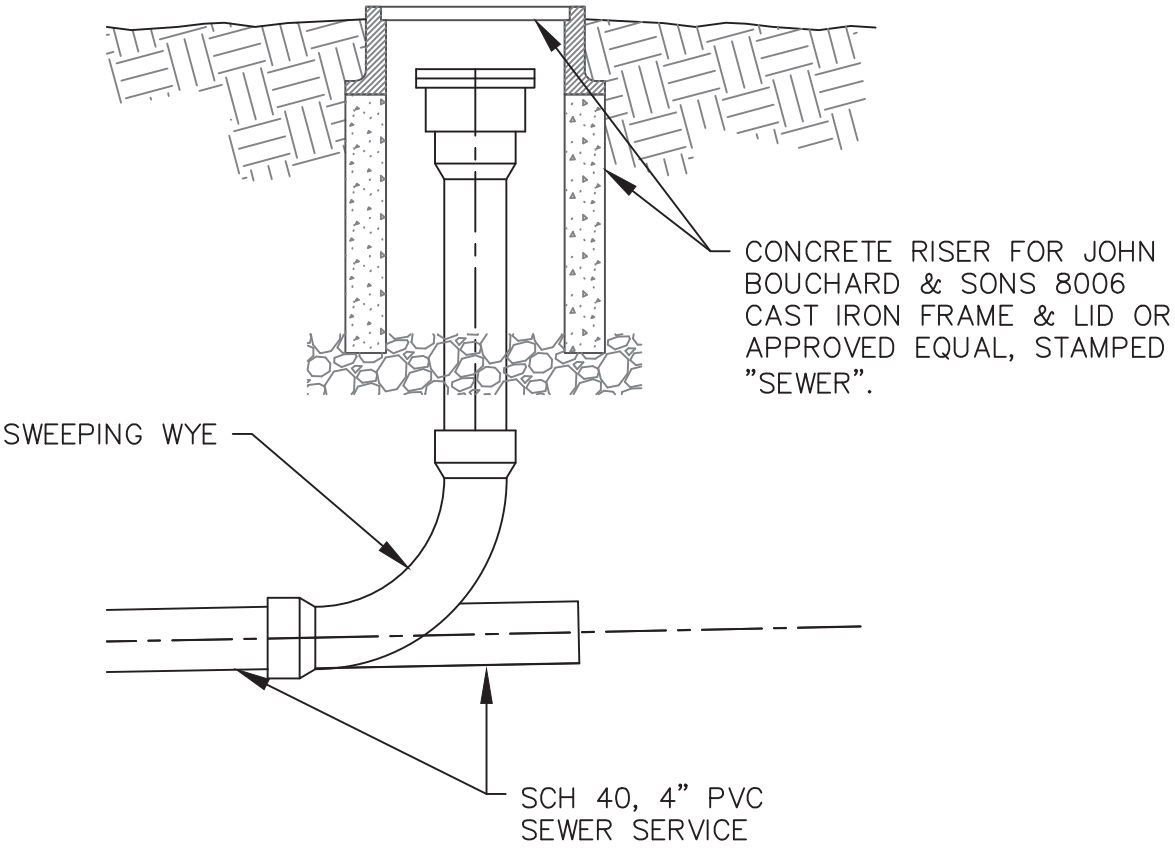
DEPARTMENT OF UTILITIES – SEWER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: 01.19.2022

WW–12

NOTES:

1. CONCRETE RISERS SHALL BE USED FOR ANY CLEANOUTS INSTALLED UNDER HARD SURFACE (I.E. PAVEMENT, CONCRETE, OR GRAVEL DRIVEWAYS)
2. CONCRETE BOXES SHALL BE INSTALLED ON ALL COMMERCIAL AND INDUSTRIAL LOCATIONS.
3. PLASTIC RISERS MAY BE USED FOR ANY CLEANOUTS ON A RESIDENTIAL CUSTOMER SIDE INSTALLED UNDER SOFT SURFACES (I.E. GRASS) AND AT LEAST THREE (3) FEET AWAY FROM ANY HARD SURFACE (I.E. PAVEMENT, GRAVEL, ETC..)



4–INCH CLEANOUT ASSEMBLY & BOX

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DEPARTMENT OF UTILITIES – SEWER
STANDARD SEWER DETAILS

REVISION NO: 1
DATE: 02–15–2022

WW–13