City of Brentwood, Tennessee
Water Services Department

Water and Sewer Planning Guidelines and Standard Specifications

Approved By: _____ **8/27/12**
Director **Date**

August, 2012

Prepared by the City of Brentwood, Water Services Department

WATER AND SEWER PLANNING GUIDELINES
and STANDARD SPECIFICATIONS

APPROVALS PAGE

Engineer's Seal:

Approval, State of Tennessee, Division of Water Supply:

WS 12-0966

APPROVAL EXPIRES
OCT 10 2015
TENN DEPT OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER SUPPLY

Approval, State of Tennessee, Division of Water Pollution Control:

DOCUMENT BEARING THIS STAMP HAS BEEN RECEIVED AND REVIEWED
TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
AND IS HEREBY APPROVED FOR CONSTRUCTION BY THE COMMISSIONER

NOV 02 2012

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

Adnan Bahou

APPROVAL EXPIRES
NOV 02 2015
TN. DEPT OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER POLLUTION CONTROL

TABLE OF CONTENTS

ADDENDUM #1

SECTION 02730 - SANITARY SEWER SYSTEM

3.5 HOUSE LINE CONNECTIONS - NEW MAIN INSTALLATIONS

(Delete)

A. Make connection of a 4 inch house service line to the 6 inch service line using a FERNCO coupling sized appropriately.

(Add)

A. Make connection of a 4 inch house service line to the 6 inch service line using glue fitting sized appropriately and a 6 inch clean-out assembly per the std drawing.

Chris Milton, Director

02-07-13
Date

ADDENDUM #2

July 2013

(Updates in Red)

(Page 4) **APPENDIX I - BRENTWOOD WATER SERVICES STANDARD DRAWING INDEX**

WATER		SEWER		GENERAL	
W1	Typical Trench Section	S1	Standard Manhole	G1	Street Replacement Trench Width
W2	Fire Hydrant Assembly	S2	Standard Precast Manhole Sections	G2	Street Replacement – Full Overlay
W3	Concrete Thrust Blocking – Tee / Plug	S3	Standard Precast Shallow Manhole	G3	Boring Detail
W4	Concrete Thrust Blocking - Bends	S4	Standard Drop Manhole	G4	Concrete Cap
W5	Concrete Anchor	S5	Manhole Covers	G5	
W6	5/8" – 2" Service Assembly	S6	Service Connection	G6	
W7	STD. Backflow Preventer	S7	Manhole Vent Detail	G7	
W8	Gate Valve, Box and Cover w/ Concrete Pad	S8	Sewage Air Release Valve	G8	
W9	Fire Service Backflow Preventer	S9	Grinder Pump Details	G9	
W10	Air Valve and Vault	S10	Grinder Pump Layout	G10	
W11	TYP. Small Meter & Sewer Service Plan	S11	Force Main Service Valve Box	G11	
W12	4" OR Greater Commercial Fire line Plan w/ Domestic & Irrigation Supply	S12	Force Main Connection to Existing Manhole	G12	
W13		S13		G13	
W14		S14		G14	
W15		S15		G15	
W16		S16		G16	
W17		S17		G17	

APPENDIX II – DESIGN BASIS FOR SEWER SYSTEMS

END OF DOCUMENT 00000 - TABLE OF CONTENTS

(Page 9) 1. Request for Water / Sewer Availability

Prior to submitting any plan proposing to connect to, or expand an existing usage of~~,~~ the public water or sewer system…

(Page 12) Sewer Facilities

A. The State of Tennessee, "Design Criteria for Sewage Works" latest revision, shall be followed when designing public sewer systems within the City of Brentwood, unless otherwise stated. "Appendix II," "Design Basis for Sewer Systems" shall be followed in determining project flows. The State of Tennessee, "Design Criteria for Sewage Works" shall be followed in the absence of relevant flow data contained within Appendix II"

(Page 19) GUIDANCE TO BIDDERS OF A PUBLIC CONTRACT

SECTION 02660 – WATER DISTRIBUTION SYSTEM

(Page 108) 2.11 HYDRANTS

A. Manufacturers:
1. Model "Super Centurion 250 A-423" Mueller.

B. General: Provide fire hydrants with threaded male nozzle conforming to "American National Standard Fire Hose Connection Screw Threads" unless other hose connection required by local fire authorities.

B. Provide dry-barrel fire hydrants (base valve type) complying with UL 246 and AWWA C502, inside dimension of 5 1/4 inches minimum, with minimum 5 inches diameter valve seat opening; minimum net water area of barrel not less than 190 percent of valve opening; 6 inch bell or mechanical joint inlet connection with accessories, gland bolts, and gaskets; all bronze working parts.

C.
1. Working pressure, 250 psi and 500 psi hydrostatic pressure.
2. Valve opening direction, counterclockwise, indicated by arrow and word "Open" cast on dome; 5 inch size minimum.
3. Nozzles, two hose nozzles and one pumper nozzle with caps and chains. Nozzle cap nuts to match operating stem nuts.
   (a) Operating stem nuts, 1-1/2" pentagon.
4. Bury Depth 3'-6"

SECTION 02730 – SANITARY SEWER SYSTEM

(Page 123) 3.4 INSTALLATION - PIPE

F. Lay pipe to slope gradients indicated; with maximum variation from true slope of 0.05%, 1/16 inch in 10 feet.
1. Slope sewer lines to maintain a minimum velocity of 2 feet per second when flowing full. The minimum slopes allowable are as follows:

STANDARD DRAWING G1 – STREET REPLACEMENT TRENCH WIDTH UPDATED

STANDARD DRAWING G2 – STREET REPLACEMENT FULL WIDTH UPDATED

STANDARD DRAWING S6 – SEWER SERVICE CONNECTION UPDATED

STANDARD DRAWING W1 - TYPICAL TRENCH SECTION UPDATED

STANDARD DRAWING W6 – 5/8" – 2" SERVICE ASSEMBLY UPDATED

STANDARD DRAWING W9 - FIRE SERVICE BFP UPDATED

STANDARD DRAWING W12 – 4" OR GREATER COMMERCIAL FIRE LINE PLAN WITH DOMESTIC AND IRRIGATION SUPPLY UPDATED

Chris Milton

Chris Milton, Director

07-10-13

Date

APPENDIX II

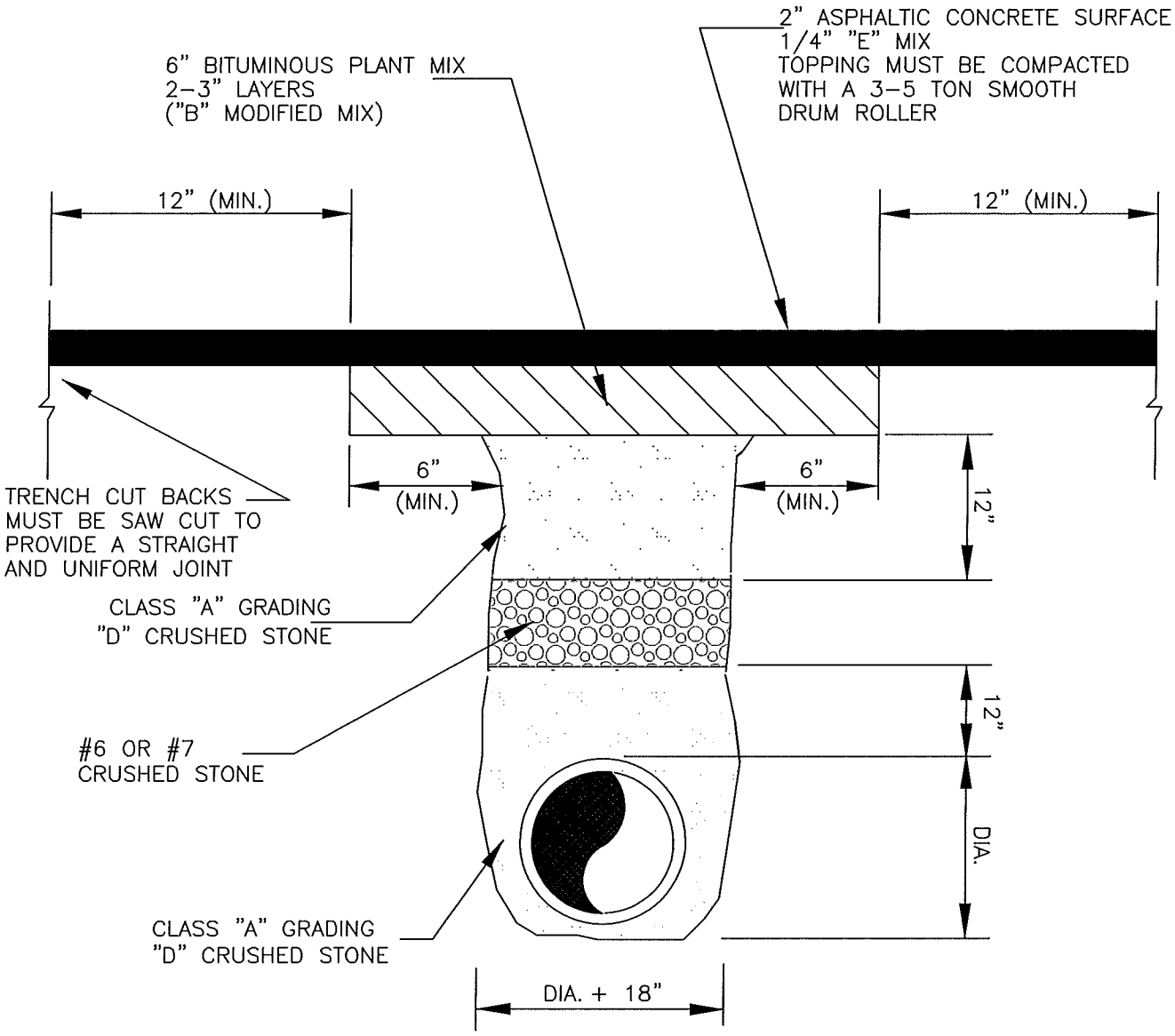
Water Services Department
Design Basis for Sewer Systems

DISCHARGE CLASSIFICATION	*DESIGN UNITS*	*FLOW - Gallons / Day*
Single Family Over 2,000 s.f.	Each	310
Single Family 2,000 s.f. or less	Each	233
Schools w/ showers & cafeteria	Faculty, Staff, and Students	16
Schools w/out showers & cafeteria	Faculty, Staff, and Students	12
Hotels/motels	per bedroom	130
Restaurants	Per Indoor Seat	40
Service (Fuel) Station w/ car wash	per fuel island/wash bay	1,000/500
Service (Fuel) Station w/ out car wash	per fuel island	1,000
Car wash facility	use historical data	--
Commercial Office	Per Employee (per sq. ft.)	25 (0.25)
Commercial Office w/ showers	Per Employee (per sq. ft.)	31 (0.31)
Commercial Retail	Per Square Foot	0.15
Warehouse space	Per Employee	25
Church (w/out kitchen, daycare, school, or other act.)	Per Sanctuary Seat	3
Church (w/kitchen but no daycare, school, or other act.)	Per Sanctuary Seat	5
Churches[1] (large, multi-purpose facilities)	Per Seat and each addtl. usage[1]	--
Salon	per station	200
Nursing Homes / Assisted Living	Per Bed	120
Child/Day Care Center	Per Child and Adult	10
Child/Day Care Center w/ showers and/or café.	Per Child and Adult	15
Laundromat (self service)	per machine	250
Dry cleaning (drop off)	Per Employee	25
Swimming pools	per swimmer	10
Theaters, auditoriums	per seat	5
Factory	per person per 8 hr. shift	25
Fitness, exercise, dance center	Per 100 square feet	50

Notes:
1 - Design flow shall be determined by the sum of each usage classification being provided.
Unlisted classifications may use flow data for similar classification or plumbing fixture count method for determining flow.
2 - Per employee calculations are based on maximum employees based on use and space.

Director

February 2013
Date



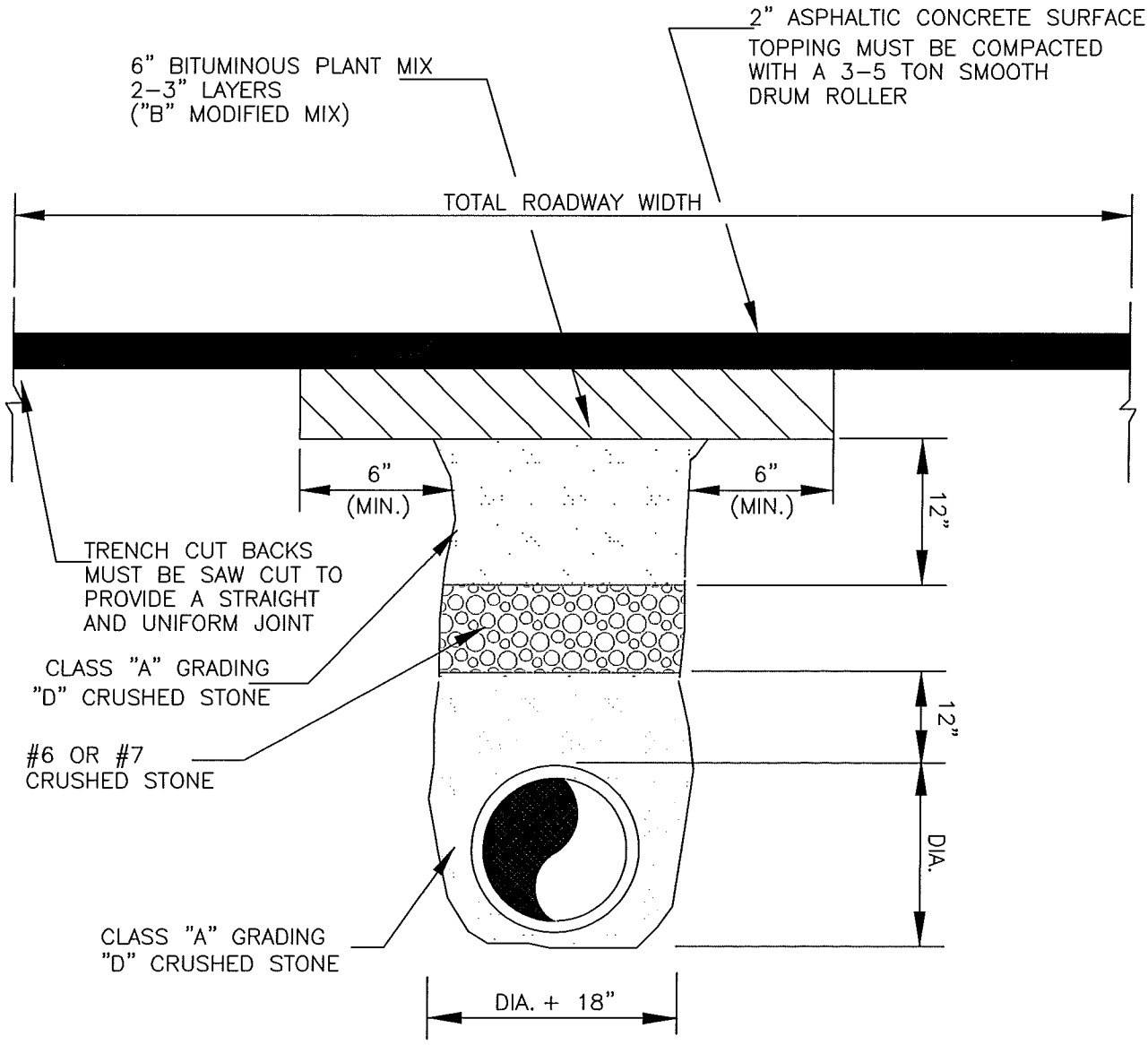
TRENCH WIDTH

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

STREET REPLACEMENT
TRENCH WIDTH

JULY, 2013

DRAWING NO. G1



FULL OVERLAY

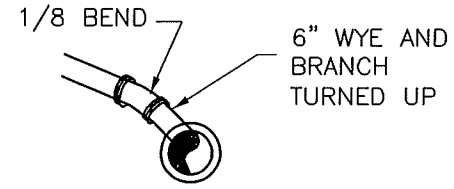
CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

STREET REPLACEMENT
FULL OVERLAY

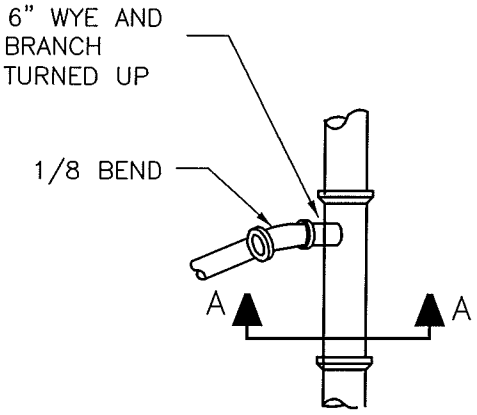
JULY, 2013

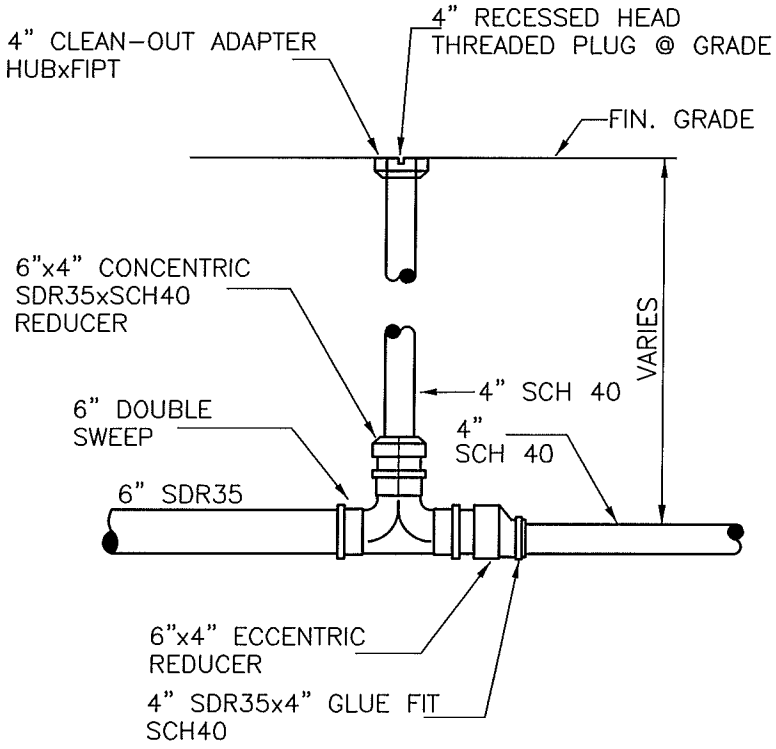
DRAWING NO. G2

LOCATE CLEAN-OUT
AT PROPERTY LINE
OR EDGE OF EASEMENT

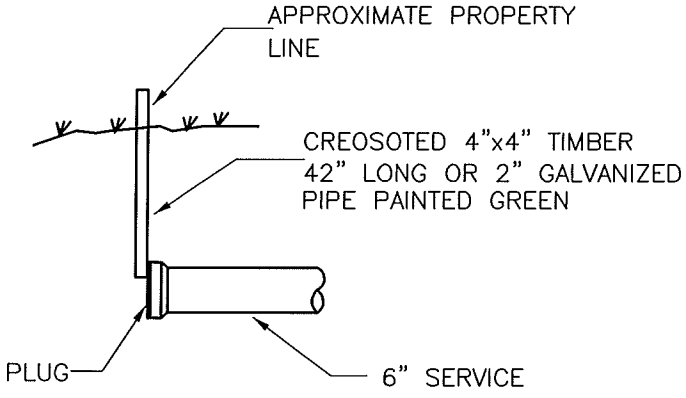


SECTION "A-A"





CLEAN-OUT



FITTING	PART No.*
6" DOUBLE SWEEP	G1006
6"x4" CONCENTRIC REDUCER	G1216
4" CLEAN-OUT ADAPTER HUB	P1404
4" RECESSED HEAD THREADED PLUG	P1144
6"x4" ECCENTRIC REDUCER	G1306
4" SDR35xSCH40 ADAPTER	P1213

*AS MANUFACTURED BY PLASTIC TRENDS, INC.
OR EQUIVALENT

HOUSE CONNECTION

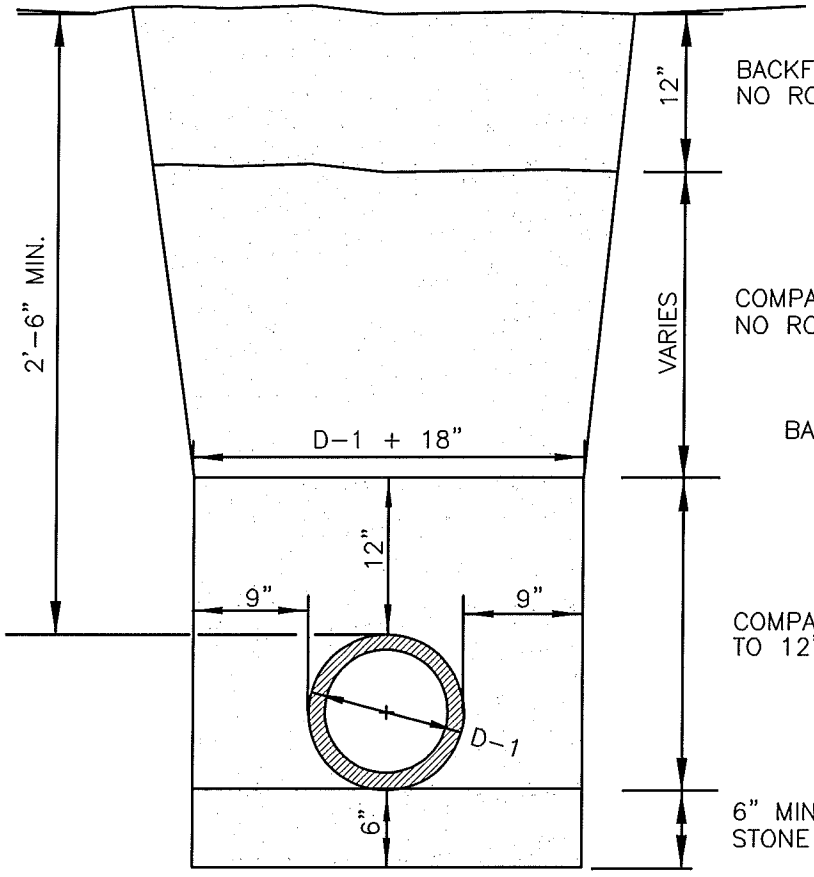
NOTE:
SERVICES > 6" MUST
CONNECT AT A MANHOLE

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

SEWER
SERVICE CONNECTION
JUNE, 2013

DRAWING NO. S6

NOTE: BACKFILL TO SUBGRADE WITH STONE AS PER TDOT SPECIFICATIONS UNDER PAVED SURFACE



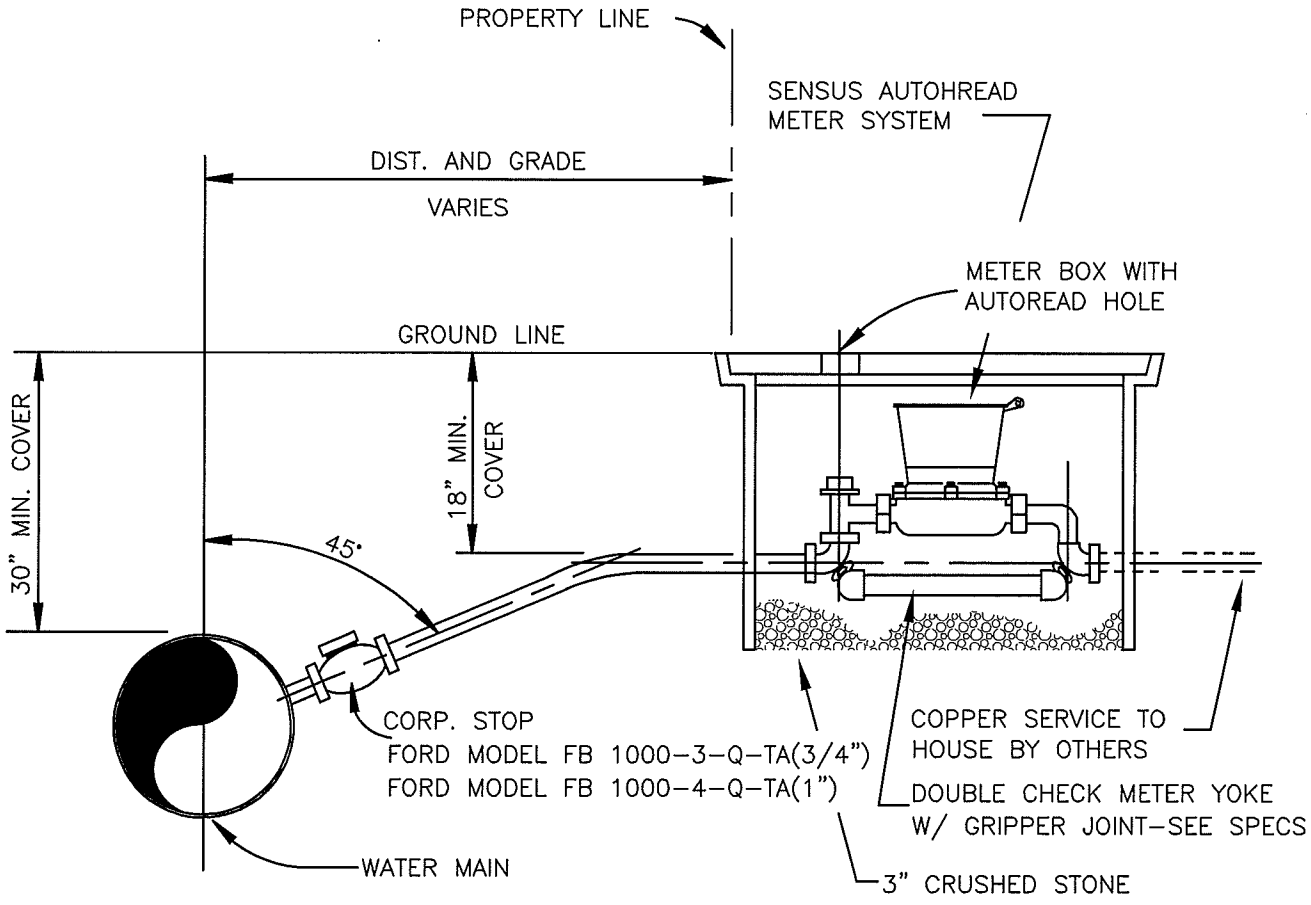
D-1 = OUTSIDE DIAMETER OF BELL

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

TYPICAL TRENCH SECTION-ALL PIPE

JUNE 2013

DRAWING NO. W1



LID:

POLYMER CONCRETE AS MANUFACTURED
BY OLDCASTLE PRECAST AS FOLLOWS:

5/8"-3/4"- LID, PC1118-D, WATER METER-PICKHOLE-4.125"TRH
1"-LID, PC1527-D, WATER METER,-PICKHOLE-4.125" TRH
1½"-2"-LID, PC1730-D, WATER METER-PICKHOLE-4.125"TRH

YOKE:

FORD
APPROPRIATE SIZE
WITHOUT BYPASS

BOX:

HD POLYETHYLENE METER BOX WITH
AUTOREAD CAPABLE METER LID
AS MANUFACTURED BY CARSON INDUSTRIES
AS FOLLOWS:

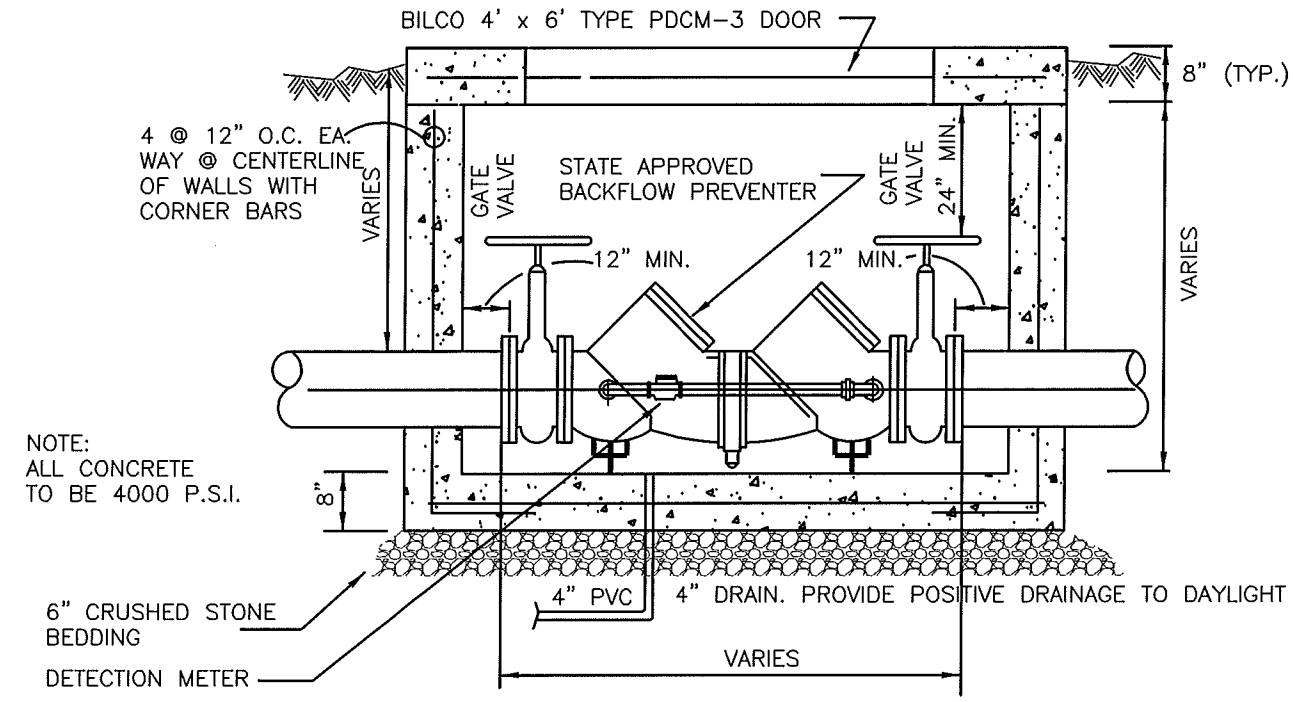
5/8"-3/4" - [redacted]BCF1118-18XL
1" - [redacted]BCF1527-18XL
1½"-2" - [redacted]BCF1730-18XL

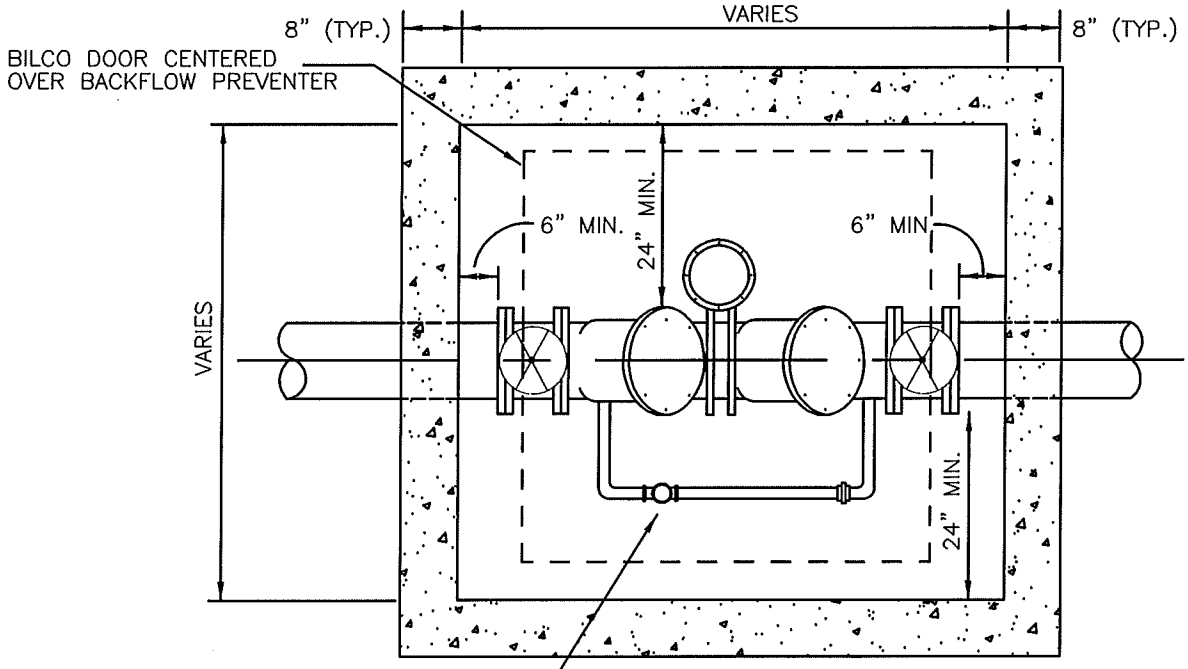
CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

5/8" - 2" SERVICE
ASSEMBLY

JULY, 2013

DRAWING NO. W6





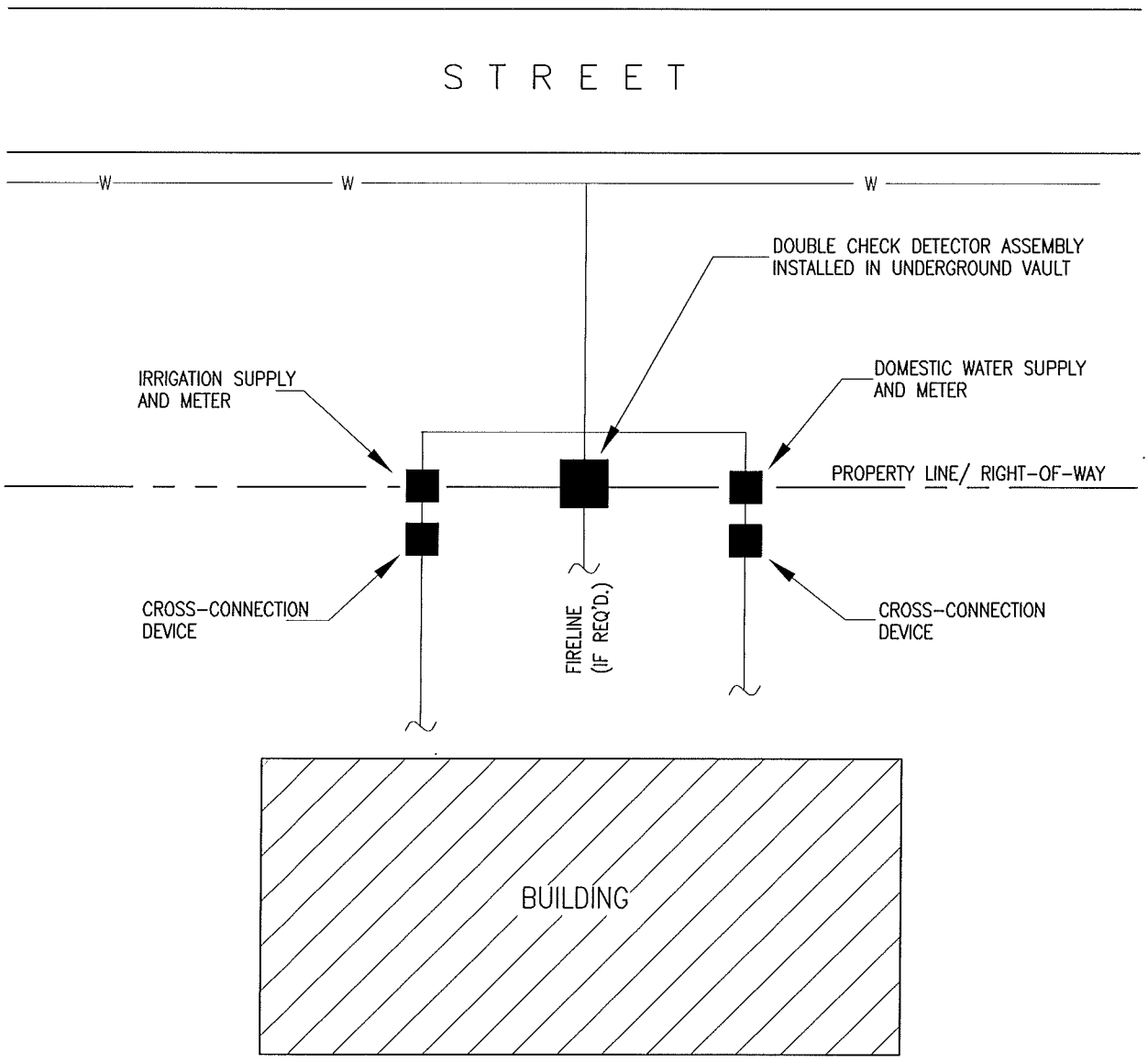
DETECTION METER W/SMART POINT HOOK-UP FOR USE W/FLEX-NET AUTO READ SYSTEM 4" AND LARGER

CITY OF BRENTWOOD WATER SERVICES
STANDARD DETAIL

4" AND LARGER COMMERCIAL FIRE SERVICE DCDA BACKFLOW PREVENTER

JUNE 2013

DRAWING NO. W9



CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

4" OR GREATER
COMMERCIAL FIRELINE PLAN
WITH DOMESTIC AND
IRRIGATION SUPPLY
JUNE 2013

DRAWING NO. W12

ADDENDUM #3

March 2014

(Updates in Red)

(Page 123)

SECTION 02730 SANITARY SEWER SYSTEM

3.4 INSTALLATION PIPE

F. Lay pipe to slope gradients indicated; with maximum variation from true slope of 0.05%, 1/16 inch in 10 feet.

1. Slope sewer lines to maintain a minimum velocity of 2 per second when flowing full. The minimum slopes allowable are as follows:

a)

Line Size	Minimum Slope
8	0. 40%
10	0. 28%
12	0. 22%

For additional pipe sizes and their associated minimum slopes use TDEC design criteria.

Chris Milton, Director

03/14/14
Date

BRENTWOOD WATER SERVICES
STANDARD DRAWING INDEX

WATER		SEWER		GENERAL	
W1	Typical Trench Section	S1	Standard Manhole	G1	Street Replacement Trench Width
W2	Fire Hydrant Assembly	S2	Standard Precast Manhole Sections	G2	Street Replacement – Full Overlay
W3	Concrete Thrust Blocking – Tee / Plug	S3	Standard Precast Shallow Manhole	G3	Boring Detail
W4	Concrete Thrust Blocking - Bends	S4	Standard Drop Manhole	G4	Concrete Cap
W5	Concrete Anchor	S5	Manhole Covers	G5	
W6	¾" Service Assembly	S6	Service Connection	G6	
W7	1" Meter Assembly	S7	Manhole Vent Detail	G7	
W8	2" & 3" Meter Assembly	S8	Sewage Air Release Valve	G8	
W9	Combination Fire and Domestic Meter Pit	S9	Grinder Pump Details	G9	
W10	Fire Meter Box	S10	Grinder Pump Layout	G10	
W11	Reduced Pressure Backflow Preventer	S11	Force Main Service Valve Box	G11	
W12	Fire Service Backflow Preventer	S12	Force Main Connection to Existing Manhole	G12	
W13	Gate Valve, Box and Cover w/ Concrete Pad	S13		G13	
W14	Air Valve and Vault	S14		G14	
W15	Typical Small Meter and Sewer Service Plan	S15		G15	
W16	Fireline Plan with Domestic and Irrigation Supply	S16		G16	
W17	Multi-Tenant Building Water Service Plan	S17		G17	

END OF DOCUMENT 00000 - TABLE OF CONTENTS

INTRODUCTION

Purpose:

The purpose of these planning guidelines and specifications is to provide general design, planning and construction guidance to owners, their representative engineers and contractors when designing and constructing new water and sewer facilities. And to streamline, standardize and update the materials utilized in the City of Brentwood's water and sewer systems and the procedures followed when installing, inspecting and testing those materials. This is intended to be a "living document," with frequent updates that will be available on-line. These standards are intended to apply, where applicable, to facilities installed in conjunction with private developments as well as the City's capital improvement projects.

The intention is to maintain a current set of specifications and details on the City's Website. ***It is the responsibility of the Developer / Contractor / Supplier to ensure their version of these standards is current.***

BRENTWOOD WATER SERVICES
NEW DEVELOPMENT GUIDELINES & PROCEDURES

The City of Brentwood's, Water Services Department or WSD, in an effort to streamline and formalize its procedures for development, is providing this general guideline for the approval process. Potential Developers are encouraged to thoroughly review the following information prior to beginning a project:

- The current water and sewer service providers coverage map for the City of Brentwood;
- The Department's current Standard Specifications and Detail Drawings for Water and Sewer Construction;
- The pertinent sections of the City Code;
- The State-imposed sewer moratorium area, if applicable.

The above information may be found at the WSD webpage.

The general steps, outlined in detail below, are as follows:

STEP	DESCRIPTION	
1	Request for Water / Sewer Availability	☑
2	Planning Commission Review	☑
3	Construction Plans Review	☑
4	Shop Drawing Review	☑
5	Preconstruction Conference	☑
6	Construction	☑
7	Testing and Acceptance	☑
8	Warranty Inspections / Bonding	☑

1. Request for Water / Sewer Availability

Prior to submitting any plan proposing to connect to, or expand an existing usage of, the public water or sewer system, an Owner or his representative must apply for Availability. A request form is available at the WSD webpage. Each request for Availability must be completed in its entirety, signed by the Owner or their representative and include a detailed sewer capacity analysis and domestic water, fire protection and irrigation hydraulic analysis. Upon receipt of the request, the City will review and respond accordingly.

2. City Planning Commission Review

It is encouraged that, at the conceptual stage of the design, a meeting be held with the WSD staff to provide an overview of the project. The initial step in the City of Brentwood for new development is to obtain Planning Commission approval for the project. The Water Services Department takes part in the review process as new developments or re-developments are considered. At a minimum, the following information should be included at the Planning Commission review stage:

A. General layout of all water and sewer facilities, with appurtenances;
B. Identification of size and point(s) of connection to the existing water and sewer system;
C. Determination of Availability.

3. Design Guidelines

Water Facilities

A. The State of Tennessee, "Community Public Water Systems Design Criteria" latest revision, shall be followed when designing public water systems within the City of Brentwood, unless otherwise stated.
B. Water distribution lines should be designed and sized for an instantaneous peak (IP) demand of 2 gpm per connection for water lines serving up to 100 residential connections. Peak design demands can be reduced to 1.5 gpm per connection for 150 - 299 residential connections, 1.0 gpm per connection for 300 - 499 residential connections, 0.75 gpm per connection for 500 - 999 residential connections and 0.5 gpm per connection for 1000 or more residential connections.
C. Extensions to the public water system shall be sufficiently designed to generally provide 40 psi during peak demand at all service connections (at the meter); pressure shall never be less than 20 psi at each service connection during peak flows.
D. All projects which, in the opinion of the WSD, may have a significant impact on the water system, shall be required to prepare a hydraulic analysis (or have one performed by a firm approved by the WSD and pay for all costs associated with the analysis) prior to granting approval of

Availability. The analysis shall include anticipated average and peak flow calculations associated with a typical unit and project as a whole, including domestic, irrigation and fire protection, residual pressures of system under average and peak conditions. The analysis shall include recommended meter and service line size information for each structure/use within the development. Meter and service line determinations shall adhere to AWWA Manual 22, latest edition and manufacturer's specifications.

E. Generally, all water lines shall be ductile iron pipe as specified in Section 02660; water lines shall be located outside the roadway, adjacent and parallel to public right-of-ways, generally behind the curb or at the top of bank where open ditches exist. Water lines should be located on opposite sides of the road from electric and gas lines; or maintain 5 feet horizontal separation when installed in the same general location. Water lines must maintain 10 feet horizontal separation from sanitary sewer lines. A minimum 20 ft. public utility and drainage easement shall be provided for water lines 12 inches in diameter and smaller, where water facilities are located outside public right-of-ways. For water lines greater than 12 inches in diameter, the width of the PUDE will be established on a case by case basis. Water lines shall be installed in casing pipe when located under headwalls, storm structures 24 inches or greater in diameter or other above ground features that, in the opinion of the WSD, create an unnecessary burden to maintain or repair.

F. Each deeded parcel shall have a single service line and meter for domestic water service and a cross-connection device for irrigation service (when installed). Fire protection service (for nonresidential service) shall include an appropriately sized cross-connection device installed at property line. Residential fire lines shall be designed on a case by case basis. Service lines shall generally be located at the center of a lot. All meters shall be located at the customer's property line.

G. Water distribution lines shall be a minimum 6 inches in diameter unless otherwise approved by the WSD. All dead end lines shall have a fire hydrant assembly.

H. Valves shall be generally placed at no more than 500 foot intervals when fire protection is not required and on each line where water lines intersect.

I. When fire protection is to be provided, system design should consider the recommendations of the state Insurance Services Organization and recommendations of the City of Brentwood, Fire Department. Fire hydrant locations shall be approved by the Brentwood Fire Department and WSD. However, in no case shall fire hydrants be located in excess of 250 feet from the furthest point of any structure.

J. Water booster stations shall generally be below grade, top entrance, pumping stations designed for unattended operation and include SCADA for remote pump operations, telemetry for monitoring station operating conditions and pressure gauges. Station configuration shall include a

deeded site, site preparation that includes asphalt driveway and site, landscaping and approved security fence.

Sewer Facilities

A. The State of Tennessee, "Design Criteria for Sewage Works" latest revision, shall be followed when designing public sewer systems within the City of Brentwood, unless otherwise stated. "Appendix A," "Design Basis for Sewer Systems" shall be followed in determining project flows. The State of Tennessee, "Design Criteria for Sewage Works" shall be followed in the absence of relevant flow data contained within Appendix "A."

B. Generally, sewer service shall be provided by gravity means except where not practical or as determined by the WSD. Extensions to the public sewer system shall be approved only if sufficient capacity exists in the downstream facilities to adequately convey the added loading, where improvements are a part of an approved plan (developer improvements), or where downstream improvements to provide adequate conveyance are anticipated to be constructed by the City.

C. All projects which, in the opinion of the WSD, may have a significant impact on the sewer system, shall be required to prepare a hydraulic analysis (or have one performed by a firm approved by the WSD and pay for all costs associated with the analysis) prior to granting approval of Availability. The analysis shall include anticipated average and peak flow calculations associated with the project, an assessment of the downstream sewer system and recommendations for improvements if needed as a result of needed capacity.

D. Generally, gravity sewer pipe shall be PVC as specified in Section 02730; gravity sewer lines shall be located inside the roadway where possible, centered in a travel lane. Only when necessary shall gravity sewer lines be located at the rear of properties, between structures or outside public right-of-ways. A minimum 20 ft. public utility and drainage easement shall be provided for sewer lines 12 inches in diameter and smaller and installed less than 12 feet in depth, where sewer facilities must be located outside public right-of-ways. For sewer lines greater than 12 inches in diameter and/or installed at depths greater than 12 feet, the width of the PUDE will be established on a case by case basis.

E. Gravity sewer lines shall generally not be installed with less than 4 feet of cover, nor at depths greater than 15 feet without prior approval of the WSD. Gravity pipe at depths greater than 12 feet, based on average depth of section between manholes, shall be ductile iron pipe as specified in Section 02730.

F. A pressure sewer system may be approved for providing service when, in the opinion of the WSD, gravity sewer service is not practical.

G. Gravity sewer service lines shall generally be located 10 feet from the water service line (when centered on lot) and on the sewer's downstream

side of the meter, out of the way of driveways, landscaping, headwalls, etc. Sewer lines shall be installed in casing pipe when located under headwalls, storm structures 24 inches or greater in diameter or other above ground features that, in the opinion of the WSD, create an unnecessary burden to maintain or repair.

H. Individual pressure system pumping units (grinder units) shall be located next to the structure, in an easily accessible location, clear of driveways, landscaping features, headwalls, etc. Service line check valves installed on sewer pressure systems shall be located at customer's property line. A clean out shall be installed on the customer's gravity sewer lateral, between the structure (home or business) and the pumping unit's tank; adjacent to the pumping unit's tank.

I. Sewer lift stations shall generally include submersible pumps installed below grade in a wet well configuration with check valves located in a separate and adjacent vault and include emergency "quick" connect capability. Odor control features shall also be considered and may be required if installed near residences. Station shall include flow monitor, pressure valves, SCADA system for remote pump operations and telemetry for monitoring station operations. Station configuration shall include a deeded site, site preparation that includes asphalt driveway and site, landscaping and approved security fence.

4. Construction Plan Review

Once the project has moved beyond the Planning Commission stage, utility and grading construction plans shall be submitted. Although utilities are reviewed and approved by the WSD and grading plans are reviewed and approved by the Engineering Department, concurrent reviews can generally be performed by both departments. For the WSD, at a minimum, the following guidelines for preparing/submitting construction plans shall be followed:

A. Two sets of completed construction plans, stamped by a Professional Engineer licensed by the State of Tennessee;

B. Size and location of existing and proposed water and sewer lines and associated appurtenances;

C. Specifications for any items not in the City's Standard Specifications;

D. Detailed plans and engineering report for any special construction, such as water booster stations, sewer lift stations, creek crossings, etc.;

E. A cover sheet that includes a project location map, project identification, Owner contact information, appropriate approval signatories (Brentwood Water Services Department and State of Tennessee);

F. General layout of all existing and proposed non-City owned utilities (i.e. gas electric, communication, etc.);

G. All topographical features such as driveways, streets, rights-of-way, property lines and all drainage features;

H. Profile all sewer lines; also any utilities that conflict with water and sewer lines and water lines over 12 inches in diameter;
I. Show location of existing and proposed easements;
J. Copies of approvals from all applicable agencies (plans will not be approved for construction until other jurisdictions provide their approval), including:

    a. Tennessee Department of Environment and Conservation – Aquatic Resource Alteration Permit
    b. Tennessee Department of Transportation Utility Permit
    c. US Army Corps of Engineers
    d. Railroads
    e. TVA
    f. Columbia Gulf Gas
    g. Other Utilities as Required

Plans are considered to be acceptable for construction by the WSD once all comments are addressed and all plan sets are signed by the WSD. Submit six sets of water and sewer plans to be stamped by the WSD as approved. Plans are now ready to be approved by the State of Tennessee. ***A set of approved plans, signed by both the WSD and the State, shall be kept at the jobsite at all times.***

5. Shop Drawing and Project Cost Estimate Review

At least 5 business days prior to scheduling a preconstruction conference, submit for review:

- Four complete sets of material submittals;
- Cut sheets for sewer manholes;
- Cost estimate of the water and sewer improvements including quantities and unit costs (to be used in calculating bond amounts for this project)

6. Preconstruction Conference

A preconstruction conference will be held for all projects involving the installation of public utilities. The Developer shall schedule this meeting, at least 5 business days in advance of construction and after steps (1) through (3) above have been completed.

To this conference, the Developer will need to bring:

- Approved plans;
- Approved shop drawings;
- Documentation that TDEC has received a construction start notification;
- Contact listing for Developer, Engineer, and Contractor key personnel;
- Proof of State contracting license;

- Documentation that the required public utility easements have been obtained and recorded;
- An executed agreement with the City for any cost participation (if applicable) by the City, in accordance with City Code;

7. Construction Phase

Workmanship

A. All water and sewer construction work shall be in accordance with the latest specifications of the WSD.
B. The Owner shall ensure the project contractor provides properly licensed, competent, qualified personnel to survey, layout and construct the work. Contractor shall maintain an orderly and safe site at all times.
C. Except when otherwise authorized, water and sewer facilities work at the site or adjacent thereto shall be completed during working hours of 7 a.m. to dark, Monday through Friday. No work on water and sewer facilities, that require an inspection, shall be completed on Weekends or Holidays without permission of the WSD.
D. All grading work shall be completed, all roads constructed to subgrade and lot corners shall be marked prior to the installation of water and sewer lines.
E. Backfill for water and sewer lines within roadways shall conform to the requirements of the agency having jurisdiction (i.e. TDOT, City, County).

8. Inspection

Throughout construction, the WSD will be performing on-site inspections of the progress of construction. If *any* deviations from previously-approved plans are necessary, the Developer shall immediately notify the City in writing of the issue and the proposed resolution. City personnel will perform inspections in a frequency as deemed necessary by the WSD and will bill the Developer for actual costs of those services, including, at a minimum, labor, equipment, materials and laboratory fee costs.

9. Service Lines to be Abandoned

Any water or sewer services that are to be abandoned must be abandoned in accordance with Section 02660 - Water Distribution System and Section 02730 - Sanitary Sewer System accordingly.

10. Testing and Acceptance

Once the construction is complete, the Developer shall notify the City in writing that the facilities are ready for testing. The testing of the facilities shall be in conformance with the procedures outlined in the City's Standard Specifications. *NO CONNECTIONS TO*

EXISTING WATER AND SEWER FACILITIES SHALL BE MADE UNTIL SATISFACTORY TEST RESULTS HAVE BEEN RECEIVED.

At this time the City will perform a punch list inspection of the facilities and provide the Developer with a listing of items that need to be addressed prior to the City accepting the improvements. The Water Services Department will not sign off on a plat until this punch list has been addressed, all fees (i.e. tap fees, inspection services) have been paid in full and appropriate easements obtained and recorded. Upon completion of all punch list items to the satisfaction of the WSD and confirmation of fee payment, the project (or section thereof) shall be considered "Accepted" and ready for service.

11. Warranty Inspections / Bonding

As part of the overall development process, prior to signing a plat, the City will require bonding of the public improvements, of which the water and sewer facilities are a part. The Developer shall post security in an amount equal to 110% of the estimated cost of the remaining construction improvements, plus sufficient amounts to cover engineering and/or land acquisitions. As construction progresses, that bond amount may be reduced in accordance with the City's Subdivision regulations.

During the time that the project is bonded, the Developer is responsible for addressing and correcting warranty items regarding the public water and sewer facilities. Prior to release of the bond, the WSD will perform a final warranty inspection of the improvements.

12. Record Drawings

As part of the acceptance of the public facilities, the Developer shall provide the City with record information noting any changes or deviations from the approved construction drawings. A digital file shall be submitted containing GPS information of all installed infrastructure in accordance with the following:

Water System – GPS data shall include horizontal location, material identification, size and installation date of all water features including pipe segments, valves hydrants, meters and other installed system components. Booster stations shall include lot corners and all station component features.

Sewer System – GPS data shall include horizontal location, material identification, size and installation date of all pipe segments, valves, manholes, grinder pumps and other installed system components. Manholes shall include invert data. Sewer lift stations shall include lot corners and all station component features.

O&M documents related to any mechanical features, particularly station equipment, and line valves, etc.

GPS information shall conform to the City of Brentwood's GIS system information. For more information, contact the City's GIS office.

END OF SECTION – DEVELOPMENT GUIDELINES AND PROCEDURES

GUIDANCE TO BIDDERS OF A PUCLIC CONTRACT

DOCUMENTS 00100 – 00800

The following Engineers Joint Contract Documents Committee (EJCDC) contract documents, latest edition and revisions, shall govern all water and sewer infrastructure improvement project work publicly bid, or contracted on behalf of, the WSD:

EJCDC 00100 ADVERTISEMENT FOR BIDS

EJCDC 00200 INSTRUCTIONS TO BIDDERS

EJCDC 00400 BID FORM

EJCDC 00410 BID BOND

EJCDC 00500 AGREEMENT FORM

EJCDC 00610 PERFORMANCE BOND

EJCDC 00620 PAYMENT BOND

EJCDC 00625 INDEMNIFICATION AGREEMENT

EJCDC 00635 DRUG FREE WORKPLACE AFFIDAVIT

EJCDC 00650 STATEMENT OF LICENSE CERTIFICATE

EJCDC 00700 GENERAL CONDITIONS

EJCDC 00800 SUPPLEMENTARY CONDITIONS

AIA documents may be substituted if approved by the Director of the WSD.

END OF SECTION 00100 – 00800 GUIDANCE TO BIDDERS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Water and sewer facilities constructed by private ownership in conjunction with private development and within the service area of City of Brentwood, Tennessee.

1.2 CONTRACT METHOD

A. Construct the Work under the terms of the private agreement.

1.3 WORK BY OTHERS

A. No valves shall be operated except by, or in the presence of, the City's Representative.

B. The Owner, or the Owner’s representative routinely will conduct observations of all Work and keep a record of the observations.

C. Water and sewer line trenches will be inspected by a representative of the City before sewers are laid in trenches, during laying, during backfilling, and during testing. None of these steps shall be started without prior approval of City Inspector.

D. If lines have been constructed without approval by the City of its design, or if they have been laid or backfilled or tested without approval by the City's Inspector, then the City has the right to refuse to accept sewer lines and/or allow them to be connected to the City System.

1.4 WORK SEQUENCE

A. Perform all Work between the hours of 7:00 a.m. and dark, Monday through Friday. No work is to be performed on Weekends or Holidays, except such work as is necessary for proper care and protection of Work already performed or except in case of an emergency and, in any case, only with permission of the City.

B. Night work may be established as a regular procedure if Contractor first obtains written permission from the City, and that such permission may be revoked at any time by the City if Contractor fails to maintain, at

night, adequate force and equipment for reasonable prosecution and to justify inspection of the Work.

1.6 WORK PERFORMED ON ADJACENT PROPERTY.

A. In connection with Work performed offsite of the developer's property, particularly property necessary to install off-site water and sewer facilities, take every precaution to avoid damage to buildings, grounds and facilities. The contractor shall be responsible to make all repairs of damage. Carefully remove and protect fences, hedges, shrubs, and other site items within construction limits. Reinstall hedges, shrubs, and other site items when construction is completed.

B. Grade, fertilize and seed grassed areas when construction is completed in accordance with requirements set out hereinafter in these Specifications. Restore property owners' facilities and grounds to as good or better than their original condition when construction is completed.

C. Remove large trees, or other facilities within actual construction limits that cannot be preserved and replaced and only after receiving permission by the property owner. The Developer will assume responsibility for settling with any adjacent property owner for loss of said trees or facilities, damaged by the contractor.

D. Support any foundations or structures adjacent to an excavation which is to be carried below bottom of foundation by shoring, bracing, or underpinning. Be responsible for damage to said foundation and structure.

E. Do not store equipment of any kind outside easements without prior written consent of the property owner of land in easement. Be responsible for obtaining written approval from land owner and providing one copy to the City.

F. Storage of equipment in easements shall be limited to period of time necessary to complete work on the line segment within easement.

G. Perform a pre-construction survey, when directed by the City, prior to beginning work in off-site easement or public right-of-ways. Provide a copy of pre-construction survey with pictures or video to each affected property owner and the City.

H. When directed by the City, video tape off-site easements and public-right-of-ways prior to beginning construction. Water and sewer facilities shall be staked to show alignment on the video tape. Time and date of video shall be evident on actual video tape. Provide a copy of tape to the property owner and the City.

I. All blasting shall adhere to the latest State of Tennessee regulations. A blasting plan shall be submitted to the City's Fire Marshall. The contractor shall be responsible for blast damage. Settle claims put forth by third parties at no additional cost to the City. Upon notification by the City, Contractor, through his Surety, shall investigate each claim for property damage and shall file a statement within ten days of such notification, with the City and the individual homeowner receiving a copy of the findings from said claim. Failure to comply with above shall result in suspension of Work.

J. Assume full responsibility for protection and safekeeping of employees and all materials during the course of the Work.

1.8 LETTER OF CREDIT

A. Provide a Letter of Credit to the City to cover all costs of facility completion if necessary and in accordance with City Code; The Letter of Credit shall be submitted prior to recordation of the plat and shall remain in effect until acceptance of the project. After acceptance of the project the Letter of Credit may be reduced in accordance with City Code but shall remain in effect for repair and maintenance for a period of one year from the date of acceptance of the project for all Work.

1.9 PERMITS AND EASEMENTS

A. Developer shall obtain and be responsible for any crossing permits or pavement cuts, including any special backfill and pavement repair as required by the Agency having jurisdiction.

B. Be responsible to obtain and record any easements or deeded property for new facilities. Easement forms shall be approved by the City Attorney. Physically locate and establish easement boundaries for easy identification during period of Work.

C. Place a written notification on the doors of the affected property owners forty-eight hours prior to construction in any easements or streets. This notification shall include Contractor's name and name and phone number of contact person(s) to receive complaints during working and non-working service hours.

D. Upon final acceptance of a water and sewer project, the line along with appurtenances shall be deeded to the City of Brentwood. At that same time, easements for water lines and sewers constructed on private property shall be executed and given to the City.

2.0 INSPECTION FEES

A. Contractor shall pay all fees associated with the work including established City rates for inspection time and materials and laboratory testing fees.

END OF SECTION 01010 - SUMMARY OF WORK

SECTION 01040

COORDINATION

PART 1 GENERAL

1.1 DESCRIPTION

A. Coordinate scheduling, submittals, and work of the various sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

B. Coordinate with City 5 business days in advance of anticipated interruptions to water and sewer service.

1.3 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals specified in Section 01300.

B. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate requests for substitutions to assure compatibility of space, of operating elements, and effect on work of other sections.

1.4 COORDINATION OF PROJECT COMPLETION

A. Coordinate completion and cleanup of work of separate sections/phases in preparation for project completion.

B. Submit all project documents as required for acceptance of facilities by City.

END OF SECTION 01040 - COORDINATION

SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.1 QUALITY CONTROL

A. Land Surveyor: Registered in the State of Tennesee, and acceptable to the City.

B. Professional Engineer: Registered Professional Engineer of the discipline required for specific service on Project, licensed in the State of Tennessee and acceptable to the City.

1.2 SUBMITTALS

A. Submit name, address and telephone number of Surveyor or Engineer before starting survey work.

B. Upon request, submit documentation verifying accuracy of survey work.

C. Submit certificate signed by Surveyor or Engineer certifying that elevations and locations of improvements are in conformance, or nonconformance, with Contract Documents.

1.3 PROJECT RECORD DOCUMENTS

A. Maintain complete, accurate log of control and survey work as it progresses.

B. Submit Record Documents under provisions of the "New Development Guidelines and Procedures" and Section 01720.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify locations of survey control points prior to starting work. Promptly notify City of any discrepancies discovered.

3.2 SURVEY REFERENCE POINTS

A. Existing basic horizontal and vertical control points for the Project are those designated on Drawings.

B. Protect survey control points prior to starting site work, and preserve permanent reference points during construction. Make no changes or relocations without prior written notice to Architect/Engineer.

C. Promptly report to the City the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey control points based on original survey control.

3.3 PROJECT SURVEY REQUIREMENTS

A. Establish a minimum of two permanent bench marks on site, referenced to data established by survey control points. Record locations, with horizontal and vertical data on Project Record Documents.

B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:

1. Site improvements, including pavements; lot corners; centerline of water and sewer lines; cut and fill areas; utility slopes and sewer line segment elevations; manhole inverts; corners of station property; easement locations.

C. Periodically verify layouts.

END OF SECTION 01050 - FIELD ENGINEERING

SECTION 01120

ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.1 QUALITY ASSURANCE

A. Assign moving, removal, cutting, replacing, repair and patching, to trades qualified to perform the Work in a manner to cause least damage to each type of work, and provide means of returning surfaces to appearance of new work.

B. Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new work.

PART 2 PRODUCTS

2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. New Materials: As specified in individual Sections.

B. Match existing products and work for patching and extending work.

C. Determine type and quality of existing products by inspection and any necessary testing, and workmanship by use of existing as standard. Presence of a product, finish, or type of work, requires that patching, extending, or matching shall be performed as necessary to make Work complete and consistent with existing quality.

D. Salvage sufficient quantities of cut or removed material to replace damaged work of existing construction, when material is not readily obtainable on current market.

F. DO NOT incorporate salvaged or used material in new construction except with permission of the City.

G. Water services shall be replaced from the water main, in whole when damaged or improperly installed.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that demolition is complete, and areas are ready for installation of new work.

B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Cut, move or remove items as necessary to provide access or to allow alterations and new work to proceed; replace and restore at completion.

B. Remove unsuitable or extraneous materials not marked for salvage, such as abandoned furnishings and equipment, rotted wood, rusted metals, and deteriorated masonry and concrete; replace materials as specified for finished work.

C. Remove debris and abandoned items and items serving no useful purpose, such as abandoned piping, conduit, and wiring from concealed and exposed spaces.

D. Prepare surfaces and remove surface finishes to provide for proper installation of new work and new finishes.

3.3 INSTALLATION

A. Coordinate work of alterations and renovations to expedite completion.

B. Perform cutting and removal work to remove minimum necessary, and in a manner to avoid damage to adjacent work.

C. Refinish visible existing surfaces that are to remain to specified condition for each material, with a neat transition to adjacent new finishes.

3.4 TRANSITIONS

A. When new work abuts or finishes flush with existing work, make a smooth and seamless transition. Patched work shall match existing adjacent work in texture and appearance.

B. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface.

C. Patch, repair, and refinish existing items to remain, to the specified condition for each material, with a workmanlike transition to adjacent new items of construction.

3.5 ADJUSTMENTS

A. Where an extreme change of plane of two inches or more occurs, request instructions from the City as to method of making transition.

3.6 REPAIR OF DAMAGED SURFACES

A. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections, with matching material.

B. Repair substrate prior to patching the finish.

3.7 STREET AND DRIVEWAY REPAIR

A. Reconstruct streets, sidewalks, curbs, driveways and alleys disturbed by the Work with "like" material, to existing grades and in such a manner as to leave surfaces in as good or better condition than before construction started.

B. Cut pavement with a pavement cutter prior to excavation.

3.8 FINISHES

A. Finish surfaces as specified in individual Sections.

B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

C. Cut finish surfaces such as masonry, tile, plaster, or metals, by methods to terminate surfaces in a straight line at a natural point of division.

3.9 CLEANING

A. Clean surfaces, and remove surface finishes as needed to install new work and finishes. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

B. At completion of work of each trade, clean area and make surfaces ready for work of successive trades. At completion of alterations work in each area, provide final cleaning and return space to a condition suitable for use by Owner.

3.10 PROTECTION

A. Protect existing finishes, equipment, and adjacent work which are scheduled to remain, from damage.

END OF SECTION 01120 - ALTERATION PROJECT PROCEDURES

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 CONSTRUCTION PLANS

A. Submit Two (2) sets of Preliminary water and sewer construction plans to the WSD for review and comment.

B. Submit Six (6) sets of Final water and sewer construction drawings to the WSD for signatures.

B. Deliver submittals to the WSD located at:

1750 General George Patton Drive
Brentwood, Tennessee 37027

C. Transmit each item under a transmittal form.

D. Include in each plan submittal the following information:

1. Complete set of construction plans, stamped by a Professional Engineer licensed by the State of Tennessee;
2. Size and location of existing and proposed water and sewer lines and associated appurtenances;
3. Specifications for any items not in the City's Standard Specifications;
4. Detailed plans and engineering report for any special construction, such as water booster stations, sewer lift stations, creek crossings, etc.;
5. A cover sheet that includes a project location map, project identification, Owner contact information, appropriate approval signatories (Brentwood Water Services Department and State of Tennessee);
6. General layout of all existing and proposed non-City owned utilities (i.e. gas electric, communication, etc.);
7. All topographical features such as driveways, streets, rights-of-way, property lines and all drainage features;
8. Profile all sewer lines; also any utilities that conflict with water and sewer lines and all water lines over 12 inches in diameter;
9. Show location of existing and proposed easements;

E. Copies of approvals from all applicable agencies (plans will not be approved for construction until other jurisdictions provide their approval), including:

1. Tennessee Department of Environment and Conservation – Aquatic Resource Alteration Permit;

2. Tennessee Department of Transportation Utility Permit;
3. US Army Corps of Engineers;
4. Railroads;
5. TVA;
6. Columbia Gulf Gas;
7. Other Utilities as Required.

F. Developer/Contractor shall distribute copies of Final Plans to appropriate persons and shall maintain approved set of drawings on site at all times.

1.5 SHOP DRAWINGS

A. Submit Four copies. Provide blank space on each submittal for Contractor, Engineer and WSD stamps. After review and comment by the WSD, revise and resubmit as required. After final approval, Contractor shall distribute to any subcontractors.

B. Present Shop Drawings in a clear and thorough manner. Title each drawing with Project and Contract name and number.

C. Identify field dimensions; show relation to adjacent or critical features or Work or products if applicable.

D. Minimum Sheet Size: 8-1/2 x 11 inches or larger multiples thereof.

1.6 PRODUCT DATA

A. Submit only pages which are pertinent. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work. Include manufacturers' installation instructions when required by the Specification section.

1.7 MANUFACTURER'S INSTRUCTIONS

A. Where directed by the WSD, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities as specified by the WSD.

1.8 SAMPLES

A. When applicable, submit full range (not less than 3) of manufacturers' standard colors, textures, and patterns for WDS selection.

B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

C. Include identification on each sample, giving full information.

1.9 CONTRACTOR REVIEW OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of this documents technical specifications.

B. Coordinate submittals with requirements of the Work.

C. Sign each product sheet of shop drawings and product data, and each sample label to certify compliance with requirements of the technical specifications. Notify WSD in writing at time of submittal, of any deviations from requirements of the technical specifications.

D. Do not fabricate products or begin work which requires submittals until return of submittal with WSD acceptance.

E. When phrase, "by others," appears on Shop Drawings, General Contractor shall indicate on drawing who is to furnish material or operations so marked on submittal.

1.10 NONCOMPLYING SUBMITTALS

A. Submittals not in compliance with this Section will be returned by the WSD for resubmittal with appropriate deficiencies noted.

END OF SECTION 01300 – SUBMITTALS

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 QUALITY CONTROL, GENERAL

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

B. Sizes and locations of mains, valves, fittings, plugs and blowoffs shall be in accordance with the plans approved by the City.

C. "Cut-ins" or taps to live mains will be made only in the presence of the WSD's representative.

D. Special construction problems or conditions not covered by the technical specifications contained within shall be submitted to the WSD for approval prior to construction.

E. Water line and sewer line trenches shall be inspected by a representative of the WSD before water lines are laid in trench, during laying, during backfilling, and during testing. None of these steps shall be started without the prior approval of the WSD. If water lines or sewer lines have been constructed without approval by the WSD of its design, or if they have been laid or backfilled or tested without the approval of the WSD, then City has the right to refuse to accept the water and sewer facilities or to allow it to be connected to the public system.

1.2 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 persons qualified to produce workmanship of specified quality and licensed by the State of Tennessee where applicable.

C. Secure products in place when required and per the manufacturer's requirements.

1.3 MANUFACTURERS' INSTRUCTIONS

A. When directed by the WDS, submit manufacturer's printed instructions, in the quantity requested for product data, for delivery, storage, assembly, installation, startup, adjusting, and finishing.

B. Comply with manufacturer’s instructions in full detail, including each step in sequence. Should instructions conflict with this document’s technical specifications, request clarification from the WSD before proceeding. Failure to do so will result in the WSD not accepting the completed work until it meets the manufacturer’s instructions in full.

1.4 MANUFACTURERS' CERTIFICATES

A. When required by the WSD, submit manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

1.5 MANUFACTURERS' FIELD SERVICES

A. When directed by the WSD, Contractor shall 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 WSD listing observations, certifications and recommendations.

END OF SECTION 01400 - QUALITY CONTROL

SECTION 01410

PRODUCT AND MATERIAL TESTING

PART 1 GENERAL

1.1 REFERENCES

A. ANSI/ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. ANSI/ASTM E329 - Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.2 SELECTION

A. Contractor shall employ and pay for services of an independent testing laboratory to perform specified inspection and testing where required by the WSD.

B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform Work in accordance with this document.

1.3 QUALITY ASSURANCE

A. Comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740.

B. Laboratory shall maintain a full-time registered Engineer on staff to review services.

C. Laboratory authorized to operate in State in which Project is located.

D. Testing equipment shall be calibrated at reasonable intervals with devices of an accuracy traceable to either NBS Standards or accepted values of natural physical constants.

1.4 CONTRACTOR SUBMITTALS

A. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full-time registered Engineer and responsible officer.

B. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent tour

of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

1.5 LABORATORY RESPONSIBILITIES

A. Test samples of mixes submitted by Contractor.

B. Provide qualified personnel at site after due notice; cooperate with the WSD and Contractor in performance of services.

C. Perform specified inspection, sampling, and testing of products in accordance with standards specified by the WSD.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify the WSD and Contractor of observed irregularities or non-conformance of Work or products.

F. Perform additional inspections and tests required by Architect/Engineer.

G. Attend preconstruction conferences and pertinent progress meetings.

1.6 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to the WSD and to Contractor. Include: Date issued, Project title and number, name of inspector, date and time of sampling or inspection, identification of product, location in the Project, type of inspection or test, date of test, results of tests. When requested by the WSD, provide interpretation of test results.

1.7 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not approve or accept any portion of the Work.

B. Laboratory may not assume any duties of Contractor.

C. Laboratory has no authority to stop Work.

1.8 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing, together with proposed mix designs.

B. Cooperate with laboratory personnel, and provide access to Work and to manufacturer's facilities, as applicable.

C. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.

D. Notify WSD and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

END OF SECTION 01410 – PRODUCT AND MATERIAL TESTING

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

Unless specified otherwise, ALL costs for providing temporary controls, utilities and services shall be borne by the Contractor until the project is accepted by the WSD. The Contractor or Developer shall be responsible for any damage resulting from authorized or unauthorized use of public facilities.

1.1 WATER

A. Provide service required for construction operations. Coordinate all connections and piping with WSD. No connection shall be permitted without proper cross-connection device and metering. Unauthorized connections shall be turned over to the City of Brentwood, TN, Police Department.

B. Water for testing of lines, elevated tank, and other uses shall be made available through Owner, but Contractor shall pay cost for pumping water used and shall provide for connecting and receiving same. Water used up to day of final acceptance by Owner shall be at Contractor's expense and billed at the current commercial rate.

1.2 SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures.

B. Materials may be new or used, adequate for purpose, which will not create unsanitary conditions.

C. Toilet Facilities: Use enclosed portable self-contained units or temporary water closets and urinals, secluded from public view. Provide separate facilities for men and women. Temporary containment units shall be cleaned and maintained in a timely manner as not to cause a nuisance to the public or to users of the facilities.

D. Provide facilities at time of site mobilization.

E. Clean areas of facilities daily, maintain in sanitary condition. Provide toilet paper, paper towels, and soap in suitable dispensers.

F. Remove temporary facilities prior to or at the time of Completion.

1.3 BARRIERS

A. Provide as required to prevent public entry to construction areas to provide for WSD's use of site, and to protect existing facilities and adjacent properties from damage from construction operations.

B. Provide barricades as required by governing authorities for public rights-of-way.

C. Provide barriers at boundary of easements and around trees and plants designated to remain. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddling or continuous running water.

1.7 PROTECTION OF INSTALLED WORK

A. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

B. Prohibit traffic and storage on lawn and landscaped areas.

1.8 SECURITY

A. Provide security to protect Work, existing facilities, and operations from unauthorized entry, vandalism and theft.

1.9 WATER CONTROL

A. Grade site to drain. Maintain excavations and site free of standing water.

B. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing.

C. Provide adequate barriers which will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through utility work excavations.

D. Provide and operate drainage and pumping equipment as needed to maintain ground water at a level below utility work excavations, until backfilling is completed.

1.10 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish weekly; dispose of off-site. Recycle materials when practical. Keep excavations and trenching operations free and clear of trash and debris at all times.

1.11 STORAGE AREAS

A. Storage areas for Tools, Materials and Equipment should be appropriately protected from weather, with adequate space for organized storage and access, and lighting for inspection of stored materials.

1.12 REMOVAL

A. Remove temporary materials, equipment, services, and construction prior to acceptance of the Work.

B. Clean and repair damage caused by installation or use of temporary facilities. Restore existing facilities and site used during construction to specified, or to original, condition.

END OF SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

SECTION 01560

TEMPORARY CONTROL

PART 1 GENERAL

A. Not Used.

PART 2 PRODUCTS

B. Not Used.

PART 3 EXECUTION

3.1 DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

3.2 POLLUTION CONTROL

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

B. Contractor's attention is directed to the Tennessee Water Pollution Control Act of 1977 as modified by the 1987 amendments. Special attention is called to the following sections which read in part:

(1) "TCA 69-3-113 Causing Pollution...- (a) It shall be unlawful for any person to discharge any substance into the waters of the state or place or cause to be placed in any location where such substances either by themselves or in combination with others, cause any of the damages as defined in 69-3-013 (22), unless such discharge shall be due to an unavoidable accident or unless such action has been properly authorized.

(2) In addition it shall be unlawful for any person to act in a manner or degree which is violative of any provision of this part or of any rule, regulation, or standard of water quality promulgated by the Board or of any permits or issued pursuant to the provisions of this part. .

(3) 69-3-103 (22) Pollution means such alteration of the physical, chemical, biological, bacteriological or radiological properties of waters of this state including but not limited to changes in temperature, taste, color, turbidity, or odor of the waters:

(A) As will result or will likely result in harm, potential harm or detriment of the public health, safety, or welfare;

(B) As will result or will likely result in harm, potential harm or detriment to the health of animals, birds, fish, or aquatic life;

(C) As will render or will likely render the waters substantially less useful for domestic, municipal, industrial, agricultural, recreational, or other reasonable uses; or

(D) As will leave or will likely leave the waters in such condition as to violate any standards of water quality established by the board; "Waters" means any and all water, public or private, on or beneath the surface of the ground, which are contained within, flow through, or border upon Tennessee or any portion thereof except those bodies of water confined to and retained within the limits of private property in single ownership which do not combine or effect a junction with natural surface or underground waters. Acts 1971, ch. 164, Section 3; 1977, ch. 366, Section 1; T.C.A., Section 70-326; Acts 1984, ch. 804, Section 1; 1987, ch. 111, Section 1."

END OF SECTION 01560 - TEMPORARY CONTROLS

SECTION 01563

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

A. Contractor shall maintain erosion control and comply with and reporting for the Stormwater Pollution Prevention Plans and/or Aquatic Resource Alteration Permits.

B. In the event that a fine is assessed by a regulatory agency regarding a Contractor's failure to comply with an erosion control permit, those costs and any incidental costs resulting from it shall be borne by the Contractor.

1.1 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.2 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perrenial Sorrel and Brome Grass.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Submit an erosion control plan including but not limited to sediment trap volume, and embankment cross section.

1.4 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.5 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Comply with Federal, State, and Local agencies' requirements.

C. Provide items, including but not limited to, straw waddles, siltation fences, rip-rap and special construction techniques, necessary to comply with the

Tennessee Water Quality Control Act of 1977 as modified by the 1987 amendments.

D. In the event this Section conflicts with Federal, State, or Local agencies, the more restrictive regulations shall apply.

Provide seed certified by the department of agriculture of the State of Tennessee.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Deliver grass seed in original, sealed containers. Damaged packages are not acceptable.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.7 SEQUENCING AND SCHEDULING

A. Make efforts to maintain natural covers as long as possible and to stabilize graded areas as soon as possible.

B. Apply soil stabilization within 10 days to disturbed areas, and immediately if rain is forecast.

1.8 MAINTENANCE SERVICE

A. Maintain disturbed areas for 12 months from date of acceptance by the WSD.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: Excavated from site and free of weeds.

B. Seed Mixture: Fast growing annuals such as cereal rye, annual ryegrass, sudan grass or millet.

C. Mulch: Oat or wheat straw, free from weeds and foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

D. Fertilizer: FS O-F-241, type and grade recommended for grass, with 50% of elements derived from organic sources; of proportions necessary to eliminate

deficiencies of topsoil to the following proportions: 18% nitrogen, 24% phosphoric acid, and 6% potassium.

E. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

F. Water: Clean, fresh, and free of substance or matter which could inhibit vigorous growth of grass.

G. Stakes: 1 x 2 inches wood or equivalent metal with a minimum length of 3 feet.

H. String: Inorganic fiber.

I. Burlap: 10 ounce per square yard fabric.

J. Baled Hay: Hay or straw containing five cubic feet or more of material; either wire-bound or string-tied.

K. Rip-Rap: Irregular shaped rock, stone or broken concrete; solid and nonfriable.

L. Fill Material for Embankment: Materials that are free of roots or woody vegetation, organic material, large stones, and other deleterious material.

M. Other Materials: Chemical binders and tacks, nettings, and plastic filter sheets.

2.2 SILT FENCES

A. Fence Posts: 3 inch minimum diameter wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet; steel posts with projections for fastening wire.

B. Fence Reinforcement: Wire mesh 42 inches minimum height, 14 gage minimum; maximum mesh spacing of 6 inches.

C. Filter Fabric: Pervious sheet of propylene, nylon, polyester or ethylene yarn; containing ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 degrees F; conforming to the following:

PHYSICAL PROPERTY	**TEST**	**REQUIREMENTS**
Filtering Efficiency	VTM-51	75% (min.)
Tensile Strength at (max.) Elongation*	VTM-52	Extra Strength- 20% 50 lbs/lin in (min.) Standard Strength- 30 lbs/lin in (min.)
Flow Rate	VTM-51	0.3 gal/sq ft/ (min.)

* Requirements reduced by 50 percent after 6 months of installation.

PART 3 EXECUTION

3.1 GENERAL

A. Control erosion on cut and fill operations, excavation, backfill, and other construction activities within limits of construction site, easements, and borrow site used during construction.

B. Coordinate erosion and sediment control systems with erosion control features as specified under Division 2 sections to assure economical, effective, and continuous erosion control throughout construction and post-construction period.

C. Conduct construction in a manner which minimizes soil erosion and resulting sedimentation.

D. Protect properties adjacent to site from land disturbances due to sediment deposition.

E. Construct cut and fill slopes in a manner which will minimize erosion.

F. Soil stabilization measures shall be appropriate for time of year, site conditions, and estimated duration of use.

G. Stabilize or protect soil stockpiles with sediment trapping measures to prevent soil loss.

3.2 RIP-RAP

A. Stabilize slopes 2 to 1 or steeper with rip-rap. Place riprap by hand so that surfaces will be embedded and even with surface of slope or ground adjoining it at both top and bottom.

B. Place riprap upon prepared foundation. Set stones as closely together as is practicable in order to keep voids to a minimum. Bed each stone with depth perpendicular to surface upon which it is set.

C. Place each main stone against adjoining stones with sides and ends in contact. Place stone in such manner as to stagger joints insofar as possible.

D. Reduce tracking of sediment onto public rights-of-way by placing a pad of crushed stone at construction entrances. Maintain temporary entrances with placement of additional stone as conditions demand.

3.3 MULCH APPLICATION

A. Apply mulch to soil surface for temporary soil stabilization. Use mulch on graded or cleared areas for 6 months or less where seeding may not have a suitable growing season to produce an erosion resistant cover.

B. Apply mulch to a thickness of 1/8 inches.

C. Final grading is not required prior to mulching. Mulch may be applied to final grade.

D. Install structural erosion control features prior to mulching.

E. Mulch seeding made in fall.

F. Mulch seeding made on slopes greater than 4:1 and during excessively hot or dry weather.

3.4 TEMPORARY SEEDING

A. Stabilize soil surfaces that are not to be fine-graded for 30 days and longer by seeding disturbed areas. Such areas include but are not limited to soil stockpiles, dikes, dams, sides of sediment basins, and temporary road banks.

B. Install necessary erosion control devices such as berms, waterways, and basins, prior to seeding.

C. Where soils are acidic, pH 5.5 or lower, apply lime at rate of two tons per acre.

D. Apply fertilizer at rate of 450 lbs per acre. Incorporate lime and fertilizer into top 4 inches of soil.

E. Where area is compacted or hardened, loosen soil surface by discing, raking, harrowing, or other acceptable means.

F. Apply seed evenly with a cyclone seeder, drill, cultipacker seeder, or hydroseeder. Plant small grains no more than one inch deep. Plant grasses and legumes no more than 1/4 inch deep.

G. Re-seed areas which fail to establish adequate vegetative cover.

3.5 RUNOFF CONTROL

A. Temporarily divert surface water which flows toward construction area around construction area.

B. Temporary Berms: Construct temporary berms of compacted soil, with a shallow ditch, and grade to drain.
   1. Construct berms with a minimum height of 18 inches, maximum side slopes of 1.5:1, and a minimum base width of 4.5 feet. Provide channel behind berm with a positive grade to a stabilized outlet.
   2. Use temporary berms above newly constructed cut and fill slopes to prevent excessive erosion until more permanent control features are established.
   3. Apply seed and mulch to berm within 15 days of construction.
   4. After slope has stabilized, remove temporary berm.

C. Temporary Swales: Use temporary swales above and below disturbed areas to intercept runoff and divert runoff to a safe disposal area.
   1. Provide channel with a slope of 5% or less; otherwise use a temporary slope drain.
   2. Place straw bale barriers in drainage way every 150 feet or as needed to control sediment deposition.
   3. Remove temporary swale after disturbed area is permanently stabilized.

D. Temporary Slope Drain: Use a temporary slope drain to carry concentrated runoff down a slope prior to installation of permanent facilities or growth of adequate ground cover on slopes.
   1. Construct a temporary slope drain consisting of stone gutters, fiber mats, plastic sheets, concrete or asphalt gutters, half-round pipe, metal pipe, plastic pipe, sod or other materials to carry water down slopes and reduce erosion.
   2. Remove temporary slope drain after disturbed area is stabilized.

3.6 SEDIMENT CONTROL

A. Silt Fences: Use silt fences along downgrade edges of construction to prevent sediment from leaving construction site. Use only where sheet or overland flows are expected.
   1. Place silt fences on downgrade side of soil stockpiles.
   2. Drainage area shall be less than 1/4 acre per 100 feet of silt fence length, maximum slope length behind barrier shall be 100 feet, and maximum grade behind fence shall be 2:1.
   3. Do not use silt fences where flows are likely to exceed 1 cfs.
   4. Remove sediment deposits when deposits reach one-half height of barrier.

5. Staple or wire filter fabric to fence. Extend 8 inches of fabric into trench. Do not extend fabric more than 36 inches above original ground surface. Do not staple filter fabric to existing trees.
6. Backfill trench and compact soil over filter fabric.
7. Remove silt fences when they have served their useful purpose, but not before upslope area has been permanently stabilized.

B. Construct brush barriers consisting of brush, tree trimmings, shrubs, plants, and approved refuse from clearing and grubbing to intercept and retain sediment. Use brush barriers in areas subject to sheet and rill erosion, where enough material is available to construct them.
1. Height of a brush barrier shall be a minimum of 3 feet; width of a brush barrier shall be a minimum of 5 feet at its base.
2. If a filter fabric is used, cut fabric into lengths sufficient to lay across barrier from its upslope base to just beyond its peak. Where joints are necessary, splice fabric together with a minimum 6-inch overlap and securely seal.
3. Excavate trench 6 inches wide and 4 inches deep along length of barrier and immediately uphill from barrier.
4. Drape lengths of filter fabric across width of barrier with uphill edge placed in trench and edges of adjacent pieces overlapping each other.
5. Secure filter fabric in trench with stakes set approximately 36 inches on center.
6. Backfill trench and compact soil over filter fabric.
7. Set stakes into ground along downhill edge of brush barrier, and anchor fabric by tying twine from fabric to stakes.

C. Construct sediment traps consisting of a small, temporary ponding area, formed by constructing an earthen embankment with a gravel outlet, across a drainage swale to detain runoff from disturbed areas long enough to allow majority of sediment to settle out. Use below drainage areas of 5 acres or less.
1. Sediment traps shall not be used longer than 18 months.
2. Periodically remove sediment from trap.
3. When used, install sediment traps before land disturbance takes place in drainage area. Clear, grub, and strip area under embankment of vegetation and root mat.
4. Compact embankment in 8-inch layers by traversing with construction equipment.
5. Seed earthen embankment within 15 days of construction.
6. Remove structure and stabilize area when upslope drainage area has been stabilized.
7. Cut and fill slopes shall be 2:1 or flatter.

3.7 MAINTENANCE

A. Inspect erosion and sediment control facilities immediately after each rainfall and at least daily during construction activities. Make required repairs immediately.

B. Should fabric on a silt fence decompose or become ineffective prior to end of expected usable life and barrier still be necessary, replace fabric promptly.

C. Remove sediment deposits after each storm event. Remove deposits when deposits reach approximately one-half height of barrier. Spread deposits on a stockpile area and allowed to dry.

D. Maintain silt fence sediment areas and insure that water is not short circuiting filter cloth. Inspect downstream area for erosion caused by discharge from sediment area. Correct erosion problems.

E. Dress, prepare and seed sediment deposits remaining in place after a silt fence is no longer required to conform with existing grade.

END OF SECTION 01563 - EROSION AND SEDIMENT CONTROL

SECTION 01570

TRAFFIC REGULATION

PART 1 GENERAL

A. Not Used.

PART 2 PRODUCTS

2.1 SIGNS, SIGNALS, AND DEVICES

A. Post-mounted and wall-mounted traffic control and informational signs as required by the City of Brentwood, Tennessee Department of Transportation, or as recommended in the Manual of Uniform Traffic Control Devices.

B. Automatic Traffic Control Signals: As approved by local jurisdiction.

C. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdiction.

D. Flagman Equipment: As required by local jurisdiction.

PART 3 EXECUTION

3.1 GENERAL

A. Maintain, in a passable and safe condition, roadways and such temporary roadways and structures as may be necessary for accommodation of traffic on, or diverted from, roadway where construction is in progress.

B. Provide, in safe condition, approaches to temporary structures and crossings of intersecting highways. Footways, gutters, storm water inlets, and portions of highways adjoining road where construction is in progress shall not be obstructed more than is absolutely necessary. At street crossings and road crossings, excavate one-half of such street crossings and road.crossings before placing temporary bridges over side excavated, for convenience of traveling public.

3.2 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking and access by emergency vehicles.

Monitor parking of construction personnel's vehicles. Maintain vehicular access to and through parking areas.

B. Prevent parking on or adjacent to access roads, private property or non-designated areas.

3.3 FLAGMEN

A. Provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.4 FLARES AND LIGHTS

A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

B. Guard ditches or other obstructions by barricades and flare lights. Mark equipment left on street or roadway after dark with flares. Flares along open ditches shall not exceed 100'-0" intervals, with at least two at ends of ditches.

3.5 HAUL ROUTES

A. Consult with authorities, establish public thoroughfares to be used for haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.6 TRAFFIC SIGNS AND SIGNALS

A. At approaches to site and on site, install traffic signs and signals at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

B. Provide temporary bridges, barricades, lanterns, and watchmen by night and such other signals and signs by day, as shall be necessary to warn the public of dangers caused by excavations and other obstructions.

C. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.

D. Relocate as Work progresses, to maintain effective traffic control.

3.7 REMOVAL

A. Remove equipment and devices when no longer required. Repair damage caused by installation. Remove post settings to a depth of 2 feet.

END OF SECTION 01570 - TRAFFIC REGULATION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 PRODUCTS

A. Products include material, equipment, and systems.

B. Comply with Specifications and referenced standards as minimum requirements.

C. Components required to be supplied in quantity within a Specification section shall be the same, and shall be interchangeable.

D. Do not use old or previously used materials and equipment unless specifically allowed by the WSD.

1.2 TRANSPORTATION AND HANDLING

A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.3 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

B. Cover all ends of water distribution pipe immediately upon delivery to site and during storage. Uncover only after installation.

C. For exterior storage of material, cover materials subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

E. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

F. After installation, provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.

1.4 PRODUCT OPTIONS - SUBSTITUTIONS

A. Products Specified by Naming One or More Manufacturers with a Substitute Paragraph: Submit a request for substitution for any manufacturer not specifically named.

B. Products Specified by Naming Several Manufacturers without a Substitute Paragraph: Products of named manufacturers meeting specifications; no options, no substitutions allowed.

C. Products Specified by Naming Only One Manufacturer without a Substitute Paragraph: No options, no substitutions allowed.

1.6 LIMITATIONS ON SUBSTITUTIONS

A. Substitutions will be considered only when a product becomes unavailable due to no fault of Contractor.

B. Substitute products shall not be ordered or installed without written acceptance.

D. Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.

E. The WSD will determine acceptability of proposed substitution, and will notify Contractor of acceptance or rejection in writing within a reasonable time.

1.7 REQUESTS FOR SUBSTITUTIONS

A. Submit separate request for each substitution. Document each request with complete data substantiating compliance of proposed substitution with the specified product.

B. Identify substitution by manufacturer's name and address, trade name of product, and model and catalog number. List fabricators and suppliers appropriate.

C. Attach product data as specified in Section 01300.

D. List similar projects using product, dates of installation, and names of Architect/Engineer and Owner representing agency where the product is installed.

E. Give itemized comparison of proposed substitution with specified product, listing variations in quality, performance, durability, appearance and size.

F. Give comparison between proposed substitution and specified product including differences in composition, and physical and chemical properties.

G. Give cost data comparing proposed substitution with specified product, and amount of net change.

H. List availability of maintenance services and replacement materials.

I. State effect of substitution on construction schedule, and changes required in other work or products.

1.8 SUBSTITUTION SUBMITTAL PROCEDURES

A. Submit three copies of request for substitution.

B. WSD will review Contractor's requests for substitutions with reasonable promptness.

C. After review, WSD will notify Contractor, in writing, of decision to accept or reject requested substitution with reasonable promptness.

E. For accepted products, submit shop drawings, product data, and samples under provisions of Section 01300.

1.9 SYSTEMS DEMONSTRATION

A. If applicable, prior to acceptance by the WSD, demonstrate operation of each system to WSD.

B. Instruct WSD's personnel in operation, adjustment, and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

END OF SECTION 01600 - MATERIAL AND EQUIPMENT

SECTION 01650

FACILITY STARTUP

PART 1 GENERAL

1.1 SUBMITTALS

A. Submit preliminary schedule listing times and dates for start-up of applicable equipment, two weeks prior to proposed dates.

B. Submit manufacturer's representative reports within 10 days after start-up, listing satisfactory startup dates.

1.2 QUALITY CONTROL

A. When specified in individual Sections, require manufacturer to provide authorized representative to be present at site under provisions of Section 01400 to inspect, check, and approve equipment installation prior to start-up; to supervise placing equipment in operation; and to provide a written report that equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting lines or anchor bolts, and has been satisfactorily operated under full load conditions.

1.3 PROJECT CONDITIONS

A. Any building enclosure is complete and weathertight.

B. Excess packing and shipping bolts are removed.

C. Interdependent systems have been checked and are operational.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that Project conditions comply with requirements.

B. Verify that status of Work meets requirements for starting of equipment and systems.

3.2 PREPARATION

A. Coordinate sequence for start-up of various items of equipment.

B. Notify WSD seven days prior to start-up of each item of equipment.

C. Have all appropriate documents including shop drawings, product data, and operation and maintenance data at hand during entire start-up process.

D. Verify that each piece of equipment has been checked for proper lubrication, drive rotation, belt tension, control sequence, and other conditions which may cause damage.

E. Verify control systems are fully operational in automatic mode.

F. Verify that tests, meter readings, and specific electrical characteristics agree with those specified by electrical equipment manufacturer.

G. Verify wiring to motors and controls required by mechanical work for operational smoke and fire protection demonstrations is complete.

H. Verify wiring and support systems for equipment installed under separate contracts is complete and checked.

I. Bearings: Inspect for cleanliness; clean and remove foreign matter. Verify alignment; take corrective measures.

K. Drives: Inspect for tension on belt drives, adjustment of varipitch sheaves and drives, alignment, proper equipment speed, and cleanliness. Take corrective action.

L. Motors: Verify that motor amperage agrees with nameplate value. Inspect for conditions which produce excessive current flow and which exist due to equipment malfunction. Take corrective action.

3.3 STARTING SYSTEMS

A. Execute start-up under supervision of responsible Contractor personnel.

B. Place equipment in operation in proper sequence.

END OF SECTION 01650 - FACILITY STARTUP

SECTION 01700

PROJECT ACCEPTANCE

PART 1 GENERAL

1.1 FINAL COMPLETION AND ACCEPTANCE OF WORK

A. When Contractor considers Work is complete, submit in writing:
   1. Work has been completed in accordance with the project plans and is ready for final inspection by the WSD.
   3. List any known deficiencies which must be corrected and a schedule of completion for the corrected work.
   4. Equipment and systems have been tested adjusted, and balanced, and are fully operational.
   5. Submit verification from all stakeholders that work is completed to the satisfaction of the governing agency (State, railroad, other utility, etc.).

B. Should the WSD inspection find Work incomplete, the WSD will promptly notify Contractor in writing listing observed deficiencies.

C. Contractor shall remedy deficiencies and send a second certification of final completion.

D. When the WSD finds work is complete, he will issue a project acceptance letter.

1.2 FINAL COMPLETION SUBMITTALS

A. Prior to issuing Certification of Acceptance, Contractor shall submit the following:
   1. Evidence of Compliance with Requirements of Governing Authorities:
   2. Project Record Documents.
   3. Operation and Maintenance Data.
   4. Warranties and Bonds.
   5. Spare Parts and Maintenance Materials.
   6. Keys and Keying Schedule.

END OF SECTION 01700 – PROJECT ACCEPTANCE

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. In addition to requirements in the “New Development Guidelines and Procedures” and the General Conditions, maintain at site for Owner one record copy of:
   1. Contract Drawings.
   2. Project/Equipment Manuals.
   3. Addenda.
   4. Reviewed shop drawings, product data, and samples.
   5. Field test records.
   6. Inspection certificates.
   7. Manufacturer's certificates

B. Clearly identify and maintain working copy of Record Documents at site for WSD review and inspection at all times protected from deterioration and from loss and damage until completion of Work and transfer of recorded data to Final Project Record Documents.

F. In event of loss of recorded data, use means necessary to again secure data to the WSD. Such means shall include removal and replacement of concealing materials. In such case, provide replacements to standards originally required by the specifications.

1.2 SUBMITTALS

A. Review and approval of Record Documents by the project Developer’s Engineer will be a prerequisite to WSD’s approval.

B. Transmit Final Project Record Documents with cover letter to the Water Services Department and include in addition to the items listed in the “New Development Guidelines and Procedures:”
   1. Date.
   2. Project title.
   3. Contractor's name, address and phone number.

PART 2 EXECUTION

2.1 MAINTENANCE OF JOB SET

A. Immediately upon receipt of Job Set, identify each of Documents with title, "RECORD DOCUMENTS - JOB SET."

B. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information. In the event of overlapping changes within individual systems, use different colors for overlapping changes. Record information concurrently with construction progress. Make entries within 24 hours after receipt of information that change has occurred. Do not conceal any work until required information is recorded.

C. Date entries.

D. Call attention to entry by a "cloud" drawn around area or areas affected.

E. Clearly identify all items.

F. Show, by symbol or note, vertical location of water and sewer facilities.

G. Legibly mark each item to record actual construction, including:
1. Measured depths of facilities.
2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements by dimension accurate to within one inch to centerline of each run of items.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction by dimension accurate to within one inch to centerline of each run of items.
4. Field changes of dimension and detail.
5. Changes made by Modifications.
6. Details not on original Contract Drawings.
7. References to related shop drawings and Modifications.

H. Maintain manufacturer's certifications, inspection certifications, field test records, required by individual Project Manual sections.

I. Do not use Job Set for any purpose except entry of new data and for review by the WSD.

2.2 FINAL PROJECT RECORD DOCUMENTS

E. Record changes from work performed under Warranty.

F. Provide a digital file with GPS information for all public water and sewer infrastructure in accordance with the requirements of the latest edition of the Development Guidelines.

END OF SECTION 01720 - PROJECT RECORD DOCUMENTS

SECTION 02225

EARTHWORK FOR UTILITY WORK

PART 1 GENERAL

1.1 DEFINITIONS

A. Rock: Stratified material in place which rings under the flow of a hammer; boulders having a volume of one-half (1/2) cubic yard or more. Shale, slate, soapstone, and chert are not classified as rock.

B. Utility: Any buried pipe, conduit, or cable.

1.2 REFERENCES

A. ASTM C33 - Concrete Aggregates.

B. ASTM C94 - Ready-Mixed Concrete.

C. ASTM C150 - Portland Cement.

D. ASTM D698 - Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 5.5 lb (2.49 kg) Rammer and 12 inch (305 mm) Drop.

E. ASTM D1556 - Density of Soil in Place by the Sand Cone Method.

F. ASTM D2167 - Density of Soil in Place by the Rubber Balloon Method.

G. ASTM D4253 - Maximum Index Density of Soils Using a Vibratory Table.

1.3 SUBMITTALS

A. Submit two copies of following test reports when requested by the WSD:
1. Test reports on borrow material. Verification of each footing subgrade.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Perform work in compliance with requirements of governing authorities having jurisdiction.

B. Inspection and Testing: Provide inspection and testing under provisions of Section 01410.

C. Excavator: Engage an experienced excavator, experience in rock removal, sheeting, bracing, soil stabilization, dewatering, well pointing,

backfilling, and similar operations commonly encountered in major excavation projects.

1.5 JOB CONDITIONS

A. Existing Utilities: Locate existing underground utilities in areas of work. Protect utilities indicated to remain in place.
   1. If uncharted or mischarted utilities are encountered, immediately notify the WSD and utility owner. Keep services and facilities in operation under direction of utility Owner.

B. Repair damaged utilities to satisfaction of utility owner.

C. The WSD will not be responsible for non-City mischarted utilities.

D. Do not interrupt existing utilities that are in use without written permission of the WSD and the non-City utility Owner so affected and then only after temporary services have been provided.

1.6 EXISTING CONDITIONS

A. Perform a pre-construction survey prior to beginning work in easement or streets. Document pre-construction conditions by video or pictures along any route of new water and sewer lines outside the property of the developer (i.e. offsite facilities). Provide copy of documentation the WSD.

1.7 EXPLOSIVES

A. Use of explosives is permitted only with the prior written approval of the WSD and Fire Marshall.

1.8 PROTECTION OF PERSONS AND PROPERTY

A. Barricade open excavations occurring as part of this work and post warning lights. Operate warning lights as recommended by authorities having jurisdiction.

B. Protect structures, utilities, sidewalks, pavements, and other facilities indicated to remain in place from damage caused from possible settlement, lateral movement, undermining, washout and other hazards created by excavation.

C. Protect plant growth and trees scheduled to remain. Do not excavate or store material within drip line of trees.

D. Restore property to a condition similar or equal to that existing before construction and to the satisfaction of the WSD.

1.9 COORDINATION

A. Verify work associated with lower elevation utilities are complete before placing higher elevation utilities.

B. Where excavation and backfill for utility work passes through or occurs in a landscaped area, repair or replace the landscape work to match original condition and quality of work.

C. Where excavation and backfill for utility work passes through or occurs in an area of paving, restore construction and finish of paving to match original condition and quality of work.

D. Coordinate excavations with weather conditions, to minimize the possibility of washouts, settlements and other damages and hazards.

E. Coordinate with utility owner for shutdown of service. Provide notice as required by the owner of utility before interrupting any utility.

1.10 SCHEDULING AND SEQUENCING

A. Do not excavate for utility work until the work is ready to proceed without delay, so that the total time lapse from excavation to completion of backfilling will be minimal.

B. At street and road crossings, with no exception of public streets and roads excavate only 1/2 of crossings before placing temporary bridges over side excavated, for convenience of traveling public.

1.11 MAINTENANCE

A. Where subsidence is measurable or observable at utility work excavations during warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment.

B. Restore appearance, quality and conditions of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

PART 2 PRODUCTS

2.1 FILL

A. Soil Backfill and Bedding: Soil to be free of roots and organic material, debris and other material considered deleterious by WSD. Soil selected shall consist of residual clay occurring within designated borrow areas, or which occurs within on-site areas which are to be excavated. Soil shall be free of rock fragments greater than 2 inches in maximum dimension.

B. Stone Bedding and Backfill Material: Only Tennessee Department of Transportation specified grade stone material.

C. Stone Bedding Material: Only Tennessee Department of Transportation specified grade stone material. Well graded sand, gravel, crushed stone or crushed slag, with 100% passing a 3/8 inch sieve.

2.2 ACCESSORIES

A. Topsoil: Natural, fertile, agricultural soil capable of sustaining plant growth; free of subsoil, slag, rocks, clay, sticks, and roots to a depth of 18 inches.

B. Lean Concrete: Provide concrete in accordance with the following:

1. Cement: ASTM C150 normal - Type 1 Portland.
2. Fine and Coarse Aggregates: ASTM C33.
3. Water: Clean and not detrimental to concrete.
4. Mix concrete in accordance with ASTM C94 with a compressive strength (28 days) of 3,000 psi and a 4 inch slump.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to be excavated, and conditions under which work is to be performed, and notify WSD in writing of conditions detrimental to the proper completion of the Work.

B. Do not proceed with excavating until unsatisfactory conditions have been corrected in an acceptable manner by the WSD.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Strip topsoil and stockpile separate from all other material on site for respreading. Do not pile over 8 feet and protect from erosion.

C. In cases where other utilities or other pipe is encountered, pipe shall not be displaced nor disturbed unless necessary, in which case replace it in good condition as soon as possible.

3.3 EXCAVATION

A. Excavate for piping with clearance on both sides of pipe as shown in the appropriate detail drawings. Excavate for other utility work to provide minimum clearances as required by Tennessee Department of Environment or as practical and adequate for working clearances.

B. Hand trim for bell and spigot pipe joints if necessary. For stone bedding installations, shape bedding to fit shape of bottom half pipe including bell end, for uniform continuous support.

C. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate the bottom cut to accurate elevations. Support cast-in-place concrete on undisturbed soil at the bottom of the excavations:

D. Depth for Bedding Support: For large piping (6 inch pipe size and larger), tanks and where indicated for other utility work, excavate for installation of bedding material in the depth indicated or, if not otherwise indicated, 6 inches below bottom of work to be supported.

E. Depth for Unsatisfactory Soil Conditions: Where unsatisfactory soil condition at bottom of indicated excavation are encountered, excavate additional depth to reach satisfactory soil-bearing condition. Backfill with bedding material as directed by the WSD and compact to indicated excavation depth.

F. Depth for Piping: Excavate for water and sewer pressure pipe so that top of piping will not be less than 2'-6" vertical distance below finished grade. Excavate for gravity sewer lines so that top of piping will not be less than 2'-6" in open fields and 4'-0" in roadways vertical distance below finished grade.

G. When excavating within drip line of large trees, perform the work by hand, and protect the root system from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of one inch diameter and larger with asphaltic tree paint.

H. Correct areas over excavated. Correct unauthorized rock removal with lean concrete fill.

I. Previous Excavations: Where piping crosses over an area more than 5'-0" wide which has been previously excavated to a greater depth than required for piping installation, provide suitable subsidence-proof support for piping.

J. Comply with the details shown. Where not otherwise shown excavate to undisturbed soil, in a width equal to pipe diameter plus 2'-0". Install 8 inch courses of bedding material, each compacted to 95% of maximum density, as required to fill excavation and support piping.

K. Excavate to subgrade elevations directed by the WSD, regardless of character of materials and obstructions encountered.

L. Unauthorized excavation includes removal of material beyond elevations or dimensions without direction of the WSD.

1. Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by WSD.

M. Stability of Excavations: Slope sides of excavations to comply with applicable codes. Shore and brace where sloping is not possible. Maintain sides and slopes in safe condition until completion of backfilling.

N. Shoring and Bracing: Comply with applicable code requirements for shoring and bracing. Provide materials that are in good serviceable condition. Carry down shoring and bracing as excavation progresses and maintain in place as long as excavations are open.

O. Material Storage: Stockpile satisfactory material where directed until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Do not stockpile material at edge of excavation. Dispose of excess soil and waste material. Do not store under trees within the drip line.

3.4 COMPACTION

A. Before compacting and filling, proofroll area. Remove soft spots, fill and compact to required density.

B. Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Percentage of Maximum Density Requirements: Compact soil to not less than the listed percentages of dry density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D698 (Standard Proctor); and not less than listed percentages of relative density,

determined in accordance with ASTM D4253, for soils which will not exhibit a well-defined moisture-density relationship.

1. Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material at 98% maximum dry density or 90% relative dry density for cohesive soil material.
2. Roadways: 90% for cohesive soils; 95% for cohesionless soils.
3. Lawn or Unpaved Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material at 90% maximum dry density.
4. Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material at 95% maximum dry density.

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

E. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

1. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value. Reuse stockpiled material only after dried to proper moisture content.

3.5 BACKFILL AND FILL

A. Keep all debris and trash out of trench.

B. Backfill trenches to contours and elevations with unfrozen materials. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

1. Provide finely-graded bedding material for wrapped, coated and plastic pipe and tanks.

C. Place acceptable fill in layers to required subgrade elevations, for each area classification listed below.

D. Place and mechanically compact aggregate fill materials in continuous layers not exceeding 8 inches compacted depth each.
1. Place aggregate fill over top of pipe in landscaped areas to depth as shown.

2. In areas of asphaltic concrete paving, fill trench as shown on Standard Detail Drawings.

E. Place and mechanically compact earth fill material in continuous layers not exceeding 8 inches compacted depth from top of aggregate fill to finish grade.

1. For site filling, in excavations, under grassed areas, under walks or pavements, use satisfactory excavated or borrow material.

F. Backfill excavations as soon as work permits, but not until acceptance by WSD of the following:

1. Below grade construction.
2. Inspection, testing, approval and recording locations of underground utilities.
3. Removal of formwork and shoring and bracing.
4. Removal of trash and debris

G. Employ a placement method that does not disturb or damage or create injurious side pressures on pipe in trench.

H. Topsoil Spreading: Respread topsoil stockpiled on site to a minimum depth of 6 inches. If amount of topsoil is inadequate, provide topsoil or borrowed material approved by the WSD.

3.6 GRADING

A. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines: Slope grade away from buildings to drain away water and prevent ponding.

C. Grading Tolerances: Finish surfaces free from irregular surface changes and to following tolerances above or below required subgrade elevations.

1. Lawns and Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevations.
3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2 inch

above or below required subgrade elevations when tested with a 10 foot straight edge.

D. Compaction: After grading, compact subgrade surfaces to depth and percentage of maximum density for each area classification.

E. Time: After completion of the installation, lawns and unpaved areas shall be restored within a reasonable time. For off-site excavations, no later than 30 days. The Contractor may request an extension of time due to unusual circumstances. The request must be in writing and include the amount of time needed for completion.

3.7 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch 0.08 feet from required elevations.

B. Top Surface of General Backfilling: Plus or minus 1 inch 0.08 feet from required elevations.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01410.

B. Testing During Construction: When applicable, testing agency shall inspect and approve subgrades and fill layers before continuing with construction.

1. Perform testing in accordance with ASTM D1556 (sand cone method) or D2167 (rubber balloon method).

C. If compacted subgrade or fills which have been placed do not meet specified densities provide additional compaction and testing.

3.9 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Remove excess excavated material, trash, debris and waste materials and dispose of it properly.

B. Excess materials excavated shall be disposed of so as to interfere as little as possible with public travel and, in all cases, the disposition of excavated material shall be satisfactory to the WSD.

3.11 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Section 01500.

1. Do not walk on or work on top of finished piping until trench has been backfilled.

B. Reshape and re-compact fills subjected to vehicular traffic during construction period. Add mineral aggregate base course as required to maintain trenches in asphaltic concrete areas in a safe and passable condition.

END OF SECTION 02225 - EARTHWORK FOR UTILITY WORK

SECTION 02229

BORE AND JACK CASINGS

PART 1 GENERAL

1.1 SCOPE

A. The work covered by this Section includes furnishing all labor, materials and equipment required to bore and jack casings and to properly complete pipeline construction as described herein and/or shown on the Drawings.

B. Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards. Latest revisions of all standards are applicable. If requested by the WSD, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two years.

1.2 BONDING

A. For work performed within any Tennessee Department of Transportation's right-of-way, the Developer shall post a Performance and Maintenance equal in amount to the estimated construction cost as determined by the WSD, prior to the start of any work.

1.3 SUBMITTALS

A. Submit shop drawings, product data and experience in accordance with Section 01300.

B. Material Submittals: The Contractor shall provide shop drawings and other pertinent specifications and product data as follows:
   1. Shop drawings for casing pipe showing sizes and connection details, and end seals.
   2. Design mixes for concrete and grout.
   3. Casing Spacers.

C. Experience Submittals:
   1. Boring and jacking casings is deemed to be specialty contractor work. If the Contractor elects to perform the work, the Contractor shall provide evidence as required by

the General Conditions. A minimum of five continuous years of experience in steel casing construction is required of the casing installer. Evidence of this experience must be provided with the shop drawings for review by the WSD.

1.4 STORAGE AND PROTECTION

A. All materials shall be stored in accordance with the manufacturer's recommendations and as approved by the Engineer.

PART 2 PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

A. Casing

1. The casing shall be new and unused pipe. The casing shall be made from steel plate having a minimum yield strength of 35,000 psi. The steel plate shall also meet the requirements of ASTM A 36.
2. The thicknesses of casing shown in paragraph B. below are minimum thicknesses. Actual thicknesses shall be determined by the casing installer, based on an evaluation of the required forces to be exerted on the casing when jacking. Any buckling of the casing due to jacking forces shall be repaired by the Contractor.
3. The diameters of casing shown in paragraph B. below and shown on the Drawings are minimum. Larger casings, with the WSD's approval, may be provided, for whatever reasons the Contractor may decide, whether casing size availability, line and grade tolerances, soil conditions, etc.

B. Minimum Casing Sizes

UNDER RAILROADS

Pipe Diameter, Inches	*Casing Diameter, Inches*	*Wall Thickness, Inches*
		Uncoated
6	14	0.282
8	18	0.375
10	20	0.375
12	22	0.375
14	24	0.407
16	30	0.469

18	30	0.469
20	32	0.501
24	36	0.532
30	42	0.563

UNDER HIGHWAYS

Pipe Diameter, Inches	*Casing Diameter, Inches*	*Wall Thickness, Inches*
6	12	0.250
8	16	0.375
10	16	0.375
12	18	0.375
14	22	0.375
16	24	0.375
18	30	0.375
20	30	0.375
24	36	0.375
30	42	0.375

C. Casing Spacers: Casing spacers shall meet one of the following requirements:

1. Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float in within the casing. Casing spacers shall be Cascade Waterworks Manufacturing Company, Style CCS or equal.
2. Casing spacers shall be two-section, flanged, bolt on style constructed of heat fused PVC coated steel, minimum 14 gauge band and 10 gauge risers, with 2-inch wide glass reinforced polyester insulating skids, heavy duty PVC inner liner, minimum 0.09-inch thick having a hardness of 85-90 durometer, and all stainless steel or cadmium plated hardware shall be Pipeline Seal and Insulator, Inc.
3. Substitutions: Under provisions of Section 01600.

D. Carrier Pipe: Carrier pipe shall be as specified in Sections 02660 or 02730.

E. Surface Settlement Markers: Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall wooden hubs.

F. End seals shall be minimum 1/8" flexible neoprene rubber eccentric wrap with minimum ½ inch stainless steel bands placed at each end of the rubber boot manufactured for casing end seal; or a modular end seal with bolt driven force dispersion plates with direct ground burial applications.

2.2 EQUIPMENT

A. A cutting head shall be attached to a continuous auger mounted inside the casing pipe.

B. On casing pipe for gravity sewer over 60 feet in length, the installation equipment shall include a steering head and a grade indicator.

C. The steering head shall be controlled manually from the bore pit. The grade indicator shall consist of a water level attached to the casing that will indicate the elevation of the front end of the casing or some other means for grade indication approved by the WSD.

PART 3 EXECUTION

3.1 GENERAL

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. Casing Design: Design of the bore pit and required bearing to resist jacking forces are the responsibility of the project engineer. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor if approved by the WSD. Due to restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal 20 foot length may be necessary.

E. Highway Crossings

1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.
3. All installations shall be performed to leave free flow in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department or agency who has ownership of the right-of way.
5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.
6. The Contractor shall be responsible for obtaining a blasting permit in a timely manner.
7. The Contractor shall be responsible for maintaining an executed copy of the bore permit from the appropriate authority at all times.

F. Railroad Crossings

1. The Contractor shall secure permission from the Railroad to schedule work so as not to interfere with the operation of the Railroad.
2. the Contractor shall satisfy all permitting and insurance requirements of the railroad prior to beginning any work.

3. All work on the Railroad right-of-way including necessary support of tracks, safety of operations and other standard and incidental operation procedures may be under the supervision of the appropriate authorized representative of the Railroad affected and any decisions of this representative pertaining to construction and/or operations shall be final and construction must be governed by such decisions.

4. If, in the opinion of the Railroad, it becomes necessary to provide flagging protection, watchmen or the performance of any other work in order to keep the tracks safe for traffic, the Contractor shall coordinate such work.

5. No blasting shall be permitted within the Railroad right-of-way unless expressely permitted by the railroad and the WSD. The Contractor shall be responsible for maintaining an executed copy of the bore permit from the appropriate authority at all times.

3.2 GROUNDWATER CONTROL

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

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

C. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap and comply with requirements in Section 01563 of these specifications.

3.3 SURFACE SETTLEMENT MONITORING

A. Provide surface settlement markers, placed as specified and as directed by the project's Engineer or the owner of right-of-way.

B. The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the direction of the project Engineer or jurisdictional owner.

C. Promptly report any settlement and horizontal movement immediately to the project Engineer and WSD.

3.4 BORING AND JACKING

A. Shaft

1. Conduct boring and jacking operations from a shaft excavated at one end of the section to be bored. Where conditions and accessibility are suitable, place the shaft on the downstream end of the bore.
2. The shaft shall be rectangular and excavated to a width and length required for ample working space. If necessary, sheet and shore shaft properly on all sides. Shaft sheeting shall be timber or steel piling of ample strength to safely withstand all structural loadings of whatever nature due to soil and site conditions. Keep preparations dry during all operations. Perform pumping operations as necessary.
3. The bottom of the shaft shall be firm an unyielding to form an adequate foundation upon which to work. In the event the shaft bottom is not stable, excavate to such additional depth as required and place a gravel sub-base or a concrete sub-base if directed by the project Engineer or WSD, due to soil conditions.

B. Jacking Rails and Frame

1. Set jacking rails to proper line and grade within the shaft. Secure rails in place to prevent settlement or movement during operations. The jacking rails shall cradle and hold the casing pipe on true line and grade during the progress of installing the casing.
2. Place backing between the heels of jacking rails and the rear of the shaft. The backing shall be adequate to withstand all jacking forces and loads.
3. The jacking frame shall be of adequate design for the magnitude of the job. Apply thrust to the end of the pipe in such a manner to impart a uniformly balanced load to the pipe barrel without damaging the joint ends of the pipe.

C. Boring and jacking of casing pipes shall be accomplished by the auger boring method without jetting, sluicing or wetboring.

D. Auger the hole and jack the casing through the soil simultaneously.

E. Bored installations shall have a bored-hole diameter essentially the same as the outside diameter of the casing pipe installed.

F. Execute boring ahead of the casing pipe with extreme care, commensurate with the rate of casing pipe penetration. Boring may proceed slightly in advance of the penetrating pipe and shall be made in such a manner to prevent any voids in the earth around the outside perimeter of the pipe. Make all investigations and determine if the soil conditions are such to require the use of a shield.

G. As the casing is installed, check the horizontal and vertical alignment frequently. Make corrections prior to continuing operation. For casing pipe installations over 100 feet in length, the auger shall be removed and the alignment and grade checked at minimum intervals of 60 feet.

H. Any casing pipe damaged in jacking operations shall be repaired or removed and replaced.

I. Lengths of casing pipe, as long as practical, shall be used except as restricted otherwise. Joints between casing pipe sections shall be butt joints with complete joint penetration, single groove welds, for the entire circumference, in accordance with AWS recommended procedures. Prior to welding the joints, the Contractor shall ensure that both ends of the casing sections being welded are square.

J. The Contractor shall prepare a contingency plan which will allow the use of a casing lubricant, such as bentonite, in the event excessive frictional forces jeopardize the successful completion of the casing installation.

K. Once the jacking procedure has begun, it should be continued without stopping until completed, subject to weather and conditions beyond the control of the Contractor.

L. Care shall be taken to ensure that casing pipe installed by the boring and jacking method will be at the proper alignment and grade.

M. The Contractor shall maintain and operate pumps and other necessary drainage system equipment to keep work dewatered at all times.

N. Adequate sheeting, shoring and bracing for embankments, operating pits and other appurtenances shall be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing shall be removed.

O. Trench excavation, all classes and type of excavation, the removal of rock, muck, debris, the excavation of all working pits and backfill requirements of Section 02225 are included in this Section.

P. All surplus material shall be removed from the right-of-way and the excavation finished flush with the surrounding ground.

Q. Grout backfill shall be used for unused holes or abandoned pipes.

R. Any replacement of the carrier pipe in an existing casing shall be considered a new installation, subject to the applicable requirements of these Specifications.

3.5 VENTILATION AND AIR QUALTITY

A. Provide, operate and maintain for the duration of casing project a ventilation system to meet safety and OSHA requirements.

3.6 ROCK EXCAVATION

A. In the event that rock is encountered during the installation of the casing pipe which, in the opinion of the project Engineer, cannot be removed through the casing, the project Engineer may authorize the Contractor to complete the crossing using an alternate method. An alternative method must be approved by the WSD and agency authorizing the work by permit (i.e. Railroad, TDOT, etc.).

B. At the Contractors option the Contractor may continue to install the casing, and remove the rock through the casing.

3.7 INSTALLATION OF PIPE

A. After construction of the casing is complete, and has been accepted by the project Engineer and WSD, install the pipeline in accordance with the Drawings and Specifications.

B. Check the alignment and grade of the casing and prepare a plan to set the pipe at proper alignment, grade and elevation, without any sags or high spots.

C. The carrier pipe shall be held in the casing pipe by the following method:

1. The pipe shall be supported within the casing by use of casing spacers sized to limit radial movement to a maximum of 1-inch. Provide a minimum of two casing spacers per nominal length of pipe with an interval no greater than seven linear feet between spacers. Casing spacers shall be attached to the pipe per the manufacturer's instructions and in accordance with these specifications.

D. Close the ends of the casing per this Section, paragraph 2.1.

3.8 SHEETING REMOVAL

A. Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring and bracing shall be done in such a meaner as not to endanger or damage either new or existing structures, private or public properties and also to avoid cave-ins or sliding in the banks.

3.9 INTERSTATE RESTORATION

A. When boring and jacking operations encroach upon the right-of-ways of the federal interstate system, the Contractor shall restore all screened trees with seedlings of like species.

END OF SECTION 02229 – BORE AND JACK CASINGS

SECTION 02506

CRUSHED STONE PAVING

PART 1 GENERAL

1.1 REFERENCES

A. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.

1.2 TESTS

A. Gradation of stone materials will be performed in accordance with ASTM C136 and with Section 01410.

PART 2 PRODUCTS

2.1 MATERIALS

A. Coarse Stone: Angular, natural stone; free of shale, clay, friable materials and debris; graded in accordance with ASTM C136 within the following limits:

1.

Sieve Size	Percent Passing
2 inches	100
One inch	95
3/4 inch	65 to 95
5/8 inch	75 to 100
3/8 inch	55 to 85
No. 4	35 to 55
No. 16	15 to 45
No. 40	10 to 25
No. 100	4 to 15

B. Sand: Natural river or bank sand; washed, free of silt, clay, loam, friable or soluble materials, and organic matter.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify compacted subgrade is dry and ready to receive work of this Section. Proof-roll with loaded dump truck, then remove and compact all soft and yielding areas.

B. Verify gradients and elevations of base are correct.

C. Contractor may begin installation of water and sewer facilities after acceptance of subgrade conditions by the WSD.

3.2 PLACING STONE PAVING

A. Spread stone material over prepared base to a total compacted thickness of 8 inches.

B. Place stone in 4 inch layers and compact.

C. Level surfaces to elevations and gradients indicated.

D. Add small quantities of sand to stone mix as appropriate to assist compaction.

E. Compact placed stone materials to achieve 95% maximum dry density.

F. Add water to assist compaction. With an excess water condition, rework topping and aerate to reduce moisture content.

G. Perform hand tamping in areas inaccessible to compaction equipment.

END OF SECTION 02506 - CRUSHED STONE PAVING

SECTION 02510

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.1 SUBMITTALS

A. Submit product data under provisions of Section 01300.

B. Submit manufacturers' instructions under provisions of Section 01300.

1.2 QUALITY ASSURANCE

A. Shall conform to agency having jurisdiction for placing asphaltic pavement

1.3 ENVIRONMENTAL REQUIREMENTS

A. Shall conform to agency having jurisdiction for placing asphaltic pavement. =

PART 2 PRODUCTS AND MATERIALS

2.1 Shall conform to agency having jurisdiction for placing asphaltic pavement.

PART 3 EXECUTION

3.1 Shall conform to agency having jurisdiction for placing asphaltic pavement.

END OF SECTION 02510 - ASPHALTIC CONCRETE PAVING

SECTION 02520

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.1 QUALITY ASSURANCE

A. Shall conform to agency having jurisdiction for placing asphaltic pavement.

1.3 REGULATORY REQUIREMENTS

A. Shall conform to agency having jurisdiction for placing asphaltic pavement.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Shall conform to agency having jurisdiction for placing asphaltic pavement.

PART 2 PRODUCTS AND MATERIALS

2.1 Shall conform to agency having jurisdiction for placing asphaltic pavement.

PART 3 EXECUTION

3.1 Shall conform to agency having jurisdiction for placing asphaltic pavement.

END OF SECTION 02520 - PORTLAND CEMENT CONCRETE PAVING

SECTION 02607

MANHOLES AND COVERS

PART1 GENERAL

1.1 REFERENCES

A. ASTM A48 - Gray Iron Castings.

B. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

C. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and pipes.

1.2 SYSTEM DESCRIPTION - SANITARY SEWER

A. Manholes shall generally be located in the public right-of-way, in the middle of a travel lane when possible. Space manholes, generally, at not more than 400 feet, center to center.

B. Place manholes at breaks in grade or alignment and at intersections of lines. Use care when locating manholes, particularly in residential neighborhoods; to ensure manholes are not located in the center of lots, inside future or existing fence enclosures, designated landscape areas, etc.

C. For manholes less than 6'-0" in depth, use shallow manholes as shown on Standard Drawings.

D. Manholes located along streams or within a flood plain or floodway shall be watertight and shall have watertight covers in accordance with Standard Drawings.

E. In accordance with Standard Drawings, place manhole vents at every third manhole when three or more watertight covers are used on consecutive manholes. Place vents, when possible, at fence lines or less conspicuous locations but not in violation of State or design rules. Place tops of manhole vents above known flood elevation, if it is not known, calculated 50-year flood elevation.

F. Where a sewage forcemains enter a manhole, the cover and frame on the three downstream manholes, including the one containing the forcemain connection, shall be GMI Composite Manhole Frame and Cover with 24” clear opening and ¼” turn paddle locks or approved equivalent. Manholes shall also be coated with spray applied epoxy resin as per section 02765– Sanitary Sewer Manhole Rehabilitation.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate manholes locations, elevations, conduit, and sizes and elevations of penetrations.

C. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478. Reinforced cast-in-place concrete as specified in Section 03001 will be allowed on a case by case basis with WSD approval.

2.2 COMPONENTS

A. Cover and Frame: ASTM A48, Class 30B lid molded with the words, "SANITARY SEWER".
   (1) Traffic Type: "Number 1150" John Bouchard or approved equivalent.
   (2) Non-Traffic Type: "Number 1155," John Bouchard or approved equivalent.
   (3) Watertight Type: "Number 1150 or 1155 with bolts and gasket," John Bouchard or approved equivalent.

B. Manhole Steps: Either of the following:
   (1) Formed aluminum rungs; 3/4 inch diameter. Formed integral with manhole sections.
      (a) "Part 12653B," Alcoa
      (b) "PSI-45," M. A. Industries
   (2) ASTM C478; injection molded, copolymer polypropylene plastic covered, Number 4, Grade 60, rebar; 5-3/4 inches projection, 12 inches overall width, 9-1/8 inches overall depth; serrated tread; 1500 pounds pullout strength.
      (a) Model "PS1-PF," M. A. Industries, Inc., Peachtree City, GA.

C. Base Pad: Either precast concrete type or cast-in-place concrete of type specified in Section 03001, leveled top surface.

D. Manhole Inverts: Form from concrete as shown on Standard Drawings. Form inverts for a "straight-thru" manhole by laying pipe straight through manhole, pouring concrete invert, and then breaking out top half of pipe. Construct curved inverts of concrete as shown and form a smooth, even half-pipe section as shown.

E. Pipe Connectors: Flexible pipe-to-manhole EPDM gaskets in accordance with ASTM C923; with non-magnetic 304 stainless steel wedge type expander and pipe clamp; tested without leakage to the following:
   (1) Head pressure of more than 10 psi for 10 minutes per ASTM C923-7.1; Deflection of over 7 degrees in any direction per ASTM C923-7.2.2; Load of over 150 pounds per inch pipe diameter per ASTM C923-7.2.3.
   (2) "Kor-N-Seal," NPC, Inc., Milford, NH.

F. Lean Concrete: As specified in Section 02225.

2.3 CONFIGURATION

A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female dry joints; sleeve to receive conduit sections.

B. Shape: Cylindrical.

C. Clear Inside Dimensions: 48 inch diameter, minimum, unless indicated otherwise.

D. Design Depth: As indicated.

E. Clear Lid Opening: 26 inches diameter.

F. Pipe and Conduit Entry: Provide openings as required.

G. Steps: 12 inches wide, 15 inches on center vertically, set into manhole wall.

2.4 FABRICATION

A. Manhole sections showing evidence of cracking, crazing, honeycombing, crumbling, or excessive roughness will not be accepted. Manhole sections with improper cut-outs for pipes will not be acceptable. Poorly finished or ill-fitting manhole sections will be rejected.

B. Castings shall be first quality, free from blow holes, shrinkage, distortion, or other defects.

C. Manholes shall be smooth and well-cleaned, and shall be coated with Xypex Admix C-1000. Using normal practices to ensure formation of homogeneous mixture. PRECAST BATCH PLANT – PAN TYPE MIXER: Add Xypex Admix to the rock and sand, then mix thoroughly for 2-3 minutes before adding the cement and water. The total concrete mass should be blended using standard practices. A colorant shall be added to verify the Xypex Admix was added to the concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located. Verify that built-in items are in proper location, and ready for roughing into Work. Verify excavation for manholes is correct.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.3 PLACING MANHOLE SECTIONS

A. Place base pad, trowel top surface level. At manholes 14'-0" and over in depth, provide an 8 inch lean concrete footing as shown on Standard Drawings.

B. Place prefabricated manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Form and place cast-in-place concrete manhole cylinder plumb and level, to corrections dimensions and elevations. As work progresses, build-in fabricated metal items.

D. Cut and fit for conduit and sleeves.

E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

F. Form manhole inverts from concrete as shown on Standard Drawings. Slope bench uniformly to trough. Slope inverts at same slope as sewer either entering or leaving manhole.

G. Install drop inlet assemblies at manholes in which difference of flow lines is more than 24 inches. For differences of flow lines less than 24 inches, slope manhole invert to connect grades.
   (1) Drop Inlet Assemblies: Stacks placed adjacent to manhole supported by poured concrete, as shown on Standard Drawings.

H. Set cover frames and covers level without tipping, to correct elevations.

I. Set top of manhole covers level with surrounding ground. Grade so that no water will flow into manhole cover or stand on cover.

J. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION 02607 - MANHOLES AND COVERS

SECTION 02660

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

A. ANSI/ASTM D2466 - Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

B. ANSI/AWS A5.8 - Brazing Filler Metal.

C. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

D. ANSI/AWWA C500 - Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.

E. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.

F. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.

G.. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

H. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.

I. ASTM B88 - Seamless Copper Water Tube.

J. UL 246 - Hydrants for Fire - Protection Service.

1.2 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Submit manufacturer's product data and installation instructions for pipe and fittings, valves, hydrants, and accessories.

C. Shop Drawings: Submit shop drawings for system, showing pipe type, size, location, and elevations. Include details of underground structures, fittings, connections, anchors and thrust blocks.

D. Manufacturer's Certificate: Project Engineer shall certify that products meet or exceed specified requirements.

E. Manufacturer shall certify that pipe material shall meet or exceed applicable AWWA standards.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01720.

B. Accurately record actual locations of piping mains, valves, connections, and invert elevations. Provide digital file with GPS coordinates for incorporation into City GIS system.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of water distribution system materials of types and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.

B. Local Fire Department/Marshall Regulations: Comply with governing regulations pertaining to hydrants, including hose unit threading and similar matching of connections.

C. Perform Work in accordance with municipality.

D. Valves: Manufacturer's name and pressure rating marked on valve body; approved by FM, listed by UL.

E. Ductile Iron Pipe: Manufacturer's name, working pressure, DIPRA approval, and latent production code rated on pipe body.

F. Provide factory fabricated products to comply with governing regulations and AWWA standards.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.1 PIPE

A. Ductile Iron Pipe: ANSI/AWWA C151.
   1. Ductile iron pipe shall be ANSI Class 52 thickness unless otherwise indicated and shall be of the bell and spigot type. .
   2. Fittings: ANSI/AWWA C110 or C153, ductile iron, mechanical joint type.
   3. Joints: ANSI/AWWA C111, rubber gasket, push-on type:
      a) "Fastite"
      b) "Tyton"
      c) "Bell-Tite
      d) Substitutions: Under provisions of Section 01600.

B. Copper Tubing: ASTM B88, Type K, annealed:
   1. Joints: Compression connection or ANSI/AWS A5.8, BCuP silver braze.

2.2 GATE VALVES - UP TO 3 INCHES

A. Manufacturers:
   1. Mueller.
   2. M & H.
   3. Clow.
   4. American-Darling: Model AFC-250
   5. Substitutions: Under provisions of Section 01600.

B. Brass or bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box and two valve keys.

2.3 GATE VALVES - 3 INCHES AND OVER

A. Manufacturers:
   1. Mueller.
   2. M & H.
   3. Clow
   4. Substitutions: Under provisions of Section 01600.

B. ANSI/AWWA C509, Iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint ends, control rod, opening counter clockwise, extension box.

2.4 MECHANICAL JOINT TAPPING SLEEVE 4” – 24”

A. Manufacturers:

1. Mueller.
2. Substitutions: Under provisions of Section 01600.

B. ANSI/NSF 61, Ductile Iron Body with ¾" NPT test plug, Outlet flange dimensions and drilling comply with ANSI B16.1, class 125.

2.5 SWING CHECK VALVES - FROM 2 INCHES TO 24 INCHES

A. Manufacturers:
1. American 50 Line M & H AWWA Clow
2. Substitutions: Under provisions of Section 01600.

B. ANSI/AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends; 150 psi capacity; removable cover for removal of internal parts without having to remove valve from line.

2.6 VALVE BOXES

A. Valve Box: Adjustable valve boxes with cover.
1. Three Inch Diameter and Smaller:
(a) Roadway Screw Type H-10366, with H-10369 Lid by Mueller.
(b) Substitutions: Under provisions of Section 01600.
2. Four to Twelve Inch Diameter: Concrete valve box, rectangular product with cast iron frame and cover.
(a) Concrete Products of Nashville, Inc.
(b) Substitutions: Under provisions of Section 01600.

2.7 VACUUM-RELEASE OR AIR-RELEASE VALVES

A. Vacuum-Release or Air-Release Valves: Two inch inlet diameter, fitted with proper size orifices; NSF 61 Reinforced Nylon body and cover;; and NSF 61 foamed polypropylene float; suitable for use in lines having a maximum water pressure of 250 psi.
1. ARI D-040 TP 02 or approved equivalent.

2.8 RESIDENTIAL WATER METER

A. Manufacturer: Sensus Technologies, Inc.

B. Meters, General: shall be new, unused, 5/8" through 1" Sensus iPERL™ electromagnetic flow technology, appropriately sized (Meters larger than 1" for residential applications shall be approved by the WSD).

1. Register shall be electronic device encapsulated in glass with 9 programmable digits utilizing a LCD.

2. Meter shall have a magnetic coupling to connect with the currently installed reading system.

C. Provide the following material for each service.
   1. 3/4 inch corporation stop with coupling unit shall be Ford Model FB-1000 3-Q-TA or for 1" corp FB1000 4-Q-TA
   2. 3/4 inch standard copper tubing, wall thickness 0.065 inch, bent to form a gooseneck.
   3. Double check meter yoke with gripper joint for 5/8" x 3/4" meter: Ford

D. Provide double strap service clamps with PVC mains. Bronze wide double band, Ford Model S-70.

E. Abandoned Service: Any water service to be abandoned must be dug up back to the water main, the copper service line removed from the corporation stop and a cap be installed in the place of the compression fitting. The service must also be GPS'd as an abandoned service.

2.9 NON-RESIDENTIAL METER

A. Manufacturer: Sensus Technologies, Inc.

B. Meters, General: shall be new, unused, 1-1/2" through 8" Sensus Omni FBT flow technology, appropriately sized. Meters sized less than 1-1/2" shall be iPERL technology.

   1. Register shall be electronic device encapsulated in glass with 9 programmable digits utilizing a LCD.
   2. Meter shall have a magnetic coupling to connect with the currently installed reading system.

C. Abandoned Service: Any water service to be abandoned must have a plan of abandonment developed and approved by Brentwood Water Services prior to abandonment.

2.10 METER BOX

A. General: Plastic, rectangular meter boxes traffic rated, with non-locking cover and autoread hole.
   1. 5/8"-3/4" - Carson Industries type MSBCF1118-18XL
   2. 1"-1 1/2" - Carson Industries type MSBCF1527-18XL
   3. 2" - Carson Industries type MSBCF1730-18XL

Substitutions: Under provisions of Section 01600.

2.11 HYDRANTS

A. Manufacturers:
   1. Model "Super Centurion 200" Mueller.

B. General: Provide fire hydrants with threaded male nozzle conforming to "American National Standard Fire Hose Connection Screw Threads" unless other hose connection required by local fire authorities.

C. Provide dry-barrel fire hydrants (base valve type) complying with UL 246 and AWWA C502, inside dimension of 5 1/4 inches minimum, with minimum 5 inches diameter valve seat opening; minimum net water area of barrel not less than 190 percent of valve opening; 6 inch bell or mechanical joint inlet connection with accessories, gland bolts, and gaskets; all bronze working parts.

D.
   1. Working pressure, 150 psi and 300 psi hydrostatic pressure.
   2. Valve opening direction, counterclockwise, indicated by arrow and word "Open" cast on dome; 5 inch size minimum.
   3. Nozzles, two 4-1/2" pumper connection with caps and chains. Nozzle cap nuts to match operating stem nuts.
      (c) Operating stem nuts, 1-1/8" pentagon.

D. Finish: Prior to any hydrant being accepted into service, said hydrant shall be flow tested per AWWA Standard M-17. Results of the test shall be provided to the City, including static, residual, flow, and time of test. Hydrant shall be color coded based on accepted flow testing results, including primer and two coats of enamel color coded as follows:

NFPA CLASS		
AA	Blue	>1500 gpm
A	Green	1000-1499 gpm
B	Orange	500-999 gpm
C	Red	0-499 gpm

2.12 BEDDING MATERIALS

A. Bedding: Aggregate fill and earth fill types as specified in Section 02225.

2.13 ACCESSORIES

A. Anchorages: Provide anchorages for tees, plugs, caps, bends and hydrants.

   1. Clamps, Straps and Washers: Steel, ASTM A506. Rods: Steel, ASTM A575. Rod Couplings: Malleable iron, ASTM A197. Bolts: ASTM A307. Cast Iron Washers: ASTM A126, Class A.

B. Back Flow Prevention Assembly (Cross Connection Assembly): Commercial and Irrigation back flow prevention assemblies shall be Watts Model 909 or state and WSD approve equivalent. Assembly shall be installed no closer than 12" from any wall or obstruction, the relief valve shall be installed no less than 12" above grade and assembly shall be installed per manufacturer's requirements.

C. Manhole and Cover: Refer to Section 02607.

D. Thrust Blocks:
1. 3000 psi concrete, ASTM C94 ready-mixed concrete, 400 pounds of cement per cubic yard; water reducing admixture ASTM C494, Type A.
2. MEGALUG^{R} Series 1100 or approved equal when approved by the WSD and designed and installed per MEGALUG^{R} specifications.

E. Saddles: Factory-fabricated products to comply with governing regulations; bronze.
1. Vega Manufacturing Company "H-13431," Mueller or Ford Equal.
2. Substitutions: Under provisions of Section 01600.

E. Flanged Mechanical Joint Coupling Adapter with Joint Restraint:
1. Smith-Blair Model 911 & 920
2. Substitutions: Under provisions of Section 01600.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions.

B. Verify that building service connection and municipal utility water main size, location and inverts are as indicated.

3.2 PREPARATION

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

D. Cover pipe ends during storage.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 02225 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. For unpaved or non-traffic installations, place loose soil bedding material at trench bottom, level in one continuous layer to a minimum depth of 6 inches depth. When installing pipe in paved or traffic areas, bed and backfill shall be compacted stone to 12” above top of pipe.

C. Backfill with loose soil, free of rock greater than 2” in diameter around sides of pipe and to a height of 12 inches over top of pipe.

D. Backfill over pipe up to finish grade in accordance with Section 02225.

E. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with the appropriate code.

B. Install pipe to indicated elevation to within tolerance of 5/8 inches.

C. Install ductile iron piping and fittings to ANSI/AWWA C600.

D. Route pipe in straight line.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Install access fittings to permit disinfection of water system performed under Section 02675.

G. Slope water pipe and position drain at low points.

H. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main.

I. Establish elevations of buried piping to ensure not less than 2'-6" of cover.

J. Shape bed of each piece of pipe so that each individual piece of pipe will have a uniform bearing. Lay pipe in a straight line and grade without kinks or sags. Lay pipe in a workmanlike manner.

K. Before each piece of pipe is lowered into trench, swab pipe thoroughly to insure its being clean. Lower each piece of pipe separately unless special permission is given otherwise by the project Engineer and approved by the WSD. Prevent damage to pipe coating.

L. Do not lay pipe or castings which are known to be defective. If defective pipe or special casting is discovered after it has been laid in line, remove and replace it with a satisfactory section of pipe or special casting. In case a length of pipe is cut to fit in a line, cut it as to leave a smooth end at right angles to longitudinal axis of pipe. When Contractor is not actually laying pipe, plug pipe.

M. After installation, apply a full coat of asphalt or other acceptable corrosion-retarding material to unprotected surfaces of rods and clamps.

N. Cast-Iron Pipe: Not applicable.

O. Ductile-Iron Pipe: Install in accordance with recommended procedures of Ductile Iron Pipe Research Association.

P. At taps on existing PVC pipe, install a saddle if applicable.

Q. Joint Adapters: Make joints between cast iron pipe and other types of pipe with standard manufactured ductile iron, mechanical joint fittings.

R. If indicated on Drawings, place pipe under roads by boring in accordance with requirements of the authority having jurisdiction and Section 02229.

S. Make creek crossings with ductile iron pipe regardless of type pipe used elsewhere and per the State of Tennessee.

T. Where water lines cross ditches or culverts, place line under invert of same at such a depth as to provide adequate cover. Line shall begin to slope on either side of ditch or culvert at a sufficient distance to hold a uniform gradient in line without sags or short breaks.

U. Water mains in cul-de-sacs shall extend straight through the cul-de-sac and terminate beyond curb line and include an approved hydrant.

V. In cases where gas, sewer, or other pipe is encountered, replace it in good condition as promptly as is possible.

W. If applicable, for non-metallic pipe installations, install metallic marking tape continuous buried 12 inches below finish grade, above pipe line; coordinate with Section 02225.

X. Backfill trench in accordance with Section 02225.

3.5 SEPARATION OF WATER MAINS AND SEWERS

A. At a minimum, install parallel lines in accordance with State of Tennessee design standards.

B. Crossings: Under normal conditions when laying water mains over sewer pipe, provide a separation of at least 18 inches between bottom of water main and top of sewer.

1. Unusual Conditions: When local conditions prevent desired vertical separation as described above, protect water mains passing under sewers by providing:

a) A vertical separation of at last 18 inches between bottom of sewer and top of water main;

b) Adequate structural support for sewers to prevent excessive deflection of joints and settling on and breaking water mains;

c) Length of water pipe shall be centered at point of crossing so that joints will be equidistant and as far as possible from sewer and capped with concrete per the direction of the WSD.

C. No water pipe shall pass through or come into contact with part of a sewer or sewer manhole.

3.6 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing in accordance with manufacturer's instructions.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Install hydrants in accordance with AWWA M17. and the Tennessee Inspection Bureau. Set hydrants plumb and locate pumper nozzle perpendicular to roadway.

D. Set hydrants to grade and so that the 4-1/2 inch connection will be a minimum of 18 inches from bottom of nozzle to the ground, and turned so as to be unobstructed by poles or other objects.

E. Locate control valve immediately adjacent to the hydrant.

F. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

G. Paint hydrants in accordance with State of Tennessee color code.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 02675.

3.8 SERVICE CONNECTIONS

A. Provide water service to utility company requirements.

3.9 INSPECTION

A. Interior Inspection: Inspect pipe to determine whether line displacement or other damage has occurred.
   1. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects to satisfaction of the WSD.

3.10 CLEANING

A. Cleaning Pipe: Clear interior of pipe of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.

   1. In large, accessible pipe, brushes and brooms may be used for cleaning.

B. Place plugs in end of uncompleted pipe at end of day or whenever work stops and remove all debris and trash from trench.

3.11 FIELD QUALITY CONTROL

A. Field testing will be performed under provisions of Section 01410.

B. Perform operational testing of hydrants and valves by opening and closing under water pressure to insure proper operation.

C. Test pipe under 200 pounds pressure. This may be done from valve to valve or by plugging open end of pipe. All tests shall be conducted in presence of WSD representative.

D. Inspect each joint thoroughly and make joints watertight, before backfilling about joint. Furnish equipment and material for testing. Duration of each pressure test shall be at least two hours.

1. Include hydrants and service lines to meter in test.

E. Conduct a leakage test after pressure test has been satisfactorily completed. Furnish pump, pipe, connections, gauges, and measuring devices and other necessary apparatus. Furnish necessary assistance to conduct test.

F. Duration of each leakage test shall be two hours and during test main shall be subjected to 200 psi pressure.

G. Upon completion of construction of underground utilities, retest water lines for leakage.

H. Do not connect to municipal system until testing and disinfection of lines have been completed and permission granted by the WSD.

I. Leakage is defined as quantity of water to be supplied into newly laid pipe, or valve section thereof, necessary to maintain specified leakage test pressure after pipe has been filled with water and air expelled.

J. Test each valve section separately unless otherwise approved by Architect/Engineer.

K. Each valve section shall be watertight as no leakage will be allowed. Leakage and pressure tests shall be in accordance with methods set forth in Section 13, Hydrostatic Tests AWWA Standards C600-80.

L. If test of pipe laid discloses leakage greater than that specified, locate and repair defective joints until leakage is within specified allowance.

END OF SECTION 02660 - WATER DISTRIBUTION SYSTEM

SECTION 02675

DISINFECTION OF WATER DISTRIBUTION SYSTEMS

PART1 GENERAL

1.1 REFERENCES

A. AWWA C651-05 Disinfecting Water Mains.

1.2 SUBMITTALS

A. Test Reports: Indicate results comparative to specified requirements.

B. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

1.3 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01720.

B. Disinfection report; record:
1. Type and form and amount of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Chlorine residual before, during and after disinfection.
4. Test locations.
5. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological report; record:
1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.

D. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
1. Coliform bacteria test results for each outlet tested.
2. Certification that water conforms, or fails to conform, to bacterial standards of The State of Tennessee.
3. Bacteriologist's signature and authority.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI/AWWA C651-05.

1.5 QUALIFICATIONS

A. Personnel experienced in testing potable water systems.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code or regulation for performing work of this Section.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of water system.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: ANSI/AWWA B300, Hypochlorite.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping system has been cleaned, inspected, and pressure tested.

B. Perform scheduling and disinfection activity with startup, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 EXECUTION

A. Adhere to to the latest version, “Rules of TDEC, Division of Water Supply, Chapter 1200-5-1, Public Water Systems.”

B. Provide and attach required equipment to perform Work of this Section.

C. Inject treatment disinfectant into piping system sufficient to insure a chlorine dosage of at least 50 ppm in the lines. While solution is being applied, water shall be allowed to escape at ends of lines until tests indicate that a dosage of at least 50 ppm has been obtained throughout the pipe.

D. Maintain disinfectant in system for 24 hours. A residual of at least 25 ppm should be present in pipe at end of 24 hour period.

E. Flush, circulate and clean until required cleanliness is achieved; use municipal domestic water. A bacteriological sample will be taken and submitted for

approval to the State Health Department by the Contractor before lines are put into service. If samples are positive, lines shall be disinfected until a negative sample is obtained.

F. Replace permanent system devices removed for disinfection.

G. Pressure test system to 200 psi. Repair leaks and re-test.

3.3 QUALITY CONTROL

A. Provide analysis and testing of treated water under provisions of Section 01410.

3.4 All laboratory, equipment and labor costs to the WSD shall be invoiced to the Owner.

END OF SECTION 02675 - DISINFECTION OF WATER DISTRIBUTION SYSTEMS

SECTION 02730

SANITARY SEWER SYSTEM

PART1 GENERAL

1.1 REFERENCES

A. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

B. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

C. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

D. ANSI/ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

E. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

F. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

G. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

1.2 SUBMITTALS

A. Submit shop drawings under provisions of Section 01300 for system, showing pipe sizes, locations, elevations and slopes for horizontal runs. Include details of underground structures, fittings, connections, and mechanical equipment.

B. For staking sewer lines submit two copies of each "cut sheet" showing depths of cut from top of offset stake. If a laser beam is used, cut sheet shall also show cut for each 50'-0" station in order to compute depth of cut.

1.3 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01720.

B. Record location of pipe runs, connections, cleanouts, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.4 QUALITY ASSURANCE

A. Installer: A firm specializing and experienced in sanitary sewer system work for not less than 2 years.

B. Pipe: Pipe shipped to project site shall bear mark of the manufacturer with manufacturer's date of production and pertinent product testing specifications.

PART 2 PRODUCTS

2.0 GRAVITY PIPE

A. Ductile Iron Pipe: Pressure Class 52, AWWA C150 and AWWA C151; Service type, minimum inside nominal diameter of 8 inches for public mains and 6 inches for service lines.

1. Ductile Iron Pipe Joint Device: ANSI A21.11, rubber gasket joint devices.

B.. Plastic Pipe: ANSI/ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; SDR 35; minimum inside nominal diameter of 8 inches for public sewer lines and 6 inches for service lines.

1. Pipe Gaskets: Rubber ASTM D1869.
2. Minimum Pipe Stiffness (F/AY) at 5% Deflection: 26 for sizes when tested in accordance with ASTM D 2412.
3. Minimum thickness shall be as follows:

Nominal Size	Minimum Wall Thickness
6	0.180"
8	0.240"
10	0.300"
12	0.360"

2.1 PRESSURE PIPE

A. Ductile Iron Pipe for 4" diameter and larger Sewage Force Main: Pressure Class 52, ANSI A21.51, lined with 40 mils Protecto 401 Ceramic Epoxy or approved equal.

B. Plastic Pipe for small diameter sewage force mains, typically associated with the WSD's grinder sewer system: ANSI/ASTM D3034, Poly Vinyl Chloride (PVC) material; SDR 21;

2.1 PIPE ACCESSORIES

A. Pipe Connectors: Flexible pipe-to-manhole EPDM gaskets as specified in Section 02607.

B. Trace Wire (if applicable): Magnetic detectable conductor, metallic tape clear plastic covering, imprinted with "CAUTION BURIED SEWER LINE" in large letters.

C. Tap Saddle: Aluminum type, as manufactured by Ford or approved substitute.

D. House Line Connection Couplings: Standard manufacturer's product.
1. FERNCO
2. Substitutions: Under provisions of Section 01600.

E. Fittings: ASTM F477; SDR 35; same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
1. Manufacturer: HARCO
2. Substitutions: Under provisions of Section 01600.

2.2 BEDDING MATERIALS

A. Aggregate Fill: As specified in Section 02225.

B. Earth Fill: As specified in Section 02225.

C. Concrete: As specified in Section 03001.

D. Lean Concrete: As specified in Section 02225.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout

3.2 PREPARATION

B. Hand trim excavations to required elevations. Correct over excavation with bedding material or lean concrete as directed by project Engineer.

C. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate pipe trench in accordance with Section 02225 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Provide non-metallic sewer pipe except house connection lines with 2'-6" minimum cover in fields, yards, lawns, and other landscaped areas and 4'-0" minimum cover in streets, roads, shoulders and driveways.

1. Where the above minimum cover is not possible either encase pipe in concrete in accordance with Standard Drawings or at the direction of the WSD. Ductile iron pipe shall be used in this application.

a) For concrete encasement, place pipe on 6 inch concrete blocks positioned behind each pipe bell. Join pipe. Bring pipe to established grade by driving wooden wedges between pipe and concrete block.

b) Firmly affix pipe in place for true alignment. Backfill pipe trench with concrete to spring line of pipe. Suspend backfilling until concrete has attained its "initial set".

c) Backfill remainder of pipe trench with concrete to a point above pipe as shown on Standard Drawings, or as directed by the project Engineer and WSD. After 24 hours, complete backfill as specified herein.

d) Place mastic expansion joints across encasement, 25'-0" o.c.

D. Unless specifically directed otherwise by the project Engineer or where required to uncover or determine the presence of underground obstructions, do not open more than 300'-0" of trench ahead of pipe laying. Do not leave more than 200'-0" of open ditch behind pipe laying.

E. Unless specifically authorized otherwise by the project Engineer, do not excavate trenches wider than 18 inches plus nominal diameter of pipe at level of crown of pipe.

F. Open trench a minimum of 6" below bottom of pipe at proper line and grade.

G. Place aggregate fill material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth, compact to 95 percent. Provide aggregate fill 4 inches deep at house connections.

H. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with either ASTM C12 or ASTM D2321 and manufacturer's instructions. Seal joints watertight. Make house connections with same pipe material as collector sewer lines.

B. Wipe bell and spigot of each pipe clean before joint is made.

C. Coat surfaces of bell and gasket with a lubricating material in accordance with pipe manufacturer's instructions.

D. Align pipe as near as is practical to final grade and alignment with spigot entering bell of last section laid. Apply force to force spigot and gasket home in bell.

E. Begin laying of gravity sewer pipes in finished trenches, at lowest point so that spigot ends point in direction of flow.

F. Lay pipe to slope gradients indicated; with maximum variation from true slope of 0.05%, 1/16 inch in 10 feet.

1. Slope sewer lines to maintain a minimum velocity of 2'-0" per second when flowing full. The minimum slopes allowable are as follows:

a)

Line Size	Minimum Slope
8	0.26%
10	0.193%
12	0.151%

For additional pipe sizes and their associated minimum slopes use TDEC design criteria.

2. Lay service lines to a minimum grade of 1'-0" per 100'-0" (1/8" per foot).
3. Lay house connection lines as follows:
   a) 6 inch lines at 1'-0" per 100'-0" minimum.

G. Seal open ends with a stopper or bulkhead. Mark property line end of house connection on ground by a stake and a wire as shown on Drawings.

H. In general, tapping house connections into manholes will not be permitted unless otherwise approved by the WSD. Where it is necessary to do so, the invert of house connection shall not be higher than a point 3 inches below top of bench in manhole. Provide a trough in bench to prevent accumulation of solids on bench. If necessary, provide a standard drop connection for a house service that is tapped into a manhole.

J Plug open ends of pipe lines at end of each day's work.

K. Install aggregate fill at sides and over top of PVC pipe to minimum compacted thickness of 12 inches; compacted to 95 percent.

L. When a sewer line is located in a roadway or shoulder, backfill entire trench with aggregate fill.

M. Refer to Section 02225 for trenching requirements. Do not displace or damage pipe when compacting.

N. Refer to Section 02607 for manhole requirements.

O. Only one house shall be connected to one service line.

P. Install trace wire continuous over top of pipe and install tape 12 inches below grade.

Q. Provide concrete foundations under PVC tees and wyes to prevent settlement.

3.5 HOUSE LINE CONNECTIONS - NEW MAIN INSTALLATIONS

A. Make connection of a 4 inch house service line to the 6 inch service line using a FERNCO coupling sized appropriately.

B. Make connections of cast iron pipe and clay pipe with a special adapter.

C. If the house connection is being tied directly to sewer line, install sewer and service lines in accordance with this Section.

D. Make connection between house service line and sewer line, if no service line is available, by cutting in a factory tee and reconnecting pipes with PVC knock-on couplings.

3.6 CUSTOMER LINE CONNECTIONS - EXISTING MAIN INSTALLATIONS

A. If no service line is available from the sewer main, make connection using a tapping saddle with tee or cut-in tee with knock on coupling. Hammer taps are not allowed.

B. If service from the sewer main is available make connection using a hard coupling. No flexible couplings shall be allowed.

C. Allow inspection by City Inspector before backfilling.

3.7 ABANDONMENT OF NEW AND EXISTING SERVICES

A. For new service taps that have not been connected to a house or building, remove the rubber fernco cap and replace with PVC glue on cap at the stub-out location.

B. For existing sewer services previously connected to a house or building, the service line shall be cut and capped with PVC glue on cap, generally, at the R.O.W. or edge of easement.

3.8 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01410.

B. Request inspection prior to and immediately after placing bedding.

C. Upon completion of the Work, inspect sanitary sewer lines for leaks, defects, or cases of excess deflection. Repair and deficiencies to the satisfaction of the WSD.

D. Perform testing of completed pipe lines in accordance with local authorities having jurisdiction.

E. Make tests after completed backfilling.

3.9 VISUAL TESTS

A. Before backfilling lines, they should be inspected by the project Engineer and WSD. If acceptable, proceed with backfilling. Remove and correct joints, pipes, or other materials or workmanship found to be defective, without any extra compensation.

B. During and upon completion of construction, Architect/Engineer will make observations of the Work. Immediately repair leaks and defects found by such observation.

C. In addition to general cleanup and leakage, use the following standards to determine failure or defects of the Work:

1. Build sewers true to line and planned grade. Confirm In and Out inverts at all manholes to be consistent with approved plans. Note any deviations and notify the project Engineer and WSD. Replace or re-lay pipe that does not comply with the approved plans unless otherwise permitted by the WSD.

2. If PVC pipe is used, after complete backfilling, pull or float a ball thru a portion of pipe to test it for deflection. Ball shall be accurately sized to be 95% of pipe diameter of actual pipe used. Contractor will be directed by the project Engineer in his presence and witnessed by the WSD to perform this test on total pipe length of the project. One hundred percent of the tested Section shall pass this test. Mandrel testing shall not begin until thirty days after backfilling.

3.10 MANHOLE VACUUM TESTS

A. Perform a Manhole Vacuum Test of at least 10 inches Hg on manholes. Tests will be considered acceptable if the vacuum remains at 10 inches Hg or drops to no less than 9 inches Hg within two minutes. If manhole fails initial test, locate leak and make appropriate repairs, acceptable to the project Engineer and WSD. Furnish equipment necessary for this test including the manhole sealing apparatus, gauges, pump, plugs, and operating personnel.

3.11 AIR TESTS

A. Measurement of sewers subjected to air tests will be horizontal length of test section between manholes as determined by manhole stations, without allowances for service lines connected thereto.

B. Test sewer line in increments between manholes. Seal line at each end. Seal at one end shall have an orifice through which to pass air into pipe. Connect air supply to orifice at one end of line. Air supply line shall contain an on-off valve and a pressure having a range of from 0 to 5 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of plus or minus 0.04 psi.

C. Pressurize pipe line under test to 4 PSIG. Allow line to stabilize between 4 PSIG and 3.5 PSIG for a period of no less than 5 minutes. If necessary, add air to line to maintain pressure above 3.5 PSIG. After stabilization period, close valve. When line pressure drops to 3.5 PSIG, commence timing with a stop watch. Allow stop watch to run until such time as line pressure drops to 2.5 PSIG, then stop watch.

D. Compare time lapse with allowable time lapse in Schedule at end of this Section. If time lapse is greater than that specified, section undergoing test shall have passed and test may be discontinued at that time. If time is less than that specified, then line has not passed test and Contractor will be required to prepare line for retest.

E. Where ground water table is known to be above sewer, raise pressures by an amount equal to ground water pressure (0.433 psi per foot of water). Air

pressure test may be made with pipe in a dry or normal condition, but in event section fails to pass test, Contractor will be permitted to repeat test after having soaked pipe to produce moisture saturation.

F. Avoid over pressuring sewer and avoid blowing out test plugs. Do not enter an adjacent manhole while a section of sewer is under test. Plug and strap down service lines to prevent blowouts.

G. Low Pressure Air Test Time Interval Schedule in seconds

LENGTH (ft)	DIAMETER (inches)						
	8	**10**	**12**	**15**	**18**	**21**	**24**
25	24	37	54	78	85	106	138
50	48	75	109	156	170	212	277
75	72	117	163	234	256	319	416
100	97	151	218	312	341	425	555
125	121	189	273	390	426	531	694
150	145	227	327	468	512	638	833
175	169	265	382	547	547	744	972
200	194	303	436	625	682	851	1111
225	218	341	491	703	768	957	1250
250	242	379	546	791	853	1063	1389
275	267	417	600	859	938	1170	1528
300	291	455	655	937	1024	1276	1667
325	315	439	710	1016	1109	1382	1806
350	339	531	764	1094	1194	1489	1945

END OF SECTION 02730 - SANITARY SEWER SYSTEM

SECTION 02765

SANITARY SEWER MANHOLE REHABILITATION
(Level Yellow, Level Blue and Level Green Manhole Rehabilitation)

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary sewer manhole rehabilitation including:

1. Level “Yellow” Rehabilitation - Rehabilitation and leak-proofing of manholes by lining with spray applied or centrifugally cast lightweight structural reinforced concrete.

2. Level “Blue” Rehabilitation - Rehabilitation and leak-proofing of manholes by lining with spray applied epoxy resin systems.

3. Level “Green” Rehabilitation - Rehabilitation and leak-proofing of manholes as specified by Level “Yellow”, and followed by lining with spray applied epoxy resin systems.

4. The repair and sealing of the manhole base, invert, walls, corbel/cone, and chimney of brick, block, or precast manholes, including the removal of any unsound material.

5. The inspection and testing of the various types of work to insure compliance.

1.2 LINING SYSTEMS

A. The lining system used shall result in a monolithic structure to the shape and contour of the interior of the existing manhole. The lining system shall be completely water tight and free of any joints or openings other than pipe inlets, pipe outlets and the rim opening. The junction of the lining material with the pipe material at the inlets and outlets shall be watertight.

B. Lining system shall be of the type that allows rehabilitation of a concentric, eccentric or flat top manhole without removing the manhole ring and top section or corbel.

1.3 SUBMITTALS

A. Submit the following as required in Section 01340 at least 14 days prior to starting manhole rehabilitation:

1. Manufacturers' Certificate of Compliance certifying compliance with the applicable specifications and standards. The certifications shall list all materials furnished under this Section.
2. Certified copies of test reports of factory tests required by the applicable standards, the manufacturer, and this Section.
3. Manufacturer's handling, storage, and installation instructions and procedures.
4. Recommended lining thickness design to withstand groundwater pressure as specified in Part 3 of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. The materials used shall be designed, manufactured and intended for sewer manhole rehabilitation and the specific application in which they are used. The materials shall have a proven history of performance in sewer manhole rehabilitation. The materials shall be delivered to the job site in original unopened packages and clearly labeled with the manufacturer's identification and printed instructions. All materials shall be stored and handled in accordance with recommendations of the manufacturer. All materials shall be mixed and applied in accordance with the manufacturer's written instructions.

2. The Contractor shall warrant and save harmless the Owner and his Engineer against all claims for patent infringement and any loss thereof.

3. Handle and store all materials and dispose of all wastes in accordance with applicable regulations.

4. Each system shall be designed for application over wet surfaces (but not active running water) without degradation of the final product and/or the bond between the product and the manhole surfaces.

B. Stopping active leaks in concrete and masonry manholes:

1. A quick setting hydraulic cement compound used to stop seepage leaks in masonry or concrete (Permacast-Plug or equal). A premixed fast-setting, volume-stable waterproof cement plug

consisting of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents. It shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder or gas-forming agents, or promote the corrosion of steel it may come in contact with. Set time shall be approximately 60 to 180 seconds. Ten-minute compressive strength shall be approximately 500 psi.

2. The elastomeric polyurethane resin-soaked method, using dry twisted jute oakum or resin-rod with polyurethane resin (water activated).

3. Chemical grouts (Avanti AV-202 Multigrout Urethane Resin or equal) injected to the exterior for stopping *very* active infiltration in accordance with manufacturer's recommendations.

C. Patching, repointing, filling, and repairing nonleaking holes, cracks, and spalls in concrete and masonry manholes:

1. A premixed nonshrink cement-based patching material consisting of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents, which has been formulated for vertical or overhead use. It shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder, or gas-forming agents or promote the corrosion of steel it may come into contact with. Set time (ASTM C-191) shall be less than 30 minutes. One-hour compressive strength (ASTM C-109) shall be a minimum of 200 psi and the ultimate compressive strengths (ASTM C-882-Modified) shall be a minimum of 1700 psi.

D. Spray applied or centrifugally cast lightweight structural reinforced cement manhole lining:

1. The material applied to the surface of the manhole (similar to Strong Seal MS-2, Permacast CR-9000, or Quadex QM-1S) shall be a cementitious blend of acid resistant binders, silicious aggregates, non-metallic fibers and other additives for constructing a liner that is impervious to the flow of water, is resistant to sulfide attack, and restores structural integrity to existing manhole walls.

2. A monolithic liner shall be formed which covers all interior manhole surfaces and shall have the following minimum requirements at 28 days:

a. Compressive Strength (ASTM C-109) 9,000 psi

b. Tensile Strength (ASTM C-496) 600 psi

c. Flexural Strength (ASTM C-293) (Modified) 750 psi
d. Shrinkage (ASTM C-596)
0%@90%R.H.
e. Bond (ASTM C-882) 2,000 psi
f. Density, when applied 135± pcf

E. Spray applied epoxy resin system manhole lining:

1. The material sprayed onto the surface of the manhole shall be an epoxy resin (similar to Raven 405, or Warren Environmental Systems M-201 and S-301) system formulated for application within a sanitary sewer environment. The resin will exhibit suitable corrosion resistance and enhance the structural integrity of the existing manhole.

2. The cured epoxy resin system shall conform to the following minimum structural standards:

CURED PRODUCT	TEST METHOD	EPOXY RESULTS
Tensile Strength	ASTM D-638	7,000 psi
Flexural Strength	ASTM D-790	11,000 psi
Flexural Modulus	ASTM D-790	500,000 psi
Compressive Strength	ASTM D-695	12,000 psi

PART 3 - EXECUTION

3.1 REHABILITATION OF MANHOLE STRUCTURE

A. General Procedures:

1. Safety: The Contractor shall perform all work in strict accordance with all applicable OSHA, TOSHA, and manufacturer's safety standards. Each method of manhole rehabilitation in this Section requires some degree of manhole entry by workers. Particular attention is drawn to those safety requirements regarding confined space entry and respiratory protection from airborne particulate materials during cleaning and product mixing and application.

2. Cleaning: All concrete and masonry surfaces to be rehabilitated shall be clean. All grease, oil, laitance, coatings, loose bricks, mortar, unsound brick or concrete and other foreign materials shall be completely removed. Water blasting utilizing a 210° F steam unit and proper nozzles shall be the primary method of cleaning; however, other methods such as wet or dry sandblasting, acid wash, concrete cleaners, degreasers or mechanical means may be required to properly clean the surface. All surfaces on which these methods are used shall be thoroughly rinsed, scrubbed, and neutralized to remove cleaning agents and their reactant products. Debris resulting from cleaning shall be removed from the manhole and not allowed to be carried downstream.

3. Stop Infiltration: After surface preparation and prior to the application of mortars and linings, infiltration shall be stopped. This applies to defects within the manhole as well as any annular spaces between a host pipe and pipe liner. Water seepage shall be stopped with waterproof cement plug material or water activated polyurethane resins. Severe leaks which cannot be stopped with either of these two specified materials shall be reported to the Owner. If so directed by the Owner, then these severe leaks shall be stopped using chemical (urethane) grout injected through the manhole wall, the invert or the bench (as appropriate). Excess cured grout shall be completely removed from the inside surface before further patching or lining.

4. Patching: All large holes or voids around steps, joints or pipes, all spalled areas and all holes caused by missing or cracked brick shall be patched and all missing mortar repointed using a nonshrink patching mortar. All cracked or disintegrated material shall be removed from the area to be patched or repointed, exposing a sound subbase. All cracks not subject to movement and greater than 1/16 inch in width shall be routed out to a minimum width and depth of 1/2 inch and patched with nonshrink patching mortar.

5. Flow Control: The Contractor shall be responsible for plugging or diverting the flow of sewage as needed for repair and lining of manhole inverts and benches.

6. Remove all loose grout and rubble from existing channel. Work shall include aligning inflow and outflow ports in such a manner as to prevent the deposition of solids at the transition point. All inverts shall follow the grades of the pipe entering the manhole. Changes in direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the

manhole will permit, but will be shaped to allow easy entrance of maintenance equipment including buckets, T.V. camera, etc.

7. Manhole steps: Inspect all manhole steps prior to rehabilitation. Report to the Engineer any steps which appear loose, deteriorated, broken, or otherwise unsafe.

8. Each system shall be installed in accordance with the manufacturer's recommendation to withstand groundwater pressures. For manholes greater than 12 feet in depth, the lining shall withstand the pressures associated with a groundwater depth equal to the manhole depth. Linings for all other manholes shall withstand the pressures associated with groundwater depth of 12 feet. Measure groundwater depth from manhole bench to top of ground surface.

9. Application of products shall be by factory certified applicators.

3.2 SPRAY APPLIED LIGHTWEIGHT STRUCTURAL REINFORCED CEMENT (Level “Yellow” and Level “Green”)

A. The surface prior to spraying shall be damp without noticeable free water droplets or running water. Materials shall be spray-applied to a minimum uniform thickness to insure that all cracks, crevices, and voids are filled and a somewhat smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond.

B. The first application shall have begun to take an initial set (disappearance of surface sheen which could be 15 minutes to 1 hour depending upon ambient conditions) before the second application to assure a minimum total finished thickness of 1/2 inch. The final finished thickness may need to be greater than 1/2 inch as recommended by the manufacturer to withstand groundwater pressures. A depth gauge shall be used during application, at various locations, to verify the required thickness. The surface then shall be troweled to smooth finish with care taken not to over trowel so as to bring additional water to the surface and weaken it. Manufacturer's recommendations shall be followed whenever more than 24 hours have elapsed between applications.

C. The bench covers used to catch debris shall be removed and the bench and invert sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than 1/2 inch. The wall-bench intersection shall be rounded to a uniform radius the full circumference of the intersection.

D. No application shall be made to frozen surfaces or if freezing is expected to occur within the manhole for 24 hours after application. If ambient temperatures are in excess of 95° F, precautions shall be taken to keep the mix temperature at time of application below 90° F, using ice if necessary.

E. The final application shall have a minimum of four (4) hours cure time before being subjected to active flow.

3.3 CENTRIFUGALLY CAST STRUCTURAL REINFORCED CEMENT (Level "Yellow" and Level "Green")

A. The rotating casting applicator shall be positioned to evenly apply the material and be withdrawn at a rate to assure a final minimum thickness of 1/2-inch. The final finished thickness may need to be greater than 1/2-inch as recommended by the manufacturer to withstand groundwater pressures. A depth gauge shall be used during application, at various locations, to verify the required thickness.

B. The bench covers used to catch debris shall be removed and the bench and invert sprayed or hand applied so that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than 1/2-inch. The wall-bench intersection shall be rounded to a uniform radius the full circumference of the intersection.

C. No application shall be made to frozen surfaces or if freezing is expected to occur within the manhole for 24 hours after application. If ambient temperatures are in excess of 95° F, precautions shall be taken to keep the mix temperature at time of application below 90° F.

D. The final application shall have a minimum of one (1) hour cure time before being subjected to active flow.

3.4 SPRAYED APPLIED EPOXY RESIN SYSTEM (Level "Blue" and Level "Green")

A. The epoxy resin shall be sprayed onto the surfaces of the manhole walls, and the benches to produce a smooth coating and yield the required structural integrity and corrosion resistance. A depth gauge shall be used during application at various locations to verify the required thickness.

B. The epoxy resin shall be applied to a minimum thickness of 0.125 inches at the top of the manhole and gradually thickened, in accordance with manufacturer's recommendations, to withstand groundwater pressures. The application shall have a minimum of three hours cure time before being subjected to active flow.

C. The sloped surface of the manhole bench shall be made non-skid by broadcasting aluminum oxide or sand into the surface prior to gelatin/set.

3.5 MANHOLE REHABILITATION ACCEPTANCE

A. Any visible leakage in the manhole or structure, before, during, or after the test shall be repaired regardless of any test results.

B. Testing for Level "Yellow" and Level "Green" Rehabilitation (lightweight structural reinforced concrete).

1. Two test cubes (2" cube specimens according to ASTM C 109/C) of the spray applied or centrifugally cast lightweight structural reinforced concrete material shall be taken randomly as directed by the inspector at contractors's expense to verify strengths.
2. Thickness shall be verified with a wet gage at any random point of the new interior surface. Any areas found to be thinner than the minimum specified thickness shall immediately receive additional material.

C. Testing for Level "Blue" and Level "Green" Rehabilitation (epoxy coating).

1. During application a wet film thickness gauge, meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used. Measurements shall be taken, documented and attested to by Contractor for submission to Owner.

2. After the coating product(s) have set in accordance with manufacturer instructions, all surfaces shall be inspected for holidays with high-voltage holiday detection equipment. Reference NACE RPO 188-99 for performing holiday detection. All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional coating can be hand applied to the repair area. All touch-up/repair procedures shall follow the coating manufacturer's recommendations. Documentation on areas tested, results and repairs made shall be provided to Owner by Contractor.

END OF SECTION

SECTION 02936

SEEDING

PART 1 GENERAL REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.1 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perrenial Sorrel and Brome Grass.

1.2 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.3 SUBMITTALS

A. Submit seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentage of purity, germination, and weed seed for each grass seed species.

B. Submit minimum 10 oz sample of grass seed mixture proposed.

1.4 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.5 TESTS

A. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

1.6 MAINTENANCE DATA

A. Submit maintenance data for continuing Owner maintenance under provisions of Section 01400.

B. Include maintenance instructions, cutting method and maximum height; and types, application frequency, and recommended coverage of fertilizer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed in original, sealed containers. Damaged packages are not acceptable

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.8 MAINTENANCE SERVICE

A. Maintain seeded areas for three months from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Certified seed to be latest season's crop, labeled in conformance with USDA regulations and applicable state laws.

B. Seed Mixture:
1. Kentucky 31 Fescue: 50 percent.
2. Norlea Perennial Rye: 30 percent.
3. White Clover: 20 percent.

2.2 SOIL MATERIALS

A. Topsoil: Natural, fertile, agricultural soil typical of locality, capable of sustaining vigorous plant growth, from well drained site free of flooding, not in frozen or muddy condition, not less than 6% organic matter, and pH value of 5.9 to 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, weeds and foreign matter.

B. Topsoil: Excavated from site and free of weeds.

2.3 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: FS O-F-241, type and grade recommended for grass, with 50% of the elements derived from organic sources; of proportion necessary to

eliminate deficiencies of topsoil to the following proportions: 18% nitrogen, 24% phosphoric acid, and 6% potassium.

C. Water: Clean, fresh and free of substance or matter which could inhibit vigorous growth of grass.

D. Herbicide: 25% Prometon: 2, 4-bis, and 75% inert ingredients.

E. Stakes: Softwood lumber, chisel pointed.

F. String: Inorganic fiber.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify that prepared soil base is ready to receive the work of this Section.

B. Beginning of installation means acceptance of existing site conditions.

3.2 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make change in grade gradual. Blend slopes into level areas.

B. Protect existing underground improvements from damage.

C. Remove foreign materials, plants, roots, stones, and debris, from site. Do not bury foreign material.

D. Remove contaminated subsoil.

E. Cultivate to depth of 3 inches, area to receive topsoil. Repeat cultivation in areas where equipment has compacted subgrade.

3.3 PLACING TOPSOIL

A. Spread topsoil to depth of 6 inches over area to be seeded. Place during dry weather, and on dry, unfrozen subgrade. Provide imported topsoil if a sufficient amount is not available on site.

B. Cultivate topsoil to depth of 6 inches with mechanical tiller. Cultivate inaccessible areas by hand. Rake until surface is smooth.

C. Remove from site, foreign materials collected during cultivation.

D. Grade to eliminate rough, low or soft areas where ponding may occur. Maintain smooth, uniform grade.

E. Assure positive drainage away from buildings.

F. Finish ground level firm and sufficient to prevent sinkage pockets when irrigation is applied.

3.4 FERTILIZING

A. Apply fertilizer, at a rate of 16 lbs per 1,000 square feet.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply grass seed and fertilizer at same time, in same machine.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid breakdown of fertilizer and to provide moist soil for seed.

3.5 SEEDING

A. Apply seed at a rate of 8 lbs per 1,000 square feet evenly in two intersecting directions. Rake in lightly. Do not seed area in excess of that which can be mulched on same day.

B. Do not sow immediately following rain, when ground is too dry, or during windy periods.

C. Roll seeded area with roller not exceeding 112 lbs.

D. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.

E. Apply water with a fine spray after each area has been mulched. Saturate to 4 inches of soil.

3.6 MAINTENANCE

A. Maintain surfaces and supply additional topsoil where necessary, including areas affected by erosion.

B. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

C. Neatly trim edges and hand clip where necessary.

D. Immediately remove clippings after mowing and trimming.

E. Water to ensure uniform seed germination and to keep surface of soil damp.

F. Apply water slowly so that surface of soil will not puddle and crust.

G. After first mowing water grass sufficient to moisten soil from 3 inches to 5 inches deep.

H. Apply weed killer when weeds start developing, during calm weather when air temperature is above 50 degrees F.

I. Replant damaged grass areas showing root growth failure, deterioration, bare or thin spots, and eroded areas.

3.7 RESTORATION

A. Restore pavement, concrete, grassed areas, planted areas, and structures damaged during execution of work of this Section.

3.8 ACCEPTANCE

A. Seeded areas will be accepted at end of maintenance period when seeded areas are properly established and otherwise acceptable.

3.9 FIELD QUALITY CONTROL

A. Provide Field Quality Control under provisions of Section 01400.

B. Cooperate with Architect/Engineer in field and provide 4 samples of actual seed being used in Project, 6 oz minimum each, as chosen by Architect/Engineer from random locations.

C. Correct Work not in conformance with this Section.

END OF SECTION 02936 - SEEDING

SECTION 03001

CONCRETE

PART 1 GENERAL

1.1 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 318 - Standard Building Code Requirements for Reinforced Concrete, Latest Revision.

C. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

D. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.

E. ASTM C33 - Concrete Aggregates.

F. ASTM C94 - Ready-Mixed Concrete.

G. ASTM C150 - Portland Cement.

H. ASTM C260 - Air Entraining Admixtures for Concrete.

I. ASTM C494 - Water Reducing Admixture.

J. ASTM D2103 - Polyethylene Film and Sheeting.

K. ASTM C309 - Liquid Membrane Forming Compounds for Curing Concrete.

1.2 SHOP DRAWINGS

A. Submit shop drawings of reinforcing steel under provisions of Section 01300.

B. Submit shop drawings in accordance with ACI Detailing Manual 315 and Manual of Standard Practice by the Concrete Reinforcing Steel Institute.

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

D. Indicate formwork dimensioning, materials, arrangement of joints and ties.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with ACI 318.

B. Maintain copy of ACI 301 on site.

C. Confirm compatibility of curing and sealing materials with adhesives used in finish flooring application as specified in Division 9 - Finishes.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable codes for site.

1.5 TESTS

A. Testing and analysis of concrete shall be performed under provisions of Section 01400 by an ACI-certified Concrete Field-Testing Technician, Grade I.

B. Submit proposed mix design per Chapter 5 of ACI 318-89 for each class of concrete to WSD for review prior to commencement of work. Report should be not more than six months old.

C. Tests of cement and aggregates will be performed to ensure conformance with requirements stated herein.

D. Three concrete test cylinders will be taken for every 50 or less cu. yds. of each class of concrete placed each day.

E. One additional test cylinder will be taken during cold weather and be cured on site under same conditions as concrete it represents.

F. One slump test and one air entrainment will be taken for each set of test cylinders taken.

PART 2 PRODUCTS

2.1 FORM MATERIALS

A. Conform to ACI 301.

2.2 REINFORCING STEEL

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade, billet steel deformed bars; uncoated finish.
   1. Reinforcing Bars, 3/8 inch Diameter: 40 ksi yield grade.

B. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; uncoated finish.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150 normal - Type 1 Portland.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.4 ADMIXTURES

A. Air Entraining Admixture: ASTM C260, with the following limits: 3% for maximum 2" aggregate, 5% for maximum 3/4" aggregate, and 6% for maximum 1/2" aggregate.

B. Water Reducing Admixture: ANSI/ASTM C494, Type A.

2.5 ACCESSORIES

A. Epoxy Bonding Agent:
   1. "Brutem"; Master Builders.
   2. Substitutions: Under provisions of Section 01600.

B. Bonding Agent: High solids content, water dispersion of acrylic bonding polymers specifically compounded for use as a bonding agent between new to old or new to new concrete.

C. Vapor Barrier: ASTM D2103, 6 mil thick clear polyethylene film.

D. Non-Shrink Grout: Corps of Engineers CRD-C 621, premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 5000 psi.

E. Dovetail Anchor Slots: Minimum 18 gage thick galvanized steel; foam non-filled; release tapes; sealed slots; bent tab anchors.

F. Waterstops: Polyvinylchloride; Corps of Engineers C-572-74; size to suit joints; heat sealed joints; profiles as indicated on Drawings.

G. Construction Joints: Tongue and Groove metal joint material.

H. Joint Filler: ASTM D994, bituminous impregnated fiberboard.

I. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.

2.6 CURING MATERIALS

A. Membrane Curing and Sealing Compound: ASTM C309, Type I, Class B; clear, non-yellowing, acrylic polymer compound suspended in solvents, to cure and seal concrete.

B. Water: Clean and drinkable.

C. Absorptive Mat: Burlap fabric, clean roll goods.

2.7 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94.

B. Structural Concrete:
   1. Compressive Strength (28 days): 4000 psi. Slump: 4 inch.

C. Foundation and Slab on Fill Concrete:
   2. Compressive Strength (28 days): 3000 psi. Slump: 4 inch.

D. Manhole Bases:
   1. Minimum Cement Content: 6.0 bags (564 lbs) per cubic yard.
   2. Minimum 28-Day Compressive Strength: 3500 psi - average of any three cylinders.
   3. Anticipated 28-Day Compressive Strength: 3700 psi, plus.
   4. Slump: 2-1/2" to 5".

E. Concrete used for Encasement for Sewer Lines, Man-hole Drop Connections, and Inverts:
   1. Minimum Cement Content: 5.0 bags (470 lbs) per cubic yard.
   2. Minimum 28-Day Compressive Strength: 2500 psi - average of any three cylinders.
   3. Slump: 5" to 8".

F. Add air entraining agent ASTM C260 to mix for concrete exposed to freeze-thaw cycling.

G. Use water reducing admixtures.

H. Calcium Chloride: Admixtures shall not exceed 0.1% chloride ions.

PART 3 EXECUTION

3.1 FORMWORK ERECTION

A. Verify lines, levels and measurement before proceeding with formwork.

B. Hand trim sides and bottom of earth forms; remove loose dirt.

C. Align form joints.

D. Do not apply form release agent where concrete surfaces receive special finishes or applied coatings which may be affected by agent.

E. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.

3.2 REINFORCEMENT

A. Place, support and secure reinforcement against displacement.

B. Locate reinforcing splices where indicated and required. At splices lap reinforcing steel 30 bar diameters with 2'-0" minimum and wire together.

3.3 PLACING CONCRETE

A. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.
1. Place concrete in accordance with ACI 301.
2. Hot Weather Placement: ACI 301.
3. Cold Weather Placement: ACI 301.

B. Install vapor barrier under interior floor slabs on fill. Lap joints minimum 6 inches and seal. Do not disturb vapor barrier while placing reinforcement.

3.4 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill in holes and openings left in concrete, including passage of work by other trades.

3.5 TOLERANCES

A. Provide random traffic floor slab with overall flatness and levelness value of F25/17 and minimum local value of F13/10 according to ASTM E1155. Pitch to drains 1/4 inch per foot nominal.

3.6 EXISTING WORK

A. Where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-shrinking grout.

B. Prepare previously placed concrete by cleaning with steel brush and apply bonding agent in accordance with manufacturer's instructions.

3.7 SCHEDULE OF FORMED SURFACES

A. Rough form finish at concrete surfaces not exposed to view.

B. Smooth form finish at concrete surfaces exposed to view and at surfaces that are to be covered with a coating material applied directly to concrete, such as waterproofing, dampproofing, painting or similar system.

END OF SECTION 03001 - CONCRETE

SECTION 11335

GRINDER PUMP UNITS

PART 1 GENERAL

1.1 GENERAL DESCRIPTION

A. The Manufacturer shall furnish complete factory-built and tested Grinder Pump Unit(s), each consisting of a grinder pump core suitably mounted on an integral stand of stainless steel, electrical quick disconnect (NEMA 4X), pump removal harness, discharge hose and shut- off valve, anti-siphon valve and check valve assembly, electrical alarm/disconnect panel, and all necessary internal wiring and controls. For ease of serviceability, all pump motor/grinder units shall be of like type and horsepower throughout the system. The City's grinder pump maintenance program applies only to individual residential simplex grinder pump units. Duplex or larger grinder pump units shall not be included in the program.

1.2 GENERAL LAYOUT

A. The layout of the grinder pump basin shall generally be within 25' of the residence and easily accessible to maintenance crews. The basin shall not be installed in any permanently improved space such as in a patio, pool area, driveway, or heavily landscaped area nor shall it be constructed underneath an improvement such as a deck, car port, gazebo, etc. The pressure service line to the sewer force main shall be aligned to minimize crossing improvements such as sidewalks and driveways but when necessary all crossings shall be perpendicular to the improvement and sleeved for ease of maintenance. The curb stop ball valve and redundant check valve assembly shall be generally located in the yard near the R.O.W. The assemble shall be no deeper that 24" to finished grade. The control panel shall be installed generally no farther than 25' from the basin without prior approval from Brentwood Water Services (BWS). The panel shall be in line of sight from the basin and shall be installed adjacent to a 30 amp disconnect on the power supply from the house panel. Any deviations from these guidelines must be preapproved by BWS.

1.3 SHOP DRAWINGS

A. After receipt of notice to proceed, the Manufacturer shall furnish shop drawings detailing the equipment to be furnished including dimensional data and materials of construction. Upon receipt of accepted shop drawings, the Manufacturer shall proceed immediately with fabrication of the equipment.

1.3 MANUFACTURER

A. The equipment specified shall be a product of a company with experience in the design and manufacture of grinder pumps for specific use in low pressure sewage systems. The company shall submit detailed installation and user instructions for its product; submit evidence of an established service program including complete parts and service manuals, and be responsible for maintaining a continuing inventory of grinder pump replacement parts.

1.4 OPERATING CONDITIONS

A. The pumps shall be capable of delivering 15 GPM against a total dynamic head of 0 feet (0 PSIG) and 7.8 GPM against a total dynamic head of 185 feet (80 PSIG) at a maximum of 8.0 amps. The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

1.5 WARRANTY

A. The grinder pump Manufacturer shall provide a part(s) and labor warranty on the complete station and accessories, including, but not limited to, panel and redundant check valve, for a period of twenty-four (24) months after notice of Owner's acceptance, but no greater than twenty-seven (27) months after receipt of shipment. Any defects found during the warranty period will be reported to the Manufacturer by the Owner.

PART 2 PRODUCT

2.1 PUMP

A. The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with mechanical seal. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. Buna N is not acceptable as a stator material. The material shall be suited for domestic waste water service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, good aging properties, and outstanding wear resistance.

2.2 GRINDER

A. The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece stainless steel motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder will be of the rotating type with a stationary hardened and ground chrome steel shredding ring spaced in accurate close annular alignment with the driven impeller assembly, which shall carry two hardened type 400 series stainless steel cutter bars.

B. This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:
   1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
   2. The inlet shroud shall have a diameter no less than 5 inches.
   3. At maximum flow the average inlet velocity must not exceed 0.2 feet per second.
   4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

C. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects", such as paper, wood, plastic, glass, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter s/s discharge piping.

2.3 ELECTRIC MOTOR

A. The motor shall be a 1 HP, 1725 RPM, 120 or 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application.

2.4 MECHANICAL SEAL

A. The core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat

and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.5 DISCHARGE HOSE AND SLIDEFACE DISCONNECT/VALVE

A. All discharge fittings and piping shall be constructed of 304 Series stainless steel, polypropylene or PVC. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick disconnect feature to simplify installation and removal.

2.6 ELECTRICAL QUICK DISCONNECT

A. The grinder pump unit shall include a single NEMA 4X electrical quick disconnect for all power and control functions. An integral tube shall allow venting of the control compartment to assure proper operation of the pressure switch level system. The grinder pump will be furnished with a length of 6 conductor, 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements.

2.7 CHECK VALVE

A. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge pipe. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Working parts will be made of a 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 an injection molded part made of glass filled PVC.

B. Each grinder pump station shall also include a separate curb stop valve assembly including a wastewater check valve and a ball valve installed on the 1 ½" PVC service lateral at the R.O.W. or edge of easement. The curb stop valve assembly shall be pressure-tight in both directions. The ball valve actuator shall include position stop features at the fully opened and closed positions. The curb stop/check valve assembly shall be designed to withstand a working pressure of 235 psi. The stainless steel check valve shall be integral with the curb stop valve. The check valve will provide a full-ported 1-1/4" passageway and shall introduce minimal friction loss at maximum rated flow. The flapper hinge design shall provide a maximum degree of freedom and ensure seating at low back pressure.

2.8 CORE UNIT

A. The Grinder Pump Station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit shall be established by 100% factory test at a minimum of 5 PSIG.

2.9 CONTROLS

A. All necessary controls shall be located in the top housing of the core unit. The top housing will be attached with stainless steel fasteners. Non-fouling waste water level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the waste water. High-level sensing will be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type.

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

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

2.10 ALARM/DISCONNECT PANEL

A. Each grinder pump station shall include a NEMA 3R, UL listed ALARM/DISCONNECT PANEL suitable for wall or pole mounting. The NEMA 3R enclosure shall be manufactured of thermoplastic to assure corrosion resistance. The enclosure shall include a hinged, pad lockable cover, secured dead front and component knockouts. The enclosure shall not exceed 7.5"W x 8.75"H x 3.75"D.

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

C. The Alarm/Disconnect Panel shall include the following features: audio & visual alarm, push to run switch, and high level (redundant) pump starting control. The alarm sequence is to be as follows:
   1. When liquid level in the sewage wet-well rises above the alarm level, visual and audio alarms will be activated. The contacts on the alarm pressure switch will close. The redundant pump starting system will be energized.
   2. The audio alarm may be silenced by means of the externally mounted, push-to-silence button.

3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.

D. The visual alarm lamp shall be inside a red fluted lens at least 2 5/8" in diameter and 1 11/16" in height. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 3R rating. For duplex units, in addition to the above, two high level indicator lights shall be mounted behind the access cover. During a high level alarm condition the appropriate light will illuminate to indicate which pump core requires servicing.

E. The audio alarm shall be a printed circuit board in conjunction with an 86 dB buzzer with quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being de-activated by depressing a push-type switch which is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure.

F. The entire Alarm/Disconnect Panel as manufactured, shall be listed by Underwriters Laboratories, Inc.

2.11 SERVICEABILITY

A. The grinder pump core unit shall have two lifting hooks complete with polypropylene lift-out harness connected to its top housing to facilitate easy core removal when necessary. All mechanical and electrical connections must provide easy disconnect accessibility for core unit removal and installation. A push to run feature will be provided for field trouble shooting.

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

2.12 CORROSION PROTECTION

A. All materials exposed to waste water shall have inherent corrosion protection. Acceptable corrosion protection includes epoxy powder coat, cast iron, fiberglass, stainless steel, PVC.

2.13 SAFETY

A. The Grinder Pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired Grinder Pump Station in its tank shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use.

B. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from objectionable noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the National Sanitation Foundation seal.

PART 3 EXECUTION

3.1 FACTORY TEST

A. Each grinder pump shall be submerged and operated for 5 minutes (minimum). Included in this procedure will be the testing of all ancillary components such as, the anti-siphon valve, check valve, discharge line, level sensors and each unit's dedicated controls. All factory tests shall incorporate each of the above listed items. Actual appurtenances and controls which will be installed in the field, shall be particular to the tested pump only. A common set of appurtenances and controls for all pumps will not be acceptable. The Engineer reserves the right to inspect testing procedures with representatives of the Owner, at the grinder pump Manufacturer's facility.

3.2 DELIVERY

A. All Grinder Pump units will be delivered to the job site, 100% completely assembled, including testing, ready for installation.

3.3 INSTALLATION

A. Remove packing material. Users instructions MUST be given to the WSD.
   1. Hardware supplied with the unit, if required, will be used at installation. Once installed, the property shall be restored to its original condition in all respects, including, but not limited to, curb and sidewalk replacement, landscaping, loaming and seeding, and restoration of the traveled ways, as directed by the WSD.
   2. The electrical enclosure shall be furnished, installed and wired to the Grinder Pump Station by the Contractor. An alarm device is required on every installation, there shall be NO EXCEPTIONS. Location of the grinder unit and panel shall be at the direction of the WDS.

B. The CONTRACTOR shall mount the alarm device in a conspicuous location approved by the WSD, as per national and local codes. The Alarm/disconnect Panel will be connected to the Grinder Pump Station by a length of six (6) conductor 12 gauge TC type cable in conduit as shown on

the contract drawings. The power and alarm circuits must be on separate power circuits.

3.4 START-UP AND FIELD TESTING

A. The Manufacturer shall provide the services of qualified factory trained technician(s) who shall inspect the placement and wiring of each station, perform field tests as specified herein, and instruct the WSD's personnel in the operation and maintenance of the equipment before the stations are accepted by the WSD. All equipment and materials necessary to perform testing shall be the responsibility of the Developer or installing Contractor.

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

1. Make certain the discharge shut-off valve is fully open. This valve must not be closed when the pump is operating. In some installations, there may be a valve(s) at the street main that must also be open.
2. Turn ON the alarm power circuit.
3. Fill the wet well with water to a depth sufficient to verify the high level alarm is operating. Shut off water.
4. Turn ON pump power circuit. Initiate pump operation to verify automatic "on/off" controls are operative. Pump should immediately turn ON. Within one (1) minute alarm light will turn OFF. Within three (3) minutes the pump will turn OFF.

C. Upon completion of the start-up and testing, the Manufacturer shall submit to the project Engineer and WSD the start-up authorization form describing the results of the tests performed for each Grinder Pump Station. Final acceptance of the system will not occur until authorization forms have been received for each pump station installed.

3.5 MANUALS

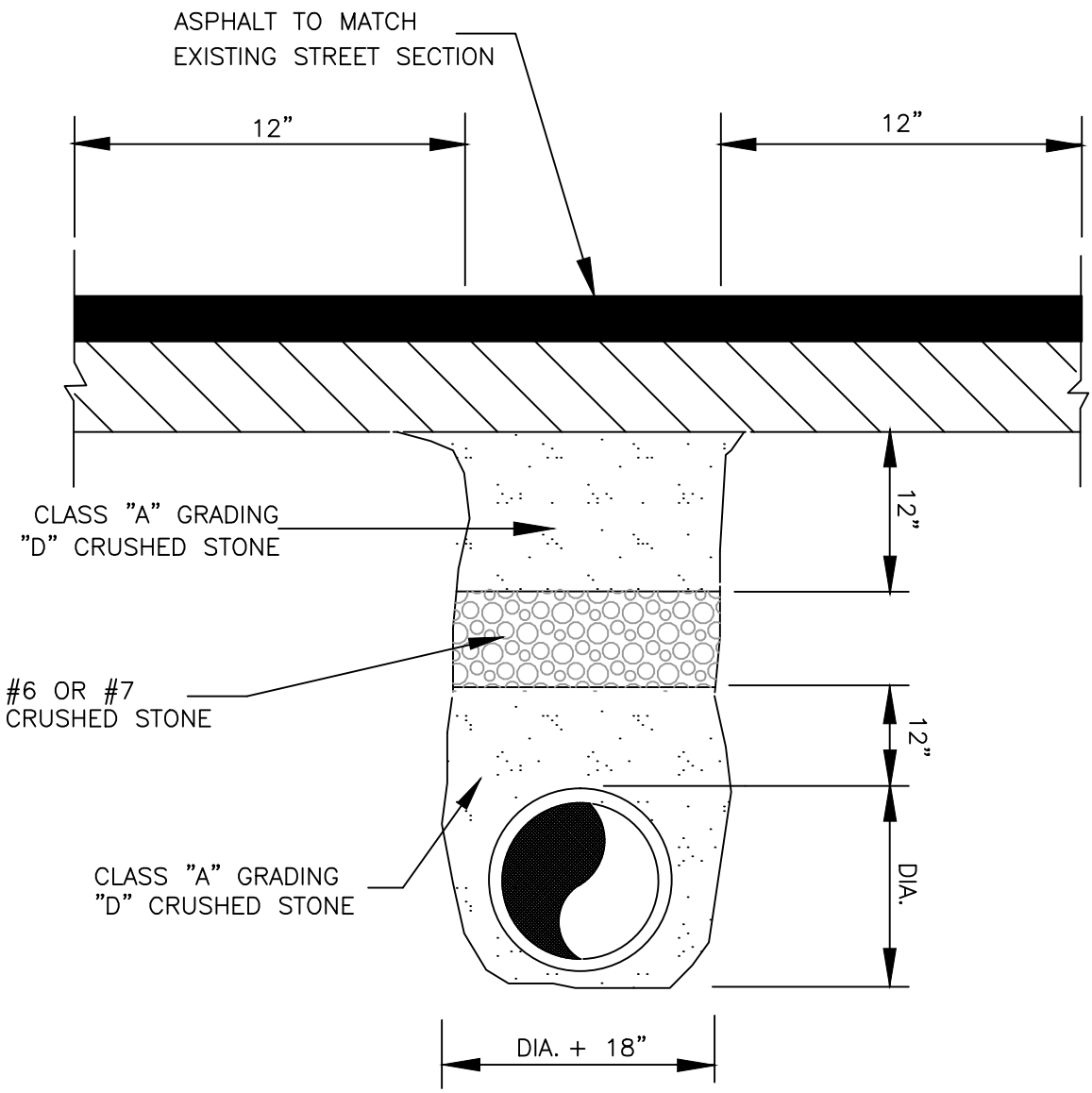
A. The Manufacturer shall supply two (2) copies of Operation and Maintenance Manuals to the WSD.

END OF SECTION 11335 - GRINDER PUMP UNITS

APPENDIX I
STANDARD DRAWINGS

BRENTWOOD WATER SERVICES
STANDARD DRAWING INDEX

WATER		SEWER		GENERAL	
W1	Typical Trench Section	S1	Standard Manhole	G1	Street Replacement Trench Width
W2	Fire Hydrant Assembly	S2	Standard Precast Manhole Sections	G2	Street Replacement – Full Overlay
W3	Concrete Thrust Blocking – Tee / Plug	S3	Standard Precast Shallow Manhole	G3	Boring Detail
W4	Concrete Thrust Blocking - Bends	S4	Standard Drop Manhole	G4	Concrete Cap
W5	Concrete Anchor	S5	Manhole Covers	G5	
W6	¾" Service Assembly	S6	Service Connection	G6	
W7	1" Meter Assembly	S7	Manhole Vent Detail	G7	
W8	2" & 3" Meter Assembly	S8	Sewage Air Release Valve	G8	
W9	Combination Fire and Domestic Meter Pit	S9	Grinder Pump Details	G9	
W10	Fire Meter Box	S10	Grinder Pump Layout	G10	
W11	Reduced Pressure Backflow Preventer	S11	Force Main Service Valve Box	G11	
W12	Fire Service Backflow Preventer	S12	Force Main Connection to Existing Manhole	G12	
W13	Gate Valve, Box and Cover w/ Concrete Pad	S13		G13	
W14	Air Valve and Vault	S14		G14	
W15	Typical Small Meter and Sewer Service Plan	S15		G15	
W16	Fireline Plan with Domestic and Irrigation Supply	S16		G16	
W17	Multi-Tenant Building Water Service Plan	S17		G17	



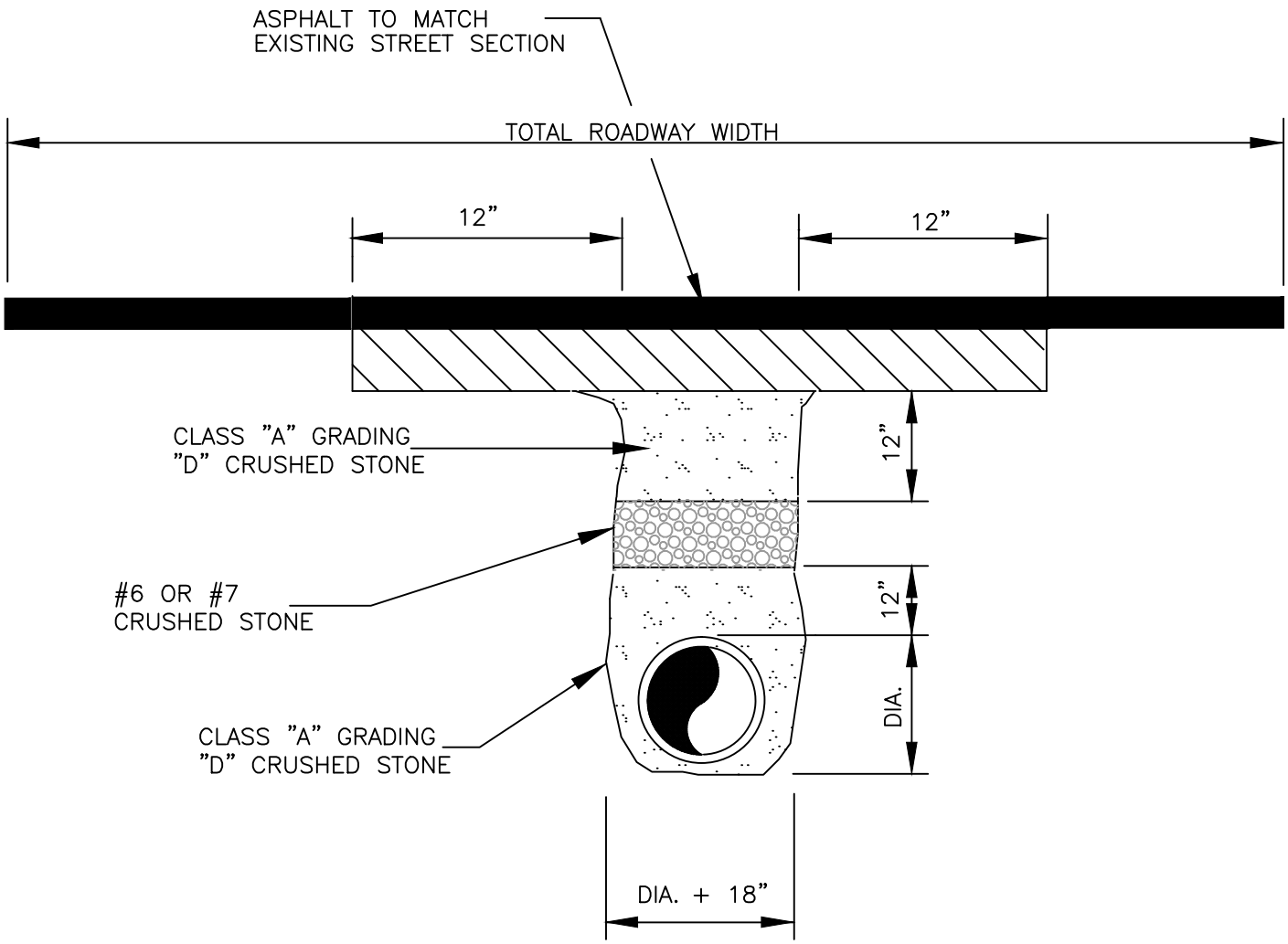
TRENCH WIDTH

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

STREET REPLACEMENT
TRENCH WIDTH

AUGUST, 2012

DRAWING NO. G1



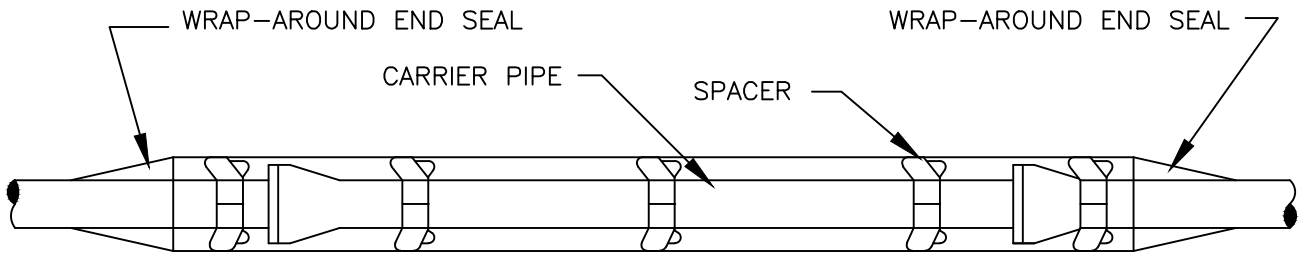
FULL OVERLAY

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

STREET REPLACEMENT
FULL OVERLAY

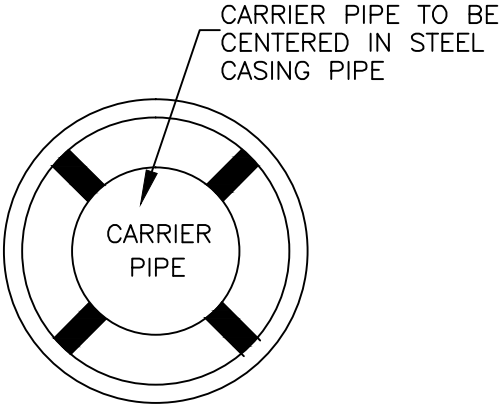
AUGUST, 2012

DRAWING NO. G2



STEEL CASING PIPE

SPACERS FOR CARRIER PIPES UP THROUGH 36–INCHES IN DIAMETER SHALL BE INSTALLED WITHIN 1–FOOT ON EACH SIDE OF THE BELL AND IN THE CENTER OF THE JOINTS. IF THE CASING OR CARRIER PIPE IS ANGLED, BENT OR DENTERD, SPACING SHALL BE AT 1/3 INTERVALS. IF SPACER IS MORE THAN 1–FOOT FROM END OF CASING PIPE, AN ADDITIONAL SPACER SHALL BE PLACED WITHIN 1–FOOT OF THE END OF THE CASING PIPE. SPACERS TO BE PIPELINE SEAL AND INSULATOT, INC. POLYPROPYLENE CASING SPACER MODEL RANFER II. END SEALS TO BE PIPELINE SEAL AND INSULATOR, INC. WRAP–AROUND (MODEL W)



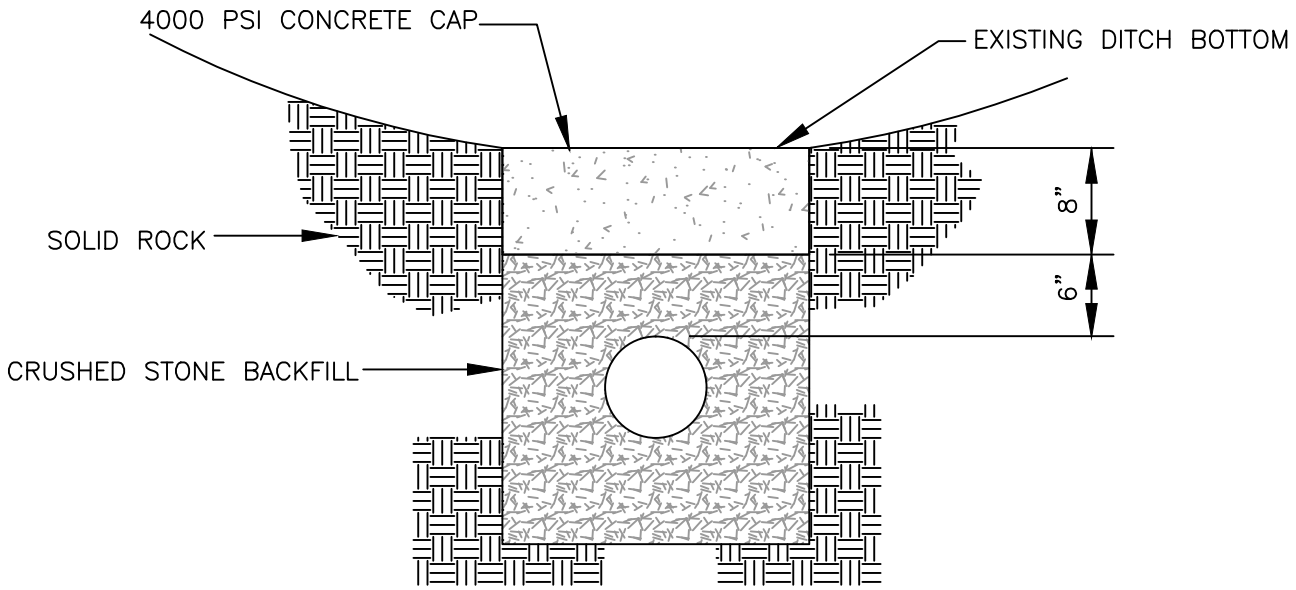
CASING SPACER INSTALLATION DETAIL

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

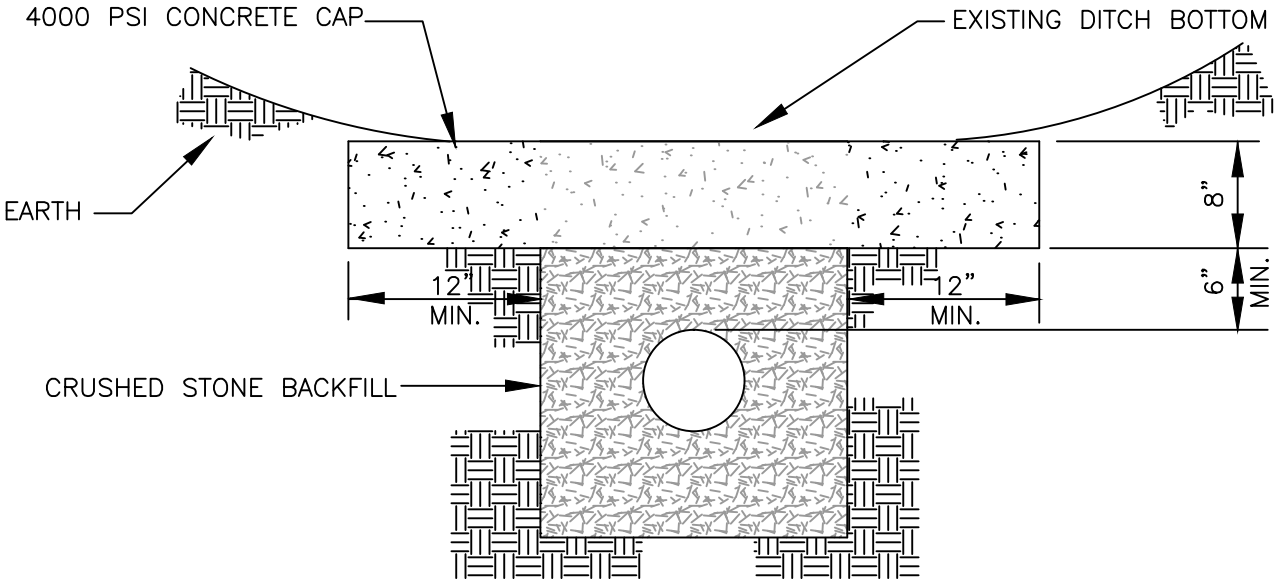
BORING DETAIL

AUGUST, 2012

DRAWING NO. G3



ROCK EXCAVATION



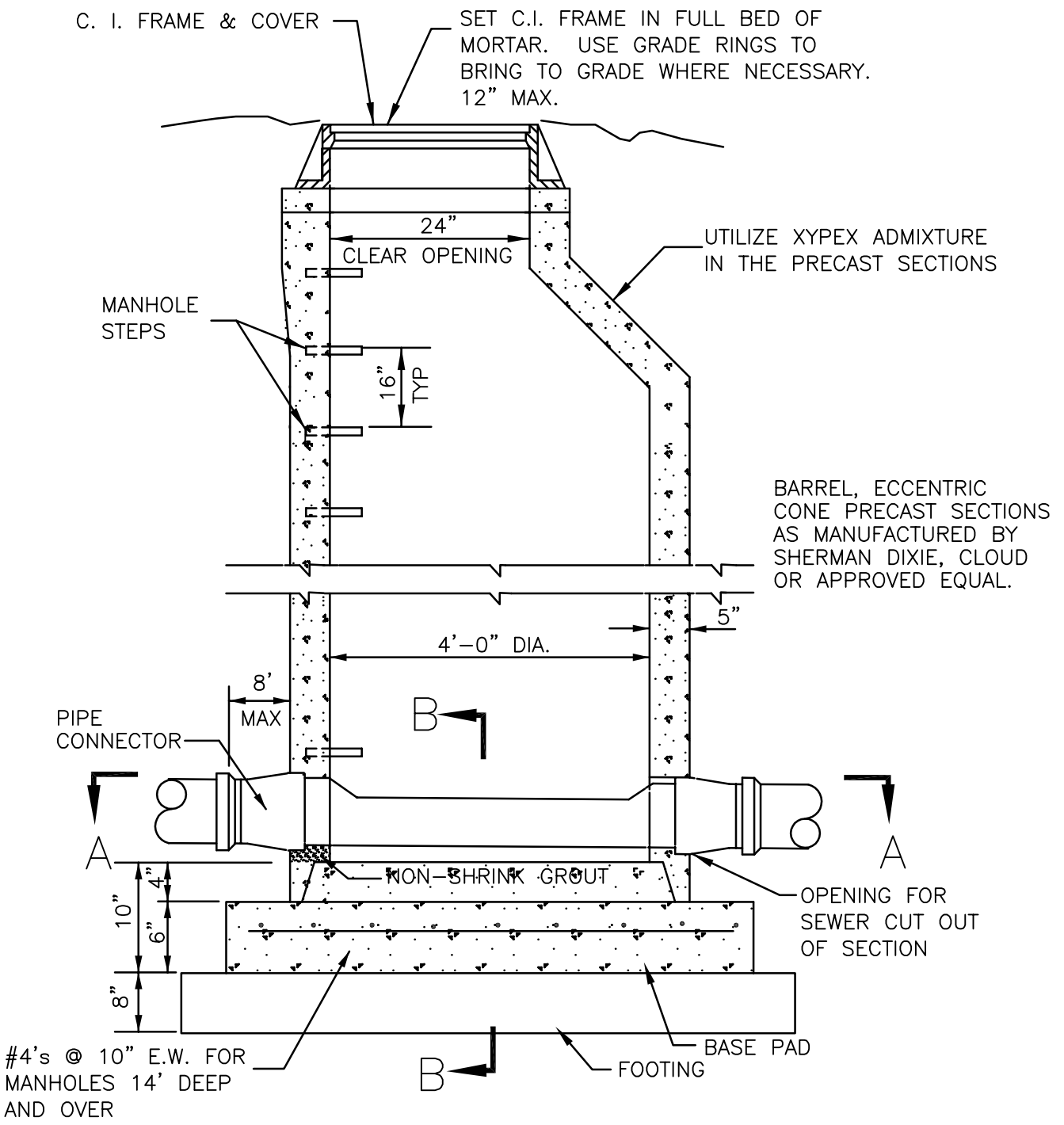
EARTH EXCAVATION

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

CONCRETE CAP

AUGUST, 2012

DRAWING NO. G4



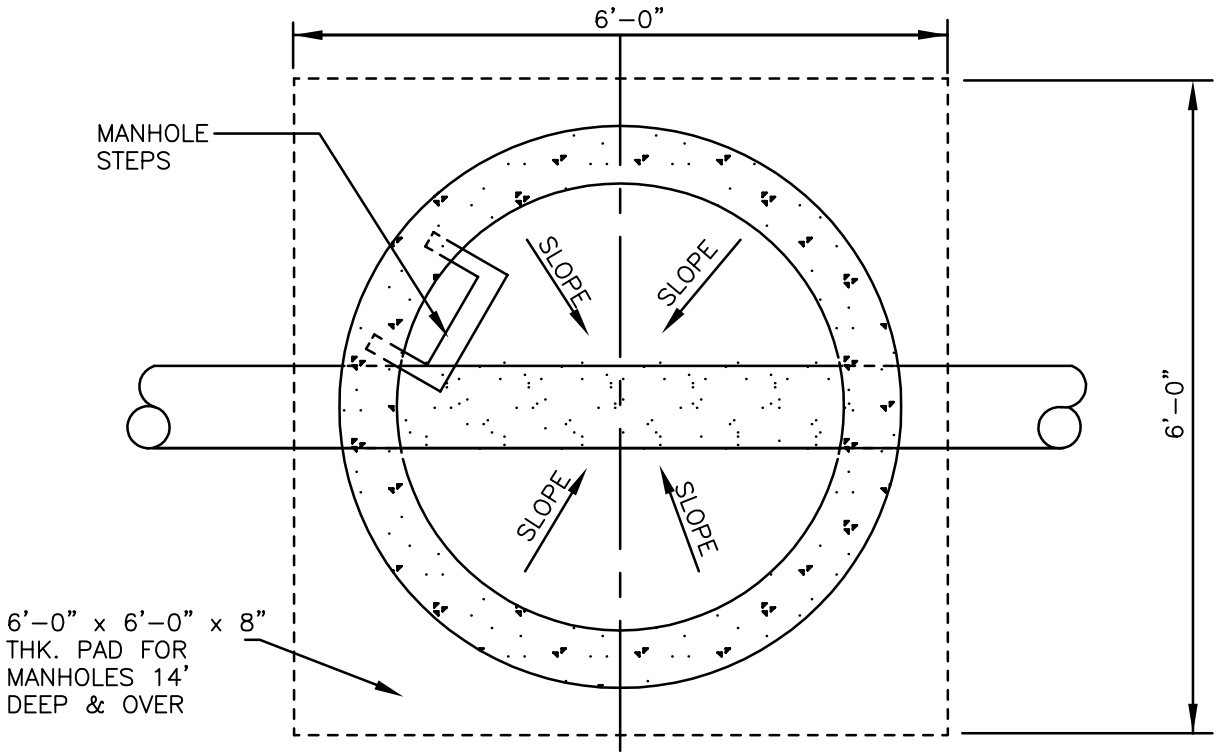
SEE DRAWING NO. S2 FOR SECTIONS

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

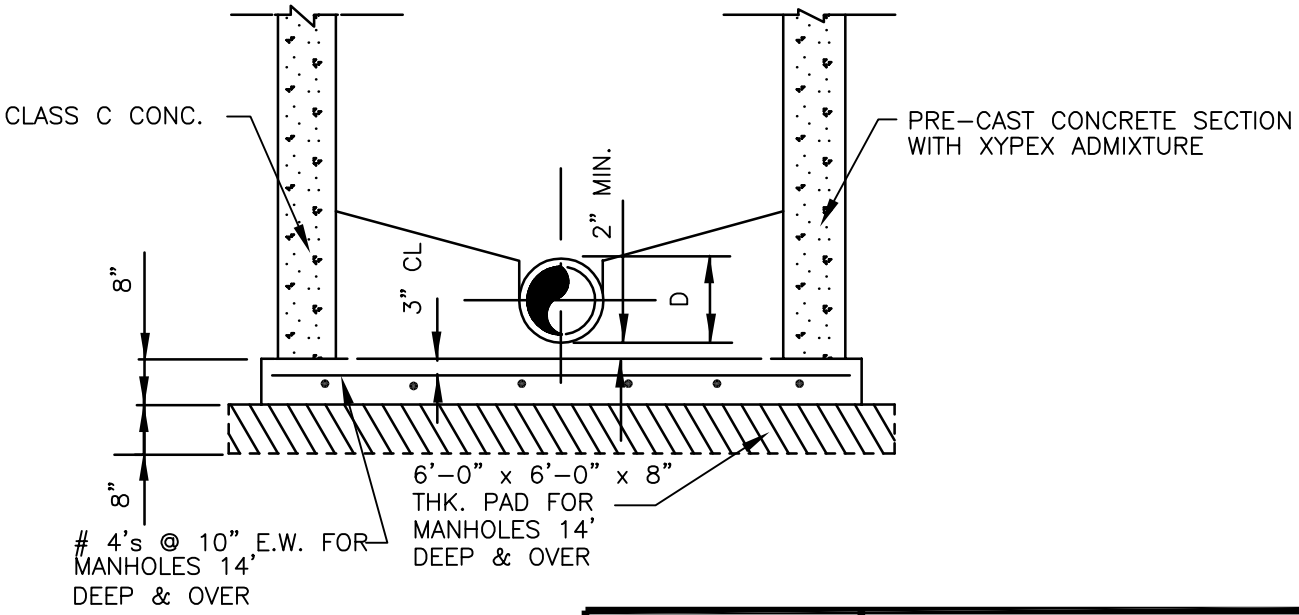
STANDARD MANHOLE

AUGUST, 2012

DRAWING NO. S1



SECTION "A–A"



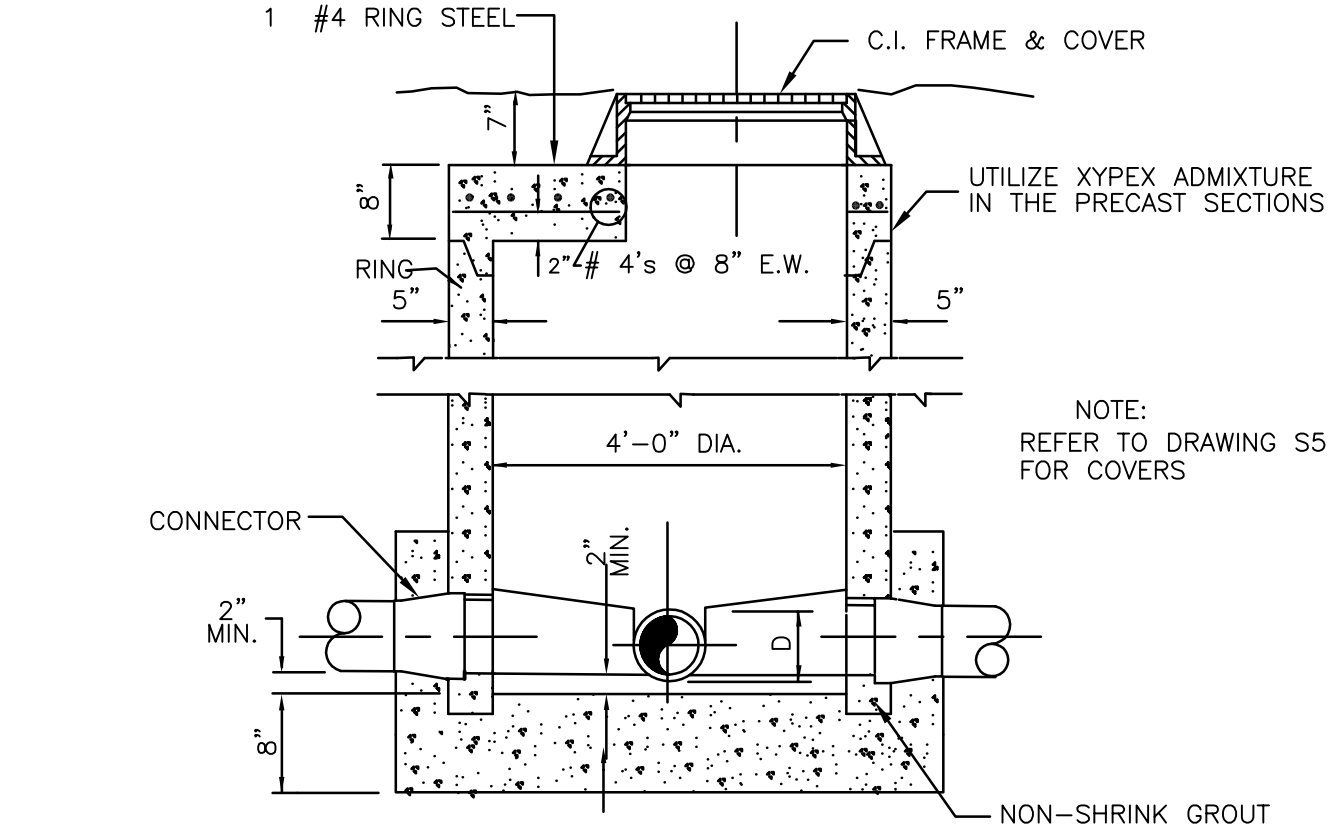
SECTION "B–B"

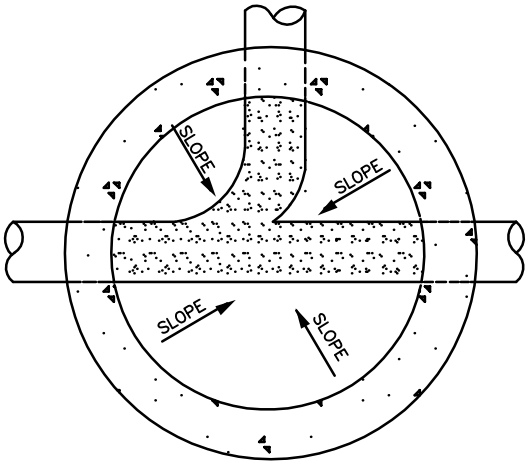
CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

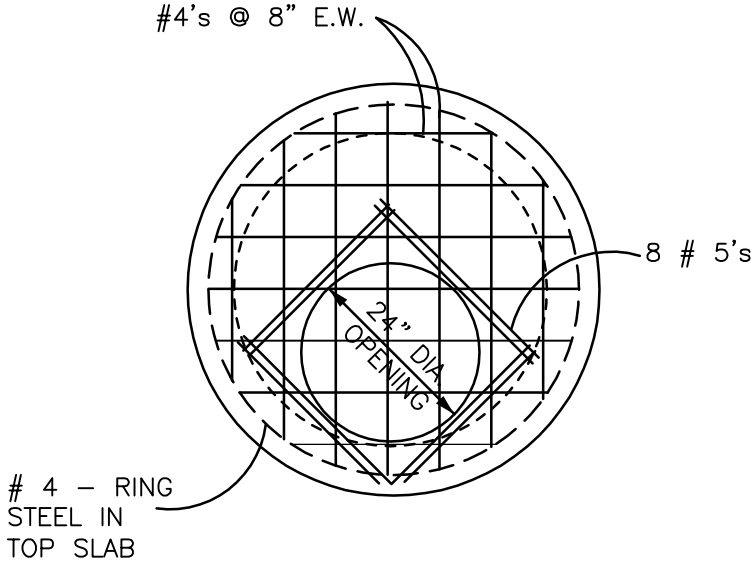
STANDARD MANHOLE SECTIONS

AUGUST, 2012

DRAWING NO. S2





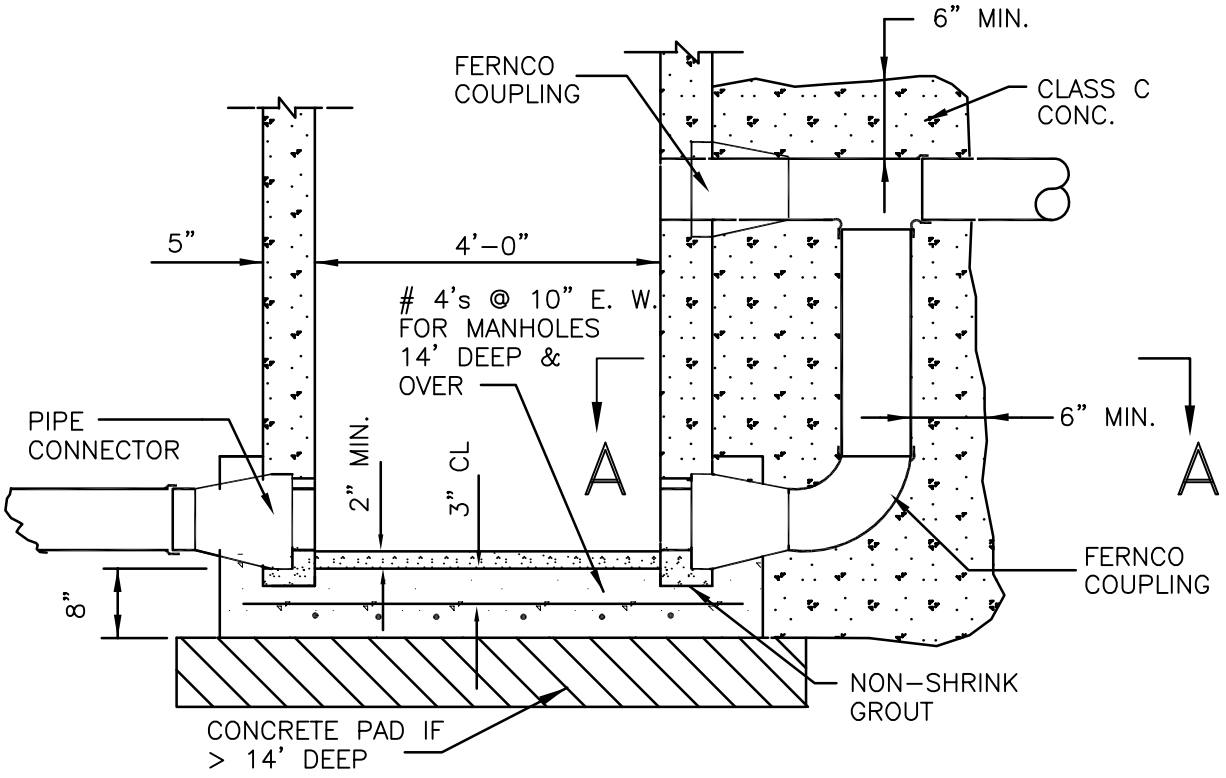


CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

STANDARD SHALLOW MANHOLE SECTIONS

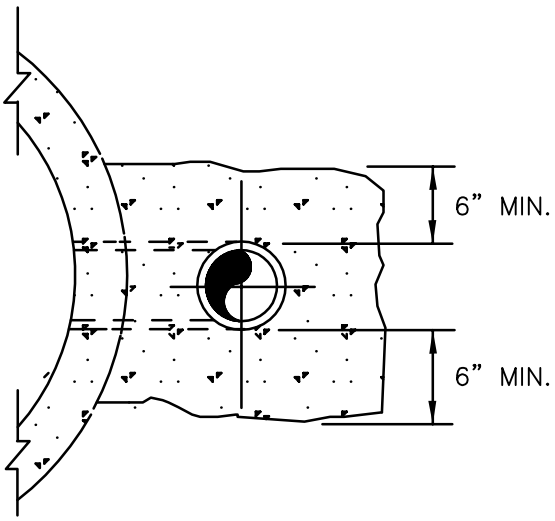
AUGUST, 2012

DRAWING NO. S3



NOTE:

USE OUTSIDE DROP MANHOLE FOR VERTICAL DROPS > 24"



SECTION "A-A"

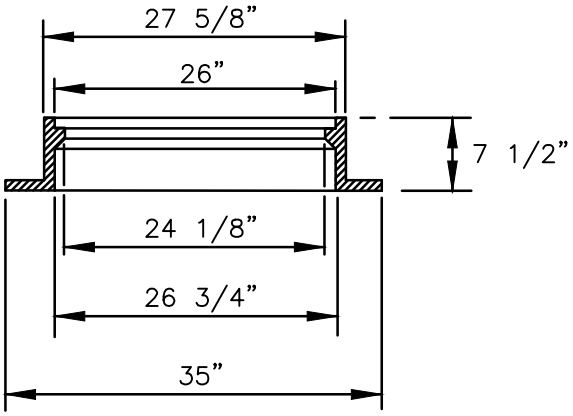
CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

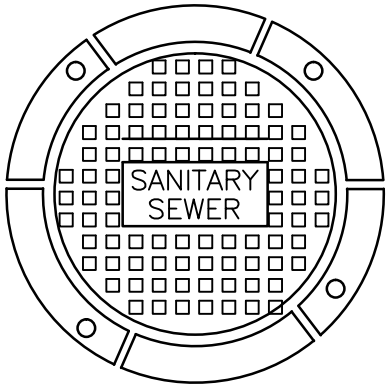
STANDARD DROP MANHOLE

AUGUST, 2012

DRAWING NO. S4

FOR WATERTIGHT FRAME AND COVER
REQUEST BOLT DOWN LID

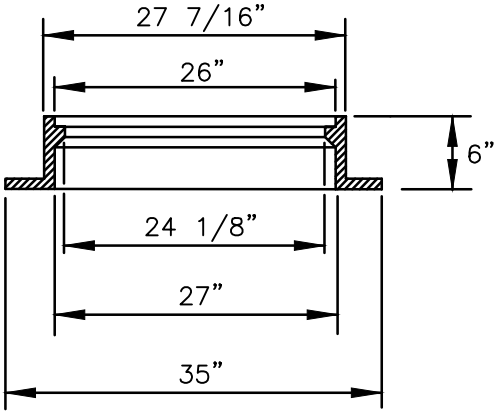


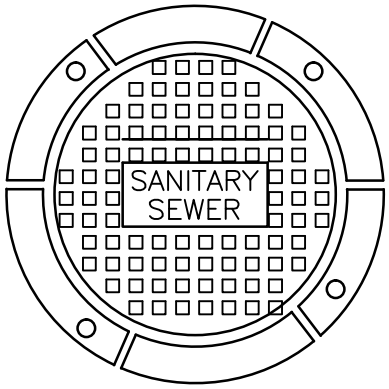


CLEAR OPENING
FRAME SECTION

TRAFFIC JBS 1150

FOR WATERTIGHT FRAME AND COVER
REQUEST BOLT DOWN LID





CLEAR OPENING
FRAME SECTION

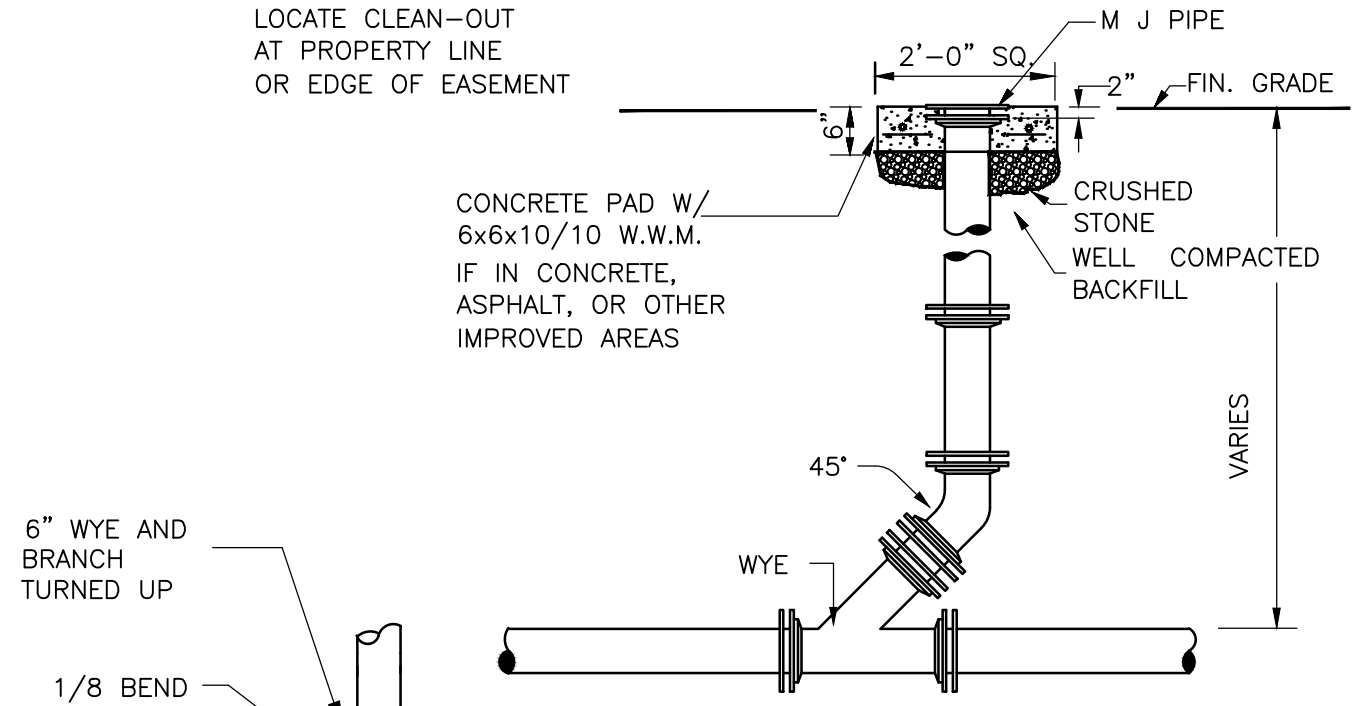
NON–TRAFFIC JBS 1155

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

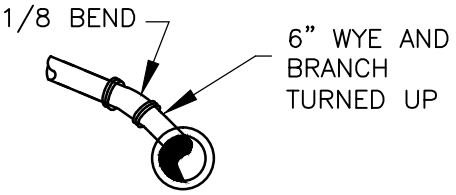
MANHOLE COVERS

AUGUST, 2012

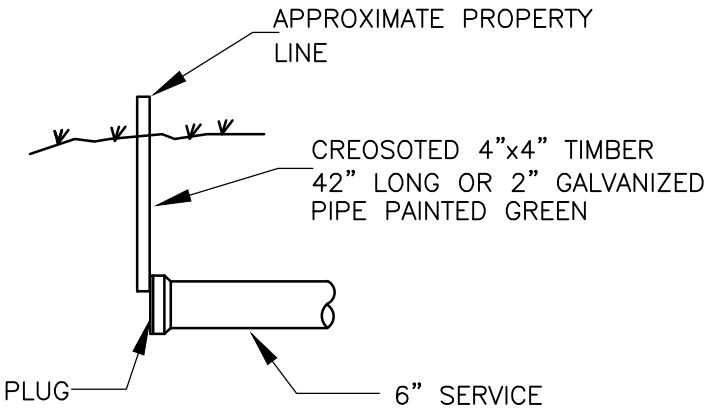
DRAWING NO. S5



CLEAN–OUT



SECTION "A–A"



HOUSE CONNECTION

NOTE:

SERVICES > 6" MUST
CONNECT AT A MANHOLE

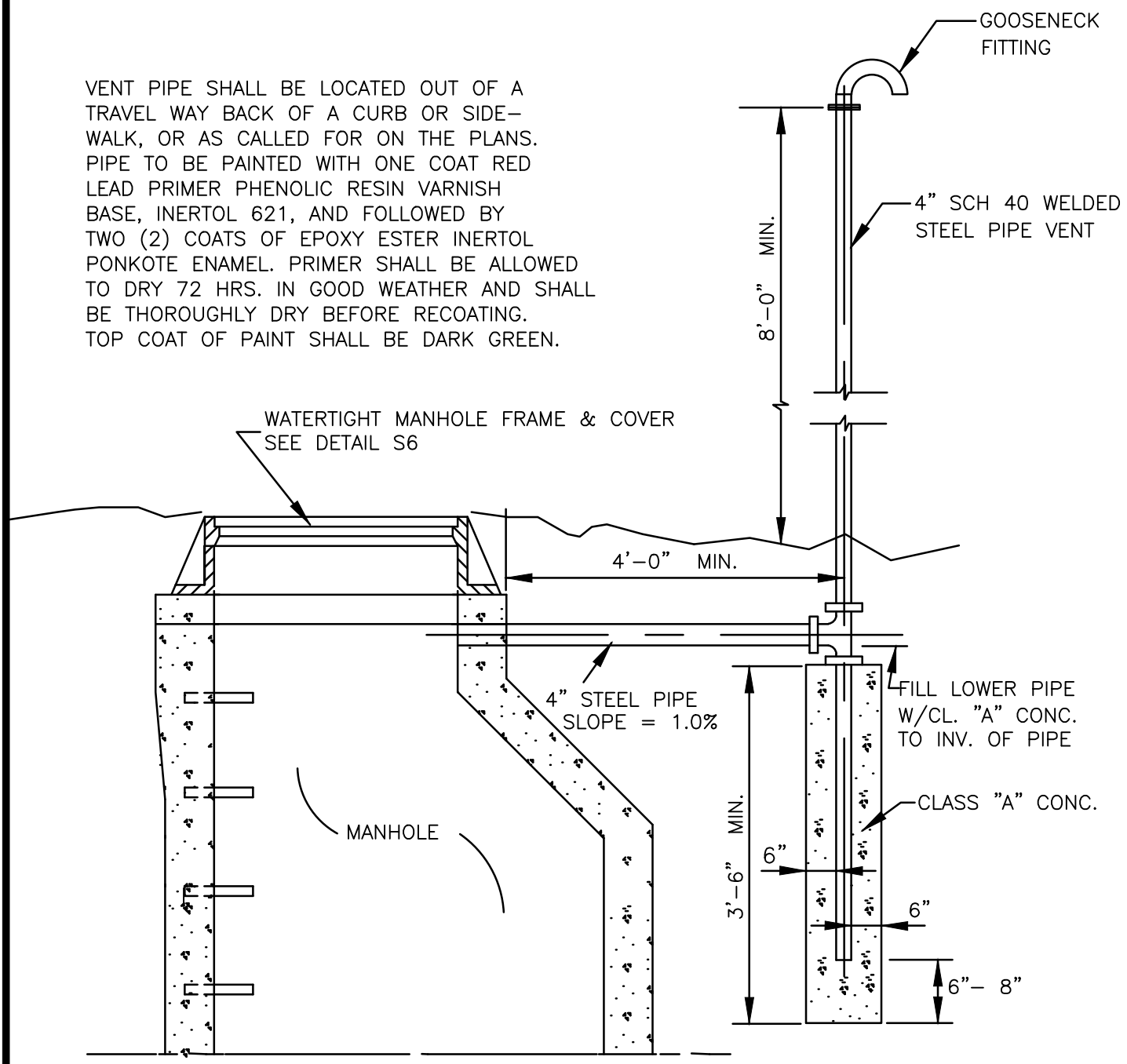
CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

SEWER
SERVICE CONNECTION

AUGUST, 2012

DRAWING NO. S6

VENT PIPE SHALL BE LOCATED OUT OF A TRAVEL WAY BACK OF A CURB OR SIDE-WALK, OR AS CALLED FOR ON THE PLANS. PIPE TO BE PAINTED WITH ONE COAT RED LEAD PRIMER PHENOLIC RESIN VARNISH BASE, INERTOL 621, AND FOLLOWED BY TWO (2) COATS OF EPOXY ESTER INERTOL PONKOTE ENAMEL. PRIMER SHALL BE ALLOWED TO DRY 72 HRS. IN GOOD WEATHER AND SHALL BE THOROUGHLY DRY BEFORE RECOATING. TOP COAT OF PAINT SHALL BE DARK GREEN.

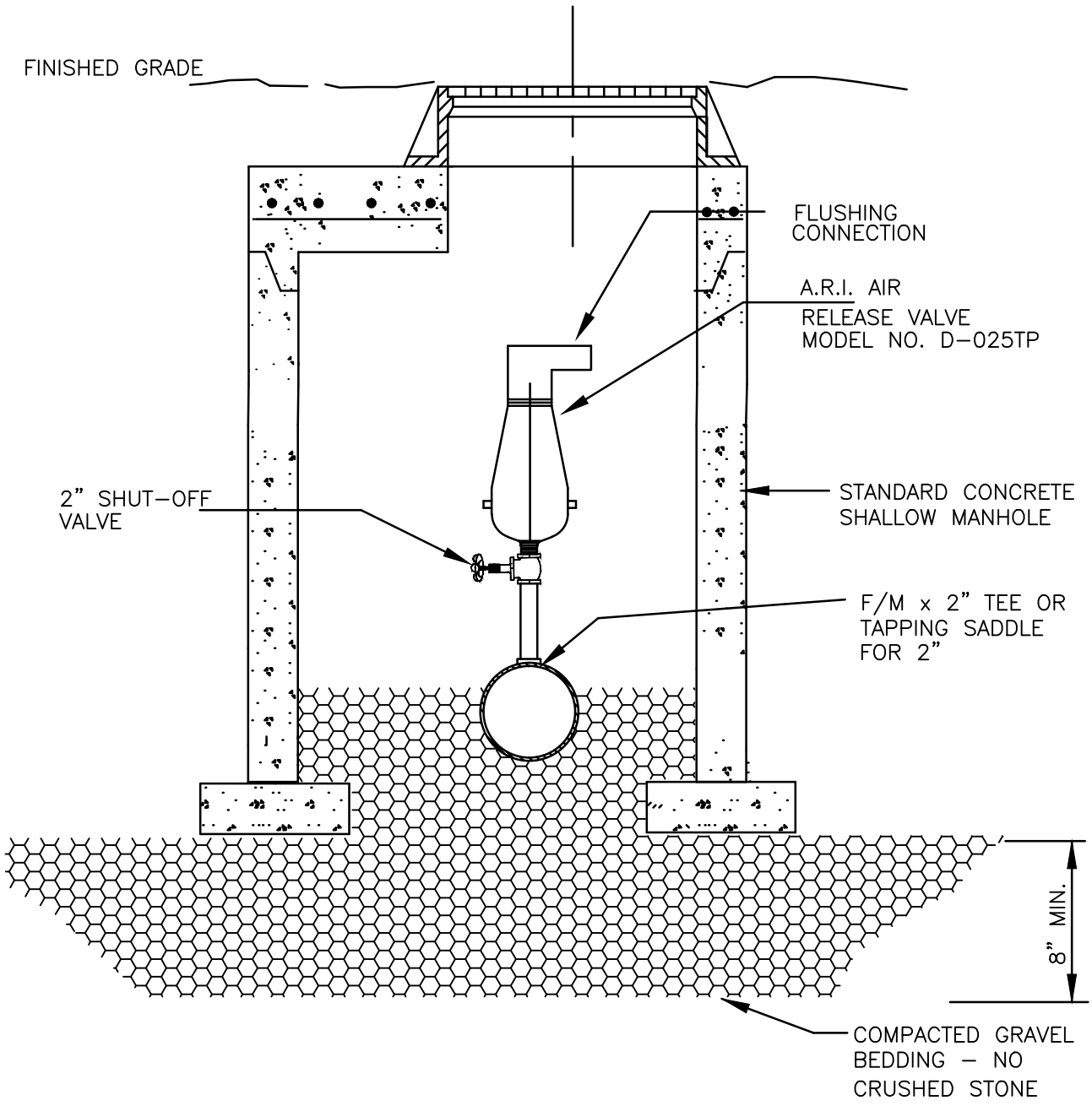


CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

MANHOLE VENT DETAIL

AUGUST, 2012

DRAWING NO. S7

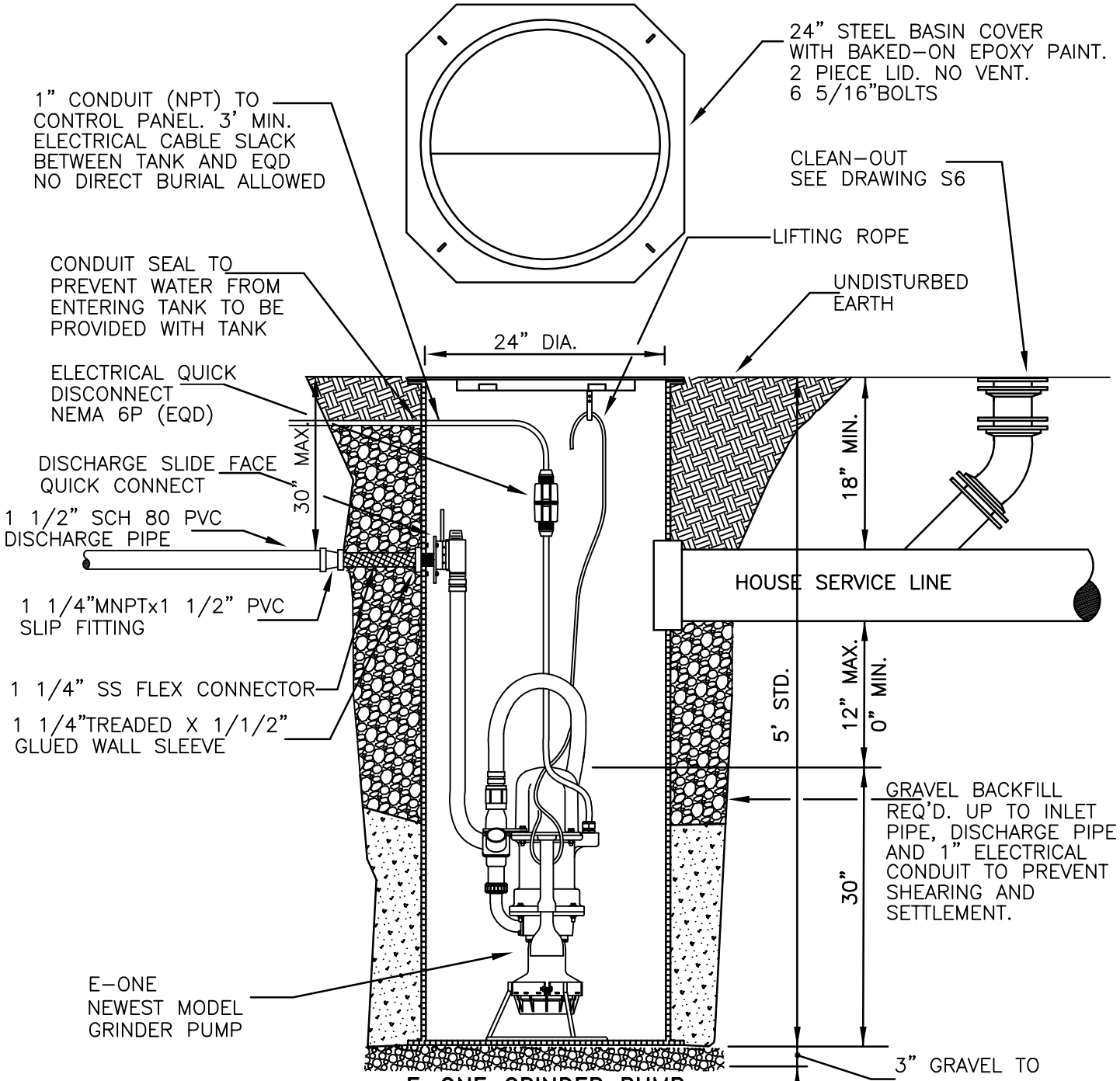


CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

SEWAGE AIR RELEASE VALVE

AUGUST, 2012

DRAWING NO. S8



E-ONE GRINDER PUMP WITH FLEX HOSE

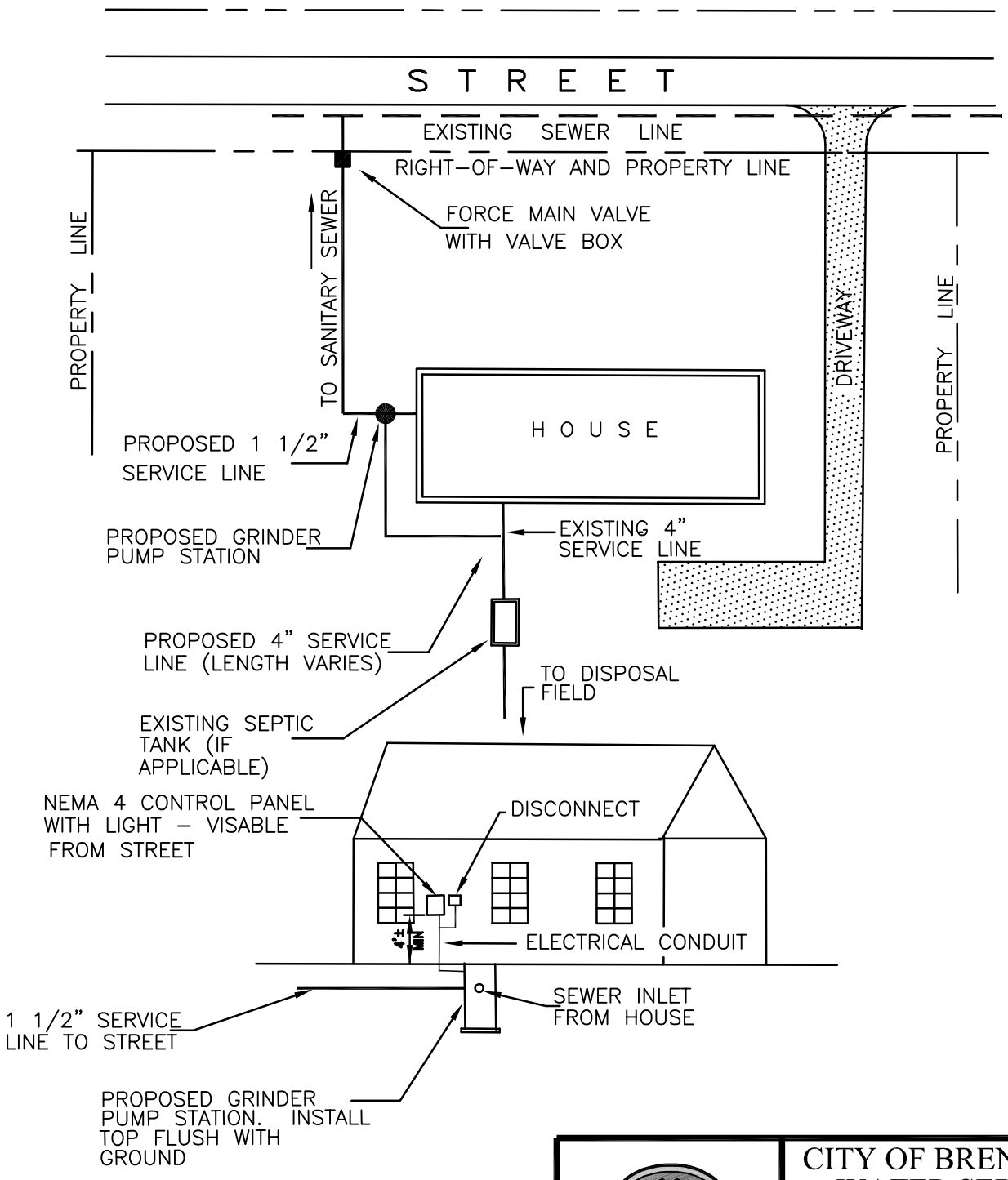
CONCRETE POURED AROUND BASIN TO PREVENT FLOTATION SHALL BE AS RECOMMENDED BY THE GRINDER PUMP MANUFACTURER. 2 CUBIC FEET OF CONCRETE REQUIRED PER FOOT OF BASIN DEPTH MINIMUM.

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

GRINDER PUMP DETAILS

AUGUST, 2012

DRAWING NO. S9



THE EXACT LOCATION OF THE GRINDER PUMP SHALL BE DETERMINED IN THE FIELD BUT NO MORE THAN 25' FROM THE HOME.

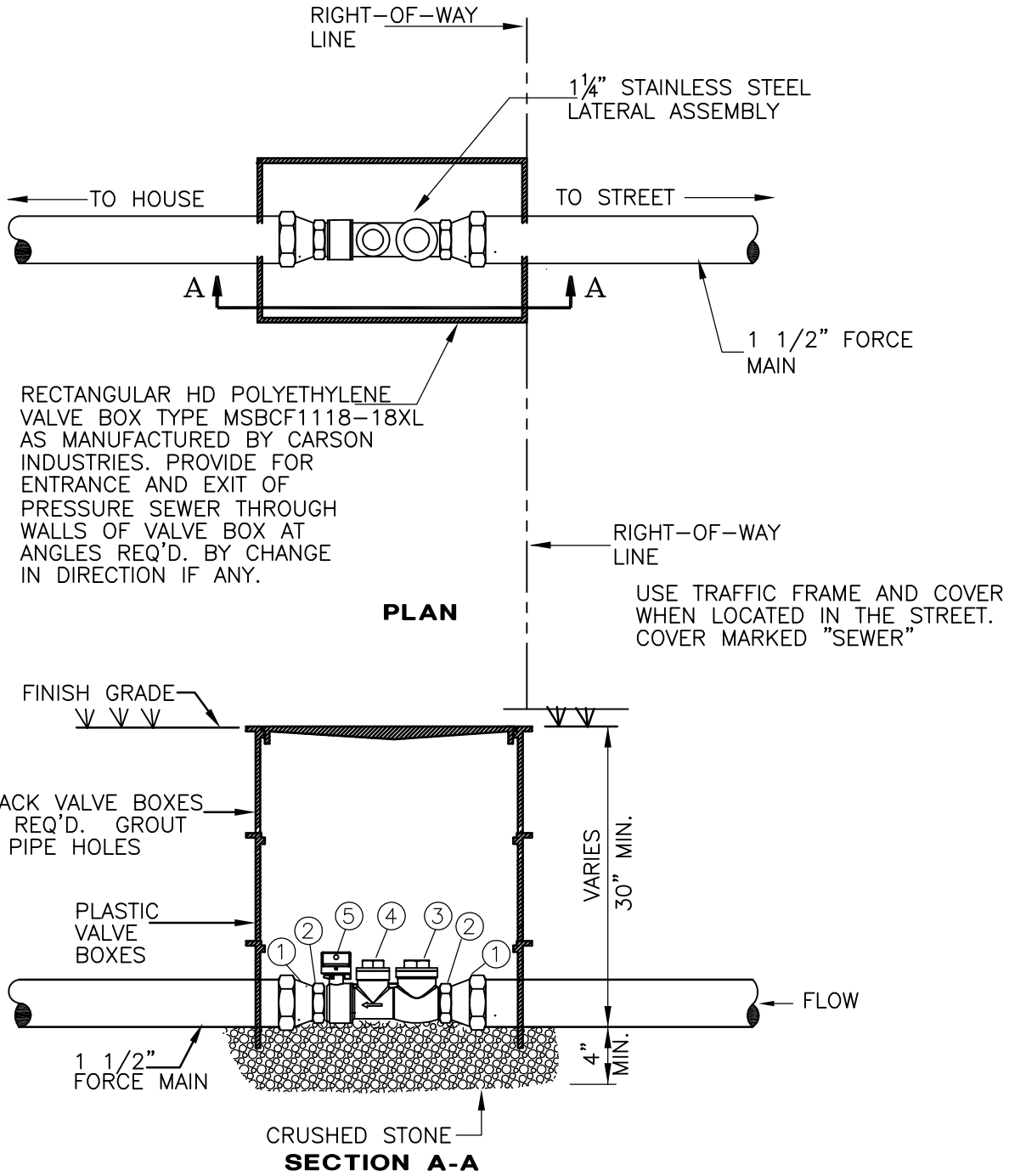
GRINDER PUMP AND SERVICE LINE NOT TO BE INSTALLED UNDER DRIVEWAY, SIDEWALK, PARKING AREA, DECK OR PATIO.

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

GRINDER PUMP LAYOUT

AUGUST, 2012

DRAWING NO. S10



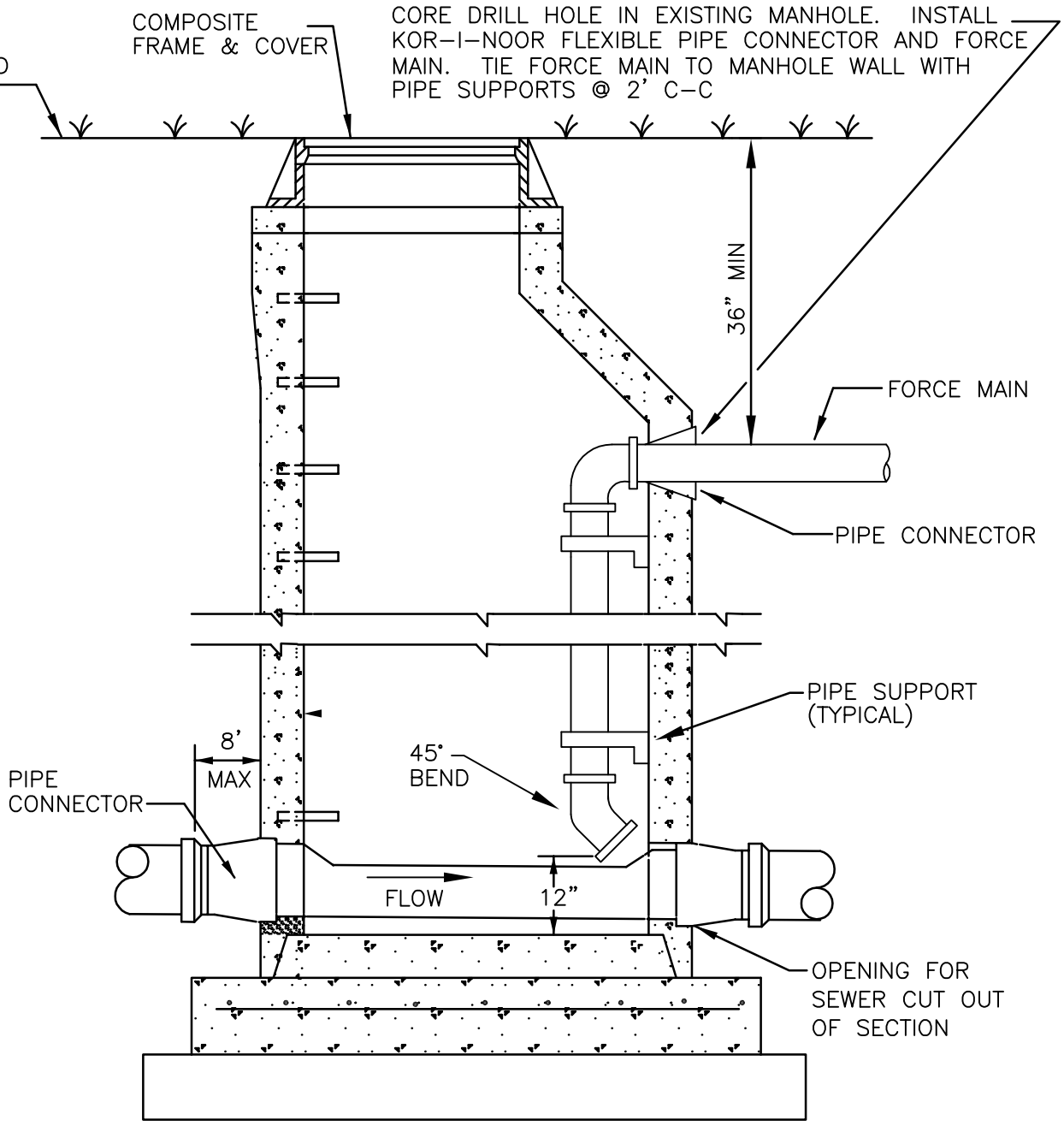
① 1½"x1¼" REDUCER
① 1¼" FEMALE NPT
② SS FLAPPER TYPE CHECK VALVE
③ 1¼" SS BALL VALVE
④ SS VALVE ACTUATOR

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

F/M SERVICE VALVE BOX ASSEMBLY

AUGUST, 2012

DRAWING NO. S11



SECTION A-A

N O T E

COAT CONNECTING MANHOLE AND TWO MANHOLES DOWNSTREAM WITH SPRAY APPLIED EPOXY RESIN. WARREN ENVIRONMENTAL M-201 AND S-301 OR APPROVED EQUIVALENT PER SPECIFICATIONS.

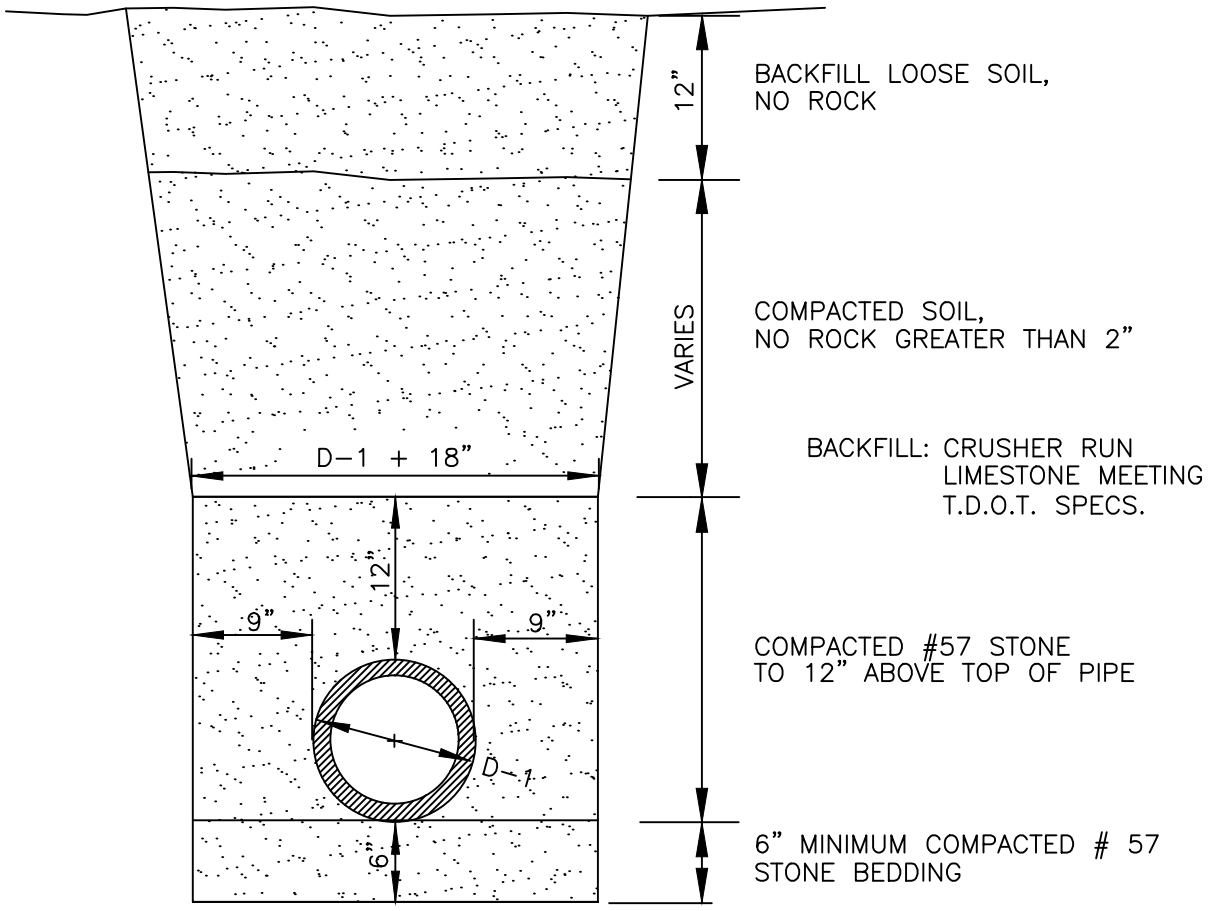
CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

F/M CONNECTION TO EXISTING MANHOLE

AUGUST, 2012

DRAWING NO. S12

NOTE: BACKFILL TO SUBGRADE WITH STONE AS PER TDOT SPECIFICATIONS UNDER PAVED SURFACE



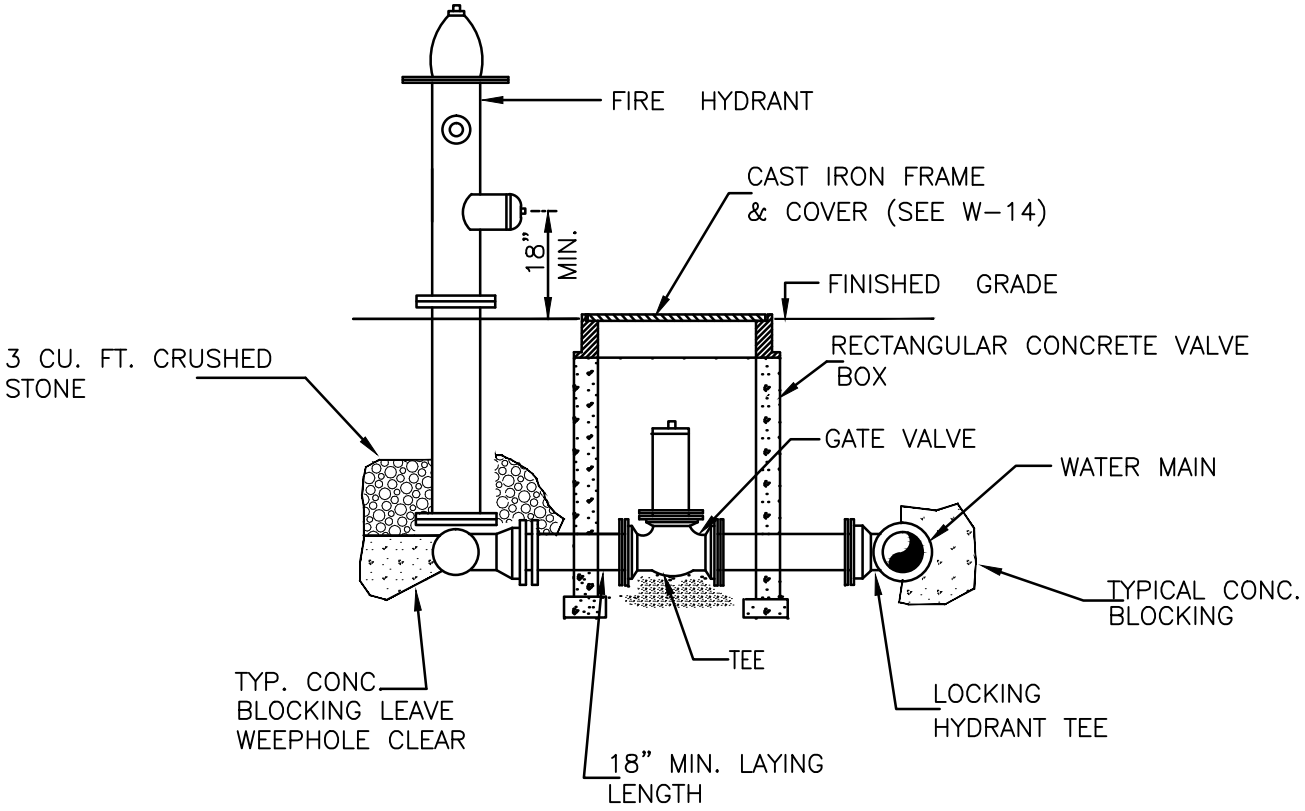
D-1 = OUTSIDE DIAMETER OF BELL

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

TYPICAL TRENCH SECTION-ALL PIPE

AUGUST, 2012

DRAWING NO. W1



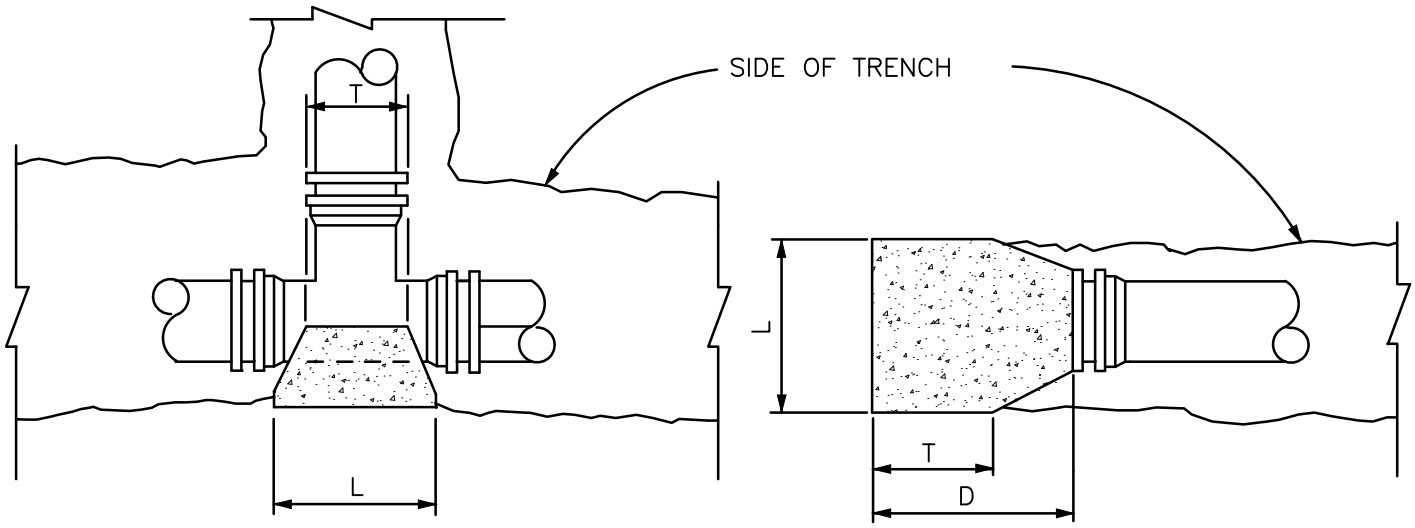
NOTE: RESTRAIN LATERAL FROM TEE TO VALVE AND FROM VALVE TO BEND

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

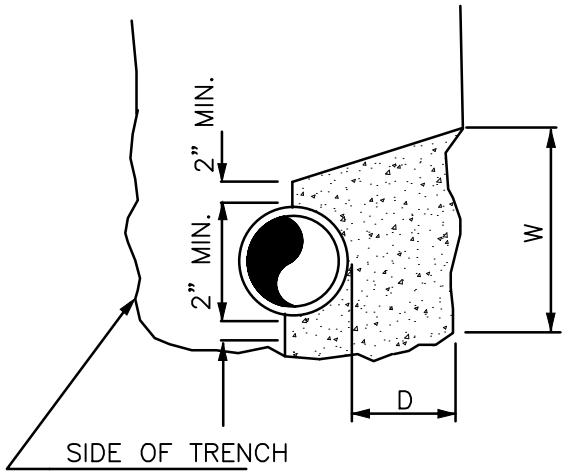
FIRE HYDRANT ASSEMBLY

AUGUST, 2012

DRAWING NO. W2



TEE



NOTE: DEPTH "D" MAY BE GREATER THAN SPECIFIED TO ALLOW WORKING SPACE PIER MUST BE AGANIST UNDISTURBED EARTH

PLUG

TEE									
SIZE	2"	3"	4"	6"	8"	10"	12"	14"	16"
D	NO BLOCKING REQ'D.		4"	8"	10"	12"	12"	12"	12"
L			8"	18"	18"	22"	27"	28"	28"
W			8"	12"	16"	20"	24"	26"	28"
T			6"	12"	12"	16"	18"	20"	20"

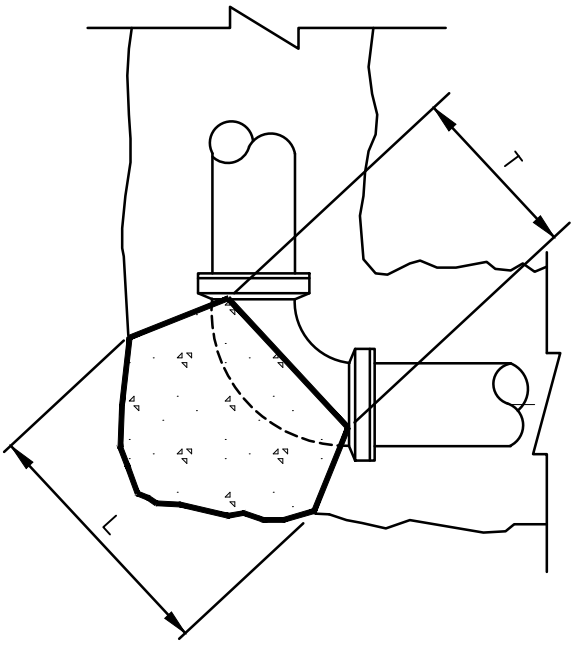
PLUG									
SIZE	2"	3"	4"	6"	8"	10"	12"	14"	16"
D	NO BLOCKING REQ'D.		8"	18"	24"	30"	30"	30"	30"
L			12"	18"	24"	30"	30"	40"	48"
W			12"	18"	18"	24"	24"	28"	30"
T			4"	12"	12"	12"	12"	12"	12"

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

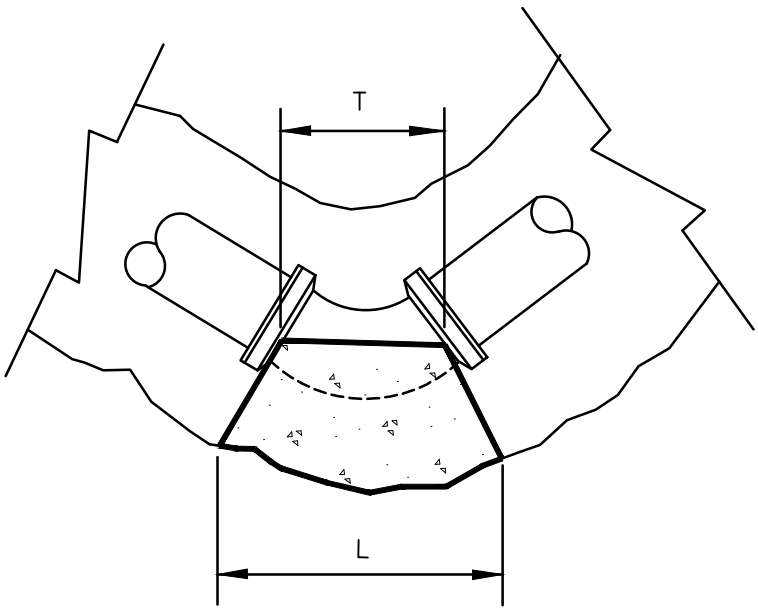
CONCRETE THRUST BLOCKING

AUGUST, 2012

DRAWING NO. W3



90° BEND (1/4th)



45° BEND (1/8th)

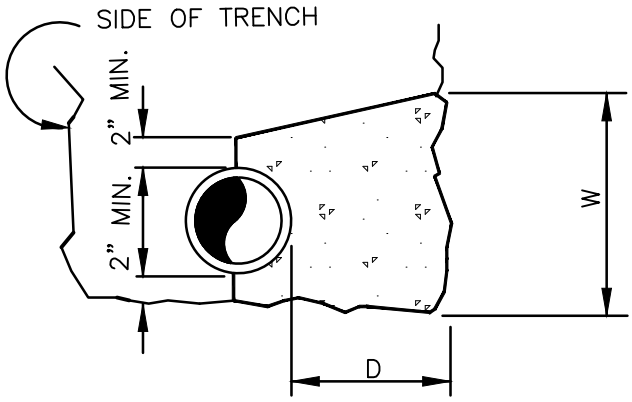
22 1/2° BEND (1/16TH)

11 1/4° BEND (1/32nd)

90° BEND (1/4th)									
SIZE	2"	3"	4"	6"	8"	10"	12"	14"	16"
D	NO BLOCKING REQ'D.		4"	8"	10"	12"	12"	12"	12"
L			8"	24"	27"	30"	34"	42"	48"
W			8"	12"	16"	20"	24"	26"	28"
T			4"	16"	18"	20"	22"	30"	36"

45° BEND (1/8th) & 22 1/2° BEND (1/16th)									
SIZE	2"	3"	4"	6"	8"	10"	12"	14"	16"
D	NO BLOCKING REQ'D.		4"	6"	6"	6"	6"	6"	6"
L			8"	18"	20"	22"	24"	30"	34"
W			8"	12"	14"	16"	18"	20"	22"
T			4"	16"	16"	18"	18"	24"	28"

11 1/4° BEND (1/32nd)									
SIZE	2"	3"	4"	6"	8"	10"	12"	14"	16"
D	NO BLOCKING REQ'D.		4"	6"	6"	6"	6"	6"	6"
L			8"	14"	16"	18"	20"	24"	30"
W			8"	12"	14"	16"	18"	20"	22"
T			4"	14"	14"	16"	16"	20"	26"



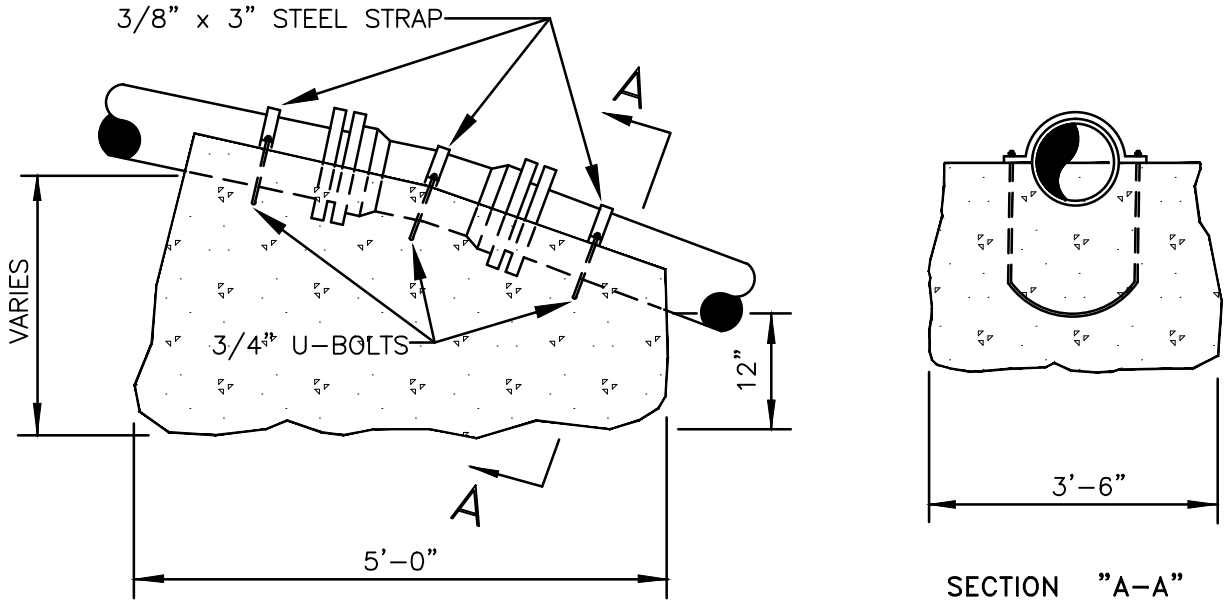
TYPICAL SECTION

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

CONCRETE THRUST BLOCKING BENDS

AUGUST, 2012

DRAWING NO. W4



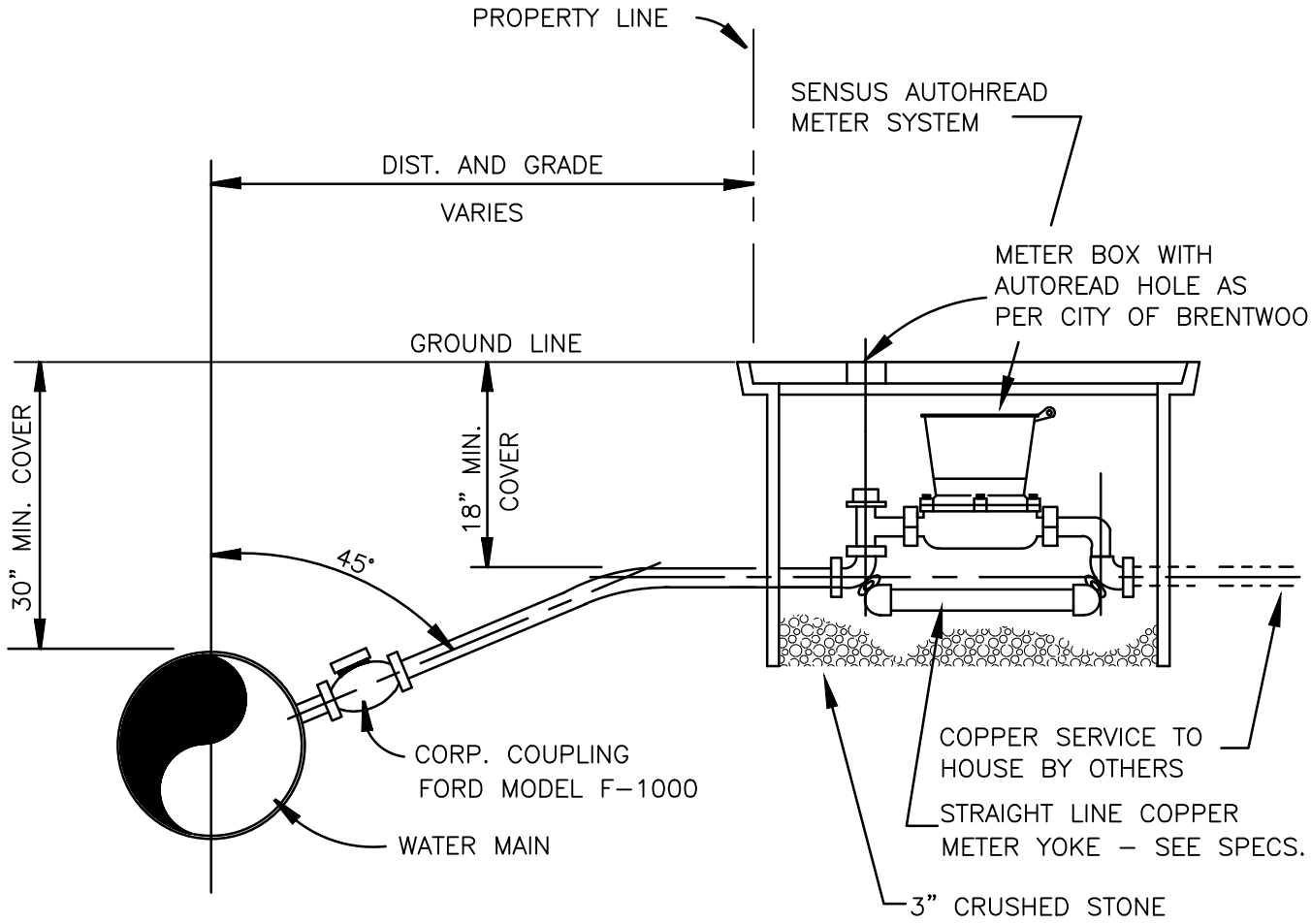
FOR VERT. BENDS 11¼° & GREATER

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

CONCRETE ANCHOR DETAIL

AUGUST, 2012

DRAWING NO. W5



BOX:

HD POLYETHYLENE METER BOX WITH
AUTOREAD CAPABLE METER LID
AS MANUFACTURED BY CARSON INDUSTRIES
AS FOLLOWS:

5/8"-3/4"	-	MCBCF1118-18XL
1"-1 1/2"	-	MCBCF1527-18XL
2"	-	MCBCF1730-18XL

YOKE:

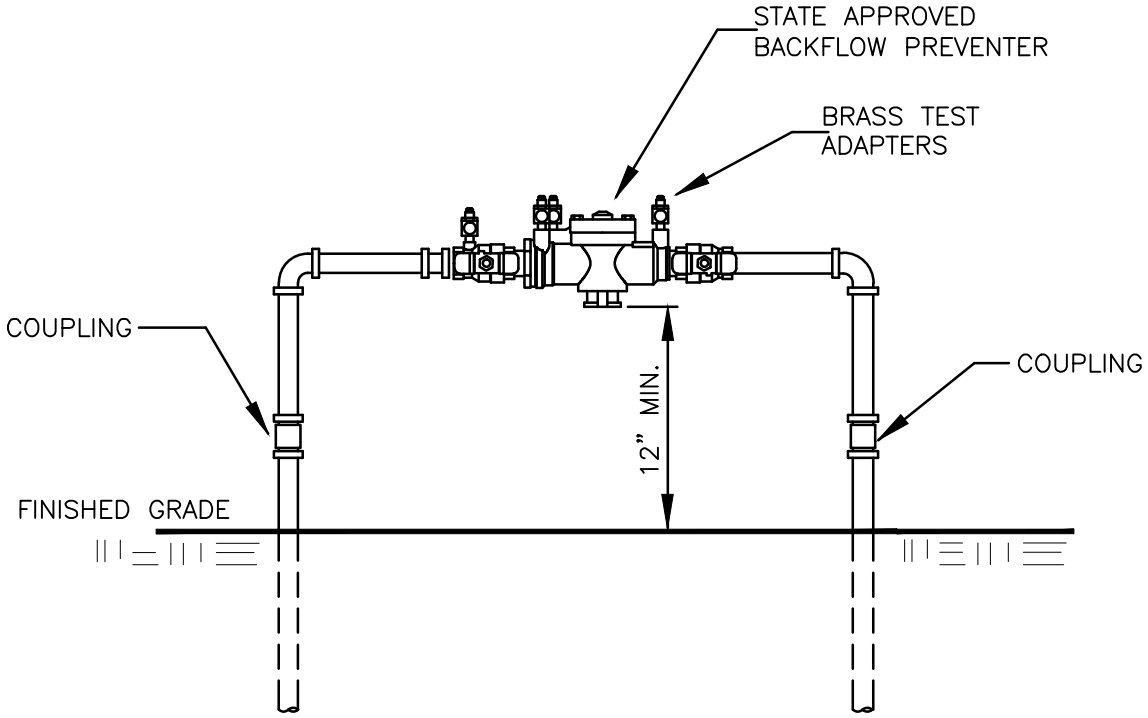
FORD OR MUELLER
APPROPRIATE SIZE
WITHOUT BYPASS

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

5/8" - 2" SERVICE ASSEMBLY

AUGUST, 2012

DRAWING NO. W6



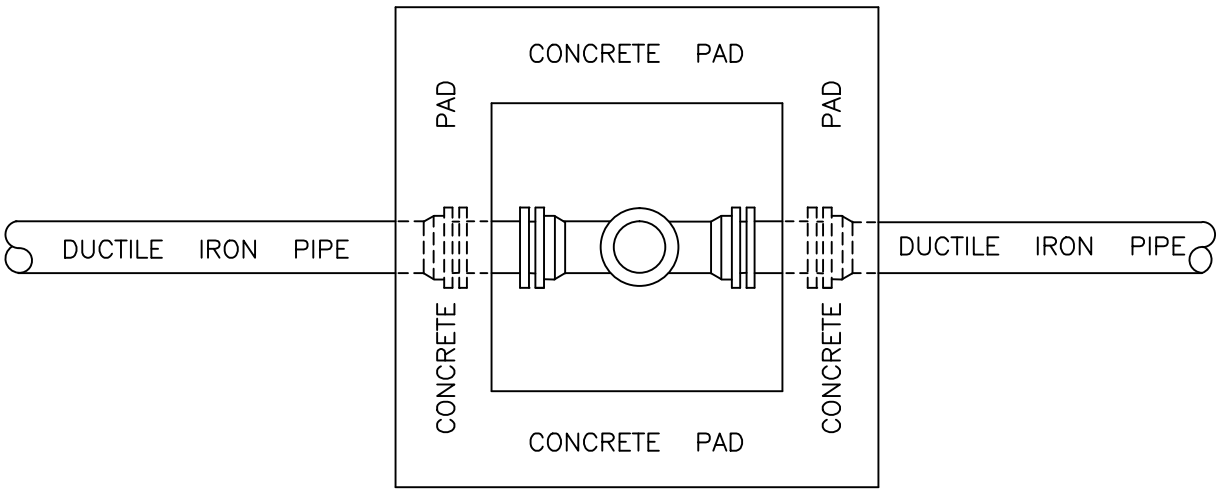
BACKFLOW DEVICE SHALL BE INSTALLED AT PROPERTY LINE OR IN ACCESSIBLE LOCATION AS APPROVED BY THE BRENTWOOD WATER AND SEWER DEPARTMENT. PROVIDE MINIMUM 12–INCH CLEARANCE AROUND DEVICE.

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

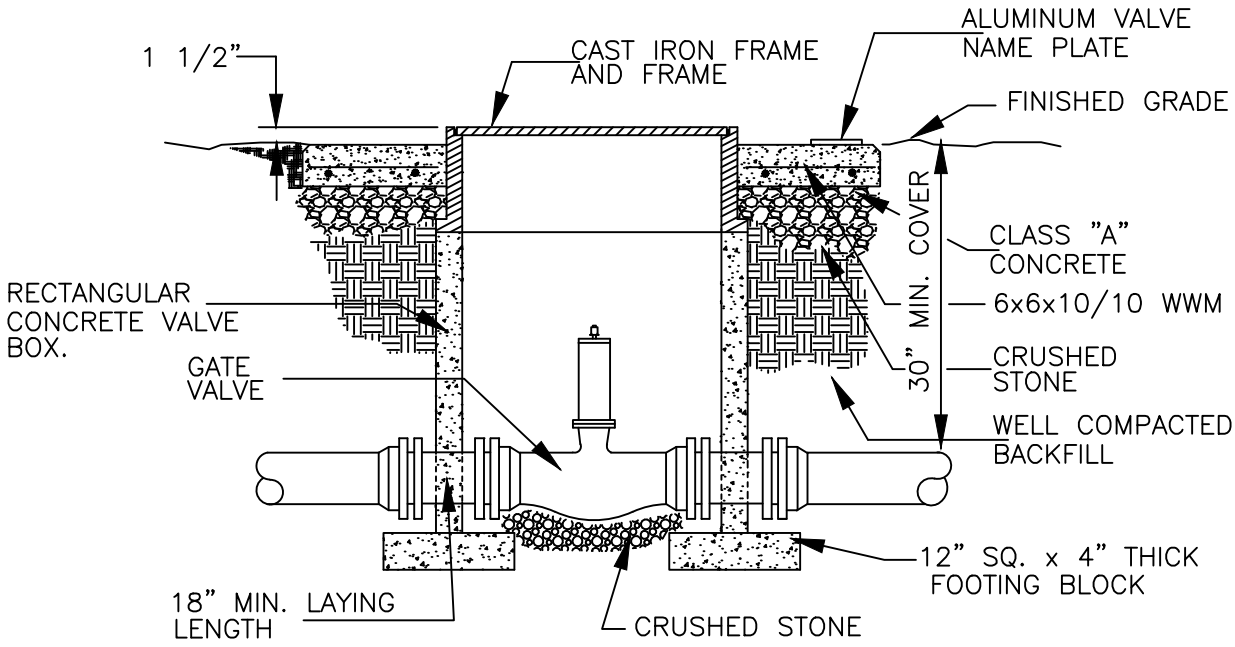
STD. BACKFLOW PREVENTER

AUGUST, 2012

DRAWING NO. W7



PLAN VIEW



SECTION VIEW

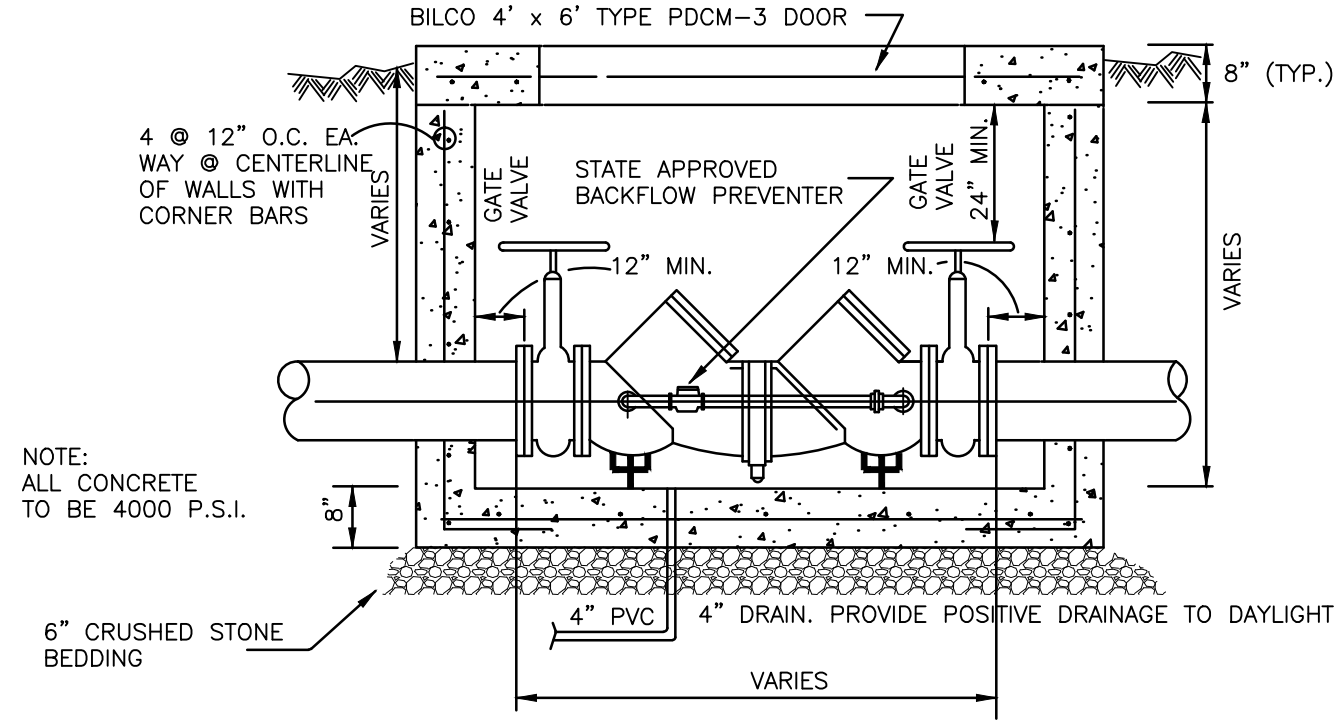
NOTE:
POUR PAD AFTER FINISHED GRADE IS COMPLETE

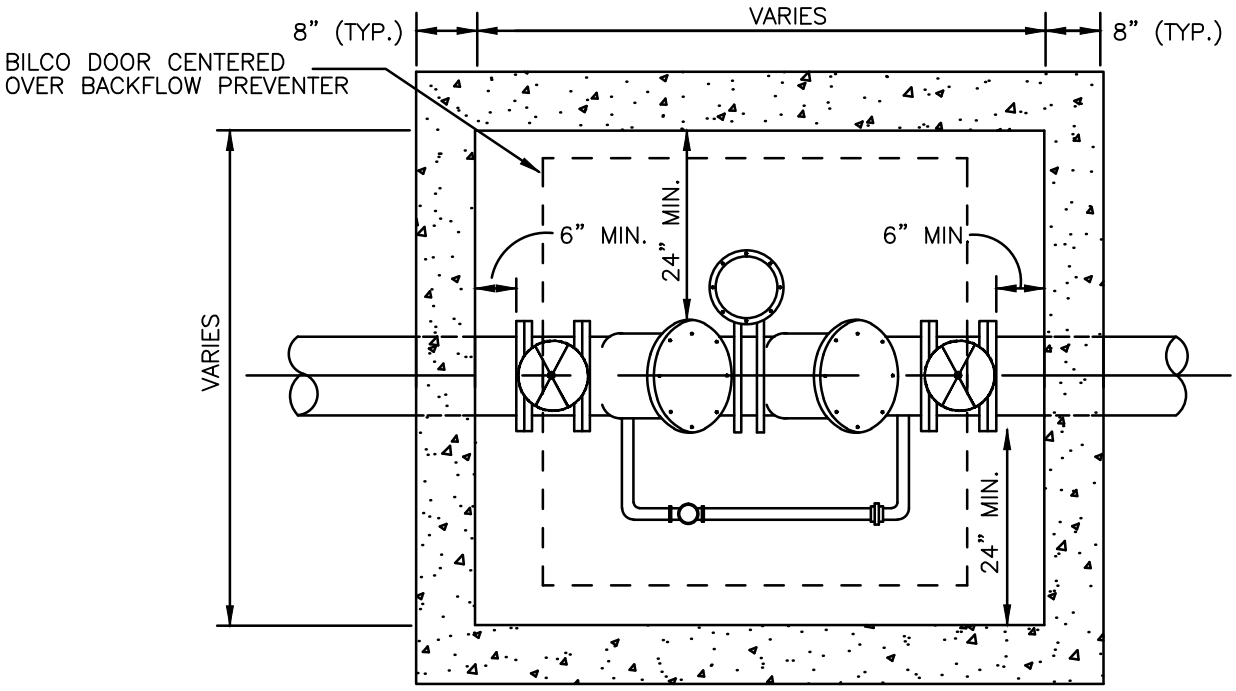
CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

GATE VALVE BOX AND COVER

AUGUST, 2012

DRAWING NO. W8



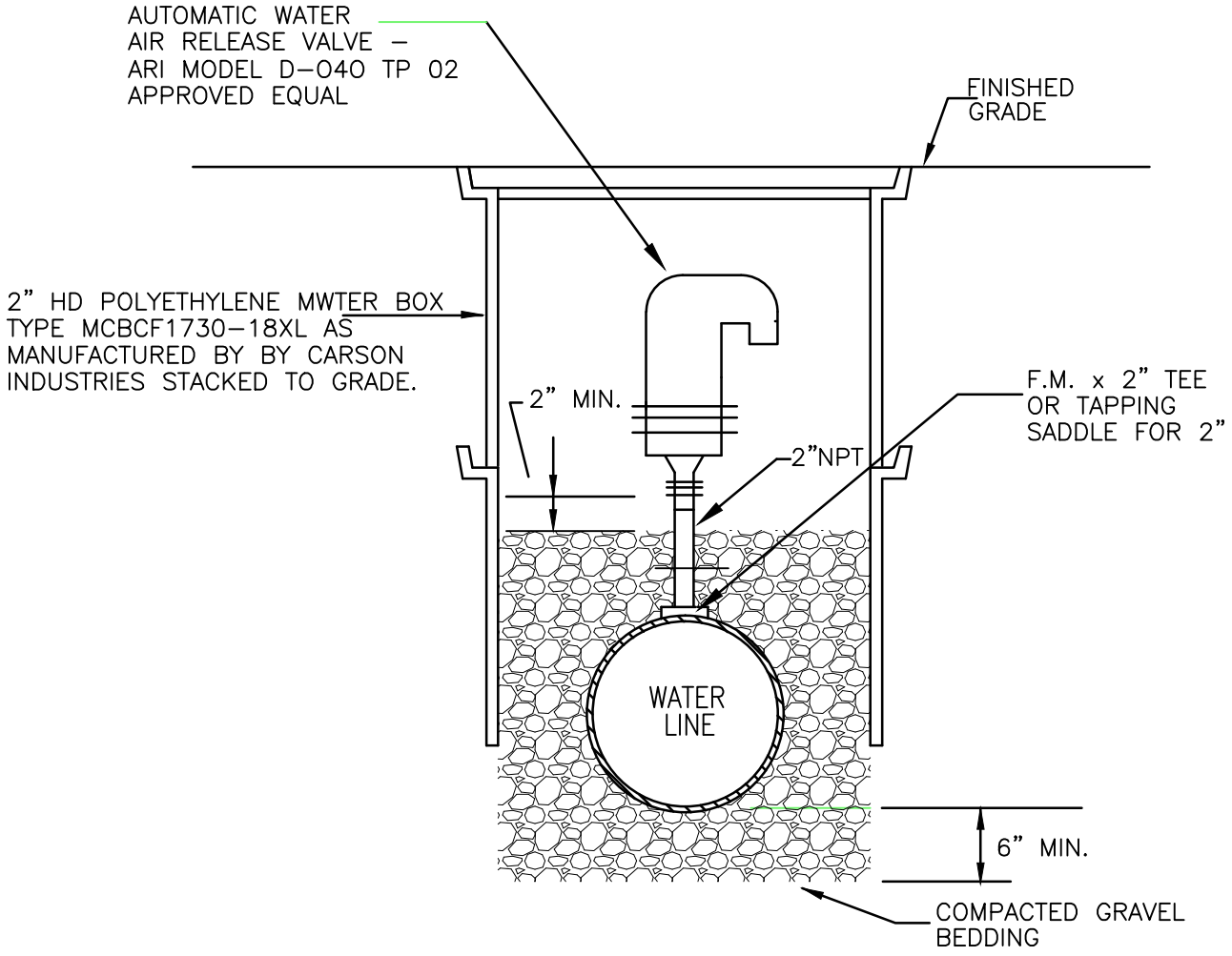


CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

FIRE SERVICE DCDA BACKFLOW PREVENTER

AUGUST, 2012

DRAWING NO. W9



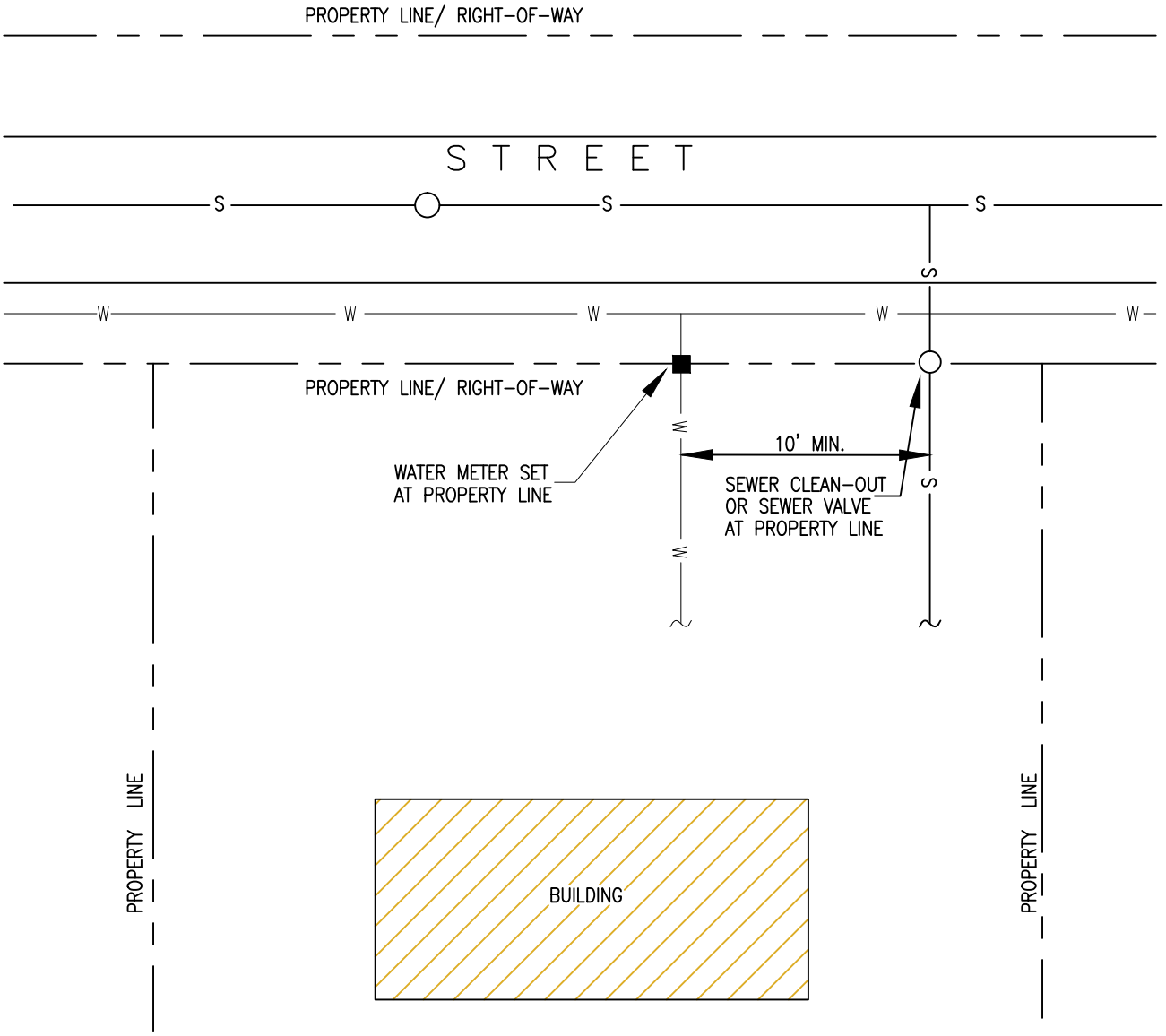
NOTE:
SEE SECTION 02660 IN
SPECIFICATIONS FOR
ADDITIONAL INFORMATION

CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

WATER AIR RELEASE VALVE & MANHOLE

AUGUST, 2012

DRAWING NO. W10

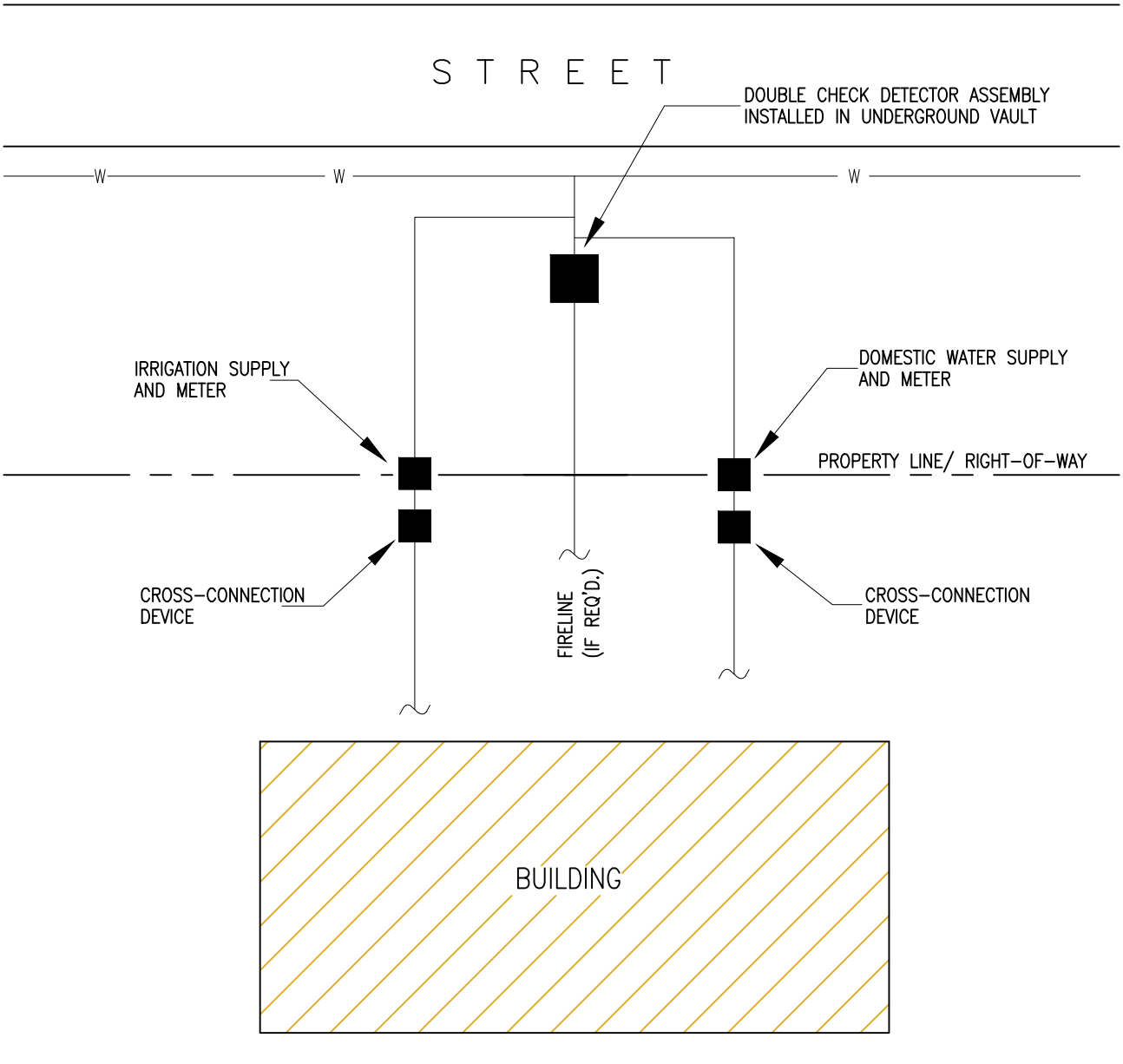


CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

TYPICAL SMALL METER (5/8" to 2") and SEWER SERVICE PLAN

AUGUST, 2012

DRAWING NO. W11



CITY OF BRENTWOOD
WATER SERVICES
STANDARD DETAIL

FIRELINE PLAN WITH DOMESTIC AND IRRIGATION SUPPLY

AUGUST, 2012

DRAWING NO. W12

ADDENDUM #1

SECTION 02730 - SANITARY SEWER SYSTEM

3.5 HOUSE LINE CONNECTIONS - NEW MAIN INSTALLATIONS

(Delete)

A. Make connection of a 4 inch house service line to the 6 inch service line using a FERNCO coupling sized appropriately.

(Add)

A. Make connection of a 4 inch house service line to the 6 inch service line using glue fitting sized appropriately and a 6 inch clean-out assembly per the std drawing.

Chris Milton, Director

02-07-13
Date