



Engineering Standards TRIVIEW METROPOLITAN DISTRICT

The enclosed Standards contain the Engineering Standards of the Triview Metropolitan District, and shall be binding and in full force and effect as of January 21, 2021. This 2nd Edition of the Triview Metropolitan District's *Engineering Standards* establishes standard requirements for constructing Triview Metropolitan District's transmission and distribution projects and includes Engineering Standards, Material Specifications, and Standard Details.

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ENGINEERING STANDARDS



**EFFECTIVE
JANUARY 2021**

ABBREVIATIONS

Technical Societies

ABPA	American Backflow Prevention Association
ACI	American Concrete Institute
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International
AWS	American Welding Society
AWWA	American Water Works Association
CDPHE	Colorado Department of Public Health and Environment
CSA	Canadian Standards Association
DIPRA	Ductile Iron Pipe Research Association
IEEE	Institute of Electrical and Electronics Engineers, Inc.
ISA	Instrument Society of Automation
MSS	Manufacturers Standardization Society
NACE	National Association of Corrosion Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	NSF International
OSHA	Occupational Safety and Health Administration
SSPC	The Society for Protective Coatings
UL	Underwriters Laboratories, Inc.
USC FCCCHR	University of Southern California Foundation for Cross-Connection Control and Hydraulic Research

General Abbreviations and Acronyms

AC	Asbestos Cement
AMR	Automatic Meter Reading
AMI	Advanced Metering Infrastructure
AP	Angle Point
ASC	Automatic Sprinkler Connection
AWG	American Wire Gauge
BFP	Backflow Prevention/Preventer
BHN	Brinell Hardness Number
BMP	Best Management Practice
Buna-N	Nitrile
CaCO ₃	Calcium Carbonate
CAD	Computer Aided Drafting
CI	Cast Iron
CLSM	Controlled Low Strength Material
CPCS	Capital Projects Construction Standards
CPDWR	Colorado Primary Drinking Water Regulations
CWP	Cold Working Pressure
CY	Cubic Yard
DC	Direct Current, Double Check Valve
DCDA	Double Check Detector Assembly
DFT	Dry Film Thickness
DI	Ductile Iron
DPDT	Double-Pole Double Throw
DR	Drain; Drive; Drawer; Dimensional Ratio
EPDM	Ethylene Propylene Diene Monomer

ERT	Encoder-Receiver-Transmitter
FPS	Feet per Second
HDD	Horizontal Directional Drilling
HMWPE	High Molecular Weight Polyethylene
HVAC	Heating, Ventilating, and Air Conditioning
I&C	Instrumentation and Control
I/O	Inputs and Outputs
ID	Inside Diameter
IRR	Irrigation
L	Liter
lb	Pound
LMDP	Linear Medium Density Polyethylene
m	Meter
mA	Milliamperes
MCL	Maximum Contaminant Level
MOA	Miller Over All
MS	Material Specification
NAD	North American Datum
NGS	National Geodetic Survey
No.	Number
NPT	National Pipe Thread
NPDES	National Pollutant Discharge Elimination System
OD	Outside Diameter
P&ID	Piping and Instrumentation Diagram
PC	Point of Curvature
PE	Plain End; Professional Engineer
PI	Point of Intersection
PLC	Programmable Logic Controllers
PLS	Professional Land Surveyor
PRV	Pressure Regulating Valve
PSI	Pounds per Square Inch
PT	Point of Tangency
POT	Point on Tangent
PUD/PBG	Planned Unit Development/Planned Building Group
PVB	Pressure Vacuum Breaker
PVC	Polyvinyl Chloride
ROW	Right of Way
RP	Reduced Pressure Principle Backflow Prevention Assembly
SCADA	Supervisory Control and Data Acquisition
SOP	Standard Operating Procedure
SPDT	Single-Pole Double Throw
SWP	Safe Working Pressure
UNS	Unified Numbering System
V	Volts
VAC	Volts Alternating Current
VDC	Volts Direct Current
WOG	Water-Oil-Gas
WQCD	Water Quality Control Division
WSP	Working Steam Pressure

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The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 1 - General

1.01 AUTHORITY

These Standards are promulgated by the Manager of Triview Metropolitan District pursuant to the authority granted by the District's Board of Directors and the Triview Metropolitan Districts Service Plan.

The administration of these Standards, including the interpretation, enforcement, revision, waiver, and variance thereof, is hereby delegated by the Manager to the District's appointed representative.

A formal variance request shall be submitted in writing to the Sales Administration Section and forwarded to the Chief Engineering Officer, or the Chief's appointed representative, for review.

1.02 EFFECTIVE DATE OF STANDARDS

These Standards shall be effective after they have remained posted in a conspicuous public place in the principal business offices of Triview Metropolitan District for a period of 15 days; they shall supersede the former Engineering Standards of the Triview Metropolitan District, Monument, Colorado.

1.03 REVISIONS, AMENDMENTS, OR ADDITIONS

These Standards may be revised, amended, or added to from time to time. Such revisions, amendments, and additions shall be binding and in full force and effect when electronically posted in the manner set forth in [1.02](#).

1.04 TRIVIEW METROPOLITAN DISTRICT CONTROL

These Standards apply to the installation, operation, maintenance, and materials of water facilities under the control of Triview Metropolitan District, including Triview Metropolitan District property interests outside of the District.

Triview Metropolitan District shall not be restricted by or limited in the exercise of its lawful powers despite any variance from these Standards that occurred, that was authorized in the past, or that may be authorized in the future. Actions in violation of these Standards, either direct or indirect, by any person, including any Owner, operator, or agent of an Owner or operator of any water facility in making any connection, disconnection, repair, or otherwise doing work with respect to any water facility served with water from the Triview Metropolitan District system, shall not continue after the discovery of such violation or the enforcement of corrective action regarding such violation.

1.05 ORGANIZATION AND INTERPRETATION OF STANDARDS

These Standards are composed of written Engineering Standards, [Material Specifications](#), and [Standard Drawings](#). The interpretation of any Section, or of differences between Sections, when appropriate, shall be made by the District Manager, or the District Managers appointed representative, and shall be binding and controlling in its application.

Whenever there is a conflict between these Engineering Standards and any referenced standard, specification, or code, the most stringent requirement shall apply. References to documents or specifications shall be the latest edition or revision thereof.

Triview Metropolitan District is committed to sustainability, incorporating it into both strategic thinking and daily operations while remaining responsible stewards of the environment and contributing to a vibrant community. Triview Metropolitan District imbeds this commitment in its Strategic Plan, Sustainability Guide, Environmental Compliance Systems, and Engineering Standards.

1.06 DEFINITIONS

As used in these Standards, unless the context shall otherwise require, the words defined herein shall have the following meanings ascribed:

Air-Gap: The unobstructed vertical distance between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture, or other assembly, and the flood level rim of said vessels. An approved air-gap shall be permanently installed and at least double the diameter of the supply pipe, measured vertically, above the top of the overflow rim of the vessel, but not less than 1-inch.

American Backflow Prevention Association Backflow Prevention Assembly Tester: A tester certified in the field test procedures published in the current Manual of Cross-Connection Control published by the USC FCCCHR. The tester shall be proficient in field test procedures and the preparation of assembly test reports.

American Society of Sanitary Engineering Backflow Prevention Assembly Tester: A tester certified in the field test procedures meeting the minimum performance requirements of the ASSE Series 5000. The tester shall be proficient in test procedures and the preparation of assembly test reports.

Atmospheric Vacuum Breaker: A type of BFP assembly that is not approved by Triview Metropolitan District.

Advanced Metering Infrastructure: An integrated system of smart meters, communications networks, and data management systems that enables two-way communication between utilities and customers.

Automatic Meter Reading: A type of AMI. A system of electronic components that permit the collection of meter readings by wireless or wired electronic communication systems. Components thereof may be attached to and become part of a customer's water meter. Other components may include central data collection units, vehicle-mounted equipment, and data transmission systems.

Backflow: The unwanted flow of water or other liquids, mixtures, gases, or substances into the distribution pipes of a potable water supply from a source other than the intended source.

Backflow Prevention: The prevention of the flow of any foreign liquids, gases, or substances into the pipelines of a potable water supply by the installation of a BFP assembly or method.

Backpressure: An increase in pressure in the downstream piping system that can cause a reversal in the normal direction of flow at a particular point. The increase in pressure can be caused by pumping, air pressure, or the elevation of piping.

Backsiphonage: A form of backflow that is a result of negative or sub-atmospheric pressure within the water system.

Board: The Board of Directors is the Triview Metropolitan District's governing body as established by the Triview Metropolitan District's Service Plan.

Capital Projects Construction Standards: Standards that apply to the design and construction of Triview Metropolitan District's capital projects. These multidisciplinary standards include General Conditions, Standard Technical Specifications, and Standard Details that apply to individual project contract documents but are not printed with them.

CEO/Manager: The Board designated CEO/Manager of Triview Metropolitan District.

Certified Welder: A skilled welder, welding operator, or tacker with adequate experience in the method of materials to be used and qualified under the provisions of the AWS Standard D1.1 using the test position in which the weld is to be performed. Welders shall be qualified by an independent, local, and approved testing agency within the 6-month period prior to beginning work. Machines and electrodes similar to those used in the work shall be used in qualification tests.

Commercial Property: Real estate zoned with a primary use including, but not limited to, business, commercial, industrial, public, manufacturing, and mixed-use (commercial/residential) properties.

Conduit: A 24-inch or larger diameter pipe that carries recycled, raw, or potable water to and from treatment facilities and storage reservoirs and to delivery points that supply the distribution system. Conduits are specifically distinguished from transmission mains (16-inch and 20-inch mains) due to head loss constraints.

Consecutive System: A water system owned and operated by a Distributor that does not meet Triview Metropolitan District's operational and maintenance standards or a private water distribution system owned by an individual entity.

Consumer: A person, firm, or corporation using or receiving water from the public water system.

Contamination: Potable water quality compromised by sewage, industrial fluids, waste liquids, compounds, or other materials to a degree that creates an actual or potential hazard to public health.

Contractor: In the context of these Standards, a Contractor is utilized for a water system extension.

Cross-Connection Control: An administered program that is designed to protect the public health, the public drinking water supply, and the recycled distribution system by the regulation and monitoring of the installation and maintenance of BFP assemblies or method.

Cross-Connection Control Containment By Isolation: The installation of a low hazard USC FCCCHR DC BFP assembly or method to serve as containment and a high hazard USC FCCCHR reduced pressure principle BFP assembly to serve as isolation. They shall be installed on a designated branch line and are acceptable as a means of protecting private plumbing and the public water supply at the discretion of Triview Metropolitan District.

Cross-Connection Control Containment Protection: The installation of a USC FCCCHR approved BFP assembly or method on a dedicated water service line that protects the public drinking water supply from an actual or potential cross-connection within a private plumbing system. Examples of potential cross-connections are listed in [5.05](#).

Cross-Connection Control Isolation Protection: The installation of a USC FCCCHR approved BFP assembly within a building or facility's private plumbing system near the source(s) of pollution or contamination to protect the internal plumbing from an actual or potential cross-connection, see [5.05](#).

Degree of Hazard: A pollutant, or non-health risk, is considered a low hazard. A contaminant, or health risk, is considered a high hazard. These classifications are determined based on conditions within a system.

Monument: The property within the Town of Monument a Statutory City within Colorado

Distribution Main: A 12-inch or smaller diameter pipe that is installed in public streets or appropriate ROW and used for the distribution of water to consumers.

Distribution Main Valve: A valve on a distribution main that is direct buried.

Distribution System: Mains that are composed of 12-inch or smaller diameter pipe, together with appurtenant and necessary valves, fire hydrants, taps, meters, service pipes, and associated materials, property, and equipment that receive recycled or potable water from conduits and transmission mains for delivery to consumers.

Distributor: An entity that is located outside the Triview Metropolitan District yet inside the Service Area that has a contract with Triview Metropolitan District for the delivery of potable water and does not comingle such water with potable water from any other source.

Distributor Contract Area: An area outside the Triview Metropolitan District covered by a contract that furnishes potable or nonpotable water to an entity that has the authority to occupy public streets, roads, and ROW as a water utility.

Distributor Main Extension: An extension to a distribution system that is within a Distributor Contract Area and outside the territorial boundaries of the Triview Metropolitan District and Total Service Area.

Domestic Service Line: Pipe, fittings, and appurtenances used to convey water from the tap on Triview Metropolitan District's or a Distributor's facilities to the plumbing of licensed premises for human consumption.

Double Check Valve Assembly: A testable assembly comprised of two internally loaded, independently operating check valves between two tightly closing resilient-seated shutoff valves and four properly located test cocks for field testing. This unit shall be a USC FCCCHR approved BFP assembly designed to protect against a non-health hazard condition.

Dual Water Supply: A water supply that is located on or is available to a customer's premises in addition to the Triview Metropolitan District approved public potable water supply (e.g., gray water, raw water, recycled water, well water, a lake, a pond, or a ditch).

Dual Water Supply Agreement: An agreement between the Board and the Property Owner declaring the premises has or may have a dual water supply other than Triview Metropolitan District's potable system. The Property Owner agrees he or she shall not cause or permit the presence of any condition or uncontrolled connection, either actual or potential, at the premises documented on the agreement. The Property Owner shall, at his or her cost, install a USC FCCCHR BFP assembly on the domestic service line supplied to the premises and shall hire an ABPA or ASSE certified tester to test the assembly upon installation and annually thereafter. A copy of the test reports shall be provided to Triview Metropolitan District's Cross-Connection Control Section.

Engineer: The Chief Engineering Officer who is a member of the CEO's/Manager's Executive Staff, or the Managers appointed representative.

Fire Service Line: Pipe, fittings, and appurtenances that convey water from distribution mains to the licensee for fire protection purposes (specifically for automatic sprinkler systems). For the purposes of these Standards, the NFPA 13 fire service line extends from the corporation stop or tee on the water main to the edge of the public ROW or easement that contains the water main.

Head Loss: The measure of the reduction in the total head of the water as it moves through a system. In Triview Metropolitan District's system, head loss constraints are 2-feet per thousand in distribution mains, 1 1/2-feet per thousand in transmission mains, and 1-foot per thousand in conduits.

High Hazard: Vulnerability from a facility's private plumbing system that constitutes a health risk to the internal plumbing and/or the public water system by the introduction of a contaminant (e.g., sewage, industrial fluids, waste liquids, compounds, or other materials). The introduction of such contaminant would cause a poisoning of the water supply or the spread of disease.

Hydrant Branch: Pipe that extends from the water main to the fire hydrant.

Hydraulic Grade Line: In closed pipelines flowing under pressure, the hydraulic grade line is the level to which water would rise in a vertical tube open to atmospheric pressure at any point along the pipeline.

Industrial Piping System: Any system used by a consumer for the transmission, confinement, or storage of any fluid, solid, or gaseous substance other than an

approved water supply. This includes pipes, conduits, tanks, receptacles, fixtures, equipment, and appurtenances used to produce, convey, or store substances that may be polluted or contaminated.

Inspector: The authorized representative of the Engineer assigned to a jobsite.

Integrated System: The Triview Metropolitan District System, Total Service Distributor Water Systems, and those Read and Bill and Master Meter Distributor Water Systems that meet Triview Metropolitan District's operational and maintenance standards and are therefore treated as part of the Triview Metropolitan District system for testing and reporting to the state health department under Triview Metropolitan District's Public Water System Identification Number (PWSID).

Irrigation Service Line: Pipes, fittings, and appurtenances that are used to convey water from the tap on Triview Metropolitan District's or a Distributor's facilities to the plumbing of the licensed premises for irrigation use only.

Isolation Valve: A valve used in a fully open or fully closed position to isolate the flow of water in the Triview Metropolitan District system.

Licensee: Any person, association, corporation, entity, or governmental agency who owns or controls the licensed premises.

Low Hazard: Vulnerability from a facility's private plumbing system that is not considered a public health risk. However, it may constitute a nuisance or could cause damage to the internal plumbing and/or the public water system.

Main Extension: An extension to the distribution system that is within the Triview Metropolitan District or Total Service Contract Area.

Manifold Service Line: Pipes, fittings, and appurtenances that are used to convey water from the manifold tap on Triview Metropolitan District's or a Distributor's facilities to the associated domestic service lines.

Master Meter Contract Area: An area in which, by contract, the Distributor is responsible for the construction, operation, and maintenance of the water distribution system, reads the customer's meter, and bills the customer.

Meter Inspector: An authorized representative of Triview Metropolitan District's Customer Service Field Section responsible for ensuring that water services and metering installations, including AMR systems, comply with applicable standards.

Multi-Family Residential: A multiple-unit residential structure consisting of attached dwelling units arranged side-by-side or vertically stacked adjacent to a public ROW or easement.

Non-Toxic Substance: Any substance of a non-poisonous nature that may create a low hazard to the water supply system.

Operating Rules: Rules adopted by the Board under Article 10.1.18 of the Charter of the City and County of Triview Metropolitan District that define how Triview Metropolitan District conducts business.

Owner: The legal owner of a parcel of land as reflected in the county assessor's records.

Plans: Engineered drawings that show the location, dimensions, materials, and details of the proposed work.

Pollution: An impairment to the quality of water to a degree that does not create an actual hazard to the public health but does adversely and unreasonably affect such water for domestic use.

Premises: A legally defined parcel of land that may have more than one tap, meter, and license.

Premises ID: A randomly assigned unique identifier for the individual service address of a physical location.

Pressure Vacuum Breaker: A vacuum breaker designed to prevent backsiphonage. It consists of a spring-loaded check valve, a spring-loaded inlet opening, a tightly closing shut off valve on each side of the assembly, and two appropriately located test cocks. This type of assembly shall not be subjected to backpressure.

Professional Engineer: An engineer registered in the State of Colorado.

Professional Land Surveyor: A land surveyor registered in the State of Colorado.

Read and Bill Contract Area: An area in which, by contract, the Distributor is responsible for the operation and maintenance of the water distribution system. Triview Metropolitan District reads the meter of the customer and bills the customer according to a specified rate.

Reduced Pressure Principle Backflow Prevention Assembly: A testable assembly comprised of two internally loaded, independently operating check valves, a mechanically independent differential pressure relief valve located between two check valves, two tightly closing upstream and downstream resilient-seated shutoff valves, and four properly located test cocks for the field testing. The unit shall be a USC FCCCHR approved BFP assembly designed to protect against a non-health and/or health hazard condition.

Residential Fire Sprinkler Suppression System: An integrated piping system used for fire protection purposes to improve and increase public safety. The integrated system shall be in accordance with NFPA 13D, Standards for the Installation of Sprinkler Systems in One-Family and Two-Family Dwellings and Manufactured Homes.

Section and Division: The words Section and Division are used as organizational subdivisions of Triview Metropolitan District (e.g., Sales Administration Section, Engineering Division).

Service Area: The City and County of Triview Metropolitan District plus the area within the outer geographical boundaries of the existing and projected service areas of all of the Distributors combined based on the legal descriptions contained in each Distributor's contract.

Service Line: The pipe, fittings, and appurtenances needed to convey water from the tap on Triview Metropolitan District's or a Distributor's facilities to the plumbing of a licensed premises.

Single-Family Residential: A single unit dwelling.

Stop Box: A valve box, service box, or curb box that is set over the property line valve or curb stop on a domestic water service.

Stub-In: A connection to a main intended to allow installation of a portion of the service line for taps, 2-inch and smaller, prior to setting the meter and activating the license for a particular premises.

Subgrade: The elevation at the bottom of pavement depth.

Tap: A physical device, pipe fitting, or connection that connects a licensee-owned service line to a distribution main owned by Triview Metropolitan District or a Distributor or to a fire service line.

Total Service Contract Area: An area in which, by contract, Triview Metropolitan District is responsible for the operation and maintenance of the water distribution system, reads the meter of the customer, and bills the customer.

Toxic Substance: Any liquid, solid, or gaseous substance, including raw sewage, which may create a danger to the health and well-being of the consumer when introduced into the water supply system.

Transmission Main: A 16-inch through 20-inch diameter pipe that receives recycled, raw, or potable water from a conduit and distributes it to consumers in public streets or appropriate ROW. Transmission mains are distinguished from conduits and distribution mains due to head loss constraints.

Transmission Main Valve: A 16-inch through 20-inch valve typically contained within a vault.

Water Feature: A structural design element that is not intended for human contact. It shall be supplied by potable or recycled water and may be located indoors or outdoors. Examples include ponds, cascades, waterfalls, and streams normally powered by pumps. Tapping the service line off an irrigation or recycled water system is subject to approval by Triview Metropolitan District. Agreements for use shall be signed in accordance with Triview Metropolitan District's Operating Rules.

Water Play Feature: A structural design element (e.g., an interactive fountain) intended for recreational use (human contact) that is supplied with potable water normally powered by pumps. The use of irrigation, fire, and/or recycled water is prohibited.

Water – Potable: Water from a source investigated by the health agency having jurisdiction and approved for human consumption.

Water – Recycled: Treated domestic wastewater that is suitable for irrigation and commercial uses but is not suitable for human consumption.

Water Main: A distribution or transmission main.

Water Service Connection: The terminal end of a service connection (i.e., where Triview Metropolitan District loses jurisdiction and quality control over the water at its point of delivery to the customer's water system). The water service connection is at the downstream end of the meter. Also included are connections from a fire hydrant, fire service line, and any other temporary or emergency water service connection from Triview Metropolitan District's potable water system. Unprotected taps on the service upstream of the meter or BFP assembly are prohibited.

Water Supply – Unapproved: A water supply that is not approved for human consumption by the official health authority having jurisdiction.

Welder: See Certified Welder.

The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 2 - Main and Distributor Main Extensions

2.01 INSIDE TRIVIEW METROPOLITAN DISTRICT

The Board has complete charge and control of its water system Inside Triview Metropolitan District under the provisions of Article X of the Charter of the City and County of Triview Metropolitan District. The Board owns, operates, and maintains facilities Inside Triview Metropolitan District.

2.02 OUTSIDE TRIVIEW METROPOLITAN DISTRICT

The Board supplies water to legal entities outside the territorial boundaries of Triview Metropolitan District through several contractual agreements. In Total Service Contract Areas, the Board operates and maintains facilities in a manner consistent with those Inside Triview Metropolitan District.

2.03 ENGINEERING STANDARDS TO APPLY

Contracts for the supply of water from Triview Metropolitan District and the design and operation of such systems are subject to the rules and regulations of the Board under the provision of its Operating Rules. These Engineering Standards are to apply uniformly to main and distributor main extensions and are subject only to contractual and procedural variations.

2.04 APPLICATION PROCEDURE

The application procedures include requirements for submittals, payment of fees, engineering design review, construction, inspection, acceptance, and warranty. Applications shall follow the application procedure detailed by the Sales Administration plan review process.

Distributor main extensions may require a separate application, plan review fees, and a review by the Distributor in addition to Triview Metropolitan District's requirements. The PE is responsible for determining and complying with the requirements of the particular Distributor while simultaneously going through the application process and review with Triview Metropolitan District.

2.05 PLANS

Submitted plans shall clearly present only the required information. The design and installation of facilities shall ensure the development of an integrated system. Plans are valid for one year from the approval date.

- A. An electronic plan set for main extensions and service lines shall be submitted to the Triview Metropolitan District for review and approval. The plan shall include CAD files. The review fee shall be paid prior to Triview

Metropolitan District's review of plans. The engineered plan sets shall meet the following requirements:

1. Information on the drawings shall be clear and legible. Triview Metropolitan District may reject plans deemed illegible.
2. Size: Architectural D (24-inch by 36-inch) or ANSI D (22-inch by 34-inch).
 - a. After the initial submittal, subsequent submittals shall be ledger-size (11-inch by 17-inch).
3. Drawings shall have a title block that contains the project's title, drawing scale, and preparation date, in addition to a revision block. A 1-inch space shall be left clear under the title block for Triview Metropolitan District's use.
4. Drawings shall be prepared by or under the direct supervision of a PE. The submitted drawings shall bear the seal and signature of the PE and the date.
5. Drawings shall be in English Units at an engineering scale between 1-inch equals 10-feet and 1-inch equals 30-feet.
6. Drawings shall contain a North arrow with preferred orientation to the top or right of the sheet. However, the orientation may be rotated to provide additional coverage and a larger, more legible plan.
7. Drawings shall be made from actual field surveys, conducted by a PLS, that are referenced to land corners or other official survey control points. Surveys shall be of sufficient accuracy to ensure facilities are accurately staked for installation and readily located after installation for maintenance, tapping, and control.
8. The identification of surface features of the water facilities (e.g., valves, hydrants, manholes, and meter pits) shall be in or readily equated to NAD83 State Plane coordinates or in Triview Metropolitan District's Grid Coordinate System with survey accuracy standards by GPS or other survey methods and equated to a unique value for each. Values shall be presented in tabular format as part of the drawings and submitted to Triview Metropolitan District by approved electronic media. If the submittal is to be converted to NAD83 State Plane coordinates, detailed and complete instructions for conversion shall accompany plan submittal. Values on valves, manholes, meter pits, etc. shall be given at the radial point of the feature and on the center of the operating nut of hydrants.
9. Show the approved permanent water source that can supply sufficient water for chlorination, flushing, and hydrostatic testing, and the anticipated water demand for these purposes.
10. Show sufficient adjacent area to demonstrate the relationship between new and existing facilities.
11. After final approval and prior to construction, the final water main plans shall be delivered to Triview Metropolitan District and shall be in accordance with the following requirements:
 - a. CAD drawing files
 - b. One set of detailed plans on bond paper (Architectural D or ANSI D) signed and sealed by the PE of record.
 - c. PDF files of the final plan set.

- B. Additionally, the CAD files and copies submitted to the Sales Administration Section shall contain the minimum following plan requirements:
1. A [cover sheet](#) with the following:
 - a. The project name, the city and county, and the Section, Township, and Range of its location.
 - b. The name of the engineering firm, including its mailing address, contact email address, and telephone and fax numbers.
 - c. A general vicinity map showing major roads and the project location.
 - d. An index of the sheets within the plan set.
 - e. A list of the abbreviations and symbols.
 - f. PLS stamp and seal with a statement of the coordinate translation.
 - g. Triview Metropolitan District [Standard Drawing](#) index.
 - h. Materials list table.
 - i. Fire flow data.
 - j. The fire department signature block and/or appropriate electronic fire department approval.
 2. General construction and water notes.
 3. A [Water Only Plan](#) showing the following:
 - a. A key map.
 - b. The location and dimensions of dedicated streets, easements, and ROW.
 - c. The address of the premises to be served with the property lines shown.
 - d. Existing and proposed curb, gutter, and sidewalks.
 - e. The proposed alignment of the water main without-distances from the property/easement line, the location of proposed water facilities (e.g., valves, fire hydrants, and fittings) with the pipe length (dimensions) between them, and the pipe diameter.
 - f. The proposed elevation, the upstream and downstream hydraulic grade line and pressure on PRVs.
 - g. Dimensions from existing valves to proposed connections.
 - h. Existing water mains (e.g., valves, hydrants, and the size and type of pipe).
 - i. Isolation valves between proposed hydrants.
 - j. The meter location for domestic connections.
 - k. The location and size of existing and proposed taps, services, stub-ins, curb stops or property line valves, meters, and BFP assemblies for fire service lines, domestic services, and irrigation services. Indicate irrigation and fire service lines to differentiate them from domestic services. A typical detail may be used provided exceptions to the typical detail are clearly identified on the plan.
 - l. Domestic, fire, and irrigation service lines including the tap, curb stop or property line valve, and meter location shall be called out by size and service line length to the BFP assembly. If a BFP assembly is not required, show the service line to 5-feet past the meter pit or vault. If the curb stop/property line valve or meter pit/vault is to be in a paved area, include a letter requesting a variance that justifies the need.

- m. The location of the USC FCCCHR approved BFP assembly and the linear distance between the meter and the BFP assembly on the dedicated water service line.
 - n. Include the USC FCCCHR approved BFP assembly type, diameter, and type of installation (above or below ground). If an irrigation branch line/takeoff is installed on a domestic water service line, show the location of the irrigation BFP assembly (upstream or downstream) in relation to the domestic containment BFP assembly. Provide the BFP assembly serial number for each existing assembly.
 - o. Existing and/or proposed drinking fountains, water features, and water play features. If applicable, include branch line/takeoffs downstream from the BFP assembly with linear distances from existing and/or proposed drinking fountains and/or features to the BFP assembly.
 - p. For proposed indoor meter installations, include a copy of the written approval for the use of an inside meter from Triview Metropolitan District's Meter Inspection Supervisor.
 - 1) Indoor meter settings shall also include the required inside meter setting drawings, in accordance with the_
 - q. For 16-inch and 20-inch pipe, or if specifically requested by Triview Metropolitan District, include a profile of the centerline of the pipe and the proposed and existing ground lines in accordance with Section 2.05B.6. Show utilities, top of pipe, slope of pipe, elevation at grade breaks, depth to top of pipe (4 1/2-feet minimum), soil conditions, and fittings.
 - r. A reference to the applicable Triview Metropolitan District Standard Drawing number and Standard Drawing Index.
 - s. Existing or proposed obstructions (e.g., vaults, catch basins, traffic islands, retaining walls, detention ponds, and foundations).
 - t. PUD/PBG complexes shall show existing and proposed structures, driveways, and parking facilities.
4. An Overall Utility Plan view (separate from the Water Only Plan) showing:
- a. The location and dimensions of dedicated streets, easements, and ROW.
 - b. The address of the premises to be served with the property lines shown.
 - c. Existing and proposed curb, gutter, and sidewalks.
 - d. A clear indication of areas that are paved (e.g., walks, parking lots, driveways, and patios) and those that are landscaped (e.g., grass, flowers, and tree squares).
 - e. Existing and proposed utilities. Sewer information may be submitted on a separate sheet.
 - f. Existing or proposed obstructions (e.g., vaults, catch basins, traffic islands, retaining walls, detention ponds, and foundations). The proposed alignment of water mains and the location of proposed facilities (e.g., valves, fire hydrants, and fittings).
 - g. The meter location for domestic connections.

- h. The location and size of existing or proposed taps, services, stub-ins, curb stops or property line valves, meters, and BFP assemblies for fire and domestic connections. A typical detail may be used if exceptions are clearly identified on the plan.
 - i. PUD/PBG complexes shall show existing and proposed structures, driveways, and parking facilities.
- 5. Typical street cross-sections showing the following:
 - a. Property, ROW, and easement lines.
 - b. Street, curb, gutter, and existing or proposed utilities with dimensions to property lines.
 - c. A reference to the applicable Triview Metropolitan District [Standard Drawing](#) number.
- 6. The profile of the centerline of the pipe showing the following:
 - a. Proposed and existing ground lines.
 - b. Any proposed or existing utility crossing the proposed water main.
 - c. The separation between the water main and other utilities.
- 7. Distributor required detail sheets showing relevant information (e.g., pipe and fitting restraints, hydrant installations, blowoff installations, proposed crossings, service lines, meter settings, and AMR/AMI devices) as required by the Distributor.
 - a. Details are not allowed on plan submittals when the project is Inside Triview Metropolitan District or Total Service Contract Areas.
- C. Submittals shall include items outlined in [Chapter 4](#) when the granting of easements is required. Partial submittals will result in the return of items received.

Addenda and modifications to plans take precedence over original documents. On drawings, calculated dimensions take precedence over scaled dimensions and noted material over graphic representations.

Dedicated streets, easements, and planned development complexes shall be in accordance with the requirements of other Sections of these Standards. The copy of the recorded subdivision plat furnished in the final submittal, a recorded copy of the deed for the property involved, or a recorded copy of an easement shall be provided to Triview Metropolitan District.

2.06 ENGINEERING

Plans submitted to Triview Metropolitan District for review, comment, and approval shall be prepared by or under the direct supervision of a PE. The PE shall be responsible for the design, the preparation of plans, the determination of materials, and the field survey. Submitted plans shall bear the PE's seal prior to approval for construction.

Any failure or unsatisfactory performance of the system, as constructed, is not the responsibility of Triview Metropolitan District and shall not be a cause for action against Triview Metropolitan District. Triview Metropolitan District does not perform engineering services for any person or entity in connection with its review of plans.

Approval of plans by Triview Metropolitan District signifies only that plans meet the minimum requirements of these Standards based upon the information provided to Triview Metropolitan District by the PE. Triview Metropolitan District makes no finding, representation, or warranty that the system and associated components (e.g., pumps, motors, valves, and meters) will perform any certain function.

If the PE responsible for the plans disagrees with any changes that are required by Triview Metropolitan District as a result of its plan review, such disagreement shall be brought to the attention of Triview Metropolitan District in writing for resolution prior to the approval of plans. The seal of the PE on plans, and the stamp: Approved for Construction by Triview Metropolitan District, shall signify that plans have been reviewed and are authorized for construction.

A signed plan review compliance letter shall be provided to Triview Metropolitan District along with the submittals required by the Sales Administration plan review process.

2.07 CONSTRUCTION PROCEDURE

Following the final approval of plans, the Contractor may proceed with construction subject to the following:

- A. Construction shall begin within one year and shall not be suspended for longer than one year. Approved projects wherein construction has not begun within one year of the approval date or where it has been suspended for longer than one year shall be resubmitted for review and approval by Triview Metropolitan District.
- B. The Contractor shall secure the easements, licenses, and permits required for the system extension entirely at its expense and shall submit any recorded plats necessary to furnish proof of public street dedication.
- C. The Contractor shall pay Triview Metropolitan District's inspection, reproduction, and plan review fees if requested.
- D. The main extension shall be accurately surveyed and staked in accordance with approved plans, see [2.08](#) and [2.09](#).
- E. Construction of dedicated streets and easements shall have progressed to at least the subgrade stage prior to the installation of water mains.
- F. The Contractor shall adjust valve boxes, fire hydrants, and related appurtenances to the ground line.
- G. Materials needed to complete the work, in accordance with the applicable [Material Specifications](#), shall be on-site for the project to proceed without delay.
- H. Outages shall be kept to a minimum in compliance with [8.22.C](#). Adequate provisions for notifying customers that may experience outages shall be implemented by the Contractor.
- I. For main extensions Inside Triview Metropolitan District and Total Service Contract Areas, the Contractor shall be responsible for scheduling a pre-construction meeting. The Contractor, the PE that designed the main extension, a representative of Triview Metropolitan District, a representative of the Distributor Contract Area (if applicable), and the licensee shall attend the pre-construction meeting. The purpose of the pre-construction meeting is to discuss the construction project and its scheduling and define

responsibilities for the personnel involved in the project. The Contractor shall give at least 2 days' notice to the Triview Metropolitan District Distribution Inspection Supervisor (000-000-0000) prior to the pre-construction meeting and prior to beginning construction.

- J. For main extensions, a Triview Metropolitan District Inspector shall be notified whenever it is necessary to open or close a valve on an existing water system. Only authorized Triview Metropolitan District personnel are to operate valves Inside Triview Metropolitan District and Total Service Contract Areas, see [8.22.B](#). The Distributor shall operate valves in Distributor Contract Areas.
- K. Mains shall not be installed unless extended from an approved permanent water source that can supply sufficient water for chlorinating, flushing, and hydrostatic testing.
- L. Triview Metropolitan District will verify the payment of fees, prepare the final documents for main installations, and authorize the tapping of the main.
- M. Small service taps, 2-inch and smaller, will be made by a qualified contractor and inspected by Triview Metropolitan District. Taps, 3-inch and larger, or tee connections will be inspected by Triview Metropolitan District. Taps on steel mains, 20-inch in diameter or smaller, shall be made using a method approved by Triview Metropolitan District. Mains shall be tapped only after the conditions and tests outlined in [8.26](#) are met; this includes a release by the health department having jurisdiction. Only one connection is allowed prior to the completion of testing.
- N. For Distributor Contract Areas, applications for taps need to be received and approved by both the Distributor and Triview Metropolitan District before taps are made on the main.

2.08 SURVEYING

Pipe shall not be installed without line and grade stakes approved by the Triview Metropolitan District Inspector. Line and grade for water mains shall be established under the direct supervision of a PLS.

The correct alignment and elevation of water mains, as shown on the approved drawings, is the responsibility of the PE. Approval of the staked alignment and elevations by the Triview Metropolitan District Inspector does not relieve the PLS of responsibility for field errors. Sufficient line and grade shall be staked to ensure continual work progress.

Exception: If a main is to be extended in an existing street and if the PE that prepared the plans can show the ground line is to remain unchanged, grade stakes shall not be required. The main shall be installed with a minimum of 4 1/2-feet of cover.

2.09 PLACING SURVEY LINES

Hubs, stakes, or appropriate survey control markers shall be set on an offset line to mark the centerline of the water main. Centerline hubs and stakes may be used in addition to offset hubs and stakes; however, they may not be used in lieu of offset hubs and stakes. Normal practice is to set offset hubs and stakes 5-feet to 10-feet, or an appropriate distance, off the centerline of the water main.

Offset line points shall be set to a maximum distance of 100-feet apart. Valves, crosses, tees, horizontal and vertical bends, fire hydrants, PCs, and PTs shall be staked for location and grade.

Stakes shall be positioned with the offset hub between the stake and the water main and shall be duly visible. The side of the stake that faces the water main shall be marked to show the point being referenced and the distance from the hub to the centerline of the water main. The back of the stake shall be stationered. Grade stakes shall be set at each hub and shall note the vertical distance from the top of the hub to the top of pipe. This vertical distance shall be based on the distance from the ground line to the top of pipe, which shall be a minimum of 4 1/2-feet.

NOTE: Triview Metropolitan District does not supervise or provide line and grade stakes.

2.10 INSPECTION

The installation of new facilities Inside Triview Metropolitan District and Total Service and Distributor Contract Areas shall be inspected and approved by Triview Metropolitan District.

Triview Metropolitan District personnel are not responsible for Contractor jobsite safety compliance or the enforcement of applicable safety regulations and standards including OSHA compliance regulations.

Triview Metropolitan District requires compliance with these Standards, especially with regard to the quality of workmanship and approved materials. Problems that may require sound field judgment in lieu of the strict interpretation of these Standards shall be resolved by the PE and the Contractor to the satisfaction of Triview Metropolitan District.

Work shall be performed in accordance with these Standards. Work that is not accepted by Triview Metropolitan District shall be reconstructed until compliance with these Standards is achieved.

Appropriate permits shall be on the jobsite; Triview Metropolitan District will check them prior to construction.

The materials used are subject to the inspection and approval of Triview Metropolitan District at any time and shall not be used prior to Triview Metropolitan District's inspection and approval. Triview Metropolitan District has the right to perform any testing deemed necessary to ensure compliance of the materials with these Standards. Failure or neglect on the part of Triview Metropolitan District to condemn or reject work or materials that are not in accordance with these Standards shall not be construed to imply acceptance if material inferiority becomes evident at any time. Materials rejected by Triview Metropolitan District shall be immediately removed from the jobsite. Directions given by Triview Metropolitan District personnel relating to field changes, the quality of materials, and workmanship on-site shall be immediately followed by the Contractor.

After the receipt of approved plans from Triview Metropolitan District, the Contractor shall give at least 2 days' notice to Triview Metropolitan District's Inspector (719-488-6868) prior to the start of construction. Construction is not allowed within the 2-day notification period.

2.11 CONTRACTORS

Work shall not begin until the pre-construction meeting is held and the Contractor is in possession of an approved set of plans. Work shall be performed in strict compliance with the approved plans and the [Material Specifications](#). Contractors shall keep a current copy of these Standards on-site during construction.

Contractors performing work for main extensions shall be competent, licensed firms with adequate manpower and equipment to accomplish the work in accordance with these Standards and applicable OSHA Standards. Contractors installing main extensions Inside Triview Metropolitan District or Total Service Contract Areas shall meet additional requirements with regard to qualification, bonding, and guarantees.

- A. Contractors need to be prequalified to construct water main systems Inside Triview Metropolitan District or Total Service Contract Areas where work is to be performed. Prequalification forms may be obtained from and shall be returned to Triview Metropolitan District. Following an evaluation of the completed form, written notice of acceptance or denial will be sent to the Contractor. Prequalification is subject to yearly application and renewal.
- B. The Owner/Developer shall be responsible for a period of one year following the final acceptance of the work. The Owner/Developer shall be responsible for the satisfactory repair or replacement of work, material, services, and equipment that becomes defective during this one year period as a result of faulty materials, faulty installation, or the improper handling of material and equipment installed by the Contractor.

2.12 POINTS OF DELIVERY

Triview Metropolitan District will deliver water from a point on its facilities that is the nearest available, adequate, and feasible for the connection; Triview Metropolitan District's determination of this point is final.

2.13 SPECIAL CONDITIONS

When applying for a main extension, special conditions that involve another agency may exist. Special conditions may include the crossing of a railroad, ditch, or highway. Conditions of the other agency shall be satisfied. Designs, drawings, and calculations submitted to another agency shall also be submitted to Triview Metropolitan District for approval. If a conflict in the plans and specifications occurs between Triview Metropolitan District and the other agency, the more stringent plans and specifications, that yield a higher quality product, will prevail as determined by Triview Metropolitan District.

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The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 3 - Service Lines, Fire Service Lines, Meters, and Appurtenances

3.01 GENERAL

The Operating Rules of the Board of Directors deal extensively with the ownership, installation, and maintenance of service lines, fire service lines, meters, and appurtenances. These Engineering Standards are intended to be supplemental and subordinate to the Operating Rules and shall be interpreted as such in conflicting situations.

Water is conveyed from mains to consumers by service lines and their associated appurtenances. Except for fire service lines, water delivered to customers shall be metered.

3.02 LAYOUT OF SERVICE LINES

- A. The service line shall be arranged to provide convenient access to the curb stop and the meter pit or vault for meter reading, operation, and maintenance. Wherever possible, the pit or vault shall be accessible from a paved street or Triview Metropolitan District easement that is accessible to maintenance vehicles and shall have line-of-sight to a public street. The curb stop or property line valve shall be located behind the curb line of the street as close to the curb as possible, in a landscaped or grassy area.

The meter pit or vault shall be located in a landscaped area that is 2-feet to 5-feet after the curb stop or property line valve. If there is a tree lawn between the curb and the sidewalk, the stop box and the meter setting shall be installed in the tree lawn. The public ROW or easement is preferred over private property. The meter setting shall be within 5-feet of the public ROW or Triview Metropolitan District easement. Curb stops and meter settings shall not be placed behind existing or future fences or walls that may block access from the public ROW or easement. The area around the stop box and meter vault shall be kept free of vegetation, structures, or other objects that may interfere with access or with the transmission of meter reading radio signals from the AMR/AMI device.

In urban landscaped areas, stop boxes and meters may be placed in paved walkways with prior written approval from the Meter Inspector. The curb stop or property line valve shall be located 6-inches to 12-inches behind the back of the curb or sidewalk. Stop box and meter pit or vault lids shall be carefully

adjusted to match the finished surface of the paved walk. Special meter pit or vault lids and AMR/AMI device configurations may be required.

Stop boxes and meter pits or vaults shall be located to provide a minimum of 5-feet of clearance from any building, retaining wall, fence, transformer pedestal, fire service line, or other permanent obstruction. The distance shall be measured from the outside wall of the valve box to the meter pit or vault.

- B. The premises to be served shall have a minimum frontage of 10-feet on the street or easement containing the water main to be tapped. The main shall extend a minimum of 8-feet along the front lot line of the premises. The tap and service line shall be located entirely on or in front of the premises to be served.
- C. The service line, to a point 5-feet past the meter pit or vault, shall be a minimum of 5-feet from any side property line. In the case of corner lots with frontage on two streets with water mains, the property may be served from either the front or the side of the lot.

The tap at the main shall be at least 5-feet from the side property lines extended to the main and at least 3-feet from any pipe joint or fitting or from the end of any pipe segment.

- D. The service line shall be installed in a continuous straight line, perpendicular to the property line or curb, from the tap to a point 5-feet past the back wall of the meter pit or vault, in accordance with the [Standard Drawings](#). A bend is allowed within 12-inches of the tapping saddle when the water main is not parallel to the property line.
- E. If service is requested for lots at the end of a cul-de-sac, the water main layout shall be in accordance with the [Standard Drawings](#). The main to be tapped shall be within 50-feet of the front property line of each lot to be served in the cul-de-sac.
- F. Service lines shall be installed 4 1/2-feet to 6-feet below the ground line. If the water main is less than 4 1/2-feet, or more than 6-feet below grade, the service line shall be brought to an acceptable depth as close to the main as possible. The depth from ground line to the curb stop or property line valve-operating nut shall not exceed 6-feet.

If the grade of the surface is raised or lowered after a service line is installed, the licensee is responsible for the lowering or relocation of the service to maintain cover between 4 1/2-feet and 6-feet.

- G. In cases where there may be confusion as to the property or building serviced by a service line, an engraved plastic tag shall be attached to the meter yoke in the pit or vault using a stainless steel braided wire. The tag shall be a minimum of 1 1/2-inch by 4-inch, 1/16-inch thick, with no more than three lines of text and a hole to accept the wire. The top and middle lines shall display the Triview Metropolitan District assigned service address and the building identification, if appropriate; the bottom line shall display the Triview Metropolitan District tap number. The tag shall have white letters engraved in a solid color. Tags for domestic service lines shall be blue; irrigation-only service lines shall be green; recycled water service lines shall be purple; fire service lines shall be red

- H. Care shall be taken to ensure that service lines do not enter the property at a driveway or a walkway. Service lines installed prior to the layout of property improvements may require reconstruction or relocation prior to activation to avoid driveways and other paved areas. Bends, offsets, and similar modifications of the straight-line layout requirements are not permitted. In cases where a landscaped area does not exist between the building and the street or easement, the curb stop and the meter may be installed in the sidewalk or in a similarly paved surface provided the installation is not subject to vehicle traffic, with the written approval of the Meter Inspection Supervisor. Special construction details shall be required and curb stops shall be placed under road boxes instead of curb boxes.
- I. The Meter Inspection Supervisor may authorize deviations to the service line standards contained in this Section. Deviations shall be requested in writing by the PE. Each request will be considered on a case-by-case basis and will not be considered a precedent for any other location. Requests shall include sufficient information to justify the need for deviation from the Standards and may include site plans, proposed service, meter configurations, or other information requested by the Meter Inspection Supervisor.
- J. When a stub-in connection is installed to permit street paving or in advance of future development, it shall be located to provide a future connection that is in accordance with applicable standards at the time of activation. There is no assurance that any stub-in will meet the requirements for conversion to a service line at the time of activation. A licensee that installs a stub-in does so with the understanding that it shall be the responsibility of the licensee to modify, reconstruct, relocate, replace, or remove the stub-in, as necessary, prior to converting it to a service line to meet current Standards. Stub-ins and converted service lines may not be located in a manner wherein the stop box and the meter setting are beneath a driveway, sidewalk, street, parking area, or within specified limits of side lot lines and permanent obstructions. Water may not be taken from a stub-in for any purpose without written approval by the Sales Administration Supervisor.
- K. Backfill material around service lines, stop boxes, and meter settings shall be carefully compacted in accordance with the requirements of [7.11](#).

3.03 SEPARATE TRENCHES

Service lines may be installed in trenches containing pipes that carry potable water; they may not be installed in trenches with pipes carrying other substances. A service line shall be separated laterally from foreign pipes by a minimum of 10-feet. However, a service line may be placed in the same trench with other pipe when:

- A. The adjacent foreign pipe is DI.
- B. The bottom of the service line is at least 12-inches above the top of the adjacent pipe and is placed on a shelf excavated on one side of the common trench with a minimum horizontal clearance of 5-feet.

3.04 COMBINATION SERVICE LINES

A property requiring a new domestic service line and a new fire service line connection may be served from a single tap at the discretion of Triview Metropolitan District.

Separate fire service and domestic service lines are required in cases where the ratio of the fire service line diameter to the domestic service line diameter is less than 4 to 1 or greater than or equal to 8 to 1.

Fire Service Line (ASC) (Inch)	Domestic Service Line (Inch)
1 1/2	Not Allowed
2	Not Allowed
3	3/4
4	3/4, 1
6	1, 1 1/2
8	1 1/2, 2
10	1 1/2, 2
12	2, 3

Fire service lines shall be sized to meet the NFPA standard maximum flow velocity of 15 fps for systems requiring fire pumps and 20 fps for systems without fire pumps. The fire service line connection shall extend straight from the main to the property line and shall have a gate valve located 2-feet to 5-feet from the property line on the street side of the property line but not in the flow line of the street. A tee or tap shall be placed on the fire service line connection on the inlet side of the property line gate valve for the domestic service line. The curb stop or property line valve shall be placed adjacent to the gate valve on the fire service line and the same distance from the property line. The tee or tap shall be 3-feet to 6-feet from the inlet side of the property line gate valve. The domestic service line shall run parallel to the fire service line at a distance that allows for at least 5-feet of clearance between the fire service line, any part of the domestic service line, and the meter pit or vault. Only one domestic service connection (tap or tee) shall be installed on a fire service line connection. The domestic service shall be installed before the activation of the fire service line. In general, combination services are not allowed if the domestic service line length of the combination service is greater than what would be required for a direct tap on the water main. Combination services are not permitted for irrigation-only services.

3.05 PUMPS

Pumps are only allowed on domestic and fire suppression systems for the purpose of increasing pressure as required for either insufficient initial pressure supplied from the distribution system to meet application needs or in the case where internal change in elevation requires an additional boost to meet pressure requirements on higher floors. Pumps may not be used for the purposes of sizing calculations under [3.09](#).

3.06 TANKS

Tanks are not allowed for either domestic or fire suppression supply (except in the case of Residential NFPA 13D and other specific instances as designated by the fire protection district having jurisdiction). Tanks may not be used for purposes of sizing calculations under [3.09](#).

3.07 CONNECTIONS FOR WATER

- A. Taps for 2-inch and smaller domestic, irrigation, or fire service lines will be made by an authorized contractor. The connection shall be made using a

corporation stop of the same size as the service line through a bronze tapping saddle, both of which shall be supplied by the contractor. The corporation stop shall be as specified in [Chapter 6](#) and [MS-23](#). The tapping saddle shall be in accordance with [MS-23](#). Taps shall be made only after satisfying the following conditions:

1. The main has been released by Triview Metropolitan District following the completion of the conditions and tests outlined in [8.26](#).
 2. The license application has been completed, signed by an authorized individual, and submitted to Triview Metropolitan District.
 3. Appropriate fees and charges have been paid to Triview Metropolitan District.
 4. The street opening permit has been obtained from the authority having jurisdiction.
 5. Underground utilities near the tap are marked.
 6. Tapping materials are on-site.
 7. Front property corners are clearly staked and the service address visibly posted.
 8. Water main valves are marked or staked.
 9. Safety equipment and procedures are in place including trench shoring.
 10. The tapping location on the main is excavated and the water main surface is exposed and clean.
- B. Taps to the main for 3-inch and larger service lines shall be made by a tee connection or a tapping sleeve in accordance with [MS-9](#). Domestic service taps, 3-inch and larger, may be installed by an authorized Contractor. The Contractor shall excavate the ditch and around the water main exposing it on all sides. The contractor will provide and install the tapping sleeve or cut-in tee at cost. The Contractor shall connect to the outlet, install the piping, set the valve boxes, and backfill the trench.

Exception: Contractors installing mains may also install fire service lines and tee connections for domestic service lines provided the connections are 3-inch and larger and the service line is installed in conjunction with the main extension. Such an installation is subject to the proper release of tap application papers, the payment of appropriate fees, and the approval of the appropriate fire department, see [8.26](#) for the acceptance of mains.

- C. Domestic service lines connected to metallic water mains shall be electrically insulated by means of Triview Metropolitan District approved insulating fittings or gaskets.
- D. Care shall be taken to properly install corporation stops and provide enough slack in the service lines to protect against pullout.
- E. When tapping mains, dig out bedding material and apply two to three wraps of adhesive tape completely around the polyethylene-encased pipe to cover the area where the tapping saddle and machine is to be mounted. After the tapping machine is mounted, install the corporation stop directly through the tape and the polyethylene. After the tap is complete, the entire area shall be inspected for damage and repaired if necessary. Any bedding material removed during excavation shall be replaced in kind and compacted in accordance with [7.10](#) and [7.11](#).
- F. Multiple taps on the same side of the main shall be a minimum of 5-feet

apart, measured longitudinally along the centerline of the main. Multiple taps on opposite sides of the main shall be staggered by a minimum of 2 1/2-feet, measured longitudinally along the centerline of the main. Taps shall not be made within 3-feet of any main line pipe fitting.

3.08 TAPS AND SADDLES

Tapping saddles with a tap size of 2-inch and smaller for DI pipe shall consist of a bronze body with two bronze straps. Saddles for PVC pipe shall be single strap bronze saddle.

Taps are not allowed on PVC pipe containing water under pressure. Tapping of dry mains shall occur only on PVC pipe. Taps on AC, CI, or DI pipe may be tapped under pressure or wet. In Distributor Contract Areas, the Distributor shall be given the option to perform the required operations to eliminate pressure in the pipeline being tapped. The contractor will perform the operations Inside Triview Metropolitan District and Total Service Contract Areas.

See [MS-23](#) for further information on tapping saddles.

3.09 SIZE

- A. Taps and service lines shall be of a size that is adequate to supply the requirements of the property being served while not being so large as to cause inaccuracies in metering low flows. The minimum size allowable for a service line shall be 3/4-inch or the minimum recommended size resulting from a fixture count document, completed by the PE, utilizing an accredited fixture unit/count methodology or one standard diameter less than required by the fixture unit/count methodology adopted by the authority having jurisdiction for commercial and multi-family service line requests.

The tap, corporation stop, meter, and the portion of the service line between the corporation stop and 5-feet past the meter shall be the same size. The service line may only be increased one standard size to the next approved larger diameter beginning 5-feet downstream of the meter, including BFP. This is permitted to satisfy maximum pressure loss criteria; it is not for achieving greater flow using a smaller tap.

Taps and services shall be sized to produce a water velocity that is no greater than 10 fps at peak demand as estimated by an accredited Fixture Unit/Count methodology. Additionally, the total pressure drop in the service line from the main to the building shall not exceed 25 psi without BFP or 35 psi and a minimum residual pressure of 20 psi at the building beyond any BFP under peak domestic demand flow. Additional fire flow demand and service sizing shall be the responsibility of the PE. Additional flow demands required to meet NFPA 13D or 13R shall be evaluated by the PE, and the service lines sized accordingly.

- B. For residential domestic service lines meeting NFPA 13D, the tap, the corporation stop, the meter, and that portion of the domestic service line between the corporation stop and 5-feet past the meter shall be the same size. The domestic service line may be increased in size to the next approved larger diameter beginning 5-feet downstream of the meter. The appropriate design of the NFPA 13D fire sprinkler system shall be the sole responsibility of the PE.
- C. The tap, corporation stop, meter, and that portion of the service line between

the corporation stop and the valve before the BFP assembly shall be the same size. The irrigation service line may be increased in size to the proper design size for the BFP assembly beginning at least 5-feet downstream of the meter pit or vault. Additional pipe increases are permitted after the BFP assembly to satisfy the maximum design water velocity in the irrigation system.

- D. The fire service line shall be designed in accordance with the building or fire code adopted by the authority having jurisdiction with no change in size between the main and the fire system control equipment that is located inside the building. The fire service line size shall be equal to or smaller than the water main size to be tapped. Fire service lines larger than the main diameter are not allowed. If redundant fire service lines are required, each fire service line shall be sized identically to meet the full demand and head loss characteristics to the fire protection system at each connection.
- E. The manifold tap, manifold service line, manifold corporation stop, and manifold trunk line shall be the same size. Manifold service lines shall not be used for irrigation service lines or fire service lines, including those that meet NFPA 13D and those that serve a common area. Downstream of the manifold, the licensee-owned domestic service line shall be in accordance with [3.02](#). The installation shall be in accordance with the [Standard Drawings](#).

3.10 PIPE MATERIAL

Pipe material is dependent on the size of the service line and shall extend from the tap to the first mechanical fitting inside the structure:

- A. Seamless copper tubing or HDPE shall be used for 3/4-inch through 2-inch service lines in accordance with [MS-24](#).
- B. DI pipe shall be used for 3-inch and larger service lines in accordance with [MS-1](#).

3.11 CURB STOPS, VALVES, AND VALVE BOXES

A curb stop or gate valve of the same size as the service line shall be installed on the service line at a location in accordance with [3.02](#). Curb stops, 2-inch and smaller, shall be in accordance with [MS-23](#). Gate valves, 3-inch and larger, shall be in accordance with [8.12](#), [MS-4](#), and [MS-5](#). Deviations to the curb stop installations, 1-inch and smaller, requested in writing by the PE may be authorized by the Meter Inspection Supervisor.

Buried valves and curb stops shall be equipped with a CI valve box and large oval base. A roadway box shall be used when a 3/4-inch or 1-inch curb stop is placed in paved areas. See [Chapter 6](#) and [MS-12](#) for valve and curb stop boxes. For requirements on valves used with meters, see [6.14](#) and [MS-23](#).

Compression fittings at the curb stop may be used by Distributors on pipe smaller than 2-inch in diameter.

3.12 METERS

- A. Meters shall not be installed until the proposed installation is approved, and the meters tested and numbered by Triview Metropolitan District.

Registers and associated AMR/AMI devices shall be fully compatible with the meter reading system in use where the meter is installed. The Meter

Inspection Supervisor will determine the AMR/AMI system to be used.

Meter installations, 3-inch and larger, will be inspected by Triview Metropolitan District prior to backfilling and upon completion of the installation. Meter installations, 2-inch and smaller, will be inspected by Triview Metropolitan District after final grade is established at a minimum of 5-feet radially around the meter setting. The AMR/AMI device will be installed by Triview Metropolitan District personnel at the time the meter installation is inspected and at the expense of the Owner of the premises.

- B. Meters shall be the same size as the corporation stop or service tee and that portion of the service pipe between the meter and the corporation stop. A meter smaller than 3/4-inch shall not be installed unless it is to serve as a replacement for an existing meter of the same size.

In cases where the full capacity of a previously used service pipe is not required, Triview Metropolitan District may allow for the installation of a meter that is smaller than the service pipe provided the service pipe is reduced to the size of the meter for a distance of no less than 10 times the larger pipe diameter on the inlet side of the meter, or 5-feet, whichever is longer.

3.13 AMR AND AMI EQUIPMENT

Meters, with the exception of those in Master Meter Contract Areas, shall be equipped with the AMR/AMI device determined by Triview Metropolitan District and installed in accordance with Triview Metropolitan District's instructions in a location that allows for the collection of a radio signal by collection equipment. Special metering and AMR/AMI systems may be required for services connected to water mains in easements.

The register of each meter shall be equipped with an AMR/AMI device, as directed by the Meter Inspector, and mounted in accordance with the [Standard Drawings](#). In most cases, the meter will be equipped with the latest model of Itron Pit ERT. In special circumstances identified by the Meter Inspector, AMI or a remote AMR device may be required at a distance of up to 150-feet of wire length from the meter pit to the vault and mounted on the outside of the building, on a post, or on another structure. The signal wire (Belden #9451) for remote AMR device installations shall be run through 1-inch PVC conduit at a minimum.

- A. For most installations on 1-inch and smaller meters, the AMR/AMI device shall be mounted through the CI meter pit lid or beneath the composite meter pit or vault lid in accordance with the [Standard Drawings](#).
- B. For most installations on 1 1/2-inch and larger meters, the AMR/AMI device shall be mounted beneath the manhole lid in accordance with the [Standard Drawings](#). For some installations on meters, 3-inch and larger, a remote AMR device with the signal cable in a conduit may be required. This determination will be made on a case-by-case basis. The Meter Inspector will provide direction as to the type and location of the AMR/AMI device required during the mandatory pre-construction meeting for meter installations. One AMR/AMI device is required for each meter register.
- C. For existing meter installations of any size, there may be AMR device installations that are not in accordance with [3.14](#). Triview Metropolitan District will make determinations to change the meter pit or vault lid and AMR device mounting at its discretion and cost. Such installations may incorporate

adapters and special mounting equipment selected and approved by Triview Metropolitan District.

- D. Where inside meter settings are approved in advance in writing by the Meter Inspection Supervisor, AMI or remote AMR devices shall be installed on the outside of the building as directed by Triview Metropolitan District. The licensee shall provide the approved signal cable in a conduit from the location of the meter to the mounting location of the AMR device; the length of the signal cable shall not exceed 150-feet.
- E. Special Circumstances: Any meter setting that differs from the configuration shown on the [Standard Drawings](#), including inside meter settings, will need to be approved in writing by Triview Metropolitan District's Meter Inspector before construction. If it is necessary to obtain radio signals using drive-by equipment from a public street or via a meter-reading network, Triview Metropolitan District may require the installation of a remote AMR device, radio repeater, network collector, and/or other special equipment or installation configuration installed at the expense of the licensee. Some meter-reading devices may require the licensee to provide a mounting location and an electric power source.

3.14 OUTSIDE METER SETTING

Outside meters shall be installed with the inlet and outlet spuds in a horizontal position and housed in a concrete or approved composite meter pit or vault in accordance with the [Standard Drawings](#). The meter shall be installed in an approved coppersetter or yoke. Coppersetters for 1-inch and smaller meters shall be installed with the meter spuds located 18-inches below the meter pit lid to facilitate maintenance and replacement. The meter shall sit horizontally with the meter register pointing up. Larger meters shall be installed in vaults in accordance with the [Standard Drawings](#). Deviations in installation height, spacing, pipe location, mounting supports, and other details need to be approved in advance in writing by the Meter Inspector.

3.15 INSIDE METER SETTING

Inside meter settings are not permitted on water service connections without the written approval of the Meter Inspection Supervisor prior to the installation of the service connection at the main. The inside meter setting request shall be accompanied by an explanation for its need, a site plan drawing to scale showing exact locations of the proposed water facilities with building footprints and paved areas, an indication of the means by which Triview Metropolitan District will gain access to the meter during normal business hours, and a detailed, dimensioned plan and profile of the meter room that shows piping, equipment, and other water-related facilities such as fire sprinkler controls and BFP assemblies.

Existing inside meter settings on water service connections are permitted to remain provided there are no changes made to the tap, the service line, or the meter setting. If the structure containing an inside meter is to be reconstructed, considerably remodeled, or the service line is to be reconstructed, relocated, or replaced, the meter shall be relocated to an outside meter pit or vault.

Inside meter settings are for use with 1 1/2-inch and larger meters where there is inadequate room for the proper installation of a meter vault after exhausting other reasonable alternatives. Inside settings will be permitted for industrial and commercial properties and multi-family premises where full-time, on-site

management is provided and directly accessible from a public ROW. Safe, unimpeded access during Triview Metropolitan District's normal working hours shall be provided by the contractor. Written approval to use an inside meter shall be obtained from the Meter Inspection Supervisor prior to tapping the water main. If the tap is already installed, written approval shall be obtained prior to converting the stub-in to a service line. Specific details of meter type, location, access requirements, AMR/AMI configuration, piping, valves, and other requirements will be assessed and approved on a case-by-case basis by the Meter Inspection Supervisor in consultation with the Meter Inspector.

An inside meter installation shall be in accordance with the CAD drawing.

Where approved, inside meter installations shall be in accordance with the following requirements:

- A. The total length of the service line measured from the street main to the inlet valve of the meter shall be 60-feet or less.
- B. The space containing the meter shall be heated to prevent the freezing of pipes and equipment and shall contain a floor drain within 10-feet of the meter.
- C. The space shall be accessible to Triview Metropolitan District's meter maintenance and meter reading employees during Triview Metropolitan District's normal working hours with minimal delay.
- D. The meter shall be located immediately adjacent to the point where the domestic service enters the building through the foundation wall with a minimum amount of exposed pipe before the meter.
- E. Meters shall be bolted in place in a flanged DI pipe system with a bolted sleeve-type coupling on the outlet side of the meter.
- F. Gate valves shall be used on the meter inlet and outlet and on the bypass. Valves shall be non-rising stem, clockwise opening, and mounted vertically. The bypass pipe shall be no greater than 6-feet above the floor and a minimum of 2 1/2-feet above the meter; allow for at least 2-feet of clearance to the wall.
- G. For any installation where a BFP is not required, a check valve shall be installed 5-feet downstream of the meter.
- H. The top of the meter shall be a maximum of 40-inches above the floor.
- I. BFP assemblies, PRVs, and other components shall be installed after the meter and downstream bypass tee. In most cases, there shall be 5-feet of pipe between the bypass tee and the first component.
- J. One or more indoor AMI devices or outdoor remote AMR devices are required for inside meter settings, the location of which will be determined during the review of the inside meter request.

3.16 METER BYPASS LINES

A bypass line is required for 1 1/2-inch and larger meters except those used for irrigation-only service, whether installed in an outside or an inside setting. Bypass lines shall contain an independent isolation valve and shall not contain tees, plugs,

or other outlets through which water could be withdrawn. Bypass lines permit the customer to have water while the meter is being repaired or replaced and may only be activated by Triview Metropolitan District. Bypass lines for 1 1/2-inch and 2-inch meters shall be integral to the meter yoke with an appropriately sized ball valve. Bypass lines for 3-inch and larger meters shall be connected to the main line at tees before and after the meter and shall include a gate valve with wheel operator. Bypass lines shall be locked in the closed position when not in use.

3.17 CONSTRUCTION

The Contractor shall be a licensed plumber by the authority having jurisdiction to perform work in the public ROW. The Contractor shall have a current plumbing license to install service lines Inside Triview Metropolitan District, Total Service, and Read and Bill Contract Areas where work is to be performed.

3.18 ABANDONMENT OR REMOVAL OF SERVICE LINES AND TAP CUTS

It may become necessary to remove or abandon a service line or a stub-in due to redevelopment and changes in water requirements for the premises, or to relocate a service line due to changes in the configuration of the premises. An abandoned or relocated service line shall have the tap cut at the main or fire service line to ensure that it cannot be used to remove water from the system. Corporation shall be removed and plug installed where practical. Service line tap cuts shall be witnessed by a Triview Metropolitan District Inspector. Service line changes shall be made in accordance with Triview Metropolitan District's Operating Rules. Tap cuts shall be coordinated through the Sales Administration Section. Taps, 3-inch and larger, shall require water plans for review, see [2.04](#). Service lines shall be metered until disconnected from the main in the presence of a Triview Metropolitan District Inspector.

- A. For 2-inch and smaller service lines, the service line connection shall be excavated where the corporation stop is inserted into the water main. The corporation stop shall be closed, the service tubing or piping shall be removed from the corporation stop, the threads shall be scarred on the corporation stop, and a section of the water service line at least 12-inches long shall be cut out. The curb or valve box over the curb stop shall be removed in its entirety or cut off at least 18-inches below the ground line. The meter shall be delivered to Triview Metropolitan District for a final test and reading. The meter may not be used again in the Triview Metropolitan District system. The meter pit, if present, may be removed in its entirety. If it is left in place, it shall be cut off at least 18-inches below the ground line and filled with sand or other fill material.
- B. For 3-inch and larger service lines, the service line connection shall be excavated over the service tee on the water main. The valve at the main shall be removed and the connecting fitting (tee or tap) plugged. The property line valve box shall be removed or cut off at least 18-inches below the ground line. The meter shall be delivered to Triview Metropolitan District for a final test and reading. The meter may not be used again in the Triview Metropolitan District system. The meter vault, if present, may be removed in its entirety. If it is left in place, it shall be cut off at least 18-inches below the ground line and filled with sand or other fill material.
- C. Before demolishing a building with an inside meter setting, the licensee shall install a meter pit or vault with a new meter and AMR/AMI device in an outside setting or cut the tap in accordance with this Section. Either action

will need to be coordinated through the Sales Administration Section prior to the demolition process.

3.19 DISINFECTION REQUIREMENTS FOR CONVERSION PROJECTS

During recycled conversion projects, an existing potable tap is cut and capped with a permanent bulkhead or blind flange and the existing service line relocated to the recycled water main or conduit. Triview Metropolitan District personnel will inspect and approve the disinfection process before the potable system is released for service.

Disinfection requirements for converting the existing potable service line to the new recycled distribution system include the following:

- A. The Contractor shall cut off potable water taps and clean and disinfect new fittings in accordance with AWWA C651 with an NSF 60 certified sodium hypochlorite solution prior to installation using a swab or spray disinfection method. The pipe shall immediately be capped with a permanent bulkhead/blind flange or a temporary pneumatic plug until the permanent cap is installed.
- B. The Contractor shall prevent environmental contamination (e.g., ground water, storm water, animals, and insects) from entering the potable distribution system and/or service line.
- C. For 3-inch and larger taps, the Contractor shall clean and disinfect the exposed pipe and blind flange where the tap is cut. Triview Metropolitan District personnel will perform a directional flush (i.e., operate the valve) to remove chlorinated water via a hydrant and dechlorinate before discharging water into the environment.
- D. Triview Metropolitan District personnel will collect physical parameter samples that are representative of the potable distribution system during the flushing process and notify Triview Metropolitan District's Inspector if passing results are attained. If passing results are attained, the existing potable service line will be released for service. If passing results are not attained, flushing and re-testing shall continue until the appropriate results are reached.

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The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 4 - Easements and Licenses

4.01 GENERAL

The following procedures are used to process easements and revocable licenses. Failure to follow these procedures will result in requests being rejected.

4.02 GRANTING AN EASEMENT TO TRIVIEW METROPOLITAN DISTRICT

When a Developer or Property Owner is required to grant permanent easements to Triview Metropolitan District prior to the installation of water mains, the following procedure shall be followed:

- A. Submit the following items to the Sales Administration Section in one package with the initial submittal of water plans as described in [2.04](#).

The easement plan review process will not begin until the following items are received by Triview Metropolitan District:

1. Letter request: A letter requesting that Triview Metropolitan District accept the easement. It shall indicate the full and legal name of the Property Owner granting the easement, the names and titles of the persons authorized to sign the easement agreement, and those persons who shall verify the identity of the authorized signer, if applicable. If necessary, the Property Owner's Articles of Organization or Articles of Incorporation shall be provided to determine the name and/or title of the person(s) legally authorized to sign real estate transaction documents. Triview Metropolitan District may elect to require the proposed grantor to submit an Application for Easement Acceptance in lieu of or in addition to the letter.
2. Legal description: Two copies of the written legal description of the proposed easement area signed and sealed by a PLS. Legal descriptions that fail to comply with the following format will not be accepted.
[Exhibit A](#):
 - a. Size: 8 1/2-inch by 11-inch (letter-size) documents.
 - b. Font: Except for the title, text within the description shall not be bold faced, italicized, or all capitalized.
 - c. Title: All capitalized; it shall be referred to as [Exhibit A](#), Legal Description at the top of the document.
 - d. Caption: The Section number and aliquot part, tract, or government lot thereof; Township; Range; Principal Meridian;

- County; City or Town, if applicable; and State shall be included. In addition, where appropriate, a Subdivision, Lot, and Block description shall be used. Any deed along with its corresponding date and recording information shall be used when appropriate (i.e., Reception No., Book, and Page).
- e. Basis of bearing: The basis of bearing shall appear as the first element in the body of the description. Descriptions shall be written to proceed from the Point of Commencement to the Point of Beginning. The Point of Commencement shall be an aliquot corner or tract corner in the Public Land Survey System with its position marked by an acceptable existing monument. The basis of bearing shall be NAD 83 State Plane values.
- 1) Whenever possible, parcels shall be tied to two monuments for which Triview Metropolitan District has established coordinate values. Such monument locations are compiled from information obtained from various municipal and other entities in the metropolitan area. No claim is made as to the accuracy of the information contained therein. Any submitter who has found discrepancies in the information or has tied to corners not included in the database is encouraged to submit the location and monument description information to keep the database current.
 - 2) An acceptable monument shall comply with CRS 38-51-104 of the Rules for Professional Land Surveying Practice 6.4 from the Bylaws and Rules of the State Board of Licensure for Architects, PEs, and PLSs.
 - a) Examples of possible basis of bearing wording:
 - (1) Commencing at the Northeast corner of Section 5, whence the North 1/4 bears (bearing), said line being the basis of bearing for this description.
 - (2) Commencing at the Northeast corner of Section 5, and considering the North line of said Northeast 1/4 to bear (bearing), said line forming the basis of bearings for this legal description.
- f. Body: Descriptions shall be written with the parcel described in a clockwise direction.
- 1) Point of Beginning (aliquot descriptions excepted) shall, wherever possible, be on a legally defined line, and be described as being on that line.
 - 2) Descriptions of existing lines or bounds being followed or encountered such as, but not limited to, aliquot, ROW, platted lot, and deed lines.
 - 3) Courses shall be reported in bearings and distances.
 - 4) Distances shall be in U. S. Survey feet at ground surface.
 - 5) Curves shall be identified as being to the left or the right.
 - 6) Curve information shall include radius, central angle, arc length, bearing to the radius point, chord bearing, and distance.

- 7) Curves shall be tangential when creating or describing a new parcel whose lines run independent of previously identified, legally defined lines unless absolutely necessary. In cases where curves are not tangential, they shall be identified as such at the start and the finish, as appropriate.
 - a) Example of possible curve wording:
 - (1) Thence along the arc of a nontangent curve to the left, whose radius point bears (bearing) from the point of curvature, having a central angle of (angle) and a radius of X feet, and an arc distance of X feet (chord bears [bearing], a distance of X feet).
- 8) When existing (e.g., deed, plat, easement, and ROW) lines are used, full recording information shall be included for the document creating said line (e.g., County, Reception No., Book and Page, date, file, and map).
- 9) Area shall be reported in acres to three decimal places followed, parenthetically, by the area in square feet to zero decimal places. Customarily, "more or less" is appended to this square footage value. Areas for parcels smaller than 1/2 acre shall be reported in square feet only.
- g. Approval block: A signature block identifying the surveyor and the name of the surveyor's company is required in compliance with CRS 38-35-106.5.
- h. Closure calculations: The closure calculation sheet shall be included showing the closure as the description is written. Geometric closure of the parcel shall exceed 1 to 20,000.
3. CAD drawing Specifications include the following:
 - a. Size: Overall 8 1/2-inch by 11-inch (letter-size).
 - b. Title block: Dimensions and text in accordance with the
 - c. Scale: The drawing shall be prepared using an appropriate, recognized civil engineering scale. Break lines, except in land corners or ties, are not acceptable.
 - d. Tie: Parcels shall have a direct tie to the two nearest available recognized land corners (i.e., the section corner, the quarter section corner, and the range point). If the easement is located within a platted subdivision, a tie shall be made to a subdivision corner. The basis of bearing statement shall be included on the CAD drawing.
 - e. Drawing accuracy: Drawn to two decimal places for distance and to one half seconds for bearing.
 - f. Descriptions of the monuments set at the ends of the line, which is the basis of the bearing, shall be supplied on the

drawing. This shall include a description of the cap, the cap size, and the markings and include a PLS number. If the markings cannot be reported, a brief statement on the reason this is the case shall be included (e.g., obliterated). A description of the monument the cap is mounted on (e.g., no. 5 rebar, 2-inch pipe) or a reason this information cannot be obtained (e.g., set in concrete or set in asphalt) shall also be included.

4. Title Commitment: A Title Commitment shall be submitted that covers the waterline easement area only. The following items shall be included:
 - a. An electronic Microsoft Outlook e-mail file of the Title Commitment from the Title Company including hyperlinks to legible paper copies of the documents that are referred to in the Schedule B-2 (Exceptions) portion of the Commitment.
 - b. A plottable drawing or exceptions map that depicts the waterline easement and all B-2 exceptions. Exceptions on the drawing or map shall be numbered correlative to the number of the exception on the Commitment for Title Insurance.
 - c. Triview Metropolitan District may require title insurance to be acquired. Expenses incurred in obtaining title insurance shall be paid by the grantor of the easement.
 - d. Title commitments are required for fire hydrant easements granted adjacent to existing waterline easements or dedicated ROW. Fire hydrant easements granted as part of a proposed distribution line easement shall be included in the Commitment for Title Insurance for the overall waterline easement.
5. Overall site plan: One copy of the overall site plan that accurately shows the relationship of the following:
 - a. The proposed water main, easement, and dedicated ROW.
 - b. Existing and proposed utilities with associated utility easements on the site.
 - c. Proposed slopes greater than 20 to 1 and areas of cut and/or fill greater than 1-foot within the easement area.
 - d. Proposed structures, landscaping, and roadways on the site.
 - e. Cross-sections of private roadways associated with waterline easements and cross-sections of public ROW in which a water main is to be installed.
 - f. Perimeter distances and bearings, or angles, of the overall site and the relationship to the tie corner of the easement.
 - g. Triview Metropolitan District's property boundary lines.
 - h. Surrounding ROW limits.
 - i. Proposed construction area.
 - j. Proposed temporary easement area.
 - k. Existing and proposed fencing.
 - l. Triview Metropolitan District's nearby facilities.
6. Subdivision plat: A copy of a recorded or preliminary subdivision plat or development plan for the area or subdivision the waterline easement is located in, any subdivision plat, or a PUD/PBG plan that directly relates to the easement and depicts property boundaries.

- B. Document Preparation: Triview Metropolitan District's Property Management Section will prepare the easement agreement on a standard Triview Metropolitan District form and return the document to the submitter for the grantor's signatures.

Easement agreement documents will be prepared for easements acquired on property Inside Triview Metropolitan District and Total Service Contract Areas. If a potential change in property ownership is known by the grantor at the time of the original easement submittal, it shall be communicated to the Property Management Section. Failure to inform the Property Management Section at the time of the original easement submittal may result in a Duplicate Document Preparation Fee of \$1,000. This fee may be charged for agreements that require more than one preparation of the easement agreement or if other significant modifications are required during preparation.

- C. Construction: The extension will not be authorized until the easement is accepted by Triview Metropolitan District, the easement agreement has been recorded, and any necessary documentation has been received, reviewed, and accepted.

4.03 GRANTING AN EASEMENT TO A DISTRIBUTOR

Prior to the approval of water plans, the following shall be submitted to Triview Metropolitan District:

- A. Procedure: For developments located Outside Triview Metropolitan District but inside a Distributor's Contract Area, a fully executed, recorded easement agreement on one of the four Triview Metropolitan District approved, distributor easement documents (e.g., Nonexclusive, Exclusive, PUD/PBG, or for those meeting the qualifications set by Triview Metropolitan District, the Distributor Nonexclusive Performance Easement) is required in hardcopy form. An interactive pdf of the easement agreements can be obtained from www.triviewmetro.com. Documents prepared on any forms other than the approved, preprinted easement document forms are not acceptable.
1. Legal description: A copy of the written legal description of the proposed easement area signed and sealed by a PLS. Legal descriptions that fail to comply with the format and specifications of [4.02.A.2](#) are not acceptable.
 2. CAD drawing: A file in accordance with [4.02.A.3](#).

4.04 ACQUIRING AN EASEMENT FROM TRIVIEW METROPOLITAN DISTRICT

When a utility company, municipality, or other entity desires to obtain the permanent right to use or cross Triview Metropolitan District's property or property interests, the following procedure shall be followed:

- A. Procedure:
1. Letter request: A letter submitted to the Property Management Section requesting that Triview Metropolitan District grant an easement. The letter shall contain the name of the entity to which the easement will be granted and its intended use.
 2. Property description: Two copies of the written legal description of the easement area written in accordance with the format and

- specifications of [4.02.A.2](#) and signed and sealed by a PLS. Property descriptions that fail to comply are not acceptable.
3. CAD drawing: A file in accordance with [4.02.A.3](#).
 4. Overall site plan: Two copies in accordance with [4.02.A.5](#).
- B. Valuation: A Triview Metropolitan District Staff Appraiser will appraise the requested easement. The minimum cost for the granting of a permanent easement is established by the Property Management Section.
- C. Document preparation: Triview Metropolitan District will prepare the necessary documents and forward them to the grantor for signature.
- D. Construction: Construction will not be authorized until a final easement is granted.

4.05 OBTAINING A LICENSE TO USE OR CROSS TRIVIEW METROPOLITAN DISTRICT PROPERTY

When requesting permission to use or cross Triview Metropolitan District's property or property interests, an Applicant shall request a revocable license for routine right-angle utility crossings of strip properties and easements or for temporary uses. The following procedure shall be followed:

- A. Procedure: Submit a letter to the Property Management Section requesting permission to use or cross its property or property interests. The letter or application shall specify the intended use of the proposed license area, the proposed term of the license, the legal name and contact information of the proposed licensee, and sufficient detail to allow Triview Metropolitan District to evaluate the request, the approval of which is at the discretion of the Property Management Section. The letter of request shall contain the exact name of the company, corporation, partnership, etc. that shall own, operate, and maintain the proposed facilities. In addition, it shall include the names and titles of the persons authorized to sign the agreement and include the following enclosures:
1. A CAD drawing file in accordance with [4.02.A.3](#) based on a field survey prepared by a PLS.
 2. A check payable to Triview Metropolitan District for the applicable fee accompanying the letter of request or application. This fee is nonrefundable and covers Triview Metropolitan District's expense for the review of the request and the performance of other administrative functions pertaining to the approval or denial of a License Agreement. The fee for the use of Triview Metropolitan District property, other than for a routine right-angle utility crossing, will be determined by the Property Management Section.
 3. Prints of the plans of the overall job in the area of the crossing, when available. In addition, prints of new or proposed subdivisions whenever they would clarify or identify the location of the request.
- B. Document Preparation: The Property Management Section will prepare the License Agreement on a standard Triview Metropolitan District form and return the document to the licensee for signatures. A copy of the completed License Agreement shall be kept on the jobsite.
- C. Letter of Authorization Request: To request a Temporary Letter of Authorization to access and use Triview Metropolitan District's property or

property interests for a period less than one year, the requestor shall submit the following items to the Property Management Section:

1. A sufficient site plan illustrating the proposed use area (links to Google Earth are not acceptable).
2. A letter describing the proposed use of the property, the activities to be performed, and any equipment and/or vehicles to be used or staged on-site.

Triview Metropolitan District may elect to require the requesting party to submit an Application for Letter of Authorization in lieu of or in addition to the letter of authorization request. The temporary use of Triview Metropolitan District's property or property interests that involve a period longer than one year may require a license issued by Triview Metropolitan District or alternative property rights agreements.

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The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 5 - System Design and Layout

5.01 GENERAL

The purpose of this Chapter is to provide information on the design and layout of acceptable water distribution systems Inside Triview Metropolitan District and Total Service and Distributor Contract Areas.

Triview Metropolitan District designed and built its system using conduits to supply water to its distribution systems. Using this framework, water is delivered to the individual customer in sufficient volumes without excessive head loss. The design and layout criterion presented herein applies solely to distribution systems. Design and layout criteria for transmission mains are covered in [Chapter 9](#) and conduits are covered in [Chapter 10](#).

5.02 QUALITY OF THE DISTRIBUTION SYSTEM

The purpose of these Standards is to ensure that only proven high quality materials are installed using first class workmanship. The determination of the best materials and construction methods are based upon the lowest life-cycle costs. The sizing and layout of a water system are elements of the total consideration of the design, operation, and maintenance of a water supply system that yields optimum quality service at the lowest total cost to the consumer.

5.03 SIZING OF DISTRIBUTION MAINS

Mains shall be sized large enough to provide for domestic, irrigation, and fire protection flows to the area requesting service but not so large as to cause water quality issues. The maximum acceptable head loss for 6-inch, 8-inch, and 12-inch mains is 2-feet per 1,000-feet of main for the maximum hour flow using a C-value of 130; however, this does not apply under fire flow conditions. Distribution mains shall also be sized for fire protection utilizing maximum day flows and needed fire flow resulting in a minimum residual pressure of no less than 20 psi in the localized area of interest. Triview Metropolitan District reserves the right to size mains to accommodate future needs.

New mains shall be 6-inch, 8-inch, or 12-inch as set by Triview Metropolitan District. If approved by Triview Metropolitan District in writing, 4-inch mains may be used in some cul-de-sacs without a fire hydrant. Dead-end mains are not permitted in Triview Metropolitan District's integrated system; however, dead-end mains in cul-de-sacs will be evaluated to determine if the appropriate number of services exist to maintain water quality turnover. The sizing of distribution mains follows a standardized grid that is based upon the careful consideration and analysis of studies that utilize network simulation. This grid requires a 12-inch main every 1/2 mile with

alternating 6-inch and 8-inch mains in the streets within the quarter section and a 6-inch or 8-inch main in the street at approximately the 1/16 line to eliminate 1/2 mile runs. For a typical grid layout, see the [Standard Drawings](#).

PBGs are treated the same as industrial or business areas because of the high fire risk and the minimal intersection of mains. In such areas, mains shall be designed to integrate and connect to adjacent parcels and existing systems to provide for overall system integration. On-site bubble loops, which can contribute to water quality problems, are not allowed unless another alternative is unavailable. In cases where there are no existing mains on undeveloped parcels adjacent to new development, the addition of easements to provide for future integration may be required. This requirement may also be applied to residential development.

Site fire flows for multi-family and mixed-use developments are evaluated with one side of the looped system out of service. This evaluation is used to simulate a distribution system outage that would result in a worst-case scenario for the development. Consideration will be given wherever water quality problems are caused by an upsizing of the main. Exceptions to looping will be evaluated at the discretion of Triview Metropolitan District and may be subject to additional requirements. Triview Metropolitan District will analyze grid systems for developing areas to determine their adequacy. Parallel mains are not allowed.

5.04 FIRE PROTECTION SYSTEMS

- A. The number and location of fire hydrants in a given area is determined by the appropriate fire department. Fire hydrants are generally installed on the Northeast corner of street intersections. If hydrants are to be installed at locations other than street intersections, they shall be located on property lot side lines that are extended to the street.

The fire hydrant branch line shall be set at a 90-degree angle to the street main. The hydrant shall be set at the end of the branch line facing the branch line. Horizontal bends, vertical bends, and reducers shall not be used in the fire hydrant branch line unless specifically approved in writing by Triview Metropolitan District. Under no circumstances shall any size or manner of tap be made on a fire hydrant branch line. Isolation valves on the main are required between two fire hydrants.

A dead-end main may only have one fire hydrant connected to it in cases where looping is not an alternative, except as specifically approved in writing by Triview Metropolitan District or the Distributor.

Redundant hydrant installations and the unnecessarily high density of fire hydrants shall be avoided where existing hydrant function would be duplicated. These types of hydrant requests are reviewed by Triview Metropolitan District and approved at its discretion. The review will be based on the number of fire hydrants in close proximity, hydraulic analysis, and correspondence with the appropriate fire department.

- B. Connections made to existing mains that run to the property line and provide water for fire protection systems are known as fire service lines. Fire service line sizes are determined by those persons responsible for protecting the structures served.

The fire service line shall be installed at a right angle to the distribution main and shall run straight from the main to the property line. Horizontal or vertical bends shall not be installed in the line; however, bends may be installed when making a wet tap where the tap location conflicts with an existing pipe joint or where interference prohibits a straight-line installation. Such horizontal or vertical bends shall be used only when specifically approved in writing by Triview Metropolitan District.

Multiple fire protection appurtenances, including any combination of fire hydrants and fire service lines for any single project site, are not allowed on a dead-end main. Additional consideration will be given in the case of single-family residential homes on a cul-de-sac where fire service lines are required.

- C. An approved USC FCCCHR BFP assembly shall be installed on water service connections that supply a fire protection system. On a fire service line that is required to have a detector check valve assembly, an approved DCDA or a RP BFP assembly is acceptable in lieu of a detector check valve assembly.

5.05 CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION

- A. Triview Metropolitan District is responsible for protecting its public water system from contamination due to backflow occurrences through residential, multi-family, irrigation, and/or commercial property water service connections (e.g., cross-connections) in accordance with CDPHE Regulation 11. Triview Metropolitan District needs the assistance and the cooperation of the public and licensees to ensure this responsibility is met. Triview Metropolitan District may request access to a property or facility to conduct an on-site cross-connection control audit.

Triview Metropolitan District requires the installation of a containment assembly on commercial property service lines. In high hazard applications, a RP BFP assembly shall be installed. In low hazard applications, a DC BFP assembly may be installed at the discretion of Triview Metropolitan District's Water Dept.

Failure to comply with installation and annual testing requirements may result in suspension of service.

- B. An approved BFP assembly shall be manufactured in accordance with AWWA C510 and C511 and meet USC FCCCHR specifications. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372.

Foundation for Cross-Connection Control and Hydraulic Research
School of Engineering MC-2531
University of Southern California
P.O. Box 77902
Los Angeles, CA 90007
Foundation Office: (866) 545-6340
<http://www.usc.edu/dept/fccchr/>

- C. Requirements for Approved USC FCCCHR BFP Assembly Installations Based on the Degree of Hazard:
 - 1. A commercial domestic service line tap:
 - a. Requires an approved RP or DC to be installed on the domestic water service line 5-feet downstream from the meter pit or

- immediately upon entry into a heated part of the building 5-feet (maximum) from the wall or floor before any connections based on the degree of hazard.
- b. Irrigation branch lines on a domestic service tap shall be located 5-feet downstream from the meter pit immediately upstream or downstream of the domestic containment assembly upon entry into a heated part of the building.
2. A commercial fire service line service tap:
- a. Installed as a wet pipe system with the use of extinguishing agents or antifreeze requires an approved RP to be installed on the fire service line immediately upon entry into a heated part of the building 5-feet (maximum) from the wall or floor before any connections and shall be in accordance with the [Standard Drawings](#).
 - b. Installed as a wet or dry pipe system without the use of extinguishing agents or antifreeze requires an approved DC to be installed on the fire service line immediately upon entry into a heated part of the building 5-feet (maximum) from the wall or floor before any connections.
- Branch lines and taps are not allowed on fire service lines downstream from the designated containment BFP assembly for any purpose other than fire protection. System branch lines designed with extinguishing agents or antifreeze (loops) shall be isolated ("containment by isolation") by the installation of an approved RP.
3. A dedicated irrigation service line tap:
- a. Requires an approved RP to be installed on the irrigation water service line 5-feet downstream from the meter pit or 10-feet downstream for irrigation installations with the use of a stop and waste valve; the line shall be above ground before any connections.
 - b. Branch lines and taps are not allowed on dedicated irrigation water service lines for domestic (potable) use.
4. A commercial drinking fountain domestic service line tap:
- a. Requires an approved DC to be installed on the domestic water service line below ground, 5-feet downstream from the meter pit below ground; above ground, 10-feet downstream from the meter pit with the use of a stop and waste valve in an approved manhole/vault; or above ground, 5-feet downstream from the meter pit.
 - b. Shall be installed in accordance with the [Standard Drawings](#) for services with only a drinking fountain to avoid water quality issues by minimizing the amount of water in the service line between the main and the drinking fountain.
5. A commercial recycled irrigation service line tap:
- a. Requires an approved RP to be installed on the irrigation water service line 5-feet downstream from the meter pit or 10-feet downstream for irrigation installations with the use of a stop and waste valve if chemical additives are used downstream from the meter, pumps are used downstream from the meter, or the existing or proposed system poses a risk to the integrity of the recycled water system.
 - b. The line shall be above ground before any connections.
 - c. Branch lines and taps are not allowed on recycled water service lines for domestic (potable) use.

- d. BFP assembly installations on recycled water service lines shall be identified as Recycled Water in accordance with [Chapter 11](#).
- 6. A domestic service line tap on the premises where an existing irrigation system is converted to a recycled water service:
 - a. Requires an approved DC to be installed on the domestic water service line 5-feet downstream from the meter pit below ground in an approved manhole/vault or above ground before any connections.
- 7. A multi-family domestic service line tap:
 - a. Requires an approved RP or DC acting as containment if the premises has a fire protection system or the premises has a common boiler.
 - b. The BFP assembly shall be installed on the domestic water service line 5-feet downstream from the meter pit or immediately upon entry into a heated part of the building 5-feet (maximum) from the wall or floor before any connections based on the degree of hazard.
- 8. A domestic service line tap on the premises with a Dual Water Supply Agreement:
 - a. Requires an approved DC to be installed on the domestic water service line 5-feet downstream from the meter pit below ground in an approved manhole/vault or immediately upon entry into a heated part of the building 5-feet (maximum) from the wall or floor before any connections.

It is at the sole discretion of Triview Metropolitan District's Water Dept. to determine if the existing dual water supply poses a high risk to Triview Metropolitan District's potable distribution system. The installation of a RP may be required 5-feet downstream from the meter pit in an above ground, heated enclosure before any connections.

It is at the sole discretion of Triview Metropolitan District's Water Dept. to approve the proposed BFP assembly installation. A BFP assembly may not be removed from use, relocated, or substituted by another type of BFP assembly without the approval of Triview Metropolitan District.
- 9. Examples of commercial properties supplied with recycled water or dual water sources that require a RP or DC BFP assembly:
 - a. Where a recycled water irrigation system is designed to inject chemical additives and the use of pumps installed downstream from the meter and/or the proposed irrigation system poses a risk to the integrity of the recycled water system, an approved USC FCCCHR RP assembly shall be installed on the designated service line to the premises 5-feet downstream from the meter pit or 10-feet downstream with the use of a stop and waste valve.
 - b. Where dual water is used for irrigation on a commercial, multi-family, or residential premises, an approved USC FCCCHR BFP assembly shall be installed 5-feet downstream from the meter pit on the domestic water service line. The type of BFP assembly will be determined by Triview Metropolitan District's Water Dept. based on the degree of hazard encountered downstream of the meter.

D. Examples of BFP Assembly Installations:

1. A USC FCCCHR approved RP BFP assembly is required when:
 - a. High-level security or restricted commercial properties do not allow Triview Metropolitan District to gain access to conduct a cross-connection control audit of the property and/or facility. An approved RP assembly shall be installed 5-feet downstream from the existing meter pit in an above ground, heated enclosure.
 - b. A landscape irrigation system is designed for the direct injection of chemical additives into the system. An approved RP assembly shall be installed on the designated service line to the premises 5-feet downstream from the meter pit or 10-feet downstream for irrigation installations with the use of a stop and waste valve.
 - c. A temporary construction water license is issued by the Sales Administration Section for construction use. An approved RP assembly shall be installed on the temporary water service line entering the building or above ground, downstream from the meter pit before any connections.
 - d. A low hazard DC BFP assembly, used as containment, is installed on a water service line downstream from the meter and a high hazard RP BFP assembly, used as isolation, is installed on internal plumbing to protect the public water supply. Both containment assemblies shall be tested annually and the report sent to Triview Metropolitan District's Water Dept.
 - e. A RP BFP assembly is required for irrigation system installations:
 - 1) An approved USC FCCCHR RP BFP assembly shall be installed on the irrigation water service line 5-feet downstream from the meter pit or 10-feet downstream with the use of a stop and waste valve; the line shall be above ground before any connections.
 - 2) Existing PVBs shall be replaced with a RP when repairs cannot be made and/or the need to replace the PVB becomes necessary.
 - 3) Branch lines or taps are not allowed on dedicated irrigation water service lines for domestic (potable) use.
 - 4) Drainage shall be provided in accordance with the Manufacturer's and authority having jurisdiction's requirements in the event of relief valve discharge.
2. A USC FCCCHR approved DC BFP assembly is required when:
 - a. There is a Dual Water Supply Agreement for the premises. An approved DC BFP assembly shall be installed on the domestic water service line 5-feet downstream from the meter pit below ground in an approved manhole/vault.
 - 1) It is at the sole discretion of Triview Metropolitan District's Water Dept. to determine if the existing dual water supply poses a high risk to Triview Metropolitan District's potable distribution system. This may require the installation of a USC FCCCHR RP BFP assembly 5-feet downstream from the meter pit in an above ground, heated enclosure before any connections.

- 2) It is at the sole discretion of Triview Metropolitan District's Water Dept. to approve in writing the placement of the BFP assembly at a distance greater than 5-feet from the meter and/or immediate entry to the premises due to driveways, sidewalks, trees, etc.
 - b. Fire protection systems are installed without extinguishing agents or antifreeze. An approved DC BFP assembly shall be installed on the designated water service line entering the building (i.e., the Mechanical Room or the Pump Room).
3. The following facilities represent high hazard commercial applications that shall be contained from Triview Metropolitan District's distribution system by a USC FCCCHR approved containment RP BFP assembly:

Amusement parks
Auto repair facilities
Autopsy facilities
Battery shops
Car wash facilities
Chemical plants
Community gardens
Cooling towers
Dental clinics
Dispensary/Grow facilities
Dry cleaners
Dual water supplies
Electrical and electronic component Manufacturers
Firefighting systems
Food and beverage processing plants
Gas stations
Green courts
Golf courses
Gray water systems
Greenhouses
Health spas
Hospitals
Hotels
Hydraulic testing facilities
Irrigation systems
Jewelry Manufacturers
Kennels
Laboratories
Laundromats
Manufacturing facilities
Medical facilities
Metal plating industries
Mobile home parks
Morgues
Mortuaries
Motels
Multistory buildings (higher than 30-feet above the ground line)
Packing plants
Parks and recreation centers
Petroleum refineries

- Pet shops
- Photographic film processing facilities
- Printing or screen printing shops
- Radiator shops
- Radioactive material processing plants
- Recreational vehicle dump sites
- Recycled water systems (chemical injection, booster pumps, or high-risk scenarios)
- Rendering plants
- Restaurants
- Salons
- Schools
- Sewage treatment plants or facilities
- Solar water heating units
- Steam generating facilities
- Stock yard facilities
- Swimming pools
- Tanneries
- Tattoo parlors
- Taxidermy shops
- Veterinary facilities
- Warehouses
- Water features
- Water play features
- Waterfront facilities
- Zoos

- E. Testing Requirements for BFP Assemblies Installed on Potable and Recycled Water Services: The licensee is required to have a certified ABPA or ASSE tester inspect and test an existing or newly installed containment BFP assembly on dedicated and recycled water service lines, if applicable, upon installation and annually thereafter. Tests shall be conducted at the expense of the licensee. BFP assemblies shall be repaired or replaced at the licensee's expense when found to be defective. Records of tests, repairs, and replacements shall be kept by the licensee and a copy of the annual test provided to Triview Metropolitan District .

Installed BFP assemblies that fail to meet the requirements of [5.05](#), but were approved assemblies at the time of installation, shall be excluded from the requirements if they have been properly maintained and pass annual testing. If the BFP assembly is replaced, the replacement shall be USC FCCCHR approved.

1. The tester is required to:
 - a. Complete BFP assembly testing and submit test reports within 2 days of Triview Metropolitan District's setting of the meter and turning on of the water service.
 - b. Submit a copy of the official ABPA or ASSE certification to Triview Metropolitan District's Water Dept. each time the certification is renewed.
 - c. Submit a copy of the test kit calibration certification annually.
 - d. Have a dedicated recycled water test gauge.
 - e. Complete the BFP assembly test report and submit a copy of the containment BFP assembly report to Triview Metropolitan

- District's Water Dept. within 5 days. Incomplete or illegible test reports will not be accepted.
- f. Indicate containment or containment by isolation on the test report.
 - g. The submission of isolation test results to Triview Metropolitan District is not required by CDPHE.
 - h. Indicate the type of usage (i.e., domestic, irrigation, fire, or recycled) on the test report.
 - i. Confirm the premises ID, Triview Metropolitan District service address, meter number, BFP assembly serial number, and record the values on the test report.
 - j. Contact Triview Metropolitan District for discrepancies regarding the meter or BFP assembly.
 - k. Sign, date, and include the time of the test on the report.

Required test reports shall be submitted to Triview Metropolitan District Water Dept.:

Phone:	719-488-6868
Website	triviewmetro.com
Mailing Address:	Triview Metropolitan District Attn: Cross-Connection Control 16055 Old Forest Point, Ste. 300 Monument, CO 80132

2. Failed Assemblies:

- a. If the BFP assembly fails and cannot be repaired on the day of its failure, the Cross-Connection Control Section shall be notified by the certified ABPA or ASSE tester within 24 hours. A copy of the failed test report shall be submitted to the Cross-Connection Control Section within 3 days.
- b. The Property Owner is responsible for coordinating the necessary repairs to the BFP assembly and retesting the unit within 15 days. The Property Owner shall submit a passing test report to the Cross-Connection Control Section. Failure to comply may result in the suspension of water service.
- c. If the premises has a high hazard BFP assembly and is deemed a threat to public health (via the private plumbing system), it is at the discretion of Triview Metropolitan District to suspend the dedicated water service line immediately. The Property Owner shall repair or replace the BFP assembly before water service will be restored.

- F. Exemptions: Single-family residential customers are exempt from Triview Metropolitan District's cross-connection control requirements unless the premises is served by a fire suppression system or a dual water supply. Dual water supply conditions require a Dual Water Supply Agreement to be in effect between Triview Metropolitan District and the Property Owner. Multi-family residential customers are

exempt from Triview Metropolitan District's cross-connection control requirements unless the premises fall under the criteria listed in [5.05.C.7](#).

For questions or concerns related to cross-connection control, please contact Triview Metropolitan District's Water Dept.:

Office: 719-488-6868

Website triviewmetro.com

5.06 OPERATING PRESSURES WITHIN THE DISTRIBUTION SYSTEM

Pressures within the distribution system shall be a minimum of 40 psi during the maximum hour demand and have a maximum of 110 psi static pressure in the main. The maximum pressure fluctuation at any location in the distribution system between maximum hour demand and minimum hour demand shall not exceed 30 psi.

5.07 PRESSURE REGULATING STATIONS

PRV installations are used to control pressures within distribution systems. When main extension plans are submitted for review, the need for a PRV installation will be determined based on existing pressure zones and the existing distribution system layout. PRV settings are to be included on plans with the elevation and the upstream and downstream hydraulic grade line and pressure. Triview Metropolitan District will make pressure settings and field adjustments. On plans submitted in Distributor Contract Areas that require a PRV, Triview Metropolitan District reserves the right to verify the settings. Triview Metropolitan District may own and maintain PRVs connected to its conduits as necessary.

Monitoring of the PRV via SCADA equipment may be required and conducted by Triview Metropolitan District in certain situations identified by Distributor PRV agreements. The equipment used shall be of the manufacture and type specified or approved by Triview Metropolitan District, see [5.14](#).

5.08 STORAGE FACILITIES

- A. Water storage facilities are allowed for the storing of water from Triview Metropolitan District's system where specifically authorized and approved in writing by Triview Metropolitan District.
- B. Storage facilities shall have built in provisions for draining as well as access and provisions for inspecting and cleaning including a suitable source of water. The cleaning and drainage of storage facilities will be subject to Triview Metropolitan District's approval.
- C. Triview Metropolitan District may require the installation of SCADA equipment for storage facilities of the type specified by Triview Metropolitan District, see [5.14](#).

5.09 ELECTRIC PUMP MOTORS

- A. Motors shall be polyphase squirrel-cage rotor induction and deliver adequate starting and running torque that is sufficient to meet the electrical and operating conditions of the installation.
- B. Motors shall be in accordance with these Standards and subject to Triview Metropolitan District approval.

- C. Motor sizing shall not make use of the service factor.
- D. Motors shall be rated for direct across-the-line, full voltage starting.
- E. Motors shall be controlled by a motor starter which employs a method of starting that is consistent with the requirements of the electric power utility, the plant power system, and the consideration of extended motor life, reliability, and acceptable voltage drop during starting.
- F. Starters shall be equipped with motor protective devices in the form of overload relays, phase reversal, phase loss and under-voltage relay trips, ground fault detection, motor winding and bearing over-temperature alarm and trip, and any other such functions as may be required by Triview Metropolitan District for a particular installation.
- G. Motors shall be designed and constructed to operate without damage in reverse rotation at the maximum speed obtainable with the connected pump acting as a turbine under the conditions given by the approved hydraulic system design.
- H. Pump motor installations shall maintain an overall electrical system power factor between 0.9 lagging and 1.0 (unity) under normal operating load. If necessary, each motor shall be equipped with power factor correcting capacitors as required to meet this standard.
- I. Pump motors shall be equal to or exceed efficiency values in accordance with NEMA MG 1, Part 12.60.

5.10 PUMPING FACILITIES

Pumping facilities are allowed on mains or services supplying water from Triview Metropolitan District's system only where specifically authorized by Triview Metropolitan District. Triview Metropolitan District will prohibit the installation of pumping facilities where such installations would be injurious to the operation, or future operation, of Triview Metropolitan District's system. This requirement is not applicable to individual building fire sprinkler system pumps, domestic system boosters required in high-rise buildings, or irrigation system pressure boosting. Such applications require BFP to eliminate the possibility of pumping into Triview Metropolitan District's distribution system. Materials, equipment, and construction shall be in accordance with applicable codes and standards and approved by Triview Metropolitan District.

- A. General Design Criteria: Pump stations receiving water from Triview Metropolitan District shall:
 - 1. Be secured against unauthorized entry.
 - 2. Be located and kept in a manner that allows for easy and safe access for maintenance and inspection.
 - 3. Provide mechanical forced ventilation in the pump station at a rate of no less than 6 air changes/hour. The intake and exhaust vents shall be designed to prevent the entry of small animals and insects. The intake vent ductwork shall include a filter rack. Vents shall have motorized dampers to prevent air infiltration into the vault when the ventilation system is not in operation. Fans, ductwork, and damper materials shall be constructed of aluminum and/or PVC. Vent stacks may be steel gooseneck type or aluminum tiered caps depending on architectural requirements.

4. Provide heating, cooling, and humidity controls to ensure the safe, dry, and efficient operation of piping, pumping equipment, instrumentation, and alarms.
5. Have pumping capacity sized to provide adequate flow coverage for minimum demands up to the maximum requirements as determined by fire demand, maximum day demand, maximum hour demand, or replenishment, whichever is greater.
6. Provide a means for measuring flow on pump discharge headers.
7. Provide corrosion protection for underground steel and iron.
8. Provide code compliant plumbing systems that include floor drains, sump pump systems, and wash-down service water systems. Pump and valve packaging leakage shall be piped to the floor drain or sump pump system.
9. Provide local and remote electronic telemetry equipment of the type specified by Triview Metropolitan District for monitoring the discharge pressure and confirming the pump motor status, see [5.14](#).
10. Provide a frost proof gravity line or sump pump for pump station drainage to the local sanitary sewer. Provide a check valve, p-trap, and cleanout on the sump discharge line.
11. Provide a means to prevent water from backing up into the pump station from other sources (e.g., installing a check valve on the drain line).
12. Standardize equipment to permit interchangeability with other equipment.
13. Ensure special care is exercised in the selection of pumping units and associated components to prevent pressure surges. Ensure the suitability, flexibility, and adaptability of the units to the hydraulic conditions of the system from which water is taken and the system into which it is pumped.
14. Ensure the horsepower rating of each pump motor will continuously carry the maximum load that may possibly develop (non-overloading at any point on the pump curve) without exceeding the motor nameplate rating and without using the service factor.
15. Provide that pumps are located to receive positive suction head and meet the Manufacturer's required net positive suction head requirements.
16. Provide steel pump and motor bases that are level, coplanar, free from internal stress, and have internal voids filled with epoxy grout above a steel reinforced concrete base.
17. Provide DI or steel piping designed according to AWWA Standards with adequate couplings for equipment, stainless steel piping supports, and drains.
18. Ensure the mechanical design, equipment selection, and installation practices are approved by Triview Metropolitan District. Drawings and information shall be provided to describe the system curve and pump curve interactions, the pump operating conditions and associated efficiencies, the pumping equipment sizing and features, the valve/actuator sizing and operating requirements, and the HVAC design loads, ductwork sizing, and equipment selections. Provide the certified Manufacturer's pump performance curves.
19. Ensure that electrical design, equipment selection, and installation practices are approved by Triview Metropolitan District. Drawings shall show the power system, switchgear, protective devices, feeder panels, and wiring and motor controllers along with sizing, fault

current, and protective device coordination calculations. The latest edition of the NEC, OSHA's Design Safety Standards for Electrical Systems, and applicable ANSI/IEEE Standards shall set the minimum standards to which the design, equipment, and installation shall conform. Triview Metropolitan District may set higher standards for safety or reliability purposes.

20. Provide slow-closing regulating and/or check valves on pumps to minimize water hammer.
21. Provide ample clearance between equipment for operation and maintenance.
22. Provide electrical outlets and lighting on walls in the pump room.

B. Conditional Design Criteria: Depending on the function and the location of the pump station, the following criteria may be required by Triview Metropolitan District:

1. Aesthetically pleasing building architecture that is compatible with the surrounding area.
2. Attractive, water-conserving landscaping around the pump station.
3. Exterior and interior lighting.
4. Access and parking for vehicles on the pump station site.
5. Fencing for securing the area around the pump station and transformers.
6. Space for the future addition of pumps and piping.
7. A means to lift heavy equipment (e.g., a bridge crane or access for a boom crane).
8. Variable speed or throttling control with the appropriate discharge valves and controls.
9. An emergency power supply for telemetry, lights, a drain sump pump, and other necessary items.
10. Surge control.
11. The installation of guard valves on each side of the pumping unit.
12. Systems capable of supplying adequate fire protection during power outages.
13. Resistance temperature detectors in stator windings of pump motors for remote alarming in the event of overheating.
14. A spare pump for backup capability.
15. Pump and motor bearing high-temperature sensors for remote alarming and lock out relays to shut down the pump and the motor in the event of bearing overheating.
16. Aquastat over the temperature shutdown switch on the pump to protect the pump from overheating. The Aquastat shall not contain mercury.
17. Reduced voltage motor starters, depending on the motor size and the electric power system.
18. Dual transformers cross-connected with a tie breaker and separately switched for isolation.
19. A remote control for pumps, gas engines, and filling valves (start – stop – position discharge valve).
20. Local and remote instrumentation for monitoring:
 - a. Discharge valve positions.
 - b. Discharge header pressure and flow.
 - c. The reservoir level, if applicable.
 - d. Upstream pressure, if applicable.
 - e. Suction header pressure, if applicable.

- f. The pump status (on-off).
 - g. Gas engine standby generator status (on-off).
 - h. Total kilowatt demand (station).
21. Provide remote and local sensors and alarms to detect:
- a. Water on the floor.
 - b. Bearing high-temperature for each pumping unit.
 - c. Motor windings high-temperature for each pumping unit.
 - d. Pump building door intrusion.
 - e. High and low room temperature.
 - f. Electrical ground fault.
 - g. Low accumulator pressure, if applicable.
 - h. Power failure.
 - i. High and low reservoir levels, if applicable.
 - j. Fire and/or smoke.

5.11 DISTRIBUTION SYSTEM LAYOUT

- A. Mains shall be installed in dedicated public streets of the width defined in [5.11.C](#). Main layout shall be of such grade, alignment, curvature, and other characteristics as to permit installation and maintenance in the usual manner. When Triview Metropolitan District determines it is not feasible for an installation to be made in a dedicated street, the installation shall be made in a Triview Metropolitan District or Distributor easement.

The conditions under which such an exception is allowed will be determined on a case-by-case basis. Only easements in accordance with the terms of Triview Metropolitan District's standard easement form and these Standards will be accepted. The easement requirements defined herein shall be complied with prior to the acceptance of any existing system for Total Service Contract Areas. Easements granted for water mains near the perimeter of a lot or property line shall abut the lot or property line to provide for future domestic and/or fire protection service from the water main to the adjoining lot or property, except as specifically approved in writing by Triview Metropolitan District.

- B. The main alignment shall be parallel to dedicated ROW or easement lines. Normal practice is to lay the main on the north or east side of the street 5-feet or 10-feet from its centerline. In cases where the main alignment is within an established public or private roadway, the main shall be installed between the limits of the curb and gutter pan, the roadside drainage ways, or other such roadway limits, except as specifically authorized by Triview Metropolitan District. In addition, there shall be a minimum of 10-feet from any edge of the dedicated ROW or easement to the centerline of transmission and distribution mains and a minimum of 15-feet for conduits, except as specifically approved in writing by Triview Metropolitan District.
- C. The cross-section of a dedicated public ROW shall meet the minimum requirements of a 28-foot surfaced roadway, flow line to flow line, with an additional 2 1/2-feet on each side.
- D. Easement Width Requirements:
- 1. Private Roadways with Island Median: Roadways designed with islands at the entrances to developments shall have easements that extend across the entire roadway with the island located in the middle. The water line shall be installed on the side of the island that is at least 20-feet wide from back of curb to back of curb. Other utilities

shall be confined to the opposite side of the island. Private Roadways: The easement shall have a minimum width of 30-feet. Triview Metropolitan District or the Distributor shall have exclusive use of 20-feet thereof, except for right angle utility crossings. The cross-section of a private roadway shall meet one of the following:

- a. A minimum of 26-feet of surfaced roadway with a 4-foot wide attached sidewalk making a total of 30-feet of surfaced area from back of curb to back of sidewalk in accordance with the [Standard Drawings](#).
- b. A minimum of 29-feet of surfaced roadway with 6-inch wide concrete curbs making a total of 30-feet of surfaced area from back of curb to back of curb in accordance with the [Standard Drawings](#).
- c. A minimum of 30-feet of surfaced roadway with permanent delineation on each side, the type, material, and location of which shall be preapproved by the Property Management Section as a part of the plan review process and where neither cross-section on the [Standard Drawings](#) is practical.

An easement in accordance with the terms of Triview Metropolitan District's Standard PUD/PBG form shall be granted to Triview Metropolitan District .

2. Undeveloped Areas: An exclusive easement shall have a minimum width of 30-feet. A nonexclusive easement shall have a minimum width of 50-feet.

E. The installation or replacement of a water main in an alley is prohibited.

F. Fire hydrants shall be installed within dedicated streets or in easements as previously defined. When Triview Metropolitan District determines it is not feasible for a hydrant to be installed in this manner, it shall be installed in an easement adjacent to the street. The fire hydrant easement shall have a minimum width of 10-feet if the length of the easement is 25-feet or less. Fire hydrant easements shall have a minimum width of 30-feet when the length of the easement is greater than 25-feet. The easement shall extend a minimum of 5-feet beyond the center of the hydrant in accordance with the [Standard Drawings](#).

Fire hydrants shall only be installed at locations authorized by the appropriate fire department.

5.12 ISOLATION VALVES

Isolation valves are required approximately every 600-feet in distribution systems that receive water from Triview Metropolitan District . Where blocks exceed 600-feet in length, or if two or more hydrants are connected to the same main, additional isolation valves are required. Street intersections that carry heavy traffic or that contain major water distribution mains in both directions, as determined by Triview Metropolitan District , require four valves, one on each extended property line. For a succession of short blocks that are perpendicular to the direction of a major feed and without residential services, several intersections may have the valve omitted in that direction but shall retain the 600-feet interval requirement. An isolation valve is required between fire hydrants.

5.13 CONNECTIONS TO CONDUITS

Triview Metropolitan District will install connections to conduits that it owns or controls unless it authorizes otherwise. Triview Metropolitan District will provide and install, at cost, fabricated pipe, tapping saddles, valves, etc. that are necessary to construct the connection.

5.14 SUPERVISORY CONTROL AND DATA ACQUISITION

The SCADA system installed for use by Triview Metropolitan District to monitor, control, and coordinate the operations of the water system or the operations between a Distributor's water system and Triview Metropolitan District's system shall be designed, installed, and maintained according to the following standards and practices:

A. General:

1. SCADA equipment and instruments shall be in accordance with these Standards and are subject to Triview Metropolitan District's approval.
2. Construction and installation of the equipment shall be in accordance with plans and specifications submitted to and approved in writing by Triview Metropolitan District prior to the beginning of the system's construction. Plans and specifications shall be prepared using ISA industry standard electrical/electronic, instrumentation symbols, and drafting practices. Changes in design or equipment specifications on approved plans need to be reapproved by Triview Metropolitan District before the changes are implemented in the system. Only plans approved by Triview Metropolitan District's Process Control Section shall be used for the construction and installation of the SCADA system.
 - a. For systems requiring 15 I/O points or more in any combination of analog and digital points and containing no more than one closed loop control loop, the following documentation is required:
 - 1) The control viewpoint containing an overview of how the system is to operate. This shall include a listing of digital and analog I/O points, control loop descriptions, set points, normal operating ranges, alarm points operating sequence, and operator interface information. The control viewpoint is used for check-out, startup, system revisions, and maintenance. An equipment list detailing the following for equipment and instruments: equipment tags to be used throughout drawings (ISA Standards), Manufacturer and model number, and a concise description of the Manufacturer's specifications as they apply to the requirements of the process. Manufacturer's cut-sheets and literature shall accompany the list. The equipment list will be used by the Process Control Section to review equipment submitted for approval and as a cross-reference guide for the drawing package.
 - 2) An I&C P&ID Typical that shows the instruments and associated equipment interconnections in block form using ISA Standards. The nomenclature established on

the equipment list shall be used. The flow of signals shall move from left to right across the drawings. Normal operating points, signal levels, frequencies, and instrument adjustments shall be shown. P&IDs are intended to be used for design and installation. They shall be in accordance with these Standards and are subject to Triview Metropolitan District's approval.

- 3) An I&C Cabinet Layout Typical that includes layouts for operating stations, push-button stations, terminal boxes, control equipment enclosures, etc. to clearly show the location of panel-mounted telemetry/control system components. Panel layout drawings are intended to be used for fabrication, installation, and maintenance. I&C Cabinets shall be in accordance with these Standards and are subject to Triview Metropolitan District's approval.
 - 4) An I&C Detail and Schedules Typical that includes parts/instrument material schedule for equipment located in the enclosure, nameplate schedule, panel cut-out details, etc. These drawings are also intended for use in fabrication, installation, and maintenance. I&C Details and Schedules shall be in accordance with these Standards and are subject to Triview Metropolitan District's approval.
 - 5) An I&C Ladder Diagram Typical that shows the necessary electrical connections to equipment in schematic form and ladder logic, if applicable. Any set points or other information pertinent to the installation of the system shall be included. Information regarding power requirements shall be shown including the main power feed capacity, voltage and origin, and transformer and power supply available load and operating voltage. I&C drawings shall be in accordance with these Standards and are subject to Triview Metropolitan District's approval.
 - 6) Wiring details that include wire numbers, colors, and sizes along with terminal numbers/names for terminals, and whether off a terminal strip or instrument terminal. Concise nomenclature for equipment functions is required. Schematics are intended for use in fabrication, installation, and maintenance. Wiring details shall be in accordance with these Standards and are subject to Triview Metropolitan District's approval.
 - 7) Software documentation in the form of a hardcopy printout and an electronic copy of the completed program is required.
- b. For systems requiring less than 15 I/O points or containing more than one closed loop control loop, the following drawings are required with those outlined above:
- 1) An I&C Site Diagram Typical that shows the relative locations of panels and field-mounted instruments in plan view and uses the designated nomenclature from the equipment list. Component layouts are intended to aid in installation and maintenance. I&C Site diagrams

shall be in accordance with these Standards and are subject to Triview Metropolitan District's approval.

- 2) An I&C Wiring Diagram Typical that shows the actual wiring interconnections from the terminal in graphical form. This drawing is used for installation and check-out and is not expected to be maintained after startup. I&C wire diagrams shall be in accordance with these Standards and are subject to Triview Metropolitan District's approval.
3. Equipment and wiring shall be installed and mounted in a manner that provides easy access and protection from mechanical and thermal damage as well as condensation or other forms of moisture. NEMA Standards shall be applied for enclosures. Wiring connections shall be made in a neat, workmanlike manner and enclosed in PVC wiring duct. In-line splices or wire nuts are not allowed. Each end of a wire shall be identified by a permanent wire marker that corresponds to the wire identification used on the final as-built detailed drawings. No more than two wires shall be permitted on each terminal block screw. A minimum of 20% of the terminal block positions or din rail space shall be provided as spare for future changes or additions. Twisted, shielded pairs shall be used for instrumentation wiring for analog devices (e.g., 4 mA to 20mA signals). Terminations of analog signal wires shall be made by the Process Control Section unless otherwise specified. Low voltage DC wires shall have separate conduit runs from 120 VAC and higher voltage wires. Each separate instrument or device in the system shall have a permanent identification label affixed to it that corresponds to the final as-built detailed drawings. The NEC and OSHA's Design Safety Standards for Electrical Systems shall set the minimum standards to which the design, equipment, and installation shall conform. Triview Metropolitan District will designate additional standards to ensure safety, reliability, and compatibility with existing systems. Wire coloring code shall adhere to the following:

120 VAC power	Black
120 VAC neutral	White
120 VAC control	Red
Ground	Green
12, 24, 48 VDC power	Blue
12, 24, 48 VDC common	White with blue stripe
Digital inputs and outputs	Blue
Foreign Power Source	Yellow
Communication wiring	Approved by DW Process Control

4. A site inspection by the Process Control Section is required prior to the installation of telemetry/control equipment. The Contractor shall notify the Process Control Section at least seven days in advance of beginning the installation to arrange an inspection date. SCADA system operation shall agree with the control viewpoint previously approved. SCADA systems and equipment shall be subject to inspection and operational acceptance tests by the Process Control Section before being placed into service. Wires shall be inspected for continuity and termination. Instruments shall be tested to ensure proper operation. The Contractor shall notify the Process Control Section seven days in advance of the completion of installation to

arrange a final inspection date.

5. Pressure transmitters shall be installed in the center of the conduit and teed with a pressure sign gauge for local pressure readings. Flow measurements shall be a combination of two differential pressure transmitters: a high range transmitter calibrated for the maximum design flow rate and a low range transmitter calibrated to 25% of the maximum design flow rate. Level transmitters, including pressure transmitters used for level measurement, shall be installed on a separate sensing line; other instrumentation is not permitted on the line.
6. Control systems that incorporate sources of motive power shall utilize electrical or hydraulic (oil) fluid power actuator mechanisms. The use of compressed air as a prime motive power source, or compressed air powered actuators, is not allowed. The use of air over oil accumulators as a source of reserve hydraulic power is allowed. These motive power systems shall be included in the SCADA system drawings submitted for approval. Standard Electrical Industry and National Fluid Power Association drafting symbols and practices shall be used.
7. Three copies of the Manufacturer's instruction manuals, parts lists, and service information in addition to three sets of as-built drawings, control viewpoint, and equipment lists shall be provided to Triview Metropolitan District within 30 days after the completion of startup and the satisfactory performance of the equipment is achieved, as dictated by Triview Metropolitan District .

B. Additional Requirements for Coordinating Operations between a Distributor's facility and Triview Metropolitan District:

1. The required standard for these SCADA systems shall not be higher than those used for telemetry installations made by Triview Metropolitan District and shall adhere to the Specifications outlined in [5.14.A](#). The control viewpoint shall be used as the design standard and written in conjunction with the Distributor and Triview Metropolitan District's Process Control Section.
2. The SCADA system power shall be provided by the Distributor including the conduit and wires from the power source to the telemetry and control panel and/or field devices. Triview Metropolitan District will provide other labor related to the design, construction, and maintenance that shall be paid for by the Distributor, unless otherwise requested by the Distributor and approved by Triview Metropolitan District.
3. The minimum I/O points required for treated water distribution are as follows:
 - a. Upstream pressure, analog signal.
 - b. Downstream pressure, analog signal.
 - c. Valve position, analog signal.
 - d. Remote/local control selector switch position, digital signal.
 - e. Local open/close valve selector switch, hardwired digital signal.
 - f. Valve open command, digital signal.
 - g. Valve close command, digital signal.
 - h. Water on floor alarm, digital signal.
 - i. Vault intrusion alarm, digital signal.
4. Instruments and equipment shall be of a Manufacturer and model

specified by [MS-31](#), unless otherwise approved in writing by the Process Control Section. Telemetry and control equipment that is not specified in [MS-31](#) will need to be approved in writing by the Process Control Section before purchase by the Distributor.

5. Triview Metropolitan District will specify, order, and pay for the monthly service of any telephone lines required for the system. The Distributor shall pay for the initial connection fee.
6. Within 30 days after completion of the system, the Distributor shall provide Triview Metropolitan District with the keys necessary to gain around the clock access to the telemetry system located at the Distributor's facility.
7. Additions, changes, or other modifications to the SCADA system after it is placed into service need to be approved in writing by Triview Metropolitan District prior to implementation. The required work will be completed by Triview Metropolitan District unless otherwise requested by the Distributor and approved in writing by the Process Control Section. The Distributor shall provide as-built drawings and documentation within 30 days after the completion of the approved work to the Process Control Section.

5.15 INTERCONNECTS WITH OTHER WATER SYSTEMS

Interconnections between Triview Metropolitan District's treated water system and another Triview Metropolitan District approved system will only be allowed in accordance with Triview Metropolitan District's Operating Rules. The design and installation of interconnections will comply with Triview Metropolitan District's plan review process.

- A. Emergency Facilities: Where the location of an interconnection within the Service Area is identified, it shall be included in a written agreement between Triview Metropolitan District and the other parties to the interconnection, and such facilities shall be constructed in accordance with the Triview Metropolitan District approved plans. Such facilities shall normally consist of one or more lines that are a minimum of 6-inch diameter, each consisting of a meter and associated piping as detailed on the submitted plans. A bypass line shall not be included.
 1. Unidirectional interconnections: A BFP assembly is required on unidirectional interconnections between Triview Metropolitan District's treated water system and another Triview Metropolitan District approved system.
 2. Bidirectional interconnections: A removable spool piece is required on bidirectional interconnections between Triview Metropolitan District's treated water system and another Triview Metropolitan District approved system.
- B. Where the location of an interconnection within the Service Area between Distributors is identified, it shall be included in a written agreement between Triview Metropolitan District and the Triview Metropolitan District Distributors, and such facilities shall be constructed in accordance with the Triview Metropolitan District approved plans. Such facilities shall normally consist of one or more lines that are a minimum of 6-inch diameter, each consisting of a meter and associated piping as detailed on the submitted plans. A bypass line shall not be included. At the sole discretion of Triview

Metropolitan District, a BFP assembly shall be installed at the Distributor's master meter points of connection(s) in accordance with [5.05](#).

- C. Where emergency conditions require the use of temporary connections between fire hydrants to serve Triview Metropolitan District's water into another system, such installation shall be in accordance with the [Standard Drawings](#).

5.16 FLOW MEASUREMENT

Triview Metropolitan District may require pitot installations for future flow measurement. If a pitot is required, a corporation stop shall be installed so that a pitot installation may be completed later and shall be in accordance with the [Standard Drawings](#).

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The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 6 - Materials

6.01 MATERIALS AND TESTING

Materials shall be in accordance with the [Material Specifications](#). For the purchase and approval of materials, detailed technical specifications are included in the [Material Specifications](#) within these Standards.

Furnished materials shall be new, undamaged, and the latest standard product of a Manufacturer regularly engaged in the manufacture of the product for at least 5 years. Everything necessary to complete installations in accordance with these Standards shall be furnished and installed including items not shown on plans and [Standard Drawings](#). Installations shall be finished as fully operable, functioning parts of the Triview Metropolitan District system.

The Contractor shall provide the materials necessary for installation when mains are extended; Triview Metropolitan District will not supply materials. Acceptance of the materials or the waiver of an associated inspection shall in no way relieve the Contractor from the responsibility of furnishing materials that meet the requirements of the [Material Specifications](#). Materials that do not meet the [Material Specifications](#) or that are damaged may be rejected by the Board and returned to the Contractor at the Contractor's expense. Triview Metropolitan District does not allow the use of Manufacturers or models not approved in the [Material Specifications](#).

New water industry products or materials will be tested if, in the opinion of the Director of Engineering – Projects, a product or material has some merit. Triview Metropolitan District will establish the criteria for the testing and evaluation of products. Triview Metropolitan District reserves the right to accept or reject any product or material regardless of test results. See [Appendix I, Procedure For Evaluation Of Materials](#). If any approved Manufacturer material fails to meet the [Material Specifications](#) and applicable test criteria, the Board, at its discretion, may promptly remove the Manufacturer and the model from the [Material Specification](#) Approved Manufacturer's list. The material will be returned to the Supplier at the Manufacturer's and the Supplier's expense.

6.02 SIZE OF MAINS

The size of mains shall be in accordance with [5.03](#). Standard acceptable nominal diameters of distribution mains are 4-inch, 6-inch, 8-inch, and 12-inch. Standard acceptable nominal diameters of transmission mains are 16-inch and 20-inch. Standard acceptable nominal diameters for conduits are 24-inch and larger.

6.03 PIPE CLASSES

Triview Metropolitan District has established minimum design safety factors for system piping considering working pressures of 150 psi concurrent with a water hammer surge pressure of 110 psi for 4-inch, 6-inch, 8-inch, 12-inch, and 16-inch pipe, and 70 psi for 20-inch and larger pipe.

Based upon these considerations, the following minimum AWWA Standard pressure classes for acceptable types of pipe are required:

DI	Special Thickness Class 50 (6-inch, 8-inch, 10-inch*, 12-inch, 16-inch, and 20-inch) Special Thickness Class 51 (3-inch* and 4-inch*) *Allowed for service lines only.
PVC	C 900 DR 14 (4-inch) C 900 DR 14 (6-inch, 8-inch, 12-inch, 16-inch, and 20-inch)

6.04 SELECTION OF PIPE

In general, the selection of the type of pipe shall be left to the discretion of the PE in charge of the design. However, Triview Metropolitan District reserves the right to deny the use of certain types of materials in specific circumstances.

Where joint restraint is required, the designer shall select a pipe along with an approved system of restraint. Installation of metallic pipe and fittings in corrosive soil areas requires corrosion protection systems.

The installation of mains through hazardous areas, at depths greater than 10-feet, and in the roadways of state and federal highways may require the selection of pressure classes in excess of the minimums stated in [6.03](#). DI with nitrile gaskets may be required at the discretion of Triview Metropolitan District. Markings of nitrile gaskets shall be permanent in accordance with AWWA C111. Special comprehensive studies of applicable laws, regulations, and detailed engineering calculations shall be submitted by the PE to Triview Metropolitan District for review in these instances.

When the installation of metallic pipe is contemplated, a soil resistivity survey of the construction area shall be performed. The survey data and calculations, coupled with the service history of other existing pipes in the area, shall be submitted by the PE to Triview Metropolitan District. Resistivity surveys shall utilize the Wenner four-pin method. Triview Metropolitan District will provide the resistivity surveys free of charge, on request. This service will also be provided when nonmetallic pipe is planned for installation to determine if protection is needed for metallic fittings and appurtenances.

When water mains are to be constructed in soils that have a resistivity of less than 1,000 ohm-centimeters or where stray current corrosion is expected to be present, an approved nonmetallic pipe system shall be selected. When water mains are to be constructed in soils that have a resistivity of more than 1,000 ohm-centimeters, metallic or nonmetallic pipe material may be selected. Metallic pipe, fittings, and appurtenances shall be protected against corrosion by polyethylene wrap in accordance with [8.23](#) regardless of soil resistivity.

Nonmetallic pipe is not allowed in areas with soil contamination. Soil contamination that consists of hazardous substances or materials or toxic substances will be determined on a case-by-case basis by Triview Metropolitan District.

When a metallic pipe needs to be used in a low resistivity soil, additional cathodic protection may be required, the design of which shall be specific to the project and subject to Triview Metropolitan District's approval.

Pipe at DEN that is 4-inch or larger, excluding nonpotable mains, shall be tape-coated or polyurethane-coated, cement-mortar-lined, welded steel pipe. Cathodic protection is required for metallic pipe at DEN; the design will be provided by Triview Metropolitan District.

6.05 PIPE FITTINGS

- A. Joints and fittings shall be in accordance with applicable AWWA Standards and bear the pressure rating of the straight pipe involved at a minimum. Acceptable types for straight lengths of pipe are push-on, mechanical joint, and bell spigot restraint systems. Mechanical joints for straight lengths of pipe are allowed in specific situations with Triview Metropolitan District's approval.

Fittings shall be furnished with mechanical joint ends and shall be in accordance with [MS-3](#). The use of wyes is prohibited.

- B. Bolted sleeve-type couplings, in accordance with AWWA C219, shall be of a gasketed, sleeve-type with a diameter that properly fits the pipe, see [MS-30](#). Tolerance on the pipe and coupling together with proper bolt and gasket arrangements shall be sufficient to ensure permanent watertight joints under all conditions. Couplings shall be sufficiently wide so that each type of pipe joined has as much pipe end inserted in the couplings as is provided by the standard push-on or mechanical joint for the pipe size and type involved.

The following table contains the minimum center sleeve dimensions for bolted sleeve-type couplings:

Pipe Diameter (Inch)	Center Sleeve Thickness (Inch)	Center Sleeve Width (Inch)
4	0.250	5
6		
8		
12	0.375	7
16		
20		

DI sleeves shall have mechanical joints of the proper size and tolerance to ensure a watertight fit.

Split sleeve couplings in accordance with AWWA C227 are acceptable.

Long bell closure pieces shall be equal in strength, at a minimum, to the straight pipe being joined and shall contain push-on joints of the proper tolerance to ensure watertight connections.

Where pipes of different types are connected or where pipe is connected to fittings or valves of different materials, care shall be taken to ensure the proper ring, insulating gasket, or adapter is selected.

- C. Flanged adapters, plugs, end caps, bulkheads, cut-in sleeves, anchor couplings, repair fittings, and other appurtenances shall be used where appropriate throughout the system subject to Triview Metropolitan District's approval. Written requests for the approval of deviating items shall be made in advance through Triview Metropolitan District.
- D. The harnessing of joints may be accomplished using one of the mechanical joint restraint systems specified in [MS-29](#) or using one of the several proprietary joint restraint systems supplied by Pipe Manufacturers. Proprietary systems will require Triview Metropolitan District's approval prior to use. Regardless of the system used, restrained lengths of pipe for various fittings where harnessing is utilized or required shall be at least equal to the lengths in accordance with the [Standard Drawings](#).

Where joint restraint is required on PVC pipe, the designer may use a joint restraint system of the type supplied by Pipe Manufacturers and approved by Triview Metropolitan District or switch to a metallic pipe. The use of rods and clamps on PVC pipe are not allowed.

6.06 ISOLATION VALVES

Isolation valves shall be resilient seat gate valves as specified in [MS-5](#). Valves shall be the same size as the main and shall open clockwise, except as provided in [Chapter 11](#). Valves with operators that open counter-clockwise shall not be used unless they are required by, or approval is obtained from, Triview Metropolitan District.

6.07 PRESSURE REGULATING VALVES

A PRV is used to keep downstream pressure uniform and less than that in the upstream main.

PRVs shall be in accordance with [MS-10](#). They shall be sized so that the velocity through the valve at maximum demand does not exceed 25 fps. If a wide range of flow rates is anticipated, more than one valve may be required. Care shall be taken to ensure an adequate pressure differential across the valve under all ranges of flow to accomplish hydraulic throttling. When pressure differentials greater than 45 psi are expected or when the downstream pressure is low relative to the differential, special valve materials or a special valve design may be required.

PRVs shall be properly supported and have adequate clearance above and below the valve to facilitate servicing. A manual bypass is required for single valve installations. Telemetry of data may be required. Each PRV shall have a gate valve on both sides for isolation purposes. The general arrangement shall be in accordance with the [Standard Drawings](#).

6.08 TAPPING VALVES AND SLEEVES

Tapping valves and sleeves shall be used concurrently to tap an existing main without interrupting service. A tapping valve does not replace a property line valve; however, a property line valve may not be required if the out-distance of the main is 15-feet or less. A valve box shall be installed with the tapping valve.

Taps, 2-inch and smaller, shall be made by a corporation stop that is the same size as the service line.

Taps, 3-inch and larger, shall be made with an existing tee (cutting a tee into a dewatered line if permitted by Triview Metropolitan District) or a tapping sleeve and a tapping valve. Whichever method is used, care shall be exercised to select sleeves and gaskets that are properly sized to fit the type and class of pipe to be tapped. Where tapping sleeves, 3-inch and larger, are used, a thrust block shall be placed behind the tapping sleeve to prevent possible damage to the main from pressure shocks that develop as valves are first opened. Tapping sleeves shall be in accordance with [MS-9](#). Thrust blocks shall be in accordance with the [Standard Drawings](#).

6.09 CHECK VALVES

A check valve permits flow in one direction only; it closes when the flow stops so reversal cannot occur. Check valves shall be in accordance with [MS-7](#). They are required for meter installations, 1 1/2-inch and larger, where there is no BFP assembly downstream and at Distributor master meter locations. Check valves are not a substitute for BFP assemblies; however, they may be omitted from the meter installation in cases where a BFP assembly is within 150-feet of the meter.

6.10 STOP AND WASTE VALVES

Service lines shall have a stop and waste valve on the service line inside the residence (near where the line enters the residence). The stop and waste valve shall have a drain plug located on the valve body so that when the valve is shut off the drain plug can be removed and the water above the valve drained out. For typical locations, see the [Standard Drawings](#). Stop and waste valves shall be in accordance with [MS-23](#).

6.11 VALVE BOXES

Buried gate valves shall be provided with a 6-inch CI valve box and large oval base. The valve box shall be of a design that shall not transmit shock or stress to the valve and shall have enough extension capability to be raised to the ground line. Valve boxes shall be in accordance with [MS-12](#). The top section of the valve box shall be acceptable for use with a butterfly valve in accordance with the [Standard Drawings](#).

6.12 VALVE REFERENCE MARKER POSTS

When valves are installed where adequate physical reference points are not available, as determined by Triview Metropolitan District, a valve reference marker post may be required. Reference marker posts shall be in accordance with the [Standard Drawings](#).

6.13 WATER METERS

Water meters used in Triview Metropolitan District's system shall be preapproved in accordance with the approved Manufacturer and model. Triview Metropolitan District will determine the type of meter to be installed at the time of the application based upon size, service requirements, location, and other conditions that may exist. Triview Metropolitan District may change the type of meter at any time based on the water usage patterns of the licensee.

- A. Displacement meters, 5/8-inch through 2-inch, shall be in accordance with [MS-16](#). Known as nutating-disc or oscillating piston meters, they are positive in action. The pistons or discs displace or carry over a fixed quantity of water for each nutation or oscillation when operated under positive pressure. Displacement meters are generally used for residential, industrial,

commercial, and irrigation applications requiring a 2-inch or smaller service. The 1-inch and smaller magnetic drive displacement type meter shall be furnished with a CI frost bottom.

- B. Compound meters consist of two meters in a single case, one to measure small flows and the other to measure large flows. Compound meters are designed for the small meter to operate during low flows. As flows begin to increase, the large meter takes over. When the large meter is in operation, the small meter may or may not be in operation. Compound meters are generally used for residential, industrial, and commercial applications requiring a service larger than 3-inch, except for irrigation and certain industrial uses where flow rates are relatively constant. Compound meters are used for applications where domestic use is provided and shall be in accordance with [MS-17](#).
- C. Turbine meters are designed to measure primarily large, fairly constant flows and shall not be used where possibilities of small flows exist below the Manufacturer's stated minimum. Turbine meters are used for irrigation applications requiring a service 2-inch and larger for certain industrial applications with relatively constant, high flows; they are not for domestic use. Turbine meters shall be in accordance with [MS-18](#).

Turbine meters, 3-inch and larger, shall have a flanged in-line basket strainer installed on the upstream side. Turbine meters smaller than 3-inch shall include an integral stainless steel strainer with a removable top plate as described in [MS-18](#).
- D. Fire service type meters, which are specialized types of compound meters, shall be used on any service that includes fire sprinklers, fire hydrants, or other fire protection behind the meter and in other cases as determined by Triview Metropolitan District . Fire service type meters are required to meet specialized standards of UL, Factory Mutual, and other certifying agencies and shall be in accordance with [MS-19](#). Single-family residences and duplexes with a limited number of sprinkler heads may be exempt from this requirement.

6.14 METER APPURTENANCES

- A. Valves For Use With Meters: Valves for meters, 2-inch and smaller, depend on the size and type of setting as follows, in accordance with the [Standard Drawings](#). Services shall have a curb stop or valve that is the same size as the tap and service line installed as close behind the curb line as possible.
 - 1. For 1-inch or smaller outside settings, install a curb stop 2-feet to 5-feet before the meter pit. The meter setting shall include an angle valve or ball valve on the inlet side of the meter.
 - 2. For 1 1/2-inch or 2-inch outside settings, install a curb stop 2-feet to 5-feet before the meter vault. The meter setting shall include angle valves or ball valves on the inlet and the outlet sides of the meter. The bypass line shall have a ball valve that may be locked in the closed position.
 - 3. For 1-inch or smaller inside settings, new meter settings are not permitted. Existing services shall have a curb stop near the front property line, usually just behind the curb. Existing services shall have a stop and waste valve installed between the service line point-of-entry and the indoor meter setting and a gate valve downstream of the meter.

4. For 1 1/2-inch or larger inside settings, new meter settings are permitted with the written approval of Triview Metropolitan District's Meter Inspection Supervisor. Install a curb stop 2-feet to 5-feet from the property line. Existing services shall have a curb stop near the front property line, usually just behind the curb. Services shall have coppersettlers on the meter. The bypass line shall have a ball valve that may be locked in the closed position.

Valves shall be in accordance with AWWA C800 and [MS-23](#).

Valves, 3-inch and larger, for use with DI service pipe shall be gate valves in accordance with [MS-5](#). Gate valves for use with meters in vaults and inside buildings shall be supported by adjustable steel valve supports in accordance with the [Standard Drawings](#), see [3.12](#).

- B. A coppersetter is a metal pipe frame that is inserted in the copper service line piping to support and convey water to the meter. Coppersettlers shall be in accordance with [MS-23](#). Coppersettlers for 1-inch and smaller meters shall include a lockable angle valve on the meter inlet. Coppersettlers for 1 1/2-inch and 2-inch meters shall include lockable angle valves or ball valves on the meter inlet and outlet and a lockable ball valve on the bypass.
- C. Meter supports shall be a solid concrete block in accordance with the [Standard Drawings](#). Fabricated metal supports or jack stands shall be used to support 3-inch and larger valves and shall be in accordance with the [Standard Drawings](#).
- D. To ensure safety, meter settings shall provide for electrical continuity in the event the meter is removed from the setting. For 2-inch and smaller meters this is normally accomplished by installing the meter in a coppersetter that provides a continuous electrical path from the metallic piping on the downstream side of the meter setting to the metallic piping on the upstream side. There shall be an electrical continuity wire or strap connecting the pipe on either side of the meter setting in accordance with the [Standard Drawings](#). The wire shall be made of copper with fittings suitable for bonding jumper and water pipe material. The meter setting installation shall be in compliance with the NEC.

6.15 METER PITS AND LIDS FOR 3/4-INCH AND 1-INCH METERS

Meter settings for 3/4-inch and 1-inch meters shall be installed in meter pits with a 24-inch nominal diameter and a total depth of 52-inches minimum from grade. The pit shall consist of a 24-inch nominal diameter by 48-inch high cylinder of concrete or composite with a dome or bell housing holding an internal frost lid and a locking top lid. The base unit shall be in accordance with [MS-25](#).

- A. Rings shall be constructed of concrete in accordance with [MS-20](#) and comply with the requirements of ASTM C 478. Meter pits shall comply with [MS-25](#).
- B. Units shall be in accordance with the requirements for composite meter pits in [MS-25](#). The pit shall be installed plumb and at sufficient depth for the top of the dome to sit at ground line or up to 1-inch below ground line. Grade adjustment rings from the same Manufacturer shall be used to raise the top of the pit or to accommodate the plumb pit to an angled ground surface.

- C. A CI dome or bell housing shall be mounted on the top of the pit. The dome or bell housing shall have a support for an interior frost lid and a rim for locking the meter pit cover. Composite and plastic domes are not permitted, see [MS-25](#).
- D. The cap-type meter pit top lid shall be constructed of CI or an approved composite material. Lids shall be of the cap-type with a locking screw and bolt that provides a tight locking of the cover to the dome or bell housing of the meter pit, see [MS-25](#). Lids shall withstand AASHTO HS 20 highway loading plus 25% impact not to exceed 20,000 lbs. Composite lids shall be available in various colors, as required by Triview Metropolitan District , and have Triview Metropolitan District Meter imprinted on the lid. When set in place of the dome, the top of the meter pit lid shall be set at ground line. The inner frost lid shall be high-density polyethylene in accordance with [MS-25](#) and the [Standard Drawings](#).

6.16 METER VAULTS FOR 1 1/2-INCH AND LARGER METERS

Meter vaults shall be precast concrete from approved Manufacturers as identified in [MS-28](#). Cast-in-place vaults may be used in special circumstances with written approval of the structural design by Triview Metropolitan District's variance process. Precast vaults shall be designed so that joints and corners are waterproof. The roof and the walls of precast and cast-in-place vaults shall be made waterproof after construction using sealants, membranes, or other approved methods. Access manholes shall be adjusted to be flush with the finished landscape grade or surrounding pavement.

- A. Circular vaults for 1 1/2-inch and 2-inch meters shall be 48-inch diameter and of sufficient depth to extend below the 4 1/2-feet to 6-feet depth below ground line of the service line. The wall thickness shall be at least 6-inches. The vault shall have a flat top with concrete grade rings supporting the manhole ring and 24-inch diameter manhole cover at ground line. When subject to traffic loads, vaults shall sit on reinforced concrete manhole beams and be in accordance with [6.19](#), [6.20](#), and the [Standard Drawings](#).
- B. Rectangular vaults for 3-inch and larger meters shall be of a size and configuration in accordance with the [Standard Drawings](#) and approved by the Meter Inspector. Vaults shall be precast concrete from an approved Manufacturer. Vaults shall be designed to support the street fill and HS 20 traffic loading in accordance with AASHTO Standards.
- C. Meter vault lids shall be ASTM A 48 Class 35B CI manhole covers with a 24-inch lid set into a 36-inch outer diameter ring. The manhole lid shall be solid with one 2-inch hole for turbine or displacement meters and two 2-inch holes for compound meters to accommodate AMR/AMI devices specified by Triview Metropolitan District or shall be of a composite material meeting the requirements of [6.19](#).
- D. Meter vaults shall include copolymer manhole steps cast into the side of the vault evenly spaced at 12-inch centers, maximum.
- E. AMR/AMI devices shall be mounted through the CI manhole lid or outer ring, inside the vault with a composite cover, in a remote location on the side of a building, or on a pole, as directed by the Meter Inspector.

6.17 CONCRETE STRUCTURES

Structures shall be designed to support applicable loads. Design calculations, drawings, and contract specifications shall be submitted to Triview Metropolitan District for review. Concrete used in structures shall be Class A, see [MS-20](#) and [8.19](#).

6.18 STEEL REINFORCEMENT FOR CONCRETE

Steel reinforcement shall be deformed bars or welded steel fabric and be in accordance with [MS-22](#).

6.19 MANHOLES

Manholes and reducing sections shall be precast concrete in accordance with [MS-35](#).

Manhole rings and covers shall be in accordance with [MS-33](#) with the following additional requirements:

- A. The 24-inch manhole rings and covers shall be City of Triview Metropolitan District, Colorado Standard pattern and constructed of CI or an approved composite material.
- B. The 24-inch CI manhole cover shall weigh approximately 165 lbs. The 24-inch CI ring shall weigh approximately 240 lbs.
- C. The 24-inch recessed manhole covers for meter vaults shall be CI Triview Metropolitan District Standard pattern with one or two 2-inch holes for the mounting of an AMR/AMI device through the lid. The lid shall be cast with the words Triview Metropolitan District Meter on the top.
- D. The 24-inch by 36-inch double ring and cover: The 36-inch cover shall have an auxiliary 24-inch opening and cover. The 36-inch cover weighs approximately 250 lbs. The CI 36-inch ring weighs approximately 280 lbs.
- E. Composite manhole covers for meter vaults shall be constructed of fiber-reinforced polymer, furnished with a locking mechanism that prevents the lid from popping from its frame under traffic conditions, and cast with the words Triview Metropolitan District Meter on the top. Composite covers shall maintain AASHTO H 20 highway load rating and other performance characteristics between -60°F and 160°F. Composite manhole covers for meter vaults shall meet or exceed the requirements for CI manhole covers and shall fit equally well in CI or composite frames. Composite covers shall be available in a variety of colors, as specified by Triview Metropolitan District, and weigh less than 50 lbs.

6.20 MANHOLE BASE SLABS AND BASE BEAMS

Manhole base beams shall be constructed of precast, reinforced concrete, see [MS-35](#). Concrete shall be in accordance with [MS-20](#); concrete reinforcement shall be in accordance with [MS-22](#).

6.21 SUMP PITS FOR VAULTS AND MANHOLES

Sumps are required for vaults and manholes where there is seepage into existing vaults, in PRV installations, and as determined by Triview Metropolitan District .

A gravity drain line or sump pump shall be used in conjunction with a sump where telemetry equipment is to be installed and be in accordance with the [Standard Drawings](#). A sump pump is not permitted in a meter vault.

Normal practice in constructing a sump is to excavate a 30-inch diameter hole roughly 3-feet deep. A 6-inch concrete floor is placed and allowed to set. A 24-inch section of cardboard tubing is then used for an inside form with concrete poured behind it to approximately 3-inches of thickness. The [Standard Drawings](#) show a sump as part of a typical PRV installation. A cast-in-place floor shall incorporate a monolithic sump pit.

6.22 VENT PIPES

Vent pipes are used in vaults and pits to provide proper ventilation. Installations that contain electrical equipment shall have a locally controlled, power-operated blower attached to the vent system. Electric powered blowers are not permitted in meter vaults. Vent pipes shall be field located at the nearest intersection of the street property line and the side lot line. Vent pipe installation details shall be in accordance with the [Standard Drawings](#).

The above ground industrial vent pipe shall be steel pipe, 6-inch nominal diameter, in accordance with ASTM A 53. The vent screen shall be a 3/4-inch No. 9-F11 flattened, expanded galvanized metal screen and be in accordance with the [Standard Drawings](#). The below ground vent pipe shall be 6-inch, black steel pipe – Schedule 40 with threaded joints. A 6-inch threaded black steel coupling shall be used to connect the pipes at ground level.

The above ground residential vent pipe shall be stainless steel pipe, 6-inch nominal diameter, Schedule 10 with a 14 gauge stainless steel hemispherical dome in accordance with ASTM A 420, Type 409. The below ground vent pipe shall be 6-inch, Schedule 40 PVC with glued joints.

6.23 MANUFACTURERS AND MODELS OF FIRE HYDRANTS

Inside Triview Metropolitan District and Total Service Contract Areas, where maintenance, repair, replacement, and parts stocking is the responsibility of Triview Metropolitan District, only the Manufacturer's brands of hydrants in [MS-13](#) are acceptable. In Distributor Contract Areas, fire hydrants in accordance with [MS-13](#), but without limitation to the brand names chosen by Triview Metropolitan District for its own use, can be used.

6.24 FIRE SERVICE LINE CONNECTIONS TO MAINS

Fire service lines that supply sprinklers shall be sized by the appropriate fire department and the persons responsible for the structure. Triview Metropolitan District will not size fire service lines.

6.25 SERVICE LINES

Service lines shall be sized to supply the requirements of the property being served. The minimum size line shall be 3/4-inch. Acceptable materials are seamless Type K soft copper pipe or HDPE pipe for 3/4-inch to 2-inch service lines in accordance with [MS-24](#). DI pipe is required for 3-inch and larger service lines. Service lines shall be the same type of material from beginning to end, unless an appropriate insulator is installed at the junctions of the dissimilar metals and be in accordance with [3.07.C](#) and the [Standard Drawings](#). Unless otherwise approved by the Meter Inspection Supervisor, there shall not be bends or changes in the size of the service line between the tap and a point 5-feet past the outside wall of the meter pit or vault for outdoor meter settings or between the tap and a point 5-feet past the curb valve for indoor meter settings.

Copper joints installed underground shall be flared or brazed. Flaring and brazing shall be performed in accordance with the best plumbing practices. Compression and press fittings shall be in accordance with [MS-23](#).

6.26 CORPORATION STOPS

Corporation stops provide the connection for the service line to the main; they shall be flared. By utilizing a corporation stop, a service can be connected to the main without taking the main out of service. Corporation stops are also used in air valve assemblies, vacuum valve assemblies, and large butterfly valve installations in accordance with the [Standard Drawings](#). Corporation stops are made in 3/4-inch, 1-inch, 1 1/2-inch, and 2-inch sizes and shall be in accordance with [Chapter 3](#), [MS-23](#), and the [Standard Drawings](#).

6.27 CURB STOP SERVICE BOXES

Curb stop service boxes, or stop boxes, shall be CI, Buffalo type. The bottom part, shaped like an inverted U, shall straddle the service line and have a flanged bottom to support itself. Curb stop service boxes shall be in accordance with [MS-12](#).

6.28 CORROSION PROTECTION SYSTEMS

CI and DI pipes and fittings shall be protected against corrosion.

- A. Polyethylene wrap shall be used on buried metallic pipe fittings, rods, and appurtenances. Polyethylene material shall be in accordance with [MS-14](#) and the [Standard Drawings](#).

Nominal Pipe Diameter (Inch)	Flat Tubing Width (Inch)
4 and 6	20
8	24
12	30
16	36
20	45

Buried harness rods shall be covered by 4-inch flat width polyethylene tubing. The entire joint shall be covered by a wrap of 48-inch wide polyethylene sheet material over each set of lugs. Irregular shaped valves and fittings shall be covered with flat 48-inch wide polyethylene sheet material. V-Bio enhanced polyethylene wrap may be required for areas where the soil resistivity is 1,000 ohm-centimeters or less.

- B. Electrical isolation is required at dissimilar metal connections and at corporation stops in accordance with the [Standard Drawings](#). Electrical isolation is achieved by installing dielectric insulating gaskets, washers, and sleeves at couplings, flanges, and corporation stops. Full face, unsegmented gaskets are required for electrically insulated flanges.
- C. In areas where the soil resistivity is 1,000 ohm-centimeters or less and metallic pipe needs to be used, joints shall be bonded with HMWPE insulated stranded copper wire and be in accordance with the [Standard Drawings](#). Exothermic welds shall be covered by an approved weld cap.
- D. Wax tape DI pipe and fittings that will be subject to submersion in manholes and vaults not equipped with sump pumps. Wax tape shall be in accordance with [MS-26](#).

6.29 KICKBLOCKS

Concrete kickblocks shall be sized for working pressure plus water hammer surge pressures as stated in [6.03](#), and soil bearing capacity. Standard shapes and sizes of kickblocks shall be in accordance with the [Standard Drawings](#). Kickblocks shall be constructed of Class B concrete in accordance with [MS-20](#) or of a premeasured, sacked industrial mix such as Sakcrete or Quikrete. Ready-mixed concrete mixes shall be approved by Triview Metropolitan District. Kickblocks shall be placed in accordance with [8.18](#).

6.30 PROTECTIVE CONCRETE PADS OVER PIPE

Under unusual circumstances, it may be necessary to lay pipe at shallow depths. Concrete pads shall be used over the pipe to protect it from traffic loading when this occurs. The pads shall be designed to support loads from traffic without transmitting the load to the pipe. Approved insulation shall be required between the pipe and the concrete pad to protect the pipe from frost. Designs are subject to Triview Metropolitan District's approval.

6.31 PIPE INSULATION

Pipe insulation shall be cellular glass with a temperature rating of -290°F to 900°F. Pipe insulation shall be Type 3 Pittsburgh Corning Foamglas with Pittwrap Jacketing or Urecon.

6.32 CASING PIPE

Installation of mains through Triview Metropolitan District ROW, or the ROW or easements of others, (e.g., highways and railroads) may require casing pipes to facilitate the installation of the main. The casing pipe may be required by the permitting agency or by Triview Metropolitan District. The type of casing material and its properties shall be specified by the agency granting permission to cross. In the absence of a casing specification, Triview Metropolitan District will specify the casing material. Such crossing will be subject to Triview Metropolitan District's approval to avoid conflicts in requirements or standards between Triview Metropolitan District and the persons or agency granting permission to cross. Final approval of the boring and casing methods and materials shall be obtained from Triview Metropolitan District prior to construction. When a bore is not required to cross interference, Triview Metropolitan District may require the installation of the main under the interference. For details, see [MS-34](#) and the [Standard Drawings](#).

6.33 CARRIER PIPE

Carrier pipe shall be in accordance with [MS-34](#).

6.34 MISCELLANEOUS METALWORK AND PIPING

Fabrication shall be equal to the best practice in modern fabricating shops. Welding shall be performed by certified welders and exposed welds shall be ground smooth. Weld spatter shall be properly removed to Triview Metropolitan District's satisfaction.

Exposed hardware such as nuts, washers, bolts, and anchor bolts shall be galvanized. Exposed metal that is to be buried shall be given two coats of CA-1200 mastic cold coating as manufactured by the Protecto Wrap Company of Triview Metropolitan District, Colorado, except for metal with shop-applied coating approved by Triview Metropolitan District. Metal exposed to the weather shall be painted with one coat of rust inhibiting priming paint and two coats of aluminum paint unless otherwise directed by Triview Metropolitan District. Surfaces that are to be painted shall be cleaned of oil, grease, weld spatter, burrs, grit, dust, or other objectionable surface irregularities. The cleaning solvent used shall be mineral spirits. Copper, aluminum, or galvanized pipe does not need to be painted unless directed by Triview Metropolitan District.

Miscellaneous piping shall be installed in the best workmanlike manner. Threads on steel pipes shall be cut with sharp dies to standard depth and left clean cut and tapered. Threaded pipe joints shall be properly sealed with an approved joint compound applied on the male threads only. Concealed joints for copper water tubing within buildings shall be soldered or brazed in accordance with the appropriate building code. The joint of the copper pipe shall be properly cleaned, flux applied, and soldered with 95-5 tin-antimony solder that is applied in accordance with the best plumbing practice. Copper piping shall be protected with a copper saddle soldered to the underside of the pipe where in direct contact with pipe hangers or other metal supports. Saddles may be made of split copper pipe.

6.35 AIR AND VACUUM VALVES

Combination air release and vacuum valves shall be required for conduits and may be required for transmission mains at the discretion of Triview Metropolitan District. Air release and vacuum valve assemblies shall be installed at high points in the conduit or main, where there is an abrupt change of slope, at isolation valves where the conduit slopes away from the valve, or as determined by Triview Metropolitan District, see [MS-11](#) and the [Standard Drawings](#).

The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 7 - Earthwork

7.01 EARTHWORK DEFINED

Earthwork includes clearing, grubbing, grading, excavation, fill, backfill, trenching, excess excavation, bedding, pipe zone and borrow material, and surface restoration that may be required to complete work.

7.02 EXPLORATORY EXCAVATION

Underground utilities and structures that may interfere with construction shall be exposed and the location verified in advance to permit necessary relocations without delay.

7.03 EXCAVATION TO LINE AND GRADE

Excavations shall be made to the lines and grades established by the approved plans. Pipe trenches shall be excavated to a minimum depth of 6-inches below the bottom of the pipe. Deviation from grades is allowed when approved in writing by Triview Metropolitan District in accordance with [8.06](#) and [8.07](#).

7.04 TRENCHING OPERATIONS

- A. Existing asphalt or concrete surfacing shall be cut vertically, in a straight line, and removed from the jobsite prior to starting the trench excavation; this material shall not be used in any fill or backfill unless approved in writing by Triview Metropolitan District.

The trench shall be excavated so that a minimum of 6-inches of clearance is maintained on each side of the pipe for proper placement and densification of bedding and pipe zone or backfill material. The maximum trench width, measured at the top of the pipe, shall be the OD plus 18-inches regardless of the type of pipe, type of soil, depth of excavation, or the method of densifying bedding and backfill, in accordance with the [Standard Drawings](#).

- B. The trench shall be adequately supported and the safety of workers provided for as required by OSHA.

Sheeting and shoring shall be utilized where required to prevent excessive widening or sloughing of the trench. Widening or sloughing of the trench could be hazardous to human safety, the pipe or appurtenances being installed, existing utilities and structures, or any other existing facility.

Excavated material shall not be placed closer than 2-feet from the top edge of the trench. Heavy equipment shall not be used or placed near the sides of the trench unless the trench is adequately braced.

7.05 EXCAVATION FOR STRUCTURES

Except as otherwise dictated by construction conditions, the excavation shall be of such dimensions as to allow for the proper installation and removal of concrete forms or precast slabs and panels and permit the construction of necessary pipe connections. Care shall be taken to ensure the excavation does not extend below established grades. If the excavation is made below such grades, the resulting excess excavation shall be filled in with squeegee No. 57/67 or No. 4 coarse aggregate in accordance with ASTM C 33 and deposited in horizontal layers of no more than 6-inches in thickness. Sufficiently tamp layers to provide firm, unyielding support.

7.06 SURPLUS EXCAVATION MATERIAL

Surplus excavation shall be removed from the jobsite and disposed of properly. If surplus excavation is disposed of on private property, written permission shall be obtained from the Property Owner and provided to Triview Metropolitan District.

7.07 BLASTING

To expedite work, blasting will generally be allowed if a permit by the local authority having jurisdiction is granted. Explosives and appurtenances shall be transported, handled, stored, and used in accordance with local, state, and federal laws, as applicable.

Blasting shall be controlled so as not to disturb any existing structure or facility. Triview Metropolitan District will set the hours of blasting. Owners and occupants of nearby structures or facilities shall be notified in writing by the Contractor at least 3 days in advance of blasting. The notice shall state the date and time of blasting as well as the Contractor responsible for the blasting.

Blasting shall be controlled to prevent making any excavation unduly large or irregular so as to shatter rock on the bottom or sides of an excavation or surface upon or against which concrete is to be placed. If, in the opinion of Triview Metropolitan District, blasting is liable to damage rock foundations or supports, concrete, or structures, excavation will only be permitted to continue by jack hammering, barring, wedging, or other methods.

Blasting in a trench shall occur only after trench walls are shored or braced in a manner that is satisfactory to Triview Metropolitan District. Liability for blasting is placed solely on the Contractor.

7.08 DEWATERING

Pipe trenches or structure excavation shall be kept free from water during pipe laying and other related work. The method of dewatering shall provide for a completely dry foundation at the final lines and grades of the excavation and be in accordance with the NPDES and CDPHE's permitting requirements.

Dewatering shall be accomplished using well points, sump pumps, rock or gravel drains placed below subgrade foundations, or subsurface pipe drains. Water shall be

disposed of in a suitable manner that is not a hazard to public health and that does not cause a public inconvenience in accordance with the CDPHE permit. Water shall not be drained into work areas that are being completed or that are under construction.

The dewatering operation shall continue until it is safe to allow the water table to rise in the excavations. Pipe trenches shall contain enough backfill to prevent pipe flotation of the carrier or the casing pipe. When pipe is laid in a casing or a tunnel longer than 30 pipe diameters, the pipe inside the casing or the tunnel shall be secured so that flotation does not occur when the pipe is emptied.

Water shall not be allowed to rise until the concrete has set for a minimum of 24 hours and the forms removed. Water shall not be allowed to rise unequally against an unsupported structural wall.

7.09 FOUNDATIONS ON UNSTABLE SOIL

If the bottom of the excavation is soft or unstable and cannot satisfactorily support the pipe or structure in the opinion of Triview Metropolitan District , a further depth and width shall be excavated and refilled to 6-inches below grade with No. 4 coarse aggregate in accordance with ASTM C 33.

7.10 PIPE BEDDING AND PIPE ZONE MATERIAL

- A. After completing the trench excavation and proper preparation of the foundation, 6-inches of bedding material shall be placed on the trench bottom for support under the pipe. Bell holes shall be dug deep enough to provide a minimum of 2-inches of clearance between the bell and bedding material. Pipe shall be installed to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade and the joint is made, the pipe zone material shall be carefully placed and tamped under the haunches of the pipe and in the previously dug bell holes.

Tamping is herein defined as the act of placing approved pipe zone material under the haunches of the pipe while paying particular attention to voids, bell holes, and sling holes. The purpose of tamping is to ensure uniform support for the pipe.

The limits of bedding and pipe zone material shall be from 6-inches below the bottom of the pipe to 6-inches above the top of pipe. Approved backfill may then be installed to the ground line. For backfill and the compaction of backfill, see [7.11](#).

- B. Bedding and pipe zone material shall be clean, free draining, poorly graded, unfrozen, friable, natural rounded (not crushed) squeegee with no clay balls or organic material that is in accordance with the following limits when tested by means of laboratory sieves:

Squeegee (For use with 20-inch or smaller diameter mains)	
Sieve Size	<u>Total Percent</u> <u>Passing by Weight</u>
3/8-inch	100
No. 50	0 to 10
No. 100	0 to 5
No. 200	0 to 3

Approved bedding and pipe zone material shall be stockpiled on the jobsite.

7.11 BACKFILL AND COMPACTION

- A. Pipes: Restrain the pipe as necessary to prevent movement during backfill operations. Place material in lifts on both sides of the pipe. Tamp each lift, including the area under the haunches, with handheld tamping bars supplemented by walking in and slicing material under the haunches with a shovel to ensure voids are completely filled before placing each succeeding lift. Compact material by a minimum of 3 passes with a vibratory plate compactor only over the area between the sides of the pipe and the trench walls taking care not to damage the pipe. Do not use power-driven impact compactors to compact the pipe zone material.

The trench excavation may provide suitable backfill material above the pipe zone. Wet, soft, or frozen material, asphalt chunks, or other deleterious substances shall not be used for backfill. If the excavated material is deemed unsuitable for backfill by Triview Metropolitan District, it shall be disposed of properly and a suitable material shall be utilized.

Backfilling shall be conducted in a continuous manner to prevent damage to the pipe and its coating and kept as close to the pipe laying operation as possible. Backfilling procedures shall be in accordance with the additional requirements, if any, of appropriate agencies or private ROW agreements.

- B. Structures: Backfill and fill within 3-feet adjacent to any structure and for the full height of the walls shall be selected nonswelling material. It shall be relatively impervious, well graded, and free from 3-inch and larger stones. Material may be job excavated; however, selectivity is required.

Stockpiled material other than topsoil from the excavation shall be used for backfilling unless an impervious structural backfill is specified. The backfill material shall be free from rubbish, clods, and frozen lumps of soil. Backfill around the structures shall be consolidated by mechanical tamping. The material shall be placed in 8-inch loose lifts within a range of 2% above to 2% below the optimum moisture content and compacted to 98% of compaction prior to placing succeeding lifts in accordance with ASTM D 6938 and ASTM D 698.

Impervious structural backfill, where shown or specified, shall be CDOT Class 1 structural fill. The material shall be placed in 8-inch loose lifts within a range of 2% below the optimum moisture content and compacted to 98% of maximum dry density as determined by ASTM D 698.

- C. Backfill and fill within 1-foot around a composite meter pit and to the bottom of the top 1-foot ring shall be squeegee sand. The squeegee shall be carefully placed and mechanically compacted to ensure the meter pit does not deform more than 1-inch out of round at any point of its depth. Compaction using the wheels of construction equipment is not permitted.

7.12 CONTROLLED LOW STRENGTH MATERIAL

Permission to use CLSM shall be requested from Triview Metropolitan District for backfill in pipe zone and other backfill locations. The request to use CLSM shall be in writing and shall include a mix design from a ready-mixed concrete producer. CLSM products shall be in accordance with [MS-21](#).

7.13 CLEANUP

Upon completion of the work, rubbish, unused materials, concrete forms, and other like materials shall be removed from the jobsite. Excess excavation shall be disposed of as specified and the areas left in a state of order and cleanliness.

7.14 SURFACE RESTORATION

- A. Unsurfaced and Surfaced Areas: Surface cuts shall be, at a minimum, restored to a condition equal to those prior to construction.
- B. Easements and Cultivated or Agricultural Areas: In easements and cultivated or agricultural areas, topsoil (to a depth of 8-inches) shall be removed from the area of general disturbance and stockpiled. After the installation of pipelines, appurtenances, and structures, and the completion of backfill and compaction, the stockpiled topsoil shall be redistributed evenly over disturbed areas. Care shall be taken to be in accordance with the original ground line or final grading plans.

7.15 SUBGRADE AND ROAD PREPARATION

Prior to the installation of water mains in dedicated streets, road construction shall have progressed to at least the subgrade stage. The road surface shall be smooth, clear of debris, and free from deep holes, ruts, and large rocks that may hamper main installation.

Mains shall be laid where the ground surface is near its final elevation, whether or not located in a dedicated street.

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The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 8 - Pipe Installation

8.01 APPROVAL BY TRIVIEW METROPOLITAN DISTRICT

Many handling and installation procedures, tools, equipment, and materials require Triview Metropolitan District's approval. Approval by Triview Metropolitan District is a way to ensure quality control and shall in no way render Triview Metropolitan District liable for any means, methods, or injuries suffered or any equipment damaged.

The safety of workers shall be provided for as required by OSHA.

8.02 HANDLING OF MATERIALS

- A. Pipe and fittings shall be loaded and unloaded by lifting to avoid shock or damage to materials. Materials shall not be dropped under any circumstances. If any part of the coating or lining of pipe is damaged, the replacement or repair of the damaged pipe shall be done to the satisfaction of Triview Metropolitan District. Any pipe or fittings not acceptable to Triview Metropolitan District shall be removed immediately from the jobsite. Pipe handling equipment and pipe handling methods shall be approved by Triview Metropolitan District.
- B. Support stockpiled pipe on sandbags placed under the pipe. Provide sandbags of sufficient size to prevent pipe from contacting the ground or any obstruction and allow for the proper use of slings. Securely cover pipe ends with polyethylene material or other suitable bulkhead to prevent the entry of animals, water, dirt, mud, or undesirable substances and prevent the drying out of the interior of the pipe.

8.03 PREPARATION AND INSPECTION OF PIPE AND FITTINGS FOR INSTALLATION

Before placing pipe in the trench, each pipe or fitting shall be thoroughly cleaned of foreign material, kept clean thereafter, and carefully examined for cracks and other defects before installation. Bell ends and spigot ends are to be examined with care.

8.04 PIPE JOINT LUBRICANT

Joint lubricant shall be supplied by the Pipe Manufacturer and approved by Triview Metropolitan District. Joint lubricant shall be non-toxic, water soluble, and certified to meet NSF/ANSI Standard 61.

8.05 CUTTING AND FITTING OF PIPE

Pipe shall be cut whenever necessary to be in accordance with the location of fittings,

line, or grade. Cuts shall be straight and true in a manner so that a smooth end is attained without damage to the pipe. Burrs shall be removed from the ends of cut pipe and the ends of the pipe lightly rasped or filed. Tools used for pipe cutting shall be approved by Triview Metropolitan District.

NOTE: Power-driven saws with abrasive discs (masonry blades) shall not be used for dry cutting or beveling AC pipe. In recognition of efforts to reduce the incidence and corresponding dangers associated with airborne asbestos fibers, PVC pipe may be used in place of MOA AC pipe wherever cutting is necessary.

8.06 PIPE ALIGNMENT AND GRADE

In pipe laying, the intent is to lay to set line and grade within a tolerance of ± 3 -inches. On slopes of zero grade, the intent is to lay to grade. Fittings, valves, and hydrants shall be installed at specified locations and elevations.

When pipe is laid on curves, the intent is to lay to the alignment. Pipe shall be kept in alignment by placing joints or bends on the curve. Bends shall be used whenever individual deflections exceed those specified by the Manufacturer.

The depth of cover over pipe, measured from ground line to top of pipe, shall be a minimum of 4 1/2-feet; it shall be known as the cover over pipe. If difficulties arise when crossing an interference, deviations from 4 1/2-feet of cover are permitted where specifically approved in writing by Triview Metropolitan District. Cover over the pipe can be, in unusual circumstances, a minimum of 3-feet and a maximum of 10-feet if approved by Triview Metropolitan District. The use of pipeline insulation shall only be used with written approval by Triview Metropolitan District and be in accordance with [6.31](#) when transmission or distribution mains are installed at a depth of cover that is less than the building code adopted County frost depth. The use of pipeline insulation may require additional corrosion protection of pipeline or upgraded protective coatings.

Any changes in alignment and grade will need to be authorized by Triview Metropolitan District and accomplished by the installation of additional fittings. The deflection of joints is permitted only when installing pipe on horizontal or vertical curves and shall not exceed those specified by the Manufacturer.

Pipe shall be laid with the bell ends facing the direction of the pipe being laid unless otherwise directed by Triview Metropolitan District.

8.07 DEVIATION OCCASIONED BY OTHER STRUCTURES

Whenever obstructions not shown on plans interfere to such an extent that an alteration in plans is required, Triview Metropolitan District will have the authority to determine the best method of correction. Triview Metropolitan District's Inspector may change the plans and order a deviation from line and grade or arrangements may be made with the Owners of the structure for its removal, relocation, or reconstruction. The licensee shall pay the costs for changes.

8.08 TEMPORARY BULKHEADS AND PNEUMATIC PLUGS

During construction projects, sections of water mains are installed and at times left

unattended leaving pipes vulnerable to human tampering and/or environmental contamination (e.g., ground water, muddy water, sanitary or storm water, and insects).

Whenever installed pipe is left unattended, temporary plugs (bulkheads or pneumatic) shall be installed at openings. Temporary plugs shall be watertight, installed properly, and designed in a way that prevents human tampering and environmental contamination. Temporary plugs will need to be approved in writing by Triview Metropolitan District.

The Contractor shall install approved bulkheads or pneumatic plugs on pipe openings before storm events and before leaving the work site unattended and immediately report any reported tampering or contamination events to Triview Metropolitan District.

Bulkheads and/or pneumatic plugs shall be thoroughly cleaned and disinfected in accordance with AWWA C651 with an NSF 60 certified sodium hypochlorite solution using a swab or spray application method before installation. Plugs shall be kept free from contamination during storage and shall not be used in nonpotable applications (e.g., sanitary sewer, storm water systems, and recycled water).

8.09 FROST

Pipe or appurtenant structures shall not be installed upon a foundation into which frost has penetrated or at any time when Triview Metropolitan District deems there is a danger of ice formation or frost penetration at the bottom of the excavation. Installation shall not occur unless backfilling can be completed before the formation of frost and ice.

8.10 DUCTILE IRON PIPE

- A. Immediately before joining two lengths of DI pipe, the inside of the bell, the outside of the spigot end, and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The rubber gasket shall be flexed inward and inserted into the gasket recess of the bell socket. Caution shall be exercised to ensure the correct type of gasket is used. A thin film of joint lubricant shall be applied to the inside face of the gasket, the spigot end of the pipe, or both.

The spigot end of the pipe shall be placed with care into the bell end to prevent the joint from contacting the ground. The joint shall be completed with a slow, steady pressure without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion is to the full depth of the joint. The spigot end of field cut pipe shall be filed or ground to resemble the spigot end of manufactured pipe.

- B. Before joining mechanical joint DI fittings to DI pipe, the outside of the spigot, the inside of the bell, and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. Normal practice is to lubricate the joint with a soap solution; however, in cold weather, the joint may be dry assembled if approved in writing by Triview Metropolitan District. Extreme care shall be exercised in making dry joints.

The gland shall be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket or bell end. The rubber gasket shall be placed

on the spigot end with the thick edge toward the gland.

Pipe shall be pushed in until the spigot end fully penetrates the bell. The gasket shall then be pressed into place evenly within the bell around the entire joint. The DI gland shall be moved along the pipe into position for bolting. Bolts shall be inserted and nuts shall first be screwed finger tight with the final tightening to be done to the Manufacturer's specifications with a torque-limiting wrench.

Pipe equipped with locking gaskets providing mechanical joint restraint shall be installed according to the Manufacturer's recommendation. The bell end of the locking gasket pipe shall be spray-painted safety red.

Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on the gland.

Mechanical joint fittings shall be wrapped with polyethylene encasement material in accordance with [6.28](#).

- C. When installing bolted sleeve-type couplings, care shall be taken to ensure connecting pipe ends, couplings, and gaskets are clean and free of dirt and foreign matter with special attention given to the contact surfaces of pipe, gaskets, and couplings. The couplings shall be assembled and installed in accordance with the recommendations and instructions of the Coupling Manufacturer.

Bolted sleeve-type couplings shall be wrapped with polyethylene encasement material in accordance with [6.28](#).

Wrenches used to bolt couplings shall be of the type and size recommended by the Coupling Manufacturer. Coupling bolts shall be tightened to secure a uniform annular space between the end rings. The body of the pipe and the bolts shall be tightened approximately the same amount. Diametrically opposite nuts shall be tightened progressively and evenly in accordance with the [Standard Drawings](#). Final tightening shall be done to the Coupling Manufacturer's specifications with a torque-limiting wrench.

8.11 POLYVINYL CHLORIDE PRESSURE PIPE

- A. Immediately before joining two lengths of PVC pipe, the inside of the bell or coupling, the outside of the spigot, and the elastomeric gasket shall be thoroughly cleaned to remove foreign material.

Lubrication of the joint and the rubber gasket shall be done in accordance with the Pipe Manufacturer's specifications.

Care shall be taken to ensure that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket into the annular groove of the bell or coupling shall be in accordance with the Manufacturer's recommendations. Pipe that is not furnished with a depth mark shall be marked prior to assembly to ensure the spigot end is inserted to the full depth of the joint.

The spigot and the bell or coupling shall be aligned and pushed until the reference line on the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion.

Pipe equipped with locking gaskets providing mechanical joint restraint shall

be installed according to the Manufacturer's recommendation. The bell end of the locking gasket pipe shall be spray-painted safety red.

- B. Pipe stored outside and exposed to sunlight for longer than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover pipe. Air circulation shall be provided under the covering. These requirements are in addition to [8.02.A](#).
- C. PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care shall be used in handling PVC pipe during cold weather.
- D. Install 6-inch wide detectable aluminum foil plastic backed tape indicating that a buried water line is installed 12-inches to 18-inches below surface grade. Tape shall be blue and manufactured by Pro-Line Safety Products or Thortec.
- E. Install minimum AWG 12 solid copper wire with 0.03-inch of blue PE insulation to the pipe with 2-inch wide PVC tape. The splicing of tracer wire shall be in accordance with the Manufacturer's recommendation. The tracer wire shall run in accordance with the [Standard Drawings](#). In lieu of tracer wire Inside Triview Metropolitan District and Total Service Contract Areas, 3M passive marking balls may be used in accordance with the [Standard Drawings](#).

8.12 INSTALLATION OF VALVES

Valves shall be handled in a manner that prevents injury or damage. Valves shall be set and joined to the pipe in the manner previously specified for cleaning, laying, and joining mechanical and push-on joints. Valves shall be set with the valve stems plumb. Valves shall be wrapped with polyethylene encasement material in accordance with [6.28](#).

Valves shall be located at the point on the main that would be intersected by the street property line if extended and as outlined in [5.12](#). Any deviations shall be at the discretion of Triview Metropolitan District.

Valves shall be operated prior to installation to ensure they are in good condition.

8.13 INSTALLATION OF VALVE BOXES

A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve; it shall be centered and plumb over the wrench nut of the valve with the box cover set to the elevation determined by Triview Metropolitan District.

8.14 INSTALLATION OF FITTINGS

Fittings shall be mechanical joint in compliance with [MS-3](#). Fittings shall be set and joined in the manner described in [8.10.B](#). Where PVC pipe is inserted into CI or DI fittings, beveled portions of the spigots shall be removed to accommodate the expansion characteristics of the plastic to the lesser depth of the bell.

Repair fittings and stainless steel repair clamps shall be wrapped with polyethylene encasement material as described in [8.23.C](#) when installed during a main repair.

8.15 INSTALLATION OF TAPPING SLEEVES

Taps are not allowed on PVC pipe containing water under pressure. Tapping of dry mains may occur only on PVC pipe. Taps on AC, CI, or DI pipe may be tapped under pressure or wet.

Tapping sleeves used for domestic service lines and fire service lines shall be spaced to provide adequate clearance between the completed service lines and meter pits/vaults, fire hydrants, and similar underground structures. The use of two tapping sleeves, side-by-side or back to back, as a substitute for a cross is prohibited.

8.16 FIRE HYDRANTS

- A. Hydrants shall be field staked for location and grade. The final location shall be in accordance with plans. Fire hydrants shall be set so that the elevation of the center of the traffic flange is 3-inches above the ground line or top of the curb. Hydrants shall stand plumb and be installed in accordance with the [Standard Drawings](#), with a minimum horizontal clearance of 5-feet.

Each hydrant shall be connected to the street main by a 6-inch branch line. The branch line shall be DI pipe only. Existing hydrant branch lines that are any material other than DI pipe shall be replaced in their entirety with DI pipe from the hydrant tee or tapping sleeve to the hydrant. An independent 6-inch gate valve shall be installed on each fire hydrant branch. The valve shall be firmly anchored to a mechanical joint tee with a 6-inch anchor coupling (also called a swivel adapter or a locked hydrant adapter) or to a mechanical joint anchor tee (also called a swivel tee or a locked hydrant tee).

The fire hydrant branch shall be anchored to the valve by mechanical joints.

Exception: When making a wet tap for a fire hydrant, a tapping valve and saddle shall be used in place of the mechanical joint tee, swivel adaptor, and valve.

- B. Drainage shall be provided at the base of the hydrant by placing rock from the bottom of the trench to at least 12-inches above the barrel flange of the hydrant and to a minimum distance of 12-inches around the elbow. The minimum distance from the bottom of the trench to the bottom of the hydrant elbow shall be 6-inches. The minimum amount of rock placed shall be 1/3 cy. The rock shall be cobble or brick sized crushed granite.
- C. To protect the hydrant from corrosion, the DI branch line and fittings from the hydrant base up to and including the tee shall be encased in polyethylene wrap. The type of polyethylene and the way it is installed shall be in accordance with [8.23.C](#). Bedding and pipe zone material shall be used from a point 6-inches below to a point 6-inches above the branch line. Bedding and pipe zone material shall be as specified in [7.10.B](#).

8.17 FIRE SERVICE LINE CONNECTIONS

The installation of fire service line connections shall be in accordance with [Chapter 3](#) and the [Standard Drawings](#). Fire service line connections shall be restrained DI pipe. The fire service line connection shall have a valve 2-feet to 5-feet from the property line that is on the street side of the property line. The fire service line connection shall be protected from corrosion, see [6.28](#). Requests for residential fire service line connections shall be submitted with the plans to Triview Metropolitan District for approval.

8.18 KICKBLOCKS

The following standard shall apply to kickblocks in accordance with the [Standard Drawings](#):

- A. Kickblocks shall be constructed at bends and fittings that require support due to unbalanced line thrust. Care shall be taken to ensure that outlets, cover bolts, nuts, clamps, and other fittings are accessible. A bond breaker shall be placed between the pipe and the kickblock to aid in future removal. If a large kickblock is to be placed, it shall be separated into sections by a suitable material. Bearing surface areas are minimum areas to bear against the undisturbed trench wall. If the soil bearing capacity is insufficient to provide adequate support based on minimum bearing areas in accordance with the [Standard Drawings](#), then the minimum bearing area shall be increased to a size that shall ensure support restraint. In every instance, the kickblock shall bear against undisturbed earth.

Before placing concrete, equipment used in the mixing and transport shall be cleaned. Debris, water, and ice shall be removed from the area to be occupied by concrete. Concrete shall not be placed on frozen subgrade. Concrete shall be placed only in the presence of the Triview Metropolitan District Inspector unless inspection is waived prior to the placement.

- B. Forming for concrete kickblocks and anchors shall be done by bulkheading around the shape of the kickblock or anchor with wood, burlap sacks, or reinforced paper sacks that are filled with sand or earth. Sacks shall be constructed of a size easily handled when full and left in place in the trench. Wood forms shall be removed before backfilling.

Horizontal struts or braces required for trench shoring shall not remain in concrete kickblocks. Prior to placing concrete, the forms and ditch bank will need to be inspected and approved by Triview Metropolitan District .

When concrete is deposited against the ground without the use of forms, the ground shall be thoroughly moistened or other provisions made to prevent the ground from drawing water in from the concrete.

- C. Newly placed concrete shall be allowed to set undisturbed for a minimum of 24 hours.
- D. Backfill may be placed over kickblocks after the surface has set sufficiently and they are able to resist the weight of the backfill. However, tamping or compacting shall not be allowed above the kickblock for a minimum of 24 hours after placement.

8.19 CONCRETE STRUCTURES

- A. Forms shall produce shapes, lines, and dimensions of the concrete structures as shown on plans.

The formwork shall be designed according to the loads and allowable stresses set forth in ACI 347.

Forms may be made of wood, metal, or other acceptable materials approved by Triview Metropolitan District. Wooden forms shall be thoroughly wetted, except in freezing weather, or a form release agent applied. Forms shall produce a smooth concrete finish to the tolerances described in ACI 301. Form material with raised grain, torn surfaces, worn edges, patches, dents, or other

defects that impair the texture of the concrete surface shall not be used.

Forms shall be mortar tight and braced or tied to maintain proper position and shape during and after concrete placement. Embedded metal ties with snap-off ends shall be used for internal form ties. Use of ordinary wire ties is not permitted. The withdrawal of form ties through the walls is also not permitted.

Exposed edges shall be chamfered with a 3/4-inch, 45-degree bevel.

The surfaces of forms and embedded items shall be cleaned of foreign material before concrete is placed. The recommendations of ACI 347 for form removal times under normal conditions shall be followed. Triview Metropolitan District will determine if additional time is required before form removal.

Forms shall be removed in a manner that ensures the integrity of the structure and its surfaces.

- B. Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C 94. Water may be added to the mix one time, i.e., immediately upon arrival at the jobsite to bring the slump within the required limits.

The concrete shall be conveyed from the mixer to the place of final deposit by methods that prevent separation. Equipment for chuting, pumping, and conveying concrete shall be of such size and design as to ensure a continuous flow of concrete at the discharge end without the separation of materials. Concrete shall not free fall a vertical distance greater than 5-feet during its discharge into the forms.

Concrete shall be deposited as near as possible to its final position to avoid segregation due to handling or flowing. Concrete shall be placed at a rate that is, at all times, plastic and flows readily between reinforcing steel. Partially hardened concrete and concrete contaminated by foreign materials are not allowed.

Concrete shall be deposited in continuous layers of such thickness that no concrete shall be deposited on or against concrete that has hardened to form seams or planes of weakness within the area or section. Concrete shall not be placed in lifts exceeding 18-inches in thickness.

The accumulation of water on the surface of the concrete due to water gain, segregation, or other causes during placement and consolidation shall be prevented by adjusting the mix design.

When placing concrete during cold weather, as defined in ACI 306, the temperature of the concrete mix during placing shall not be lower than 55°F and concrete work shall be in accordance with the recommended practices of ACI 306. When placing concrete during hot weather, as defined in ACI 305, the temperature of the concrete mix during placing shall not be higher than 85°F and concrete work shall be in accordance with the recommended practices of ACI 305. The cooling or warming of plastic concrete mixtures shall not be undertaken without Triview Metropolitan District's approval.

- C. Concrete shall be thoroughly consolidated with internal vibrators as recommended in ACI 309. Triview Metropolitan District will need to approve the size, type, and number of vibrators used for each concrete placement. The concrete shall be thoroughly worked around the reinforcing steel, around embedded items, and into the corners of the forms. Vibrators shall be

supplemented by spading, rodding, or forking to eliminate honeycombing at the form face and voids around embedded items.

- D. When concrete surface finishes are not shown on plans, unformed flat surfaces shall be screeded and wood float finished. Interior floor surfaces shall be steel-troweled with a light broom finished to Class A tolerance in accordance with ACI 301.

Do not apply water to the concrete surface during any phase of finishing operations. Do not perform concrete finishing while water is present on the surface.

- E. Construction joints not indicated on plans will need to be approved by Triview Metropolitan District. Concrete surfaces where joints are made shall be thoroughly cleaned and laitance removed prior to placing adjoining concrete. Contraction control joints shall be cut 1/4 of the depth of the slab. When power saw cutting methods are used, joints shall be cut as soon as the concrete surface is firm enough not to be torn or damaged by the saw blade. Water employed in the cutting, washing, and rinsing of concrete contraction control joints shall not stain, discolor, or affect exposed surfaces of the structures or damage the environment of the project or adjacent areas. Methods of wastewater disposal are subject to Triview Metropolitan District's approval.

- F. Concrete shall be cured by a method recommended by ACI 308. When the daily mean ambient temperature is above 40°F, the finished concrete shall be cured continuously for a minimum of 7 days or for the time necessary to attain 70% of the specified compressive strength, whichever period is less. When the mean daily ambient temperature is 40°F or lower, the finished concrete shall be continually cured at a minimum temperature of 55°F for the period recommended by ACI 306 to prevent damage from early-age freezing and provide the service category strengths required for each placement.

Concrete curing on formed surfaces shall be initiated immediately after the removal of forms or as directed by Triview Metropolitan District.

Concrete curing on slabs shall be initiated immediately after the water on the surface of the slab has evaporated or as directed by Triview Metropolitan District.

- G. Surface defects, including fins, tie holes, and honeycombed areas, shall be repaired down to solid concrete in accordance with ACI 301.

8.20 REINFORCING STEEL FOR CONCRETE STRUCTURES

- A. Reinforcing steel shall be accurately formed to the dimensions indicated on plans. Bends in bars shall be made cold. Bars with kinks or bends not shown on plans shall not be used.

Splices shall be located where shown on plans. Splices at other locations will need to be approved in writing by Triview Metropolitan District. Welded wire mesh shall be lapped one space and securely wired together.

Before reinforcement is embedded in concrete, the surfaces of the bars and the bar supports shall be cleaned of flaky rust, loose mill scale, dirt, grease, and other foreign substances that are objectionable. Reinforcement will be inspected for compliance with requirements as to size, shape, length, splicing position, and amount after it is placed.

- B. Steel reinforcing bars and welded wire fabric shall be placed accurately within forms and secured with annealed wire before concrete is placed. Steel reinforcing bars in walls shall be tied at a minimum of every other intersection or as directed by Triview Metropolitan District. Steel reinforcing bars in slabs shall be tied at every intersection. Steel reinforcement in slabs shall be supported on chairs of metal, plastic, or concrete in a manner to prevent steel reinforcement dislocation during slab construction.

Splices other than those shown on plans shall not be constructed without Triview Metropolitan District's approval.

Reinforcing steel shall be protected by the thickness of concrete indicated on plans. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:

1. Where concrete is deposited against the ground without the use of forms, the thickness shall not be less than 3-inches.
2. Where concrete is exposed to weather or exposed to the ground but placed in forms, the thickness shall not be less than 2-inches for bars larger than 5/8-inch in diameter and 1 1/2-inches for bars 5/8-inch diameter or smaller.
3. In formed surfaces not in contact with the ground or exposed to weather, the thickness shall not be less than 3/4-inch.

8.21 JOINT RESTRAINT DEVICES

Joint restraint devices shall be used at bends and fittings where joint restraint devices are specifically required. Joint restraint devices shall be required for the following installations:

- A. Fire hydrants.
- B. Fire service line connections.
- C. Domestic service line connections, 3-inch and larger.
- D. Vertical bends.
- E. Reducers.
- F. Vertical and horizontal offsets.
- G. Horizontal bends, isolation valves, and fittings.
- H. Bulkheads and plugs.
- I. Bored casings.
- J. When the bearing capacity of the soil is not sufficient to provide adequate restraint in the opinion of Triview Metropolitan District .
- K. When Triview Metropolitan District identifies potential future development that may utilize or connect to the water main to be installed.

Horizontal and vertical offsets and reducers shall be restrained on each side of the fitting. For other fittings, the length of tied pipe shall be in accordance with the [Standard Drawings](#). Joint restraint devices and appurtenances shall be in accordance with [6.05.D](#) and the [Standard Drawings](#).

8.22 CONNECTIONS TO TRIVIEW METROPOLITAN DISTRICT'S SYSTEM

- A. Connections to Triview Metropolitan District's system shall be in a neat and workmanlike manner. Triview Metropolitan District will be present during the construction of connections. Connections are subject to Triview Metropolitan District's approval. Only one connection to the existing system will be permitted until the conditions and tests outlined in [8.26](#) are met.

Triview Metropolitan District does not guarantee the water tightness of its valves on existing facilities. If existing valves leak, Triview Metropolitan District will assist in reducing the leakage; however, the Contractor shall use appropriate methods to work with the resulting leakage.

Connections will not be installed or allowed by Triview Metropolitan District unless the water supply is protected as required against actual or potential cross-connections. Water service to premises will be discontinued by Triview Metropolitan District if a BFP assembly is required in accordance with [5.05](#) and is not installed, tested annually, and maintained, if it has been removed or bypassed, or if an unprotected cross-connection exists. Water service will not be restored until such conditions or defects are corrected.

- B. When connecting to Triview Metropolitan District's system, it may be necessary to operate existing Triview Metropolitan District valves. Valves on Triview Metropolitan District's system that need to be operated to make a connection will be operated only by appropriate Triview Metropolitan District personnel. The Contractor shall give Triview Metropolitan District 2 days' notice to arrange for the operation of valves. Both the Contractor and Triview Metropolitan District will be present when valves are operated.
- C. The installation of a connection that requires the closing of existing valves may cause an outage of water to existing Triview Metropolitan District customers. Affected customers shall be notified by the Contractor in writing 24 hours in advance of service interruptions. The notices shall be delivered by hand to each customer. If a customer cannot be contacted, the written notice shall be left at the door.

The fire department having jurisdiction for the affected area shall be notified 2 days in advance of service interruptions. The Contractor shall provide a description of the boundaries of the affected area and the location of fire hydrants in that area to the appropriate fire department.

A normal outage shall be a maximum of 8 hours. If an outage is to be longer than 8 hours, the work shall be done in a manner that minimizes the inconvenience to customers, such as working at night in a continuous operation until service is restored. A connection that requires an outage longer than 8 hours will be subject to review by Triview Metropolitan District to determine the appropriate timing of the connection.

If there is an industry or building in the area that cannot be out of water during the process of the installation, such as a hospital, appropriate means shall be taken to provide and convey water. The water and the means of its conveyance will need to be approved in writing by Triview Metropolitan District.

8.23 CORROSION PROTECTION SYSTEMS

- A. Cathodic protection and electrical insulation shall be installed as required by Triview Metropolitan District. Care shall be taken to electrically insulate between dissimilar materials and at service line connections to metallic water mains.
- B. Wherever it is necessary to join pipe of dissimilar metals, a method of insulating against the passage of electrical current that is approved by Triview Metropolitan District shall be provided. Special care shall be exercised during installation to prevent electrical conductivity across joints. After the insulating joint installation is complete, a NACE Certified Cathodic Protection 3 Technologist (CP3) will test the joint. If the insulated joint fails the test, it shall be removed, inspected, and repairs made. The joint shall then be reinstalled and tested. This process shall continue until the joint passes the test. Typical insulated joints are described in [6.28](#) and shall be in accordance with the [Standard Drawings](#).
- C. Metallic pipe, joint restraint, fittings, tie rods, and appurtenances shall be polyethylene encased regardless of soil resistivity. The polyethylene encasement shall prevent contact between the pipe and bedding material; it is not intended to be a completely airtight and watertight enclosure.

Polyethylene pipe wrap material shall be applied to line pipe as described in [6.28](#) and in accordance with the [Standard Drawings](#). A polyethylene pressure-sensitive tape, 2-inch wide 10-mil thickness, shall be used to close seams or hold overlaps. Prolonged exposure to sunlight eventually deteriorates polyethylene film. Keep exposure to sunlight to a minimum.

Before Contractor will tap a water main, the trench, pipe, and polyethylene wrapping shall be in a state of readiness. Damage to polyethylene pipe wrap in the trench prior to and during the backfill process shall be repaired to the satisfaction of Triview Metropolitan District. Damage to the pipe wrap caused by tapping the main will be repaired by the Contractor.

8.24 CHLORINATION

Main extensions and Distributor main extensions shall be disinfected in accordance with AWWA C651 with an NSF 60 certified sodium hypochlorite solution and the requirements of the local health authority having jurisdiction prior to acceptance by Triview Metropolitan District. The chlorinating agent and the method of application need to be approved by Triview Metropolitan District.

The chlorination of the finished pipeline shall be completed prior to hydrostatic testing. Before filling the pipe with water, the pipe shall be cleaned and free of debris to the satisfaction of Triview Metropolitan District.

The Contractor may disinfect by chlorine slurry with a minimum 1% chlorine solution in accordance with the Water Quality Standard Operating Procedures made available at the pre-construction meeting. A single point of connection to the Triview Metropolitan District system is required for injection of the chlorine slurry by The Contractor. Disinfection by chlorine swabbing may be used for 16-inch and smaller mains that are less than 100-feet in length, in accordance with AWWA C651.

Chlorine tablets may be used for 12-inch and smaller mains. Triview Metropolitan District will not provide labor or material for disinfection by chlorine tablets to the Contractor for the installation of mains under private contract.

Chlorine tablets shall be attached to the inside top of the pipe with an approved adhesive and certified to NSF/ANSI Standard 61 prior to pipe installation in the trench. An approved adhesive is Dow Corning 748 Multipurpose Sealant. For 16-inch and larger pipe, chlorine slurry is required to be fed into the water used to fill the pipe.

Number of Hypochlorite Tablets of 5 Gram Strength Required for a Dose of 50 Milligrams Per Liter*			
Pipe Length (Feet)	Pipe Diameter (Inch)		
	6	8	12
13 or less	2	2	5
18	2	3	6
20	2	3	7
*Based on 3 3/4 grams of available chlorine per tablet.			

After the pipe is filled with water and chlorine, the chlorinated water shall be held in contact with the pipe for 24 hours. At the end of the 24-hour period, the water in the pipeline shall be tested by the local health authority having jurisdiction, or their designated representative, to ensure a residual chlorine content of no less than 25 milligrams per liter. The pipeline shall then be thoroughly flushed to remove the heavily chlorinated water. This activity requires a permit from CDPHE's WQCD prior to flushing. The application for the permit can be obtained online: <http://www.cdphe.state.co.us/permits.html> or by calling (303) 692-3500. The permit requires dechlorination, consumptive use, or land applications prior to discharge. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public. Discharges of water from blowoff assemblies or other appurtenances shall be contained or discharged in a manner approved by Triview Metropolitan District and CDPHE.

Samples of water shall be collected for bacteriological examination and residual chlorine content testing before the pipe is put into service. Testing of residual chlorine and sampling shall be carried out by the local health authority having jurisdiction or their designated representative.

8.25 HYDROSTATIC TESTING

Newly installed water mains and fire service lines shall be hydrostatic tested. Hydrostatic tests shall not be made on any portion of the pipeline until field-placed concrete has had adequate curing time as defined for kickblocks in [8.18.C](#).

The Contractor will need to perform hydrostatic pressure testing at the time of chlorination. Projects that are disinfected by chlorine tablets or swabbing will be hydrostatic tested by the Contractor. Triview Metropolitan District shall be notified 24-hours in advance of testing. Testing shall be made in the presence of Triview Metropolitan District.

Only the following methods are acceptable for supplying potable water for hydrostatic testing:

- A. Water may be taken from a nearby pressurized water source that was previously chlorinated, tested, and accepted, such as a fire hydrant.

- B. Water may be delivered to the site in a state licensed chlorinated water truck having a minimum capacity of 300 gallons. The water truck shall be used exclusively for the transportation of potable water.
- C. Any previously tested, chlorinated, and accepted water main that is pressurized and is to serve the new main extension may be tapped on the pressurized side of the closed valve.

The method of supplying water and the source of water for hydrostatic testing will need to be certified and approved by Triview Metropolitan District. The use of barrels or rented tanks, sanitary or otherwise, to supply water for hydrostatic testing is prohibited.

The pipeline shall be properly backfilled and in a state of readiness for testing. Bulkheads, pumps, taps, and appurtenances necessary to fill the pipeline and maintain the required pressure shall be in place and the pipeline filled with potable water. The test pressure of 150 psi shall then be applied to the pipeline by means of a sanitized continuously operating pump that is equipped with a bypass valve for pressure regulation. The pipeline shall be filled at a rate that does not cause surges and does not exceed the rate at which air can be released. Air in the line shall be properly purged. Where blowoffs or hydrants are not available or are not effective in purging air from the line, Triview Metropolitan District will require a tap to purge the line. The location and the size of the tap to be used are at the discretion of Triview Metropolitan District.

While the test pressure is maintained at 150 psi, an examination shall be made of the pipeline and any leaks located and repaired. Pipe or fittings found to be faulty shall be removed and replaced. After visible leaks are stopped, the full test pressure shall be maintained for one continuous hour.

If testing shows any leakage, the pipeline will not be accepted. The pipeline shall be repaired, rechlorinated as described in [8.24](#), and tested until it meets test requirements.

8.26 ACCEPTANCE AND RELEASE FOR TAPS

A main will be accepted by Triview Metropolitan District and released for taps when the following conditions are met:

- A. The main and appurtenances are installed to the satisfaction of Triview Metropolitan District and pertinent notes and measurements are made.
- B. The following tests are passed and the test outcomes provided to Triview Metropolitan District:
 - 1. A chlorination test and any other tests required by the local health authority having jurisdiction, see [8.24](#).
 - 2. A compaction test indicating the trench backfill meets Triview Metropolitan District requirements performed under the direction of a PE, see [7.11](#).
 - 3. A hydrostatic test, see [8.25](#).
 - 4. A valve and valve box inspection, see [8.13](#).

8.27 BLOWOFF ASSEMBLY

In installations where the main is to be permanently dead-ended, such as a cul-de-sac, a blowoff assembly shall be installed. Where the main is to be temporarily dead-

ended, such as the boundary of a subdivision filing, a blowoff shall be installed unless a fire hydrant, which can serve additionally as a blowoff, is located at the main's temporary end. The blowoff shall be installed at a right angle to the main and on the side that allows the water to drain away from the main to the nearest gutter.

The standard required blowoff assembly for 12-inch and smaller mains shall be 2-inch in accordance with the [Standard Drawings](#). Under special conditions, such as a long run with only a few taps, a nonstandard 2-inch and larger blowoff may be required.

The standard required blowoff for 16-inch and larger DI pipe shall be 6-inch in accordance with the [Standard Drawings](#).

8.28 SEWER CROSSINGS

When water mains or associated piping cross over or under a sanitary or storm sewer constructed of vitrified clay or concrete pipe, the sewer shall be replaced or protected as shown on plans during installation, as described below, or as otherwise directed by Triview Metropolitan District.

When the sewer is 15-inch diameter or smaller and crosses over water mains or associated piping and protection is not otherwise shown on plans, where applicable, the sewer shall be replaced with polywrapped Special Thickness Class 50 DI pipe manufactured in accordance with AWWA C151 or Type PSM SDR 35 PVC sewer pipe manufactured in accordance with ASTM D 3034. Reconnections to the existing sewer pipe shall be made with watertight, flexible couplings approved by Triview Metropolitan District and the authority having jurisdiction over the sewer being replaced. Drains that exist under the sewer shall be restored in a manner that prevents any flow from entering the trench.

When the sewer is larger than 15-inch diameter, necessary precautions shall be taken to protect the sewer during the installation of water mains or associated piping. Drains that exist under the sewer shall be restored in a manner that prevents any flow from entering the trench.

When water mains or associated piping cross over the sewer with less than 2-feet of clearance between the pipes, the sewer shall be encased with a minimum of 6-inches of concrete from the springline to 6-inches above the top of the sewer. The encasement shall extend along the centerline of the sewer for a minimum of 1-foot beyond the OD of the water main or associated piping at each end of the encasement in accordance with the [Standard Drawings](#).

In addition, when water mains or associated piping cross under a sewer, bedding material shall be replaced around the sewer to a point at least 1-foot above the top of the sewer pipe for 15-inch diameter and smaller sewers and to at least springline for larger than 15-inch diameter sewers. Bedding material shall be thoroughly compacted and consolidated to support the sewer. Water mains shall not be placed closer than 18-inches, as measured from the outside bottom of the sewer pipe to the top of the water pipe.

A sewer may not be cut without the express consent of the authority having jurisdiction over the sewer.

Typical trench sections shall be in accordance with [Standard Drawings](#).

8.29 TRENCHLESS INSTALLATION

Trenchless installation by boring or jacking may be used as a method of installing mains in accordance with [MS-34](#) using a casing pipe and a carrier pipe. Prior to any work, the Contractor shall submit to Triview Metropolitan District a bore plan drawing with the vertical scale of 1-inch equals 2-feet and the horizontal scale of 1-inch equals 20-feet. The plan shall include the bore entry point and angle, bore exit point and angle, ground line, deflection and radiuses of the pilot bore, and existing utilities with minimum vertical and horizontal clearances. The Contractor shall confirm the alignment and elevation of critical utilities by potholing, using vacuum excavation, or other suitable excavation method. Mains shall cross perpendicular to the public ROW or easement.

8.30 HORIZONTAL DIRECTIONAL DRILLING

With the approval of Triview Metropolitan District, HDD may be used as a method of installing mains. HDD is a trenchless methodology of installing pipe that consists of three primary stages: piloting (drilling of a pilot hole), reaming (pilot hole enlargement), and pull-back (installation of the carrier pipe).

The directional drilling machine generally consists of a hydraulically powered system that rotates and pushes a hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable boring head.

Prior to any work, the Contractor shall submit to Triview Metropolitan District a pilot bore plan drawing with the vertical scale of vertical scale of 1-inch equals 2-feet and the horizontal scale of 1-inch equals 20-feet. The plan shall include the bore entry point and angle, bore exit point and angle, ground line, deflection and radiuses of the pilot bore, and existing utilities with minimum vertical and horizontal clearances. The Contractor shall confirm the alignment and elevation of critical utilities by potholing, vacuum excavation, or other suitable excavation method.

The Contractor shall utilize a self-contained, closed, drilling fluid mixing system of sufficient size to mix and deliver drilling fluid (composed of bentonite clay, potable water, and appropriate additives) to lubricate the cutting head during the drilling operation and stabilize the reamed bore path prior to and during pull-back.

An electronic walkover tracking system shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. It shall enable the driller to guide the drill head by providing real-time feedback regarding the azimuth (horizontal direction) and inclination (vertical direction) of the tool face. Readings shall be recorded every 10-feet, plotted on a scaled drawing, and made available to Triview Metropolitan District. Triview Metropolitan District will need to approve the location of the pilot hole prior to the reaming of the hole.

The bore hole diameter shall be increased to 1.2 to 1.5 times the OD of the largest part of the carrier pipe to accommodate the pull-back operation. The type of hole opener or back reamer used shall be chosen by the Contractor with regard to the types of subsurface conditions identified during the pilot hole drilling operation. The open bore hole shall be stabilized by bentonite drilling slurry that is pumped through the ID of the drill pipe and through openings in the reamer.

The carrier pipe shall be assembled according to the Manufacturer's specifications and installed using the cartridge or the assembled-line methods. The cartridge assembly method assembles individual sections of pipe in a secured entry and

assembly pit. The assembled-line method consists of the preassembly of multiple pieces of pipe with a subsequent pulling installation into the bore hole as a long pipe string. For both methods, a pulling eye shall be attached to the pulling head on the lead stick of pipe that in turn shall be attached to a swivel on the end of the drill pipe. The end of the pipe shall be sealed to prevent contamination during the pull-back operation.

Tracer wire, as required for PVC carrier pipe, shall be adequately secured to the pipe prior to the pull-back operation.

The carrier pipe shall be adequately supported as it enters the bore hole to minimize forces on the pipe during pull-back. Pull-back shall be carried out in a continuous manner until the pipe reaches the original entry side of the bore. The Manufacturer's recommendations regarding bend radius and tensile strength shall be followed. Following pull-back, the Contractor shall allow the pipe to achieve mechanical and thermal equilibrium with its surroundings prior to cutting it at either end.

The Contractor is responsible for drilling fluid disposal and other restoration and shall comply with regulations regarding the proper disposal of drilling fluid. Cleaning, flushing, and hydrostatic testing of the pipe shall be conducted as specified in these Standards.

The Contractor shall provide an as-built plan and profile drawing to Triview Metropolitan District based on electronic walkover system readings showing the actual location, horizontally and vertically, of the installation.

8.31 PIPE BURSTING

Pipe bursting may be used as a method of replacing distribution mains with the written approval of Triview Metropolitan District. Pipe bursting is a trenchless methodology that involves the insertion of a conical shaped static bursting head into the pipe to fracture the pipe, thereby displacing the pipe fragments outward as the new replacement main is pulled in to replace the existing pipe.

- A. Static pipe bursting equipment includes the bursting head, pulling machine, segmented pulling rods, hydraulic power unit and associated restraint, and attachment equipment. The bursting head system shall be designed and manufactured to force its way through the existing pipe by fragmenting the pipe, pushing the fragments into the surrounding soil, and allowing for the pulling of the replacement pipe into place.

The bursting head system shall be conical in shape and center in the pipe. It shall fracture the pipe by applying radial pressure and expanding the surrounding soil and the fragments to the proper size to accept the replacement pipe. The pull head to which the replacement pipe is attached shall not be used to expand or otherwise increase the diameter of the existing fragmented pipe. The pull head shall utilize a positive through-bolt design assuring a smooth wall against the pipe cross-section.

Pulling rods shall be segmented with snap lock connections. Cutting wheels shall be utilized to assist in the demolition and fragmenting of the pipe. The system shall maintain automatic thrust and pull-back and pull from either side of the bursting head system.

- B. Pipe utilized for pipe bursting shall be fusible PVC pipe in accordance with [MS-2](#) or RJIB Certa-Lok in accordance with [MS-29](#).

- C. Existing underground utilities shall be positively identified. Exposure shall be made of facilities located within an envelope of possible impact as a result of the pipe bursting operation.

Temporary water service to customers affected by outages as a result of the pipe bursting operation shall be as approved by Triview Metropolitan District.

Service connections to the pipe being replaced shall be removed. Access pit excavation at the point of insertion of the fusible PVC pipe shall provide for a pipe radius larger than that recommended by the PVC pipe Manufacturer.

Fusible PVC pipe shall be supported on rollers and shall not contact paving, grass, or earth during the fusion process and staging for insertion.

Tracer wire, as approved by Triview Metropolitan District, shall be attached to the pulling head and installed along the pipe.

Immediately following the completion of the pipe bursting operation, the pipe shall be pushed back toward the insertion point until a small amount of movement is realized at the insertion point.

The Board of Directors Triview Metropolitan District

Engineering Standards

Chapter 9 - 16-Inch and 20-Inch Transmission Mains

9.01 GENERAL

Triview Metropolitan District and Distributor Contract Areas are experiencing changing trends in the design of subdivisions. New developments are commonly designed with curved streets, only one or two access roadways, and many cul-de-sacs. Water mains supplying these subdivisions often cannot be sized using the hydraulic grid system common to most of Triview Metropolitan District. In some instances, the maximum water demand within these developments is exceeding the allowable design capacity of a 12-inch distribution main, yet is often considerably under that of a 24-inch conduit. As a result, it has become necessary to utilize 16-inch and 20-inch transmission mains.

9.02 OTHER STANDARDS TO APPLY

This Chapter addresses transmission mains, 16-inch and 20-inch only. Standards that apply to 4-inch through 12-inch mains shall also apply to 16-inch and 20-inch mains along with the following requirements or exceptions herein. In case of a conflict with any other Chapter in these Standards, this Chapter shall govern for 16-inch and 20-inch pipe.

9.03 DESIGN

Water transmission mains shall be sized and designed in accordance with [Chapter 5](#) and the following additional requirements:

- A. Lines, 16-inch and 20-inch, shall be supplied by dual feeds, unless otherwise directed by Triview Metropolitan District.
- B. Isolation valves shall be optimally placed such that service outages during repairs or construction are minimized. This generally requires the ability to isolate and alternately supply mains extending from the transmission main; therefore, the spacing between valves shall not exceed 1,200-feet.

Isolation valves used on transmission mains shall be 16-inch or 20-inch flanged end butterfly valves in accordance with [MS-6](#) or resilient seated gate valves in accordance with [MS-5](#). The size and type of valve to be used shall be clearly indicated on the submitted plans.

If Triview Metropolitan District requires the installation of electronic monitoring and remote operation equipment, the isolation valve shall be a butterfly valve with a rectangular vault housing the motor operator and the telemetry equipment. Each installation requires individual approval.

- C. Bends, bulkheads, and fittings that require restraint due to line thrust shall be restrained by using a means of mechanical restraint and kickblocks in accordance with the [Standard Drawings](#). Restraint requirements shall be in accordance with line size. Other restraint systems will need to be approved in writing by Triview Metropolitan District.
- D. The maximum design head loss for 16-inch mains is 2-feet per 1,000-feet of main. The maximum design head loss for 20-inch mains is 1 1/2-feet per 1,000-feet of main. Head loss is based on a Hazen-Williams C-value of 130 at the maximum hourly demand. Head loss criterion does not apply under fire flow conditions.
- E. Blowoff assemblies, in accordance with the [Standard Drawings](#), shall be installed at low points in transmission mains and wherever a transmission main is dead-ended, i.e., unless a fire hydrant is provided at the dead-end location. (A fire hydrant may serve as a blowoff.)
- F. Cathodic protection requirements for transmission mains will be determined by Triview Metropolitan District on an individual basis. Mains installed in corrosive soils shall be protected using methods determined by Triview Metropolitan District. This may consist of the installation of anodes, the bonding of pipe, polyethylene encasement, or other requirements in addition to those in [6.28](#).
- G. Special Conditions: Each transmission main will be examined individually to determine any special conditions and/or requirements necessary (e.g., air valves and PRVs).

9.04 PLANS

Detailed plans for transmission main extensions shall be prepared for approval in accordance with [2.05](#) and shall contain a top of pipe profile showing the following:

- A. Proposed and existing ground lines.
- B. The elevation of grade breaks, slope of pipe, locations of bends and fittings, and minimum clearances to interference.
- C. The elevation of crossing interference verified by pothole.

9.05 MATERIALS

Pipe shall be in accordance with [MS-1](#) and/or [MS-2](#).

9.06 INSTALLATION

The Contractor shall be prequalified by the Triview Metropolitan District for the installation of 16-inch and 20-inch pipe Inside Triview Metropolitan District and Total Service Contract Areas. The Owner/Developer shall pay the costs for extending mains installed by the prequalified Contractor.

A greater danger is present when 16-inch and 20-inch mains are improperly designed or installed versus smaller mains. Triview Metropolitan District will review the design and installation of these mains closely to ensure that sound engineering and construction procedures are followed.

9.07 SEWER CROSSINGS

The provisions of [8.28](#) shall apply to 16-inch and 20-inch transmission mains.

9.08 EASEMENT WIDTH REQUIREMENTS

The easement width requirements in [Chapter 5](#) shall apply to the installation of 16-inch and 20-inch transmission mains, in addition to the following requirements:

- A. The cross-section of a dedicated public roadway shall have a 32-foot surfaced roadway from flow line to flow line at a minimum.
- B. The cross-section of a private roadway shall have 30-feet of surfaced roadway and a 4-foot attached walk or 34-feet of surface roadway, at a minimum.

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The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 10 - Conduits, 24-Inch and Larger

10.01 GENERAL

Conduits that are to become part of the Triview Metropolitan District system will be designed by a professional engineering firm and installed by a prequalified contractor. The Triview Metropolitan District will need to approve the design and installation of these conduits to ensure sound engineering and construction procedures are followed within the context of [2.06](#). The intent of this Chapter is to state the additional design requirements for conduits. This Chapter shall not be interpreted as permission to design and install conduits.

Design of the conduit shall proceed only after approval is received from Triview Metropolitan District to design and/or construct the conduit. The overall plan, size, location, and any other pertinent details will be reviewed by Triview Metropolitan District prior to the submittal of the plans and specifications required by [10.05](#).

The Owner/Developer shall pay all costs in the design and construction of conduits including those incurred by Triview Metropolitan District for its inspection, engineering review, testing of materials, and other services.

10.02 OTHER STANDARDS TO APPLY

Standards that apply to distribution mains, 4-inch through 12-inch, and transmission mains, 16-inch and 20-inch, shall apply to conduits along with any additional requirements by the PE and the exceptions stated herein. In case of a conflict with any other Chapter of these Standards, this Chapter shall govern for conduits.

10.03 PRELIMINARY INVESTIGATION

If the Owner/Developer is permitted by Triview Metropolitan District to conduct its own preliminary investigation, the following requirements shall be met:

- A. A subsoil investigation shall be performed by a PE. Exploratory holes shall be dug to determine the bearing capacity, backfill suitability of the soil, presence of groundwater or bedrock, swelling soils, water-soluble sulfates, resistivity, and any other condition that may affect the construction of the pipeline. Test holes shall be dug or drilled with a maximum spacing of 750-feet in addition to being dug or drilled at railroad, highway, and waterway crossings.
- B. A stationed alignment of the proposed conduit is required to define the route with lines, angles, and curvatures referenced to land corners and other official survey control points when available. Negative stationing is not permitted. APs, curve points, and the centerline shall be marked on the ground at a minimum spacing of 100-feet with an accuracy of at least one part in 5,000,

which will be checked by Triview Metropolitan District prior to acceptance of the survey work.

The PIs, PCs, PTs, APs, and any POTs needed for visibility shall be marked with semi-permanent steel pins in the ground such as concrete reinforcing bars, P-K nails, or survey spikes.

- C. A ground surface profile of the alignment in NGS datum tied to official survey benchmarks is required. Additional semi-permanent benchmarks shall be established every 1,500-feet by closed loops of third-order accuracy. The profile shall consist of ground surface elevations along the proposed conduit centerline at every 100-foot station and at grade breaks. Level loop and profile data shall be recorded in field books.
- D. Topographical features within the street or ROW and any topographic feature outside the ROW that may interfere with the operation or installation of the conduit shall be accurately shown on plans. Topographic features may also be compiled by aerial photogrammetry methods.
- E. In areas where the ground slope perpendicular to the centerline of the conduit exceeds 5%, cross-sections shall be taken at profile points and shall extend at least 25-feet to each side of the centerline. Cross-section data shall be entered into field books.
- F. Utility crossings or close utility interference shall be exposed by digging test pits. Field books shall be used to record the size, nature, and location of the interference by station offset and elevation.
- G. Survey data compiled in the determination of the route location, the extent of the interference, the centerline profile, and the cross-sections and level loops shall be entered into field books provided by Triview Metropolitan District and submitted with the plans and specifications. Field books shall be compiled under the guidance of a PLS.

10.04 DESIGN

Conduits shall be designed in accordance with other applicable Chapters of these Standards in addition to the following requirements:

- A. Isolation valves shall be placed such that service outages experienced during future repairs or construction is minimized. This generally requires the ability to isolate and alternately supply mains extending from the conduit; therefore, the spacing between valves shall not exceed 2,500-feet.

Isolation valves shall be full line size butterfly valves with flanged end connections in accordance with [MS-6](#). Precast concrete manholes shall be placed over valve operators. The valve installation shall include a tap on each side of the valve for chlorination and/or air release. Isolation valve installations for larger diameter conduits require individual approval by Triview Metropolitan District.

If Triview Metropolitan District requires the installation of SCADA equipment, the isolation valve shall be a butterfly valve with a rectangular vault housing the motor operator and the telemetering equipment. Each installation requires individual approval, see [5.13](#) and [5.14](#).

- B. Bends, fittings, isolation valves, and bulkheads shall be restrained by using tied joints and kickblocks. Restraint systems shall be approved by Triview Metropolitan District . Kickblocks shall be placed against undisturbed soil and have sufficient clearance from adjacent interference.
- C. The maximum design head loss for conduits shall be 1-foot per 1,000-feet of pipeline based on a Hazen-Williams C-value of 130 at the maximum hourly demand.
- D. Blowoff assemblies shall be installed at low points in the conduit, wherever a conduit is dead-ended, and at isolation valves when the conduit slopes toward the valve.
- E. Cathodic protection requirements for conduits will be determined by Triview Metropolitan District on an individual basis. Conduits installed in corrosive soils shall be protected using methods determined by Triview Metropolitan District . This may consist of the installation of anodes, the bonding of pipe, special coatings, test stations, polyethylene encasement, or other requirements in addition to those described in [6.28](#).
- F. Air release and vacuum valve assemblies shall be installed at high points in the conduit, wherever there is an abrupt change of slope, and at isolation valves when the conduit slopes away from the valve. For air valve assemblies for use with conduits, 24-inch and 30-inch, see [MS-11](#). Air valve assemblies for larger diameter conduits require individual approval by Triview Metropolitan District .
- G. Access manhole assemblies shall be installed at intervals that do not exceed 500-feet unless otherwise approved in writing by Triview Metropolitan District . The access manhole may also contain an air valve assembly if the requirements for both can be satisfied. In some cases, closure assemblies may be substituted for access manholes.
- H. Special Conditions: The location and design of the outlets, tie-ins to any existing or proposed facilities, and bulkheads at the end of conduits require approval in writing by Triview Metropolitan District .

Each conduit design shall be examined individually to determine any special condition and/or requirements by Triview Metropolitan District (e.g., PRVs, telemetry, and pitots).
- I. Vertical clearance between the conduit and the crossing interference shall be at least 18-inches. Horizontal clearance shall be at least 10-feet.

10.05 PLANS AND SPECIFICATIONS

Plans and specifications for conduits shall be prepared in accordance with the [Triview Metropolitan District's Standards & Specifications](#) by consulting an engineer on Triview Metropolitan District's pre-approved General Consultant ("On-Call") Services List. A Triview Metropolitan District Engineer will provide guidance on next steps.

10.06 MATERIALS

See Triview Metropolitan District's Engineering Standards.

10.07 INSTALLATION

Triview Metropolitan District shall permit an Owner/Developer to have a prequalified Contractor install a conduit. Owner/Developer shall pay the costs of installation by the Contractor.

Triview Metropolitan District requires that a conduit installation be witnessed and controlled by Triview Metropolitan District at the expense of the Owner/Developer. The Owner/Developer shall also furnish, at their own expense, such labor as may be required by Triview Metropolitan District to enable the thorough inspection and culling of materials, and shall furnish reasonable samples of materials at the jobsite to afford adequate testing.

10.08 SEWER CROSSINGS

The provisions of [8.28](#) shall apply to conduits, 24-inch and larger.

10.09 AS-CONSTRUCTED DRAWINGS

Plan, profile, and detail drawings shall be modified to reflect changes in the design. The final as-constructed drawing shall be submitted to Triview Metropolitan District within 30 days of the completion of work.

10.10 EASEMENT WIDTH REQUIREMENTS

The easement width requirements in [Chapter 5](#) and in [Chapter 9](#) do not apply to the installation of conduits. The adequacy of the width and alignment of dedicated public road easements and Triview Metropolitan District easements will be determined on an individual basis by Triview Metropolitan District .

The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 11 - Recycled Water System

11.01 GENERAL

The purpose of this Chapter is to provide guidelines for the planning, design, construction, and operation of Triview Metropolitan District's Recycled Water System. These Standards apply to recycled water facilities under the control of Triview Metropolitan District and its customers.

11.02 OTHER STANDARDS TO APPLY

Standards that apply to potable water distribution mains, 4-inch through 12-inch, potable water transmission mains, 16-inch and 20-inch, and potable water conduits, 24-inch and larger, shall apply to recycled water systems along with the supplemental requirements and exceptions stated herein. This includes meters, valves, service lines, BFP, and easements. In the event of a conflict with any other Chapter, this Chapter shall govern for recycled water.

11.03 WATER QUALITY

Recycled water that leaves the recycled water treatment plant shall be in accordance with applicable water quality regulations including those established by CDPHE under Regulation 84. Triview Metropolitan District will maintain a system of records for water quality analyses performed on recycled water that confirms compliance with water quality regulations.

11.04 POTABLE WATER BACKUP

If recycled water is unavailable, only Triview Metropolitan District may substitute potable water as a backup. The potable water system shall be protected by an approved Triview Metropolitan District BFP device or air-gap as described in [5.05](#).

11.05 CONVERSION FROM A POTABLE LINE TO A RECYCLED LINE

Facilities converted from a potable water supply to a recycled water supply shall be in accordance with Triview Metropolitan District's CPCS.

11.06 PROTECTION OF THE POTABLE WATER SYSTEM

- A. The potable water system shall be protected from contamination by recycled water through the physical separation of the two systems; Triview Metropolitan District will perform inspections to ensure this separation. See [5.05](#) for BFP assembly specifications and requirements.

- B. When possible, the operating pressure for recycled water conduits, transmission mains, distribution mains, and service lines shall be 5 to 10 psi less than the operating pressure in potable water conduits, transmission mains, distribution mains, and service lines. The recycled water system may be operated at a higher pressure than the potable water system depending on location.

11.07 DISCHARGES FROM THE SYSTEM

Discharges from blowoff assemblies or other appurtenances on the recycled water system shall be contained or discharged in a manner approved by Triview Metropolitan District and applicable regulations. Discharging into a watercourse, including a storm sewer that is not specifically approved by Triview Metropolitan District and the regulatory authorities having jurisdiction, is prohibited.

11.08 USER PERMITS

Customers shall obtain a written Notice of Authorization from CDPHE and/or the appropriate regulatory authorities having jurisdiction prior to obtaining a nonpotable water license for the use of recycled water. Connections to the recycled water system can only be made after applying for and obtaining a standard license from Triview Metropolitan District's Sales Administration Section.

11.09 TRIVIEW METROPOLITAN DISTRICT OWNED RECYCLED WATER MAINS

Recycled water conduits are classified as pipes, 24-inch and larger, that carry recycled water. Recycled water transmission mains are classified as pipes, 16-inch and 20-inch, that carry water. Recycled water distribution mains are classified as pipes, 4-inch through 12-inch, that carry recycled water.

It is the policy of Triview Metropolitan District to design and install conduits, 24-inch and larger, to ensure a high quality, uninterrupted, low maintenance water service system when doing so is in its best interest. In cases where Triview Metropolitan District determines the conduit is not to be part of its system, it may allow a recycled water customer to design and/or install conduits. However, Triview Metropolitan District will need to approve the design and installation of these conduits to ensure sound engineering and construction procedures are followed within the context of these Standards.

Design of the conduit shall proceed only after approval to design and/or construct the conduit is received from Triview Metropolitan District. The design, size, location, and any other pertinent details will be reviewed by Triview Metropolitan District prior to the formal submittal of plans and specifications in accordance with these Standards.

The design and construction of recycled water conduits shall be in accordance with this Chapter, the appropriate potable water sections of these Standards, and the CPCS, in addition to the following supplementary requirements:

- A. Valves in the recycled water system shall open in a counter-clockwise direction. Valve operators shall have a pentagonal-shaped operating nut. The valve bolts and operating nut shall be coated with a factory-applied epoxy, Pantone 2577U in color. Valve flanges and bolts that are not coated with epoxy shall be wrapped in wax tape in accordance with [MS-26](#). The outer tape wrap shall be purple. The maximum spacing of isolation valves for conduits and mains on the recycled water system shall be 2500-feet. Variances to the spacing will be evaluated on a case-by-case basis by Triview Metropolitan District.

Engineering Standards 2nd Edition Valve boxes shall meet the requirements of [MS-12](#) with the following exceptions:

1. Boxes shall be fitted with covers that are cast with the words RECYCLED WATER.
 2. Both the top and bottom surfaces of the cover shall be coated with a 16-mil to 20-mil DFT fusion-bonded epoxy or liquid epoxy applied in accordance with AWWA C210, Pantone 2577U in color.
- B. Recycled pipeline appurtenances in vaults or manholes shall be labeled as belonging to the recycled water system. Labels shall be inert plastic formulated for prolonged exposure. The labels shall have white lettering a minimum of 1/2-inch high on a purple background that reads RECYCLED WATER FACILITIES and be attached with heavy-duty nylon fasteners. Where applicable, exposed metal surfaces shall be protected from corrosion by wax tape wrapping in accordance with the requirements of [MS-26](#). The outer tape wrap shall be purple.
- C. Manhole covers shall meet the requirements of [MS-33](#) for potable water lines with the following exceptions:
1. Covers shall be coated with a 16-mil to 20-mil DFT fusion-bonded epoxy or liquid epoxy applied in accordance with AWWA C210, Pantone 2577U in color.
 2. Covers shall be cast with the words RECYCLED WATER.
- D. Blowoff valves with a 6-inch minimum diameter shall be installed on dead-end conduits. Blowoff valves shall be installed on dead-end distribution mains to allow a minimum of 2 1/2 fps in transmission mains.
- E. Recycled water pipes shall be separated from potable water and sanitary sewer pipes as follows:
1. One-foot separation in the vertical direction.
 2. 10-foot separation in the horizontal direction.
 3. Common trench construction is prohibited.

11.10 RECYCLED PIPE COLOR

The exterior of recycled water piping and fittings shall be colored Pantone 2577U. A warning label that reads CAUTION: RECYCLED WATER – DO NOT DRINK shall be located on the exterior of the pipe.

- A. PVC pipe shall have the Pantone 2577U color integral to the PVC material. The warning shall be stamped on the pipe or fixed by means of a separate label applied to the pipe. The warning label shall be a minimum of 3-inches high and visible on both sides of the pipe.
- B. Buried steel pipe and fittings shall have a polyurethane coating in accordance with AWWA C222 or a tape coating system in accordance with AWWA C214 or AWWA C209 that is Pantone 2577U in color. A separate warning label shall be applied to the pipe. It shall be a minimum of 3-inches high and visible on both sides of the pipe.

- C. Buried DI pipe and fittings shall be wrapped in polyethylene encasement material in accordance with the requirements of [MS-14](#), except that it shall be Pantone 2577U in color and include the warning information printed on the wrap. DI or CI pipe, fittings, and appurtenances in manholes or vaults shall be coated with wax tape in accordance with [MS-26](#). The outer wrap shall be purple.

11.11 UNDERGROUND UTILITY WARNING TAPE

Recycled pipe shall have utility warning tape installed 1-foot above the crown of the pipe in the trench. The warning tape shall be purple with black lettering. The warning shall state that a recycled water line is located below. The minimum tape width shall be 3-inches.

11.12 TRACER WIRE

Install minimum AWG 12 solid copper wire with purple PE insulation, 0.03-inch, to the pipe with PVC tape, 2-inch wide. The splicing of tracer wire shall be in accordance with the Manufacturer's recommendations. The tracer wire shall be in accordance with the [Standard Drawings](#).

11.13 PIPE LINING

Cement mortar lining shall not be used on the interior of recycled water piping.

- A. Acceptable linings for steel pipe include the following:
 - 1. Liquid epoxy lining in accordance with AWWA C210
 - 2. Polyurethane lining in accordance with AWWA C222.
- B. Acceptable linings for DI pipe include the following:
 - 1. Ceramic epoxy, product: Protecto 401.

11.14 RECYCLED WATER SERVICE LINES AND APPURTENANCES

Recycled water service lines convey water from mains to the plumbing of licensed premises.

The design and construction of service lines and appurtenances that carry recycled water shall be in accordance with this Chapter, the appropriate potable water sections of these Standards, the CPCS, and the following supplementary requirements:

- A. Service lines that convey recycled water shall be placed in a separate trench from the potable water service and the sanitary sewer service. A minimum separation of 10 horizontal feet is required between recycled water lines, potable water lines, and sanitary sewer lines. Potable water lines shall be 1 vertical foot above or below recycled water lines. Recycled water lines shall be 1 vertical foot above or below sanitary sewer lines.
- B. Fittings shall be such that an interconnection cannot be made between the potable and the recycled systems. Hoses shall not be interchanged between the systems. Signs or tags shall be used to identify recycled water quick coupling connections and, when possible, public access to these devices shall be limited by placing them in a valve box underground.
- C. Covers for curb stop boxes and meter pits in the recycled water system shall be cast with the words RECYCLED WATER. Covers shall be coated with a

fusion-bonded epoxy, Pantone 2577U in color. Covers shall be painted on the top and the bottom and be triangular. Roadway type covers, 4-inch, shall be used for service line valves, 2-inch and larger. Meter pit lids and manhole covers shall match those used for potable water, except they shall be Pantone 2577U in color and shall have the words RECYCLED WATER cast or molded on the top. Composite lids shall have the color integral to the material. CI lids shall be colored with a fusion-bonded epoxy.

- D. Triview Metropolitan District will meter users of recycled water. The meter shall be of the size and type specified by Triview Metropolitan District. Meters and meter installations shall be in accordance with [Chapter 5](#) of these Standards, the [Material Specifications](#), and the [Standard Drawings](#). Meters shall be identified as recycled water and painted purple before being used for recycled water service. For meters purchased directly from a vendor by the Owner, the purchase specifications shall indicate the meter is to be used for recycled water. If available from the Manufacturer, the meter register box and dial or screen shall be intended for use with recycled water and purple.
- E. Meters and isolation valves shall be installed in separate vaults. Isolation valve vaults shall have locking, metal door-type hatches. Meter vaults shall have standard water meter manhole covers, Pantone 2577U in color, as defined in [11.09.D](#).
- F. Buried recycled water service lines shall be required to have purple identification tape located 1-foot above the service line in the trench with the words CAUTION: RECYCLED WATER – DO NOT DRINK. The warning tape shall be a minimum of 3-inches wide. Conversions of existing potable water service lines for use in the recycled water system may require the replacement of the service line up to the curb stop box or first valve on the customer's premises. This requirement will be evaluated by Triview Metropolitan District on a case-by-case basis.
- G. On-site recycled water pumping and storage systems are not allowed unless approved, and the systems permitted, by Triview Metropolitan District. On-site recycled water storage systems shall meet a leakage rate of 1×10^{-6} cm/sec.
- H. BFP on recycled water systems is required on recycled water connections if any of the following conditions occur:
 - 1. Chemicals are injected directly into the private system.
 - 2. Recycled water is pumped to a higher pressure on the private system.
 - 3. Hazards exist on a private system that pose an additional risk of contamination to Triview Metropolitan District's recycled water system (e.g., sprinkler heads installed below the level of a surface water feature).
- I. BFP shall be required at the discretion of Triview Metropolitan District's Water Dept. See [5.05](#) for further information.
- J. PRVs in service lines may be required as determined by Triview Metropolitan District. Modifications to the potable water service line may be necessary when a new recycled water irrigation system is installed or modified. PRVs shall meet the requirements of this Chapter and [MS-10](#).

11.15 RECYCLED WATER CUSTOMER GUIDELINES

A recycled water customer shall comply with applicable regulations regarding the use of recycled water including CDPHE Regulation 84. Additionally, the customer shall adhere to the following guidelines:

- A. Designate an on-site supervisor that shall be responsible for compliance with regulations regarding the use of recycled water.
- B. If Triview Metropolitan District assigns a specific recycled water usage schedule, the customer shall follow it.
- C. Obtain prior approval from Triview Metropolitan District and the regulatory authorities having jurisdiction for proposed changes or modifications to recycled water facilities.
- D. Indicate the use of recycled water on-site at the point of use by using signs to notify workers and/or the public as required by Section 4.04.5 of Triview Metropolitan District's Operating Rules.
- E. Recycled water piping shall not be extended to or supported from any residential or domestic structure. At least one exterior hose bib supplied with potable water shall be provided at each structure.
- F. Irrigation sprinklers used in on-site recycled water systems shall have an exposed surface that is purple. This may be achieved by using dyed plastic or rubber or weatherproof paint. Sprinklers that do not meet these requirements shall be identified with purple recycled warning notification tags.
- G. On-site recycled water facilities shall have restricted public access so the public cannot draw water from the system. Wash down hydrants, blowoff hydrants, blowoffs on strainers, quick couplers, and other such facilities shall be restricted from public access. These facilities, both above and below grade, shall be housed in an approved locking container that is purple. A sign with black lettering on a purple field with the words CAUTION: RECYCLED WATER – DO NOT DRINK shall be installed on the container.
- H. Exposed service piping in the recycled water system, including piping inside the buildings, shall be spirally wrapped with warning tape with the words CAUTION: RECYCLED WATER – DO NOT DRINK.
- I. Customer systems planned for recycled water use shall be marked as belonging to the recycled water system. Pipes and tubing shall be purple with the words CAUTION: RECYCLED WATER – DO NOT DRINK or wrapped with warning tape with the words CAUTION: RECYCLED WATER – DO NOT DRINK.
- J. Customer systems converted from potable water to recycled water shall mark modifications to or replacements of the system and/or its components as belonging to the recycled water system. This includes the use of purple caps on sprinkler heads and purple pipe with the words CAUTION: RECYCLED WATER – DO NOT DRINK or spiral wrapping of the pipe with the words CAUTION: RECYCLED WATER – DO NOT DRINK.
- K. Ensure that on-site recycled water facilities remain in compliance with applicable regulations and the guidelines established by Triview Metropolitan District. Failure to comply with any of the standards or guidelines may result in the termination of service until the appropriate corrective actions are taken.

11.16 DUAL SUPPLY SYSTEMS

Distribution mains, water systems, and private systems as defined in Section 1.05 of Triview Metropolitan District's Operating Rules that have dual water supplies shall be in compliance with CDPHE Regulation 84, State Plumbing Board regulations, and codes under the regulatory authorities having jurisdiction. Dual water supply systems shall also comply with the following additional requirements:

- A. A single system that would allow for the introduction of potable or nonpotable water without the use of an air-gap as defined in [1.06](#).
- B. Parallel systems used to provide dual water supply service at the same point of use (e.g., the availability of potable and nonpotable water to serve the same garden plot or a water feature). During the plan review process outlined in Section 4.04.5 of Triview Metropolitan District's Operating Rules, Triview Metropolitan District will review the segregation of potable and proposed nonpotable water pipes to determine the risk of cross-connection and approve or reject plans based on the risk assessment.

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The Board of Directors Triview Metropolitan District

Engineering Standards Chapter 12 - Integrated Water System

12.01 GENERAL

An integrated water system is defined by the CPDWR as a system that consists of a wholesale system and one or more consecutive systems with distribution systems that are physically connected, where the wholesaler has assumed responsibility for compliance with one or more of the regulatory requirements applicable to the supplier responsible for the consecutive system (CPDWR, 5 CCR 1002-11, 11.42(1)).

A Distributor is not eligible for inclusion in Triview Metropolitan District's integrated system if the supplier responsible for the consecutive system (1) does not meet Triview Metropolitan District operational and maintenance standards; (2) is a private distribution system owned by an individual entity; (3) provides any treatment other than disinfection; or (4) is required to comply with additional or more stringent monitoring requirements or MCLs than Triview Metropolitan District .

To be included in Triview Metropolitan District's integrated system, a Distributor shall have a Total Service contract or request to be part of the integrated system. After a Distributor requests to be included in the integrated system, Triview Metropolitan District will provide a letter of agreement that stipulates the Distributor's responsibilities and states the drinking water regulations that are Triview Metropolitan District's responsibility. The Distributor may choose to retain responsibility for some of the drinking water regulations. For example, some Distributors remain responsible for compliance with CPDWR Section 11.37, the cross-connection control regulation. A key component of the agreement is the requirement that the Distributor follow Triview Metropolitan District's Operating Rules, Engineering Standards, and SOPs.

After a Distributor has signed the agreement and is following all the requirements, Triview Metropolitan District will submit a joint application to CDPHE requesting the Distributor be added to Triview Metropolitan District's integrated system. Upon CDPHE's receipt of the application, it has 45 days to notify Triview Metropolitan District of any concerns. Absent any concerns, Triview Metropolitan District will accept the Distributor as an addition to the integrated system and notify the Distributor.

Triview Metropolitan District may remove a Distributor that fails to maintain its water distribution system in accordance with the agreement from the integrated system, in which case the Distributor shall thereafter be responsible for meeting the CPDWR requirements.

and published SOPs for the operation and maintenance of its distribution system. Each SOP includes the purpose, policy, equipment, and procedures for the operation,

12.02 MAINTENANCE PROGRAMS

Triview Metropolitan District's Operations and Maintenance Division has developed maintenance, and quality assurance required for proper operation of the distribution system. The SOPs are revised as needed and provided to Distributors in Triview Metropolitan District's integrated system.

12.03 DISTRIBUTION SYSTEM COMPLIANCE MONITORING

Triview Metropolitan District is responsible for CPDWR compliance monitoring within the integrated system and completing and submitting required reports to CDPHE. CPDWR Section 11.37, the cross-connection control rule, is not included in Triview Metropolitan District's compliance monitoring.

12.04 ONLINE WATER QUALITY MONITORING

In critical areas of the distribution system, Triview Metropolitan District may require online monitors capable of transmitting data regarding pH, specific conductance, chlorine residual, and turbidity. Sites may include reservoirs, pump stations, or other appropriate locations that may be in a Distributor's boundaries. Triview Metropolitan District will be responsible for the ownership, operation, and maintenance of the monitors. Data will be telemetered to Triview Metropolitan District's Water Dept. where it will be compiled, made available on the internet, and updated each day.

12.05 FACILITY OPERATION AND STATUS

Using GIS, SCADA, and appropriate methods, Triview Metropolitan District will maintain the status of distribution system facilities and related operations and the information will be made available to Distributors on the internet.

Read and Bill and Master Meter Distributors shall be responsible for maintaining a database of operation and maintenance information specific to their individual areas. Distributors shall make the information available to Triview Metropolitan District on an as-needed basis.

12.06 DISTRIBUTION SYSTEM DISCHARGES

Activities involving the discharge of potable water into the environment are regulated by CDPHE's WQCD. These activities, including reservoir draining, cleaning, and system flushing require a discharge permit from the WQCD; however, the WQCD currently allows potable water discharges to occur without a permit if the Low Risk Guidance for Potable Water is followed. Discharges of this type require dechlorination and adherence to the BMP outlined in the guidance document prior to discharge or land application. A link to the guidance document is referenced herein:

<http://www.cdphe.state.co.us/wq/PermitsUnit/policyguidancefactsheets/policyandguidance/LowRiskguidancepotable%20water.pdf>

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Note: *These Material Specifications are provided for standardization purposes only. They represent minimum design standards that may require upgrading for specific applications.*

Material Specification – 1

DUCTILE IRON PIPE

1. GENERAL

DI pipe shall be manufactured in accordance with AWWA C151 with the following additional requirements or exceptions.

2. SIZES

This Specification covers DI pipe in 3-inch, 4-inch, 6-inch, 8-inch, 10-inch, 12-inch, 16-inch, and 20-inch nominal diameters.

3. JOINT TYPE

The joint type shall be push-on single gasket in accordance with AWWA C111. Other joint types may be acceptable if specifically approved by Triview Metropolitan District .

4. PIPE WALL THICKNESS

Pipe furnished under this Specification shall have the following minimum DI wall thickness:

Nominal Pipe Diameter (Inch)	Minimum DI Wall Thickness (Inch)
3	0.25
4	0.26
6	0.25
8	0.27
10	0.29
12	0.31
16	0.34
20	0.36

5. PIPE LENGTH

Pipe furnished under this Specification shall have a nominal laying length of 18-feet or 20-feet. Random lengths are not acceptable.

6. MATERIAL STRENGTH

The grade of iron shall be 60/42/10.

7. LININGS

Pipe furnished under this Specification shall have standard thickness cement-mortar linings in accordance with AWWA C104.

8. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to

comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested. DI pipe shall be UL listed, and a copy of the UL certification shall be provided to Triview Metropolitan District , if requested.

9. PLACE OF MANUFACTURE

DI pipe installed in the City and County of Triview Metropolitan District and Total Service Contract Areas shall be manufactured domestically.

10. APPROVED MANUFACTURERS

Manufacturers	Size (Inch)
American Cast Iron Pipe Company	4 to 20
McWane Ductile	3 to 20
U. S. Pipe and Foundry Company/Griffin Pipe Products	3 to 20

*Material Specification – 1
Ductile Iron Pipe*

Material Specification – 2

POLYVINYL CHLORIDE PRESSURE PIPE

1. GENERAL

PVC pipe shall be manufactured in accordance with AWWA C900, with the following additional requirements or exceptions.

2. SIZES

This Specification covers PVC pipe in 4-inch, 6-inch, 8-inch, 12-inch, 16-inch, and 20-inch nominal diameters with CI equivalent outside diameters.

3. JOINT TYPE

Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint.

4. CLASS AND TYPE

PVC pipe shall be of the DR or pressure class as follows:

AWWA C900	
Nominal Pipe Size (Inch)	Dimension Ratio
4	14
6	14
8	14
12	14
16	14
20	14

5. PIPE LENGTH

Pipe furnished under this Specification shall have a nominal laying length of 20-feet. Random lengths are not acceptable.

6. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

7. APPROVED MANUFACTURERS

Manufacturers	Size (Inch)
Diamond Plastics Corporation	4 to 20
IPEX	4 to 20
JM Eagle	4 to 20
North American Pipe Corporation	4 to 20
Underground Solutions (Fusible)	4 to 20
Vinyltech Corporation	4 to 16

Material Specification – 2
Polyvinyl Chloride Pressure Pipe

Material Specification – 3

DUCTILE IRON WATERWORKS FITTINGS

1. GENERAL

DI fittings shall be manufactured in accordance with AWWA C110 or C153, as applicable, with the following additional requirements or exceptions.

2. JOINT TYPE

Fittings installed in City and County of Triview Metropolitan District and Total Service Contract Areas shall be furnished with mechanical joint ends. Mechanical joint components shall be in accordance with AWWA C111 with tee-head bolts and hexagon nuts fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten, Usalloy, or Durabolt. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207.

Accessories for the mechanical joint shall consist of the gasket, gland, and fasteners and shall be furnished and packaged separately from valves. Each package shall be labeled in a manner as to provide for proper identification, and the number of units shall be listed per package or bundle.

3. PRESSURE RATING

DI fittings nominal sizes 3-inch through 20-inch shall have a pressure rating of 350 psi.

4. MATERIAL STRENGTH

The grade of DI shall be 70-50-05 or 65-45-12.

5. LININGS AND COATINGS

DI fittings shall be coated with an asphaltic material, lined with cement-mortar in accordance with AWWA C104. DI fittings may also be lined and coated with fusion-bonded epoxy in accordance with AWWA C116.

6. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District, if requested.

7. APPROVED MANUFACTURERS

Sigma
SIP Industries
Star Pipe Products
Tyler Union
U. S. Pipe and Foundry Company

Material Specification – 4

DOUBLE-DISC GATE VALVES

1. GENERAL

Double-disc gate valves shall be designed and manufactured in accordance with AWWA C500 with the following additional requirements or exceptions.

2. SERVICE

Valves shall be suitable for frequent operation and for long periods of inactivity. Valves shall operate with flows in either direction and shall not exceed the leakage rate published in AWWA C500. The minimum design working pressure for valve sizes 3-inch through 12-inch shall be 250 psi. The minimum design working pressure for valve sizes 14-inch through 20-inch shall be 200 psi. Components shall be suitable for exposure to chlorinated water.

3. SIZES

This Specification covers 150 pound class double-disc gate valves in 3-inch through 20-inch nominal diameters.

4. VALVE DESCRIPTION

Valves shall be iron body, double-disc gate valves, fully bronze-mounted with non-rising stem and parallel seats.

Valves shall be supplied with 2-inch square wrench nuts. Valves shall open clockwise.

5. INSTALLATION

Valves, 3-inch through 12-inch, shall be installed with the stem positioned vertically in buried horizontal water lines without gearing, bypasses, rollers, or tracks. Valves, 14-inch through 20-inch, shall be installed horizontally in buried horizontal water lines without bypasses, rollers, or tracks. Horizontal installations shall include a bevel gear to rotate the input shaft vertical and provide a mechanical advantage. Valve bonnet shall be installed below frost line.

6. GEARING

Bevel gear shall be bury duty rated, grease filled for life, totally enclosed gearing and fully sealed with nitrile rubber O-rings. Bevel gear housing shall be DI and bevel gears shall be AISI/SAE 4340 steel with the input shaft supported by a ball bearing. Gear reduction sized to limit maximum input torque required to operate valve in all conditions to 80 lb-ft.

7. VALVE STEMS

Valve stems shall be made of bronze in accordance with ASTM B 763, Copper Alloy No. C99500; stainless steel in accordance with ASTM A 276, Type 304, Type 316, or AISI 420; or copper alloy in accordance with ASTM B 98, Copper Alloy No. C66100/HO2.

The stem seal shall consist of two O-rings.

8. BOLTING MATERIAL

The bonnet, gland bolts, and nuts shall be in accordance with ASTM F 593, Type 304 stainless steel or electro-plated with zinc or cadmium. The hot-dip galvanizing process is not acceptable.

9. END CONNECTIONS

- A. Flanges shall be sized and drilled in accordance with ANSI B16.1, Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207.
- B. Mechanical joint components shall be in accordance with AWWA C111 with tee-head bolts and hexagon nuts fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten, Usalloy, or Durabolt.
Accessories for the mechanical joint shall consist of the gasket, gland, and fasteners and shall be furnished and packaged separately from valves. Each package shall be labeled in a manner that provides for proper identification, and the number of units listed per package or bundle.

10. TESTING

Each valve, after shop assembly, shall be operated and hydrostatic and leak tested in accordance with AWWA C500.

11. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated with a rust preventive compound; they shall not be painted or coated with the same coating as the body.

12. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

13. APPROVED MANUFACTURERS

Manufacturers	Size (Inch)
Clow	3 to 12
Mueller Company	14 to 20

*Material Specification – 4
Double-Disc Gate Valves*

Material Specification – 5

Resilient Seated Gate Valves

1. GENERAL

Resilient seated gate valves shall be designed and manufactured in accordance with AWWA C509 or AWWA C515, as applicable, with the following additional requirements or exceptions.

2. SERVICE

Valves shall be suitable for frequent operation and for long periods of inactivity. Valves shall operate with flows in either direction and shall provide zero leakage past the seat; the operating pressure for all sizes shall be 200 psi. Components shall be suitable for exposure to chlorinated water.

3. SIZES

This Specification covers 150 pound class resilient seated gate valves in 3-inch through 20-inch nominal diameters.

4. VALVE DESCRIPTION

Valves shall be iron body, resilient seated gate valves with non-rising stems. If the resilient seats are bonded to the gates, the gates shall be completely encapsulated with the material, except for guide tabs or slots. Valve bodies shall be designed to allow for the lifting of the valves by the bonnet flange, gland flanges, or other appurtenances.

Valves shall be supplied with 2-inch square wrench nuts. Valves shall open clockwise.

5. INSTALLATION

Valves, 3-inch through 12-inch, shall be installed with the stem positioned vertically in buried horizontal water lines without gearing, bypasses, rollers, or tracks. Valves, 14-inch through 20-inch, shall be installed horizontally in buried horizontal water lines without bypasses, rollers, or tracks. Horizontal installations shall include a bevel gear to rotate the input shaft vertical and provide a mechanical advantage. Valve bonnet shall be installed below frost line.

6. GEARING

Bevel gear shall be bury duty rated, grease filled for life, totally enclosed gearing, and fully sealed with nitrile rubber O-rings. Bevel gear housing shall be DI and bevel gears shall be AISI/SAE 4340 steel with the input shaft supported by a ball bearing. Gear reduction sized to limit maximum input torque required to operate valve in all conditions to 80 lb-ft.

7. VALVE STEMS

Valve stems shall be made of bronze in accordance with ASTM B 763, Copper Alloy No. C99500; stainless steel in accordance with ASTM A 276, Type 304, Type 316, or AISI 420; or copper alloy in accordance with ASTM B 98, Copper Alloy No. C66100/H02. The stem seal shall consist of two O-rings.

8. BOLTING MATERIAL

The bonnet gland bolts and nuts shall be in accordance with ASTM F 593, Type 304 stainless steel or electro-plated with zinc or cadmium. The hot-dip galvanized process is not acceptable.

9. TESTING

Each valve, after shop assembly, shall be operated and hydrostatic tested in accordance with AWWA C509 or AWWA C515.

10. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

11. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested. Resilient seated gate valves shall be UL listed, and a copy of the UL certification shall be provided to Triview Metropolitan District , if requested.

APPROVED MANUFACTURERS

Manufacturers	AWWA C509	Size (Inch)	AWWA C515	Size (Inch)
American AVK	X	3 to 16	X	3 to 12
American Flow Control/American Cast Iron Pipe Company			X	3 to 20
Clow	X	3 to 12	X	4 to 20
EJ			X	3 to 20
Kennedy	X	3 to 12	X	3 to 20
Mueller	X	3 to 12	X	4 to 20
U. S. Pipe and Foundry Company	X	3 to 12	X	4 to 20

*Material Specification – 5
Resilient Seated Gate Valves*

Material Specification – 6

RUBBER SEATED BUTTERFLY VALVES

1. GENERAL

Rubber seated butterfly valves shall be designed and manufactured in accordance with AWWA C504 with the following additional requirements or exceptions.

2. SERVICE

Valves shall be suitable for throttling service, frequent operation, and long periods of inactivity. Valves shall operate with flows in either direction and suitable for use in potable and nonpotable service. Components shall be suitable for exposure to chlorinated water.

3. SIZES

This Specification covers 150 and 250 pound class rubber seated butterfly valves in 16-inch through 20-inch nominal diameters.

4. VALVE DESCRIPTION

Valves shall be iron body rubber seated butterfly valves. Class 250B valves shall have DI bodies. The type and class of valves and the type of actuators to be supplied shall be specified. Valves shall be supplied with 2-inch square wrench nuts. Valves shall open clockwise. Valves supplied under this Specification may include buried, in-plant, and submerged.

5. INSTALLATION

Valves specified as buried shall be used for buried service in horizontal waterlines with the valve shaft positioned horizontally and the operating nut shaft positioned vertically. The body of valves shall be buried and the actuators installed in manholes.

Valves specified as in-plant shall be used for service inside buildings or other structures in a dry environment protected from weather. Valves shall be installed with the valve shaft positioned horizontally and the actuator directly coupled to the valve body.

Valves specified as submerged shall be used for service inside basins and reservoirs. Valves shall be installed with the valve shaft positioned vertically and mounted to a pipe flange. Submerged valves shall be supplied with torque tubes and actuator stands as shown on the [Standard Drawings](#).

6. SHUT OFF PRESSURE

The maximum static differential pressure across the valve shall be the same as the class of the valve. At rated pressure, the valve shall be bubble tight for flows in either direction.

7. CLASS OF VALVE

The class of valves shall be as specified.

8. VALVE BODIES

Valve bodies shall be short body. Disc stops on the body are not allowed.

9. VALVE DISCS

The valve disc shall seat at 90 degrees to the pipe axis. Discs having hollow chambers that can entrap water are not allowed. Class 250B valve discs shall be DI.

10. VALVE SEAT

Rubber seats may be applied to the body or the disc. In either case, the mating seat surface shall be stainless steel or sprayed in accordance with AWWA C504. Rubber seats shall be constructed of EPDM and may be reinforced by the Manufacturer.

Rubber seats mounted on the disc shall be a continuous, full circle 360-degree seal clamped on with corrosion-resistant retaining rings and threaded fasteners.

Rubber seats mounted in the groove of the valve body on 24-inch and smaller valves may be bonded to the body. Bonded seats shall withstand a 75 pound pull in accordance to the 90-degree stripping test procedure, Method B of ASTM D 429.

Rubber seats mounted in the valve body on valves larger than 24-inches shall be full circle 360-degree and shall be retained in the valve body by mechanical means in such a manner that the seat can be adjusted to provide a tight shutoff. The valve shaft shall not penetrate the rubber seat.

11. VALVE SHAFT

The valve shaft shall be stainless steel and through or stub type. Shafts for Class 250B valves shall be ASTM A 564, UNS designation S17400, condition H1150.

12. SHAFT SEAL

Where the valve shaft projects through the valve body for the actuator connection, a shaft seal that is designed for positive pressure within the valve shall be provided. The seal shall be self-compensating, V-type packing or an O-ring type contained in a corrosion-resistant cartridge.

On buried valves, the shaft seal area and exposed valve shaft shall be completely enclosed to prevent the infiltration of material around the shaft and the shaft seal during backfilling. Adjustable packing glands shall be accessible through the extension bonnet or by removing the enclosure around the packing gland.

13. VALVE BEARINGS

Valves furnished with an externally adjustable thrust bearing shall have the external adjusting mechanism enclosed in a substantial watertight housing.

14. END CONNECTIONS

Valves shall be furnished with flanged ends. Dimensions and drilling shall be in accordance with ANSI B16.1, Class 125. Flanges shall be finished to the true plane surfaces within a tolerance limit of 0.005-inch. The finished face shall be normal to the longitudinal axis with a maximum angular variation tolerance of 0.002-inch per foot (0.017%) of flange diameter. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207 and shall have full-sized bolt holes through the flanges. Drilled and tapped holes will be acceptable only in areas where the shaft passes through the body; flanges with all the holes tapped are not allowed.

15. VALVE ACTUATORS

Valves shall be furnished with manual actuators designed and sized to develop output torques for the specified operating service; they shall be sufficient to seat, unseat, and rigidly hold the disc in any position. The maximum velocity through the valve for actuator design shall be 16 fps.

The gearing of the actuator shall be totally enclosed and sealed with a lubricant for a temperature range of -10°F to 150°F.

Worm-gear actuators shall have worm-gear of high tensile bronze and a worm of hardened alloy steel with ground and polished threads supplemented by a spur gear attachment, as required.

The diameter of the output shaft or spline of the actuator shall be equal or greater in size than the turned-down section of the valve shaft.

Actuators shall have a position indicator. Potable water system valves shall open with a clockwise rotation of the nut. Recycled water and raw water system valves shall open with a counter-clockwise rotation of the nut.

- A. Buried Valves: Actuators shall be Auma Model GS, EIM Type WD, Rotork IW, or Limitorque Type HBC that are designed to operate temporarily in a submerged condition (i.e., 10-feet of water).

For the complete opening or closing of the valve, the minimum number of turns shall be at least 40.

- B. In-Plant and Submerged Valves: The actuators shall be traveling nut or worm-gear type. Worm-gear actuators shall be Auma Model GS, Limitorque Type PT, Rotork IW, or EIM Type WO. Traveling nut actuators shall be manufactured by the valve Manufacturer and capable of withstanding 450 ft/lbs of input torque.

16. EXTENSION BONNET

Buried valves shall be furnished with a separate one-piece CI or fabricated steel extension bonnet with access openings fitted with removable covers and located to permit access to the stuffing box for tightening the packing, if applicable. The extension bonnet shall be 24-inches in length and of a single diameter over the entire length. The minimum thickness of the removable cover shall be 14 gauge (0.0747-inch); it shall be attached to an extension sleeve with a minimum of four 1/4-inch diameter cap screws. Gasketing of the opening is not required.

17. TORQUE TUBES

Submerged valves shall be supplied with torque tube type shaft extensions and actuator support stands in accordance with the [Standard Drawings](#). Each torque tube and actuator support stand shall be sized to operate under the maximum service conditions for the valve. The torque tube shall be sized to transmit the required torque to the valve while limiting the torsional deflection to one degree at the seating position. Disc stops shall not be used to eliminate the effects of torsion twist. Torque tubes shall have threaded holes in the top suitable for lifting eyes sized for the weight of the torque tube when lifted at a 90-degree angle. The torque tube shall be connected to the valve shaft with a taper pin and nut or with a keyed connection.

18. NAMEPLATES

Corrosion-resistant nameplates shall be provided. A valve nameplate shall be attached to the valve body and an actuator nameplate attached to the valve actuator. For buried or submerged valves, the nameplate shall be attached to the valve actuator. Valve nameplates shall include the normal valve data and the serial number.

19. COATINGS

- A. Internal ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550.

- B. External surfaces, except machined or bearing surfaces, shall be carefully prepared by removing dirt, grease, and rust and cleaned to the extent that the coating will effectively bond to all surfaces.
- For buried valves, the exterior of each valve, except flange faces, shall be shop-coated with two coats of asphalt varnish or prepared and coated in the same manner as the internal surfaces.
- For in-plant valves, the exterior of each valve, except flange faces, shall be shop-coated with one coat of polyamide anti-corrosive epoxy primer to a DFT of at least 3-mils.
- For submerged valves, the external surfaces shall be prepared and coated in the same manner as the internal surfaces.
- Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.
- C. After coating is complete, a lubricant compatible with the rubber seal shall be applied to the seal surface and the mating metal surface to prevent bonding during shipment and storage. Following the application of the seal lubricant, the valve disk shall be placed in a slightly open position for shipment.

20. VALVE ASSEMBLY

Buried and in-plant valves shall be shipped fully assembled. Submerged valves shall be assembled in the Manufacturer's shop (i.e., the torque tube assembled to the valve shaft and the actuator adapter mounted to the torque tube to ensure proper fit). The assembled valves shall be performance tested in accordance with AWWA C504. If submerged valves are to be disassembled for shipment, the Manufacturer shall match-mark parts for field assembly. The torque tube connection to the valve shaft and the actuator shall also be scribed or otherwise marked to indicate relative orientation between the parts for field assembly.

21. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

22. APPROVED MANUFACTURERS

Manufacturers	Size (Inch)
Dezurik	16 to 20
M&H Valve Company	16 to 20
Mueller Company	16 to 20
Pratt	16 to 20
Val-Matic	16 to 20

*Material Specification – 6
Rubber Seated Butterfly Valves*

Material Specification – 7

SWING CHECK VALVES

1. GENERAL

Swing check valves shall be designed and manufactured in accordance with AWWA C508 with the following additional requirements or exceptions.

2. SERVICE

Valves shall be suitable for frequent operation and for long periods of inactivity. The working pressure shall be 150 psi. Components shall be suitable for exposure to chlorinated water.

3. SIZES

This Specification covers swing check valves in 4-inch through 20-inch nominal diameters.

4. VALVE DESCRIPTION

- A. The valve body and cover shall be constructed of DI in accordance with ASTM A 536. The valve body shall have a full pipe size flow area with an integral seat at 45 degrees to minimize disc travel to 35 degrees. The valve body shall include a threaded port and plug to accept a threaded back flow plunger. The body shall have a top access port allowing the removal of the disc without removing the valve from the service line.
- B. The disc shall be one-piece steel construction with a molded nylon reinforced EPDM rubber flapper. The disc shall be drop tight in the closed position.

5. INSTALLATION

Valves shall be installed in a horizontal position. Some operating conditions may dictate the need for accessories such as a valve position indicator, a backflow plunger, or cushion devices for added surge protection.

6. BOLTING MATERIAL

The bonnet, gland bolts, and nuts shall be in accordance with ASTM F 593, Type 304 stainless steel or electro-plated with zinc or cadmium. The hot-dip galvanized process is not acceptable.

7. END CONNECTIONS

Flanges shall be sized and drilled in accordance with ANSI B16.1, Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207.

8. TESTING

Each valve, after shop assembly, shall be operated and hydrostatic tested in accordance with AWWA C508.

9. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated

with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

10. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

11. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models	Size (Inch)
Cla-Val	584 Flex-Check	4 to 20
Val-Matic	500A Swing-Flex	4 to 20

Material Specification – 7
Swing Check Valves

Material Specification – 8

TAPPING VALVES – MECHANICAL JOINT TYPE

1. GENERAL

Tapping valves shall be designed and manufactured in accordance with AWWA C509 or AWWA C515, as applicable, with the following additional requirements or exceptions.

2. SERVICE

Valves shall be suitable for frequent operation and for long periods of inactivity. Valves shall operate with flows in either direction; the operating pressure for all sizes shall be 200 psi. Components shall be suitable for exposure to chloraminated water.

3. SIZES

This Specification covers 150 pound class tapping valves – mechanical joint type, in 4-inch through 12-inch nominal diameters.

4. VALVE DESCRIPTION

Valves shall be iron body, resilient seated gate valves with non-rising stems. If the resilient seats are bonded to the gates, the gates shall be completely encapsulated with the material except for guide tabs or slots.

5. INSTALLATION

Valves shall be installed with the stem positioned vertically in buried horizontal water lines without gearing, bypasses, rollers, or tracks. The valve bonnet shall be installed below frost line.

6. VALVE STEMS

Valve stems shall be made of bronze in accordance with ASTM B 763, Copper Alloy No. C99500; stainless steel in accordance with ASTM A 276, Type 304, Type 316, or AISI 420; or copper alloy in accordance with ASTM B 98, Copper Alloy No. C66100/H02.

Valves shall be furnished with 2-inch square wrench nuts. The stem seal shall consist of two O-rings. Valves shall open clockwise.

7. BOLTING MATERIAL

The bonnet, gland bolts, and nuts shall be in accordance with ASTM F 593, Type 304 stainless steel or electro-plated with zinc or cadmium. The hot-dip galvanized process is not acceptable.

8. END CONNECTIONS

- A. Flanges shall be sized and drilled in accordance with ANSI B16.1, Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207.
- B. Mechanical joint components shall be in accordance with AWWA C111 with tee-head bolts and hexagon nuts fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten, Usalloy, or Durabolt.

Accessories for the mechanical joint shall consist of the gasket, gland, and fasteners and shall be furnished and packaged separately from valves. Each package shall be labeled in a manner that provides for proper identification, and the number of units listed per package or bundle.

9. SEAT RING SIZE

The body of the valve and the seat opening shall be sized large enough to accommodate the following sizes of shell cutters:

Tapping Valve Nominal Diameter (Inch)	Shell Cutter Diameter (Inch)
4	3 7/8 ±1/32
6	5 13/16 ±1/32
8	7 7/8 ±1/32
10	9 3/4 ±1/32
12	11 7/8 ±1/32

10. TESTING

Each valve, after shop assembly, shall be operated and hydrostatic tested in accordance with AWWA C509 or AWWA C515.

11. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

12. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

13. APPROVED MANUFACTURERS

American AVK
American Flow Control/American Cast Iron Pipe Company, Series 2500 RW
Clow
Kennedy
Mueller Company
U. S. Pipe and Foundry Company

Material Specification – 8
Tapping Valves – Mechanical Joint Type

Material Specification – 9

FABRICATED CARBON STEEL AND STAINLESS STEEL TAPPING SLEEVES

1. GENERAL

Fabricated carbon steel and stainless steel tapping sleeves shall be designed and manufactured in accordance with AWWA C223 with the following additional requirements or exceptions.

2. SERVICE

The tapping sleeves shall be installed on the following types of pipe: CI, DI, AC, and PVC. The working pressure for these water pipes is 150 psi. Components shall be suitable for exposure to chloraminated water.

3. SIZES

This Specification covers tapping sleeves in 4-inch through 20-inch nominal diameters.

4. END CONNECTIONS

Carbon steel flanges shall be fabricated from steel plate; dimensions shall be in accordance with AWWA C207, Class D. Stainless steel flanges shall be fabricated from steel plate; dimensions shall be in accordance with AWWA C228, Class SD. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207 or AWWA C228 as applicable. The machined flange face shall also be recessed for tapping valves in accordance with MSS SP-60. Hollow-back flanges and segmented flanges are not acceptable.

5. GASKETS

Gaskets shall be compounded from new materials and the shape of the cross-section of the gasket shall provide an adequate seal for the working pressure. Gaskets shall be shop glued to the groove provided in the body section.

6. TESTING OUTLET

A 3/4-inch NPT threaded outlet shall be attached to the outlet nozzle of each tapping sleeve assembly complete with a 3/4-inch square head, threaded pipe plug.

7. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

8. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

9. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models	Size (Inch)	Outlet Size (Inch)
Fabricated Steel – DI Pipe			
The Ford Meter Box Company	FTSC	4 to 20	3 to 12
JCM Industries	412	6 to 20	3 to 12
Romac Industries	FTS 420	6 to 20	3 to 12
Smith-Blair	622	4 to 20	4 to 12
Stainless Steel – CI, DI, AC, and PVC Pipe			
Cascade	Style CST	4 to 20	4 to 12
The Ford Meter Box Company	FTSS	4 to 20	3 to 12
JCM Industries	JCM 432	4 to 16	3 to 12
	JCM 462	4 to 20	3 to 12
PowerSeal	3490	4 to 20	3 to 12
Romac Industries	Style SST	4 to 20	3 to 12
	STS 420	6 to 20	3 to 20

Material Specification – 9

Fabricated Carbon Steel and Stainless Steel Tapping Sleeves

Material Specification – 10

PRESSURE REGULATING VALVES

1. GENERAL

Pressure regulating valves shall be designed and manufactured in accordance with AWWA C530 with the following additional requirements or exceptions.

2. SERVICE

The function of the pressure regulating valve is to reduce an upstream high pressure to a preadjusted lower downstream pressure to vary the rates of flow without causing shock or water hammer on the system. Components shall be suitable for exposure to chloraminated water.

3. SIZES

This Specification covers 150 pound class pressure regulating valves in 4-inch through 20-inch nominal diameters.

4. VALVE DESCRIPTION

Pressure regulating valves shall be hydraulically operated and pilot controlled with a diaphragm activated globe or angle valve. A stainless steel indicator rod shall be furnished as an integral part of the valve to show the valve position. The valve shall be designed to provide an access opening in the body for the removal of internal parts without the removal of the main valve body from the service line.

5. INSTALLATION

Pressure regulating valves shall be installed in a horizontal position in an underground concrete manhole or concrete vault as applicable.

6. BODY MATERIAL

Valve body, flanges, and covers shall be CI in accordance with ASTM A 126, Class B, or ASTM A 48, Class 35B; DI in accordance with ASTM A 536, grade 65-45-12.

7. INTERNAL TRIM MATERIALS

Stem, nut, and spring shall be stainless steel. Bronze or brass alloys used for the internal trim or bushings shall comply with ANSI/NSF 61.

8. DIAPHRAGM MATERIAL

Flat or rolling diaphragm shall be nylon reinforced and bonded EPDM or Buna-N synthetic rubber.

9. DISC AND SEATS MATERIAL

Resilient disc materials shall be Buna-N or EPDM to provide a drip-tight seal with a stainless steel seat.

10. VALVE ENDS

Valves shall be furnished with flanged ends sized and drilled in accordance with ANSI B16.1, Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207 and coated with a rust-preventive compound.

11. PILOT SYSTEM

The pilot valve for controlling the operation of the main valve shall be a single seated stainless steel construction, EPDM diaphragm operated, and spring-loaded type. The pilot valve shall be attached to the main valve with stainless steel piping and isolation

ball valves and threaded nipple extending inside the valve body covering all port threads at all port connections. Provide stainless steel strainer with minimum 40 mesh screen and blow down port upstream of the pilot valve. Provide 2 1/2-inch stainless steel, bourbon tube pressure gauge integral to the pilot system to show system pressure downstream of the pilot valve. Pilot piping shall be arranged for easy access for adjustments and with isolation valves for removal from the main valve while it is under pressure.

12. NEEDLE VALVE

The needle valve shall be stainless steel and included with the main valve to control the speed of valve travel.

13. WORKING PRESSURE

The working pressure shall be 150 psi.

14. TESTING

The body shall be hydrostatic tested to 150% of the working pressure specified herein. A seat leakage test shall be made at the working pressure.

15. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

16. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District, if requested.

17. APPROVED MANUFACTURERS

CITY AND COUNTY OF TRIVIEW METROPOLITAN DISTRICT AND TOTAL SERVICE CONTRACT AREAS	
Manufacturers	Size (Inch)
Bermad 700 Series Control Valve	4 to 20
Cla-Val	4 to 20
Singer	4 to 20
DISTRIBUTOR CONTRACT AREAS	
Manufacturers	Size (Inch)
Ames	4 to 16
Bermad 700 Series Control Valve	4 to 20
Cla-Val	4 to 20
GA Industries	4 to 16
OCV	4 to 16
Ross	4 to 20
Singer	4 to 20

Material Specification – 11

COMBINATION AIR-RELEASE AND VACUUM VALVES

1. GENERAL

Combination air-release and vacuum valves shall be designed and manufactured in accordance with AWWA C512 with the following additional requirements or exceptions.

2. SERVICE

Valves shall be suitable for frequent operation and for long periods of inactivity. Valves shall be capable of venting large quantities of air during liquid piping system filling, automatically releasing small pockets of accumulated air during pressurized operation, and admitting large quantities of air into liquid piping system when internal pressure drops below atmospheric pressure. Components shall be constructed of materials suitable for exposure to chloraminated water.

3. SIZES

This Specification covers combination air-release and vacuum valves, one-inch through 6-inch.

4. VALVE DESCRIPTION

Combination air-release and vacuum valves shall be a single body design incorporating both functions of allowing air into and out of the piping system.

5. INSTALLATION

Combination air-release and vacuum valves shall be installed in a vertical position in an underground concrete manhole or concrete vault as applicable.

6. VALVE CONSTRUCTION

- A. CI valve body and cover shall be in accordance with ASTM A 48, Class 35B, or ASTM A 126, Grade B. DI valve body and cover shall be in accordance with ASTM A 536, Grade 65-45-12. Each valve shall be supplied with stainless steel trim; this includes the float, float arm, guide bushings, plug, and connecting hardware.
- B. Stainless steel valve body shall be AISI Type 304. The ends shall be epoxy coated steel or Type 304 stainless steel secured with Type 304 stainless steel rods. The floats shall be solid cylindrical high density polyethylene. The baffle plate, nozzle seat retaining plate, small orifice nozzle, and connecting hardware shall be stainless steel.
- C. Valve seats shall be synthetic rubber, Buna-N or EPDM.
- D. Valves, one-inch and 2-inch, shall be furnished with NPT inlets; valves, 3-inch through 6-inch, shall be furnished with flanged inlets that conform in dimension and drilling to ANSI B16.1, Class 125. Each flange face shall be machined to a flat surface with a serrated finish in accordance with AWWA C207.
Valves shall be provided with 1/4-inch minimum NPT pipe plugs in the bottom of the body.
- E. Valves, one-inch through 6-inch, shall include standard NPT screwed discharge connection.

7. WORKING PRESSURE

The working pressure shall be 150 psi.

8. TESTING

Each assembled valve shall be tested in accordance with AWWA C512.

9. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

10. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District, if requested.

11. APPROVED MANUFACTURERS AND MODELS

CITY AND COUNTY OF TRIVIEW METROPOLITAN DISTRICT AND TOTAL SERVICE CONTRACT AREAS		
Stainless Steel Body		
Manufacturers	Models	Size (Inch)
International Valve	Vent-Tech WTR-C Series	1 to 6
Vent-O-Mat	Series RBX	1 to 6
DISTRIBUTOR CONTRACT AREAS		
Iron Body		
Manufacturers	Models	Size (Inch)
GA Industries	Figure 945	1 to 4
Val-Matic	Series 200	1 to 6
Stainless Steel Body		
Manufacturers	Models	Size (Inch)
International Valve	Vent-Tech WTR-C Series	1 to 6
Vent-O-Mat	Series RBX	1 to 6

*Material Specification – 11
Combination Air-Release and Vacuum Valves*

Material Specification – 12

CAST IRON VALVE BOXES

1. GENERAL

CI valve box components shall be manufactured in accordance with the following requirements.

2. VALVE BOXES, 6-INCH

Valve boxes shall be the 3-piece adjustable screw type with a 16-inch top section, 18-inch extension, 24-inch stem, and 30-inch bottom and base.

Components	Minimum Weight (Lbs)
Lid	13
16-inch Top Section	34
18-inch Extension	29
24-inch Stem	35
30-inch Bottom	38
Base	68

3. APPROVED MANUFACTURERS AND MODELS FOR CI VALVE BOXES

Manufacturers	Models
Bingham & Taylor	CCO5 Series, CUL5 Series, and GRE5 Series
EJ	8560 Series and 6800 Series Drop Lid
Sigma Corporation	VB630 Series
Star Pipe Products	VB-0006 Series

4. APPROVED MANUFACTURERS AND MODELS FOR CURB STOP SERVICE BOXES

Curb stop service boxes shall be CI and of the following type:

Manufacturers	Models	Size (Inch)
Bingham & Taylor	I2B94EWOS	3/4 and 1
	I4B144RW	1 1/2 and 2 (Roadway Box)
Sigma Corporation	794E-35, 795E-35	3/4 and 1
Star Pipe Products	SB94ES, SB95ES	3/4 and 1
	RWB 145RHD	1 1/2 and 2 (Roadway Box)

5. MATERIALS

Valve box parts shall be made of grey CI in accordance with ASTM A 48, Class 35B. The use of an aluminum alloy as a casting material is not acceptable.

6. FINISH

Components shall be deburred and machined so that final dimensions are within ± 0.0625 -inch of the specified dimensions. Components shall be provided with the Manufacturer's standard rust-preventive coating.

7. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. A copy of the certification shall be provided to Triview Metropolitan District, if requested.

Material Specification – 12
Cast Iron Valve Boxes

Material Specification – 13

DRY-BARREL FIRE HYDRANT

1. GENERAL

Dry-barrel fire hydrants shall be designed and manufactured in accordance with AWWA C502 with the following additional requirements or exceptions.

2. SERVICE

Fire hydrants supplied under these Specifications shall be designed for a working pressure of 150 psi.

3. SIZES

Hydrants shall have a main valve opening size of at least 5 1/4-inches.

4. TYPE OF HYDRANT

Hydrants shall be the three-way type with one pumper nozzle and two hose nozzles located on the same horizontal plane at least 18-inches above ground line.

5. INLET CONNECTION

The hydrant base shall be provided with a mechanical joint inlet to accommodate 6-inch DI pipe complete with plain rubber gasket, gland, bolts, and nuts in accordance with AWWA C111.

Bolts and nuts shall be a high strength, low alloy, corrosion-resistant steel Cor-Ten or equal with a minimum yield of 50,000 psi in accordance with ASTM A 242. Incorporated into the base shall be two lugs for the rodding of pipe.

Mechanical joint accessories shall be attached to the hydrant for shipment.

6. MAIN VALVE ASSEMBLY

The main valve of the hydrant shall be the compression type that closes with water pressure. The seat ring shall be bronze with a machined face and external threads for threading into a bronze drain ring or a bronze bushed shoe to provide bronze to bronze seating for the main valve. The assembly shall be sealed with O-rings.

The main valve shall be a replaceable type fabricated of a resilient material with a threaded bottom plate or nut, with a seal to prevent leakage of the hydrant shaft. The upper valve plate material shall be bronze or epoxy coated DI.

The valve assembly shall include one or more drain valves that work automatically with the main valve to drain the barrel when the main valve is in the closed position. Drain tubes shall be bronze lined and sized large enough for the barrel to drain within 12 minutes when sized for a 5-foot trench depth.

The components of the main valve assembly shall be designed so that removal of the assembly from the barrel may be accomplished without excavation.

7. OPERATING SHAFT AND NUT

The upper and lower operating rods shall be stainless steel. The operating nut shall be bronze or DI and pentagon shaped with a finished height of 1 1/8-inch. The dimensions from point-to-flat shall be between 1 1/4-inch and 1 3/8-inch from the

top to the bottom of the nut. Bushings in the bonnet shall be constructed to prevent the operating nut from traveling during opening or closing operation. Also, the bushing shall house a gasket or seal to prevent moisture or foreign materials from entering the lubricant reservoir.

Hydrants shall be grease lubricated or of a dry-top design where an oil reservoir will provide permanent lubrication of the operating nut threads.

A stop nut located in the hydrant bonnet on the operating shaft shall prevent the over travel of the main valve when it is being opened.

The hydrant shall open by turning the operating nut clockwise and shall have an arrow on top of the bonnet to designate the direction of opening.

8. PUMPER NOZZLE AND CAP

The pumper nozzle shall be 4 1/2-inches nominal diameter with 5 3/8-inch outer diameter threads having 6 threads per inch; threads shall be right-hand. A sample nozzle will be furnished upon request.

The nozzle cap shall be furnished with a synthetic rubber gasket installed in a retaining groove. The dimensions and shape of the nozzle cap nut shall be the same as the operating shaft nut. The nozzle cap shall be furnished with a security chain; the end shall be securely attached to the upper barrel section of the hydrant.

9. HOSE NOZZLES AND CAPS

The two hose nozzles shall be 2 1/2-inch nominal diameter with 7 1/2 threads per inch (2.5 to 7.5 N.H.). Threads shall be right-hand and shall be National Standard in accordance with NFPA No. 1963.

Nozzle caps shall be furnished with security chains; each end shall be securely attached to the upper barrel section of the hydrant.

10. NOZZLE ATTACHMENT

Outlet nozzles shall be fastened into the barrel by mechanical means and secured by a stainless steel pin or screw, bronze wedge, or DI retainer. Nozzles shall be sealed using O-rings.

11. TESTING

Each factory assembled unit shall be hydrostatic tested in accordance with AWWA C502. Shop tests for the body and main valve will be conducted at a pressure of 300 psi.

12. COATINGS

The upper exposed section of the hydrant shall be thoroughly cleaned and painted with a prime coat of a rust inhibitive primer followed by a 10-mil DFT shop-coat of heavy duty alkyd enamel paint. The paint color shall be yellow, similar to Federal Color No. 13538.

Exposed exterior surfaces below the ground line shall be coated with asphalt varnish in accordance with AWWA C502.

The interior of the hydrant shall be coated with an epoxy coating in accordance with AWWA C502.

The hydrant shoe and connecting gland shall be lined and coated with fusion-bonded epoxy in accordance with AWWA C550.

13. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements

of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested. Dry-barrel fire hydrants shall be UL listed, and a copy of the UL certification shall be provided to Triview Metropolitan District , if requested.

14. TRAFFIC FEATURES

Hydrants shall be equipped with traffic features that include a breakaway flange or lug system with a shaft coupling.

15. APPROVED MANUFACTURERS AND MODELS

CITY AND COUNTY OF TRIVIEW METROPOLITAN DISTRICT AND TOTAL SERVICE CONTRACT AREAS	
Manufacturers	Models
American Cast Iron Pipe/Waterous	Pacer WB-67-250
Kennedy	K-81DD
Mueller Company	Centurion Model A-403
DISTRIBUTOR CONTRACT AREAS	
Manufacturers	Models
American Cast Iron Pipe/Waterous	Pacer WB-67-250
American AVK	Series 27
Clow	Medallion F-2545
Kennedy	K-81D, K-81DD
Mueller Company	Centurion Model A-403

*Material Specification – 13
Dry-Barrel Fire Hydrants*

Material Specification – 14

POLYETHYLENE ENCASEMENT MATERIAL

1. GENERAL

Polyethylene encasement material shall be manufactured in accordance with AWWA C105 with the following additional requirements or exceptions.

2. MATERIALS

Polyethylene encasement shall be linear low-density polyethylene film with a minimum DFT of 8-mils.

3. COLOR

Polyethylene encasement shall be clear (natural color).

4. INSTALLATION

Flat tube material shall be used for pipe and fitting encasement; flat sheet material shall be used for valve encasement.

5. QUALITY CONTROL

The Manufacturer shall furnish a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. A copy of the certification shall be provided to Triview Metropolitan District, if requested.

*Material Specification – 14
Polyethylene Encasement Material*

Material Specification – 15

METER REGISTERS AND REGISTER BOXES

1. GENERAL

Meters shall be compatible with the AMR/AMI system in use by Triview Metropolitan District and furnished with registers in accordance with AWWA C707 with the following additional requirements or exceptions.

The AMR system shall be Itron Model 100W series ERTs.

ERTs shall be returned to the Manufacturer at their end of life to divert unnecessary waste from the landfill.

The AMI system shall be Badger Orion Cellular LTE Endpoint.

2. REGISTERS AND REGISTER BOXES

Registers shall be electronic pulser or electronic digital encoder with a permanent potted wire connection for the AMI or ERT unit.

Registers shall be factory-wired and potted to a 5-foot long minimum wiring harness with a female, watertight, quick-connect terminal approved by Itron. Wire lengths will be indicated by Triview Metropolitan District .

Each register shall be delivered preprogrammed to provide electronic readings for up to 9 digits, as appropriate for the brand of meter. Electronic precision for a pulser register shall be one gallon; an encoder register shall be 50 gallons or less.

The register shall be compatible with both Itron Model 100W series ERTs using Itron WYSIWYG ROCLs and Badger Orion Cellular LTE Endpoint. Registers shall be straight reading, magnetic drive, U. S. gallons that are permanently sealed and protected from the environment. Additionally, they shall be protected from tampering by the inclusion of a formed joint that can be unsealed only by the destruction of one or more of the components that form the joint. The register box shall attach to the outer case of the meter by an interior or exterior locking device.

3. MECHANICAL REGISTER DIALS

Meter register dials shall be in accordance with AWWA C700, Table 4. Number wheels or stationary zeros that are used for billing purposes (1,000 gallons and up) shall have black numbers against a white background. Digits under 1,000 gallons, whether stationary or movable, shall have white numbers with a black background or shall be indicated by a box on the dial face. The register shall be equipped with a test hand and test index circle or a test hand and graduated test number wheel.

4. REGISTER CAP

Register boxes shall be equipped with a register cap that completely covers the register lens. The register cap shall be capable of being moved to another register in the event the meter is moved.

5. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models
Badger Meter, Inc.	HR-E
	HR-E LCD
Mueller Systems – Hersey	Translator Encoder Register
Neptune Technology Group	ProCoder

Material Specification – 15
Meter Registers and Register Boxes

Material Specification – 16

MAGNETIC DRIVE DISPLACEMENT TYPE WATER METERS

1. GENERAL

Magnetic drive displacement type water meters, 5/8-inch through 2-inch, shall be manufactured in accordance with AWWA C700 with the following additional requirements or exceptions.

2. SIZES

This Specification covers magnetic drive displacement type water meters in 5/8-inch through 2-inch nominal diameters.

3. METER DESCRIPTION

The meter may be a nutating disc or oscillating piston type. Meters, 1 1/2-inch and 2-inch, shall be designed for the easy removal of internal parts so as not to disturb the connections to the pipeline, and for removal of the meter. Stainless steel mounting bolts and flange gaskets shall be furnished with meters, 1 1/2-inch and 2-inch.

4. METER MAIN CASES/FLANGES

Meter main cases shall be made of copper alloy in accordance with AWWA C700.

Flanges for meters, 1 1/2-inch and 2-inch, shall be 2-hole, oval type and shall not contain slotted holes. Flanges shall be an integral part of the main case and composed of the same material; flanges shall not be removable from the main case. A test port shall be supplied on the outlet side of the meter.

5. REGISTERS/REGISTER BOXES

Registers and register boxes shall be in accordance with the requirements of [MS-15](#).

6. METER NUMBERS

The Triview Metropolitan District meter number shall be plainly stamped or engraved on the meter main case; it shall be heat stamped in a contrasting color on the plastic register cap and attached to the meter in form 39 bar code using a separate tag. Paper or plastic number labels affixed to the register are not acceptable.

7. BOTTOM PLATES

For meters, 5/8-inch through one-inch, bottom plates shall be of a breakable design made of CI. The CI bottom plates shall be coated with baked enamel to an extent adequate to protect the CI from corrosion. Plates shall be provided with a plastic line that does not prevent the bottom plate from breaking as designed.

8. PISTON/DISC SPINDLES, THRUST ROLLERS, AND THRUST ROLLER BEARING PLATES

Piston/disc spindles, thrust rollers, and thrust roller bearing plates shall be of monel or stainless steel in accordance with AWWA C700 or a suitable engineering plastic.

9. MEASURING CHAMBER DIAPHRAGMS

Measuring chamber diaphragms shall be of monel, stainless steel, or a suitable engineering plastic.

10. DRIVE SPINDLE

The upshaft, or drive spindle, shall be stainless steel or a suitable engineering plastic. The driving pawl and magnet shall be securely fastened to the drive spindle in a manner that prevents the loss of the pawl during normal operation of the water meter.

11. EXTERNAL FASTENERS

External fasteners shall be stainless steel in accordance with AWWA C700.

12. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372, and a copy of the certification shall be provided to Triview Metropolitan District , if requested.

13. DOCUMENTATION

The meter shall have a firmly attached tag that documents the Manufacturer's serial number, the Triview Metropolitan District meter number, a form 39 bar code representation of the Triview Metropolitan District meter number, the Manufacturer's certified test results, and other identifying characteristics such as nominal size, Manufacturer, meter model number, and register type and model.

14. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models
Badger Meter, Inc.	Recordall Disc Series
Mueller Systems – Hersey	400 IIS Model 500 IIS Model
Neptune Technology Group	T-10 Meter

Material Specification – 16
Magnetic Drive Displacement Type Water Meters

Material Specification – 17

MAGNETIC DRIVE COMPOUND TYPE WATER METERS

1. GENERAL

Magnetic drive compound type water meters, 3-inch through 6-inch, shall be manufactured in accordance with AWWA C702 with the following additional requirements or exceptions.

2. SIZES

This Specification covers magnetic drive compound type water meters in 3-inch through 6-inch nominal diameters.

3. METER DESCRIPTION

The displacement section of the meter may be a disc or oscillating piston type whereas the main line shall be turbine type. Meters shall be designed for the easy removal of internal parts so as not to disturb the connections to the pipeline and for the removal of the meter. Stainless steel mounting bolts and flange gaskets shall be furnished with each meter.

4. METER MAIN CASES/FLANGES

The main casing shall be made of copper alloy in accordance with AWWA C702.

Flanges shall be a 4-hole, round type and shall not have slotted holes. Flanges shall be an integral part of the main case and composed of the same material; flanges shall not be removable from the main case. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207. A test port shall be supplied on the outlet side of the meter.

5. REGISTERS/REGISTER BOXES

Registers and register boxes shall be in accordance with the requirements of [MS-15](#).

6. METER NUMBERS

The Triview Metropolitan District meter number shall be plainly stamped or engraved on the meter main case; it shall be heat stamped in a contrasting color on the plastic register caps and attached to the meter in form 39 bar code using a separate tag. Paper or plastic number labels affixed to the register are not acceptable.

The Manufacturer's serial numbers shall run consecutively for each meter in the group ordered and be stamped on the top of the register cap.

7. PISTON/DISC SPINDLES, THRUST ROLLERS, AND THRUST ROLLER BEARING PLATES

Piston/disc spindles, thrust rollers, and thrust roller bearing plates shall be of monel or stainless steel in accordance with AWWA C702.

8. MEASURING CHAMBER DIAPHRAGMS

Measuring chamber diaphragms shall be of monel or stainless steel in accordance with AWWA C702.

9. DRIVE SPINDLE

The upshaft, or drive spindle, shall be stainless steel or a suitable engineering plastic. The driving pawl and magnet shall be securely fastened to the drive spindle in a manner that prevents the loss of the pawl during normal operation of the water meter.

10. EXTERNAL FASTENERS

External fasteners shall be stainless steel in accordance with AWWA C702.

11. TORRENT SECTION

The torrent section shall be constructed in accordance with AWWA C702 and provided with stainless steel fasteners.

12. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372, and a copy of the certification shall be provided to Triview Metropolitan District , if requested.

13. DOCUMENTATION

The meter shall have a firmly attached tag that documents the Manufacturer's serial number, the Triview Metropolitan District meter number, a form 39 bar code representation of the Triview Metropolitan District meter number, the Manufacturer's certified test results, and other identifying characteristics such as nominal size, Manufacturer, meter model number, register type, and model, etc.

14. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models
Badger Meter, Inc.	Record all Compound Series Meter
Neptune Technology Group	TRU/FLO Compound Meter

Material Specification – 17

Magnetic Drive Compound Type Water Meters

Material Specification – 18

MAGNETIC DRIVE TURBINE TYPE WATER METERS

1. GENERAL

Magnetic drive turbine type water meters, 1 1/2-inch through 16-inch, shall be manufactured in accordance with AWWA C701 with the following additional requirements or exceptions.

2. SIZES

This Specification covers magnetic drive turbine type water meters in 1 1/2-inch through 12-inch nominal diameters.

3. METER DESCRIPTION

Meters shall be designed for the easy removal of internal parts, the strainer, and the meter. Strainers shall be furnished with each meter. For meters, 1 1/2-inch and 2-inch, the strainer shall be an integral part of the meter main case. The internal parts of the strainer shall be stainless steel. The casing of the strainer shall be provided with a removable top plate with stainless steel fasteners. Stainless steel mounting bolts and flange gaskets shall be furnished with each meter.

4. METER MAIN CASES/FLANGES

Meter main cases shall be made of a copper alloy in accordance with AWWA C701. For meters, 1 1/2-inch and 2-inch, flanges shall be 2-hole, oval type. For meters, 3-inch and larger, flanges shall be round in accordance with AWWA C701. Meters, 12-inch and larger, may be CI with a corrosion-resistant coating approved by Triview Metropolitan District .

Flanges shall be an integral part of the main case and composed of the same material as the case; flanges shall not be removable from the main case and shall not have slotted holes. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207. A test port shall be supplied on the outlet side of the meter.

5. REGISTERS/REGISTER BOXES

Registers and register boxes shall be in accordance with [MS-15](#).

6. METER NUMBERS

The Triview Metropolitan District meter number shall be plainly stamped or engraved on the meter main case; it shall be heat stamped in a contrasting color on the plastic register caps and attached to the meter in form 39 bar code using a separate tag. Paper or plastic number labels affixed to the register are not acceptable.

7. MEASURING TURBINES

Measuring turbines shall be made of materials in accordance with AWWA C701.

8. TURBINE SPINDLES

Turbine spindles shall be made of stainless steel or monel.

9. EXTERNAL FASTENERS

External fasteners shall be stainless steel in accordance with AWWA C701.

10. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372, and a copy of the certification shall be provided to Triview Metropolitan District , if requested.

11. DOCUMENTATION

The meter shall have a firmly attached tag documenting the Manufacturer's serial number, the Triview Metropolitan District meter number, a form 39 bar code representation of the Triview Metropolitan District meter number, the Manufacturer's certified test results, and other identifying characteristics such as nominal size, Manufacturer, meter model number, and register type and model.

12. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models	Size (Inch)
Badger Meter, Inc.	Recordall Turbo Series Meter	1 1/2 to 12
Neptune Technology Group	High Performance (HP) Turbine Meter	1 1/2 to 10

Material Specification – 18
Magnetic Drive Turbine Type Water Meters

Material Specification – 19

MAGNETIC DRIVE TURBINE TYPE FIRE SERVICE WATER METERS

1. GENERAL

Magnetic drive turbine type fire service water meters, 3-inch through 10-inch, shall be manufactured in accordance with AWWA C703 with the following additional requirements or exceptions.

2. SIZES

This Specification covers magnetic drive turbine type fire service water meters in 3-inch through 12-inch nominal diameters.

3. METER DESCRIPTION

Main casings of the meter, internal parts, and strainers shall be designed for easy removal. Strainers, stainless steel mounting bolts, and flange gaskets shall be furnished with each meter. The strainer shall be UL listed or FM approved.

4. METER MAIN CASES/FLANGES

Meter main cases shall be made of CI in accordance with AWWA C703.

Flanges shall be an integral part of the main case and composed of the same material as the case; flanges shall not be removable from the main case and shall not have slotted holes. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207. A test port shall be supplied on the outlet side of the meter.

5. MAINLINE METER

The mainline meter shall be a turbine type meter that shall be UL listed or FM approved.

6. BYPASS METER

The bypass meter may be the turbine type or the compound type. Ball valves shall be installed directly upstream of the meter and downstream of the bypass meter check valve.

7. REGISTERS/REGISTER BOXES

Meter registers and register boxes shall be in accordance with [MS-15](#).

8. METER NUMBERS

The Triview Metropolitan District meter number shall be plainly stamped or engraved on the meter main case; it shall be heat stamped in a contrasting color on the plastic register caps and attached to the meter in form 39 bar code using a separate tag. Paper or plastic number labels affixed to the register are not acceptable.

9. COATING

Main cases shall have a polymerized coating in accordance with ANSI/AWWA C550.

10. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372, and a copy of the certification shall be provided to Triview Metropolitan District , if requested.

11. DOCUMENTATION

The meter shall have a firmly attached tag that documents the Manufacturer's serial number, the Triview Metropolitan District meter number, a form 39 bar code representation of the Triview Metropolitan District meter number, the Manufacturer's certified test results, and other identifying characteristics such as nominal size, Manufacturer, meter model number, and register type and model.

12. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models
Badger Meter, Inc.	Fire Series Assembly
Neptune Technology Group	HP Fire Service Turbine Meter

Material Specification – 19

Magnetic Drive Turbine Type Fire Service Water Meters

Material Specification – 20

NORMAL WEIGHT AND PRECAST CONCRETE

1. GENERAL

Normal weight and precast concrete shall be provided in accordance with ACI 301 with the following additional requirements or exceptions.

2. CONCRETE MIX SUBMITTAL

A minimum of 10 days prior to beginning concrete work, concrete mix designs in accordance with ACI 301 shall be submitted for approval by Triview Metropolitan District. Changes shall not be made in the amounts or sources of the approved mix ingredients without Triview Metropolitan District's written approval. Production inspection and field testing of the approved mix may be made by Triview Metropolitan District.

3. CONCRETE PRODUCTS

A. Cementitious Materials:

- 1) Type II Portland cement in accordance with ASTM C 150.
- 2) Fly ash may be used in concrete mixes in accordance with ASTM C 618. The maximum amount of fly ash shall be 20% by weight of the total cementitious materials. Fly ash additions to the mix shall be on a cement substitution basis.

B. Aggregates:

- 1) Fine aggregate shall be in accordance with the grading and quality requirements of ASTM C 33.
 - a) Natural sand or a blend of natural sand.
 - b) Crushed sand provided the quantity of crushed sand is no more than 50% of the total sand by dry weight.
- 2) Coarse aggregate shall be in accordance with the grading and quality requirements of ASTM C 33 for Size No. 57, No. 67, or No. 467.
- 3) If the aggregates used are known to be reactive with high alkali cement in accordance with ASTM C 295 or if the reactivity of the aggregate is not known, the use of low alkali cement is required to ensure adequate protection from alkali-aggregate reaction.

C. Water shall be in accordance with the requirements of ASTM C 94.

D. Admixtures:

- 1) Admixtures that do not contain calcium chloride and are in accordance with ASTM C 494 for concrete may be used.
- 2) Admixtures shall be compatible with cement and other admixtures.
- 3) Admixtures shall be produced by one Manufacturer.
- 4) An air-entraining agent shall be used in accordance with ASTM C 260 and added to the batch in accordance with ASTM C 94.
- 5) Damages or difficulties that occur due to the use of admixtures are the responsibility of the user. Triview Metropolitan District will not provide compensation for the concrete due to such difficulties. The use of admixtures shall in no way relieve the responsibility for the protection and curing of concrete.

4. CONCRETE PROPORTIONS

- A. Class A: Minimum 28-day compressive strength of 4,000 psi when molded and cured in accordance with ASTM C 31. It shall be used for structural and precast concrete.
- B. Class B: Minimum 28-day compressive strength of 2,500 psi when molded and cured in accordance with ASTM C 31. It shall be used exclusively for concrete kickblocks.

Concrete shall be air-entrained to a total air content of 5% plus 2% or minus 1% of the volume of the batch. The minimum slump shall be 2-inches and the maximum slump shall be 4-inches as tested in accordance with ASTM C 143.

Fine aggregates shall be between 36% and 44% by volume of the total aggregates in the concrete.

5. ENFORCEMENT OF STRENGTH REQUIREMENTS

Triview Metropolitan District will have the right to require changes in the proportions of the concrete mix to be used on the remainder of the work if the strengths by the laboratory cured test specimens made, and tested in accordance with the provisions of the Standards and evaluated by the methods recommended in ACI 318, fall below the specified values.

Triview Metropolitan District may require a minimum of three concrete cores to be drilled in the manner described in ASTM C 42 and tested for compressive strength in the manner described in ASTM C 39 for each portion of the work where the laboratory cured concrete test cylinders indicate a failure to meet the specified strength requirement within the specified time.

If the results of this test do not satisfy the strength requirements of this Standard, Triview Metropolitan District has the right to require the strengthening or replacement of those portions of the structure that failed to develop the required strength.

Material Specification – 20

Normal Weight and Precast Concrete

Material Specification – 21

CONTROLLED LOW STRENGTH BACKFILL MATERIAL

1. GENERAL

CLSM shall be manufactured in accordance with the following requirements.

2. CLSM MIX SUBMITTAL

A minimum of 2 days prior to beginning CLSM work, CLSM mix designs shall be submitted to Triview Metropolitan District for approval. Changes shall not be made in the amounts or sources of the approved mix ingredients without Triview Metropolitan District's written approval; production inspection and field testing may be made by Triview Metropolitan District .

3. CLSM FLOW FILL

A. General Requirements:

- 1) Flow fill is permitted in the pipe zone, the backfill above the pipe zone, and as general backfill.
- 2) Cement shall be Type II Portland cement in accordance with ASTM C 150.
- 2) Fly ash shall be in accordance with ASTM C 618, Type C or Type F.
- 3) Fine aggregate grading and quality requirements shall be in accordance with ASTM C 33.
- 4) Coarse aggregate grading and quality requirements shall be in accordance with ASTM C 33.
- 5) Water shall be in accordance with ASTM C 94.
- 6) Chemical admixtures shall be in accordance with ASTM C 494 and compatible with other admixtures. They shall not contain calcium chloride.
- 7) Air-entraining admixtures shall be in accordance with ASTM C 260.

B. Pipe Zone:

- 1) Unconfined compressive strength at 28 days shall be 50 psi to 150 psi when molded and cured in accordance with ASTM D 4832.
- 2) Removability modulus less than 1.5 when calculated by:

$$RE = \frac{W^{1.5} \times 104 \times C^{0.5}}{10^6}$$

Where: W=unit weight in pounds per cubic foot and C=28 day unconfined compressive strength.

- 1) Maximum air content of 8%.

C. Above Pipe Zone and General Backfill:

- 1) Meeting the requirements of the authority having jurisdiction.
- 2) Unconfined compressive strength at 28 days shall be 50 psi to 150 psi when molded and cured in accordance with ASTM D 4832.

- 3) Air content shall be in accordance with the authority having jurisdiction; typically greater than the maximum pipe zone air content.
- 4) Removability modulus of 1.5.

4. CLSM FLASH FILL

A. General Requirements:

- 1) Flash fill is permitted in the pipe zone, the backfill above the pipe zone, and as general backfill.
- 2) Flash fill shall not be used as a wearing surface.
- 3) Fly ash shall be in accordance with ASTM C 618, Type C or Type F.
- 4) Air-entraining admixtures shall be in accordance with ASTM C 260.
- 5) Foaming agents shall be in accordance with ASTM C 869 and C 796.

B. Pipe Zone:

- 1) Unconfined compressive strength at 28 days shall be 50 to 150 psi when molded and cured in accordance with ASTM D 4832.
- 2) Removability modulus less than 1.5 when calculated by:

$$RE = \frac{W^{1.5} \times 104 \times C^{0.5}}{10^6}$$

Where: W=unit weight in pounds per cubic foot and C=28 day unconfined compressive strength.

- 3) Maximum air content of 8% as calculated below.
- 4) Not air-entrained.
- 5) No foaming agent allowed.

C. Above Pipe Zone and General Backfill:

- 1) Meeting the requirements of the authority having jurisdiction.
- 2) Unconfined compressive strength at 28 days shall be 50 psi to 150 psi.
- 3) Removability modulus of 1.5.
- 4) Minimum air content for resistance to frost-heave of 15% when tested in accordance with ASTM C 231 or by volumetric calculation using the following equation:

$$\text{Air Content} = \frac{(\text{Unit weight no foam} - \text{Unit weight foam}) \times 100\%}{\text{Unit weight no foam}}$$

Material Specification – 21
Controlled Low Strength Backfill Material

Material Specification – 22

CONCRETE REINFORCEMENT

1. GENERAL

Deformed reinforcing bars shall be in accordance with ASTM A 615, Grade 40 or 60. Welded steel wire fabric shall be in accordance with ASTM A 185, except that the weld shear strength requirement shall be extended to include a wire size differential up to and including 6 gauges.

*Material Specification – 22
Concrete Reinforcement*

Material Specification – 23

BRASS AND BRONZE GOODS

1. GENERAL

Brass and bronze goods in contact with potable water shall be manufactured in accordance with AWWA C800 using lead-free copper alloy UNS No. C89520 or copper alloy UNS No. C89833 in accordance with ASTM B 584.

Components not in contact with potable water shall be manufactured in accordance with AWWA C800 using copper alloy UNS No. C83600, commercially known as 85-5-5, in accordance with ASTM B 62 with the following additional requirements or exceptions.

Each Manufacturer shall submit samples to Triview Metropolitan District for testing. If the Manufacturer is approved, the sample shall be kept by Triview Metropolitan District and used as the standard by which future purchases will be compared.

2. TAPPING SADDLES

Double bronze strapped tapping saddles for use with DI and AC pipe shall be as follows. Outlet threads shall be AWWA Standard taper threads.

Manufacturers	Models	Size (Inch)
A.Y. McDonald	3825	4 to 20
The Ford Meter Box Company	202BS-xxx-Tap	4 to 20
	202BSD-xxx-Tap	4 to 20
Mueller Company	BR2B	4 to 20

Bronze saddles for PVC pipe shall provide full support around the circumference of the pipe, have a bearing area of sufficient width along the axis of the pipe so that the pipe will not be distorted when the saddle is tightened, and be as follows:

Manufacturers	Models	Size (Inch)
A.Y. McDonald	3805	4 to 12
	3895	4 to 8
The Ford Meter Box Company	S70-xxx-NL	4 to 12
	S90-xxx-NL	4 to 12
Mueller Company	H-13000 Series (C900)	4 to 12
	H-13400 Series (C900)	4 to 12
	S-13000 Series (C900)	4 to 8

Bronze and stainless steel saddles for PVC pipe 14-inch and larger shall provide full support around the circumference of the pipe, have a bearing area of sufficient width along the axis of the pipe so that the pipe will not be distorted when the saddle is tightened, and be as follows:

Manufacturers	Models	Size (Inch)
A.Y. McDonald	3845	4 to 20
The Ford Meter Box Company	202BS-xxx-Tap	4 to 20

3. METER YOKES (COPPER SETTERS)

Meter yokes shall be as follows:

Manufacturers	Models	Copper Meter Setter Size (Inch)
A.Y. McDonald	737-3xxWXCC xx	3/4
	737-4xxWXCC xx	1
	720-B612WWxx 660	1 1/2, Bypass
	721-612WNxx 660	1 1/2, No Bypass – IRR Meters
	720-B712WWxx 770	2, Bypass
	721-712WNxx 770	2, No Bypass – IRR Meters
The Ford Meter Box Company	V83-xxW-22-xx-NL	3/4
	V84-xxW-22-xx-NL	1
	VBB76-12B-xx-xx-NL	1 1/2, Bypass
	VBB76-12-xx-xx-NL	1 1/2, No Bypass – IRR Meters
	VBB77-12B-xx-xx-NL	2, Bypass
	VBB77-12-xx-xx-NL	2, No Bypass – IRR Meters
Mueller Company	B-2489N	3/4
	B-2489N	1
	B-2423N	1 1/2 and 2, Bypass
	B-2422-00N	1 1/2 and 2, No Bypass – IRR Meters

4. CORPORATION STOPS

Corporation stops shall be AWWA Standard taper thread by copper flare as follows:

Manufacturers	Models	Size (Inch)
A.Y. McDonald	74701B	3/4 to 2
Cambridge Brass	302NL Series	3/4 to 1

Manufacturers	Models	Size (Inch)
The Ford Meter Box Company	FB-600-x-NL	3/4 to 2
Mueller Company	B25000N	3/4 to 2

5. CURB STOPS

Curb stops shall be copper flare by copper flare as follows:

Manufacturers	Models	Size (Inch)
A.Y. McDonald	76100	3/4 to 2
Cambridge Brass	202NL-CxCx Series	3/4 to 2
The Ford Meter Box Company	B22-xxx-NL	3/4 to 2
Mueller Company	B25204N	3/4 to 2

6. COUPLINGS

Manufacturers	Types	Models	Size (Inch)
A.Y. McDonald	CTS Coupling	74758-22	3/4 to 2
The Ford Meter Box Company	Iron to Copper Pack Joint	C84-66-NL	1 1/2 x 1 1/2
		C84-77-NL	2 x 2
	Copper Flare to Copper Flare	C22-33-NL	3/4 x 3/4
		C22-44-NL	1 x 1
		C22-66-NL	1 1/2 x 1 1/2
		C22-77-NL	2 x 2
	Copper to Copper Pack Joint	C44-66-NL	1 1/2 x 1 1/2
		C44-77-NL	2 x 2
	Iron to Iron Pack Joint	C85-66-NL	1 1/2 x 1 1/2
		C85-77-NL	2 x 2
	Flared Adapter Coupling	C28-66-NL	1 1/2 x 1 1/2
		C28-77-NL	2 x 2
	Flared Coupling Adapter Loc-Pak	CF35-66-NL	1 1/2 x 1 1/2
		CF35-77-NL	2 x 2
Mueller Company	Copper Flare to Copper Flare	H-15400N	3/4 to 2

7. COMPRESSION FITTINGS

Manufacturers	Types	Models	Size (Inch)
A.Y. McDonald	Mac-Pak Compression Fittings	74753-22	3/4 to 2
	T Compression Fittings	74753T	3/4 to 2
Mueller Company	Compression Connection	H-15403N	3/4 to 2

8. PRESS FITTINGS

Press fittings shall have Buna-N sealing elements and be as follows:

Manufacturer	Type	Model	Size (Inch)
Viega	ProPress Coupling with Stop	2915	1/2 to 2

9. STOP AND WASTE VALVES

Manufacturers	Models	Size (Inch)
The Ford Meter Box Company	Z22-333SW-NL	3/4
	Z22-444SW-NL	2
Mueller Company	H-15214N	3/4 to 2

10. GATE VALVES

Gate valves, 2-inch and smaller, shall be all bronze, screwed bonnet and ends, single solid wedge gate, with non-rising stems rated at 125 psi SWP and 200 psi CWP, as follows:

Manufacturers	Models	Size (Inch)
Apollo	102T LF	1/4 to 3
Crane	LF 438	1/4 to 3
Milwaukee	Gate UP105	1/4 to 2
Nibco	113-LF	1/4 to 2
Stockham	LFB-103	1/4 to 3

11. SWING CHECK VALVES

Check valves, 2-inch and smaller, shall be all bronze body and cap, threaded ends and cap, Y-pattern, swing type disc, rated 125 psi SWP and 200 psi WOG, as follows:

Manufacturers	Models	Size (Inch)
Apollo	161T-LF, 161 S-LF	1/4 to 2
Crane	LF 37	1/2 to 2

Manufacturers	Models	Size (Inch)
Nibco	S-43-Y-LF, T-413-Y-LF	1/2 to 2
Stockham	LFB-319Y	1/4 to 2

12. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372, and a copy of the certification shall be provided to Triview Metropolitan District , if requested.

Material Specification – 23
Brass and Bronze Goods

Material Specification – 24

WATER SERVICE LINE PIPE

1. GENERAL

Water service line pipe shall be manufactured in accordance ASTM B 88 with the following additional requirements or exceptions.

2. SIZES

This Specification covers water service line pipe in 3/4-inch, 1-inch, 1 1/4-inch, 1 1/2-inch, and 2-inch nominal diameters.

3. PIPE MATERIAL

Water service line pipe shall be seamless copper water tube in accordance with ASTM B 88, furnished in coils, annealed, Type K Copper UNS No. 12200.

4. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

5. PLACE OF MANUFACTURE

Water service line pipe installed in the Town of Monument of Triview Metropolitan District and Total Service Contract Areas shall be manufactured domestically.

6. APPROVED MANUFACTURERS

Cambridge-Lee Industries
Cerro Flow Products
CMC Howell Metal
Mueller Industries
Wieland Copper

*Material Specification – 24
Water Service Line Pipe*

Material Specification – 25

METER PITS, DOMES, AND LIDS

1. GENERAL

Meter pits, domes, and lids shall be manufactured in accordance with the following requirements.

2. METER PIT

Meter pits shall be constructed as cylindrical concrete or plastic pits 24-inches in diameter and 52-inches to 78-inches deep with a metal dome or bell housing double lid of frost proof construction that fits a 20-inch ID concrete or plastic meter pit top ring.

The meter pit shall consist of a 24-inch nominal diameter by a 48-inch high cylinder of concrete or plastic with at least two units. The base unit shall have two doghouse cutouts 3-inches wide by 4-inches high and located 180 degrees apart to accommodate the service line tubing. The top unit shall have a shelf or tapered design to support a standard dome or bell housing with a 20-inch nominal diameter.

A. Concrete meter pits shall consist of a combination of two to four precast concrete rings that total 48-inches in height; the top ring shall not exceed 12-inches in height. The rings shall have a 2-inch minimum wall thickness and be suitably reinforced to minimize breakage during installation and use. The rings shall be constructed of concrete in accordance with these Specifications and ASTM C 478.

B. Plastic meter pits shall be of a 2-piece design with a nominal 24-inch diameter by 36-inch high base unit and a 12-inch top unit that tapers from a 24-inch diameter to accept a standard 20-inch diameter dome unit. The units shall be constructed of LMDP with a wall thickness of no less than 0.5-inches.

The assembled meter pit shall be able to bear a 20,000 pound vertical load when distributed evenly over the top rim of the top unit. The meter pit shall be able to withstand a 200 pound lateral load applied with a 4-inch square plate positioned one-inch below the top of the pit with a maximum deflection of one-inch. The base unit shall have a 3-inch flange at the bottom of the base unit, and a molded flange near the top of the base section to resist settling and provide additional resistance to deformation from lateral loads during backfilling. The meter pit shall be black on its exterior and bright white on its interior. The Manufacturer's name and model number shall be cast or printed on each piece. Grade adjustment rings from the same Manufacturer shall be used to raise the top of the pit to grade or accommodate the plumb pit to angled grades.

3. METER PIT DOME ASSEMBLY

The meter pit dome or bell housing shall be made of grey CI in accordance with ASTM A 48, Class 35B. It shall have a nominal 20-inch bottom diameter that tapers to a nominal 12-inch diameter opening at the top with a height of 10-inches to 12-inches. The dome or bell housing shall have an inside lip to support an inner frost lid and an upper lip to accommodate the locking mechanism of the meter pit lid.

When installed on a meter pit top ring, the dome shall be rated for AASHTO H 20 highway loading plus impact not to exceed 20,000 pounds, tested in accordance with AASHTO M306 without any damage or permanent deformation.

- A. Meter pit lid: The cap type top lid shall be grey CI in accordance with ASTM A 48, Class 35B or high-impact, no-break Hydrozone HD composite or other approved fiber-reinforced polymer material. The CI lid shall have a center hole that is 2-inches in diameter to accept the AMR/AMI device.

Composite lids shall withstand a temperature range from -40°F to 90°F and shall be resistant to ultraviolet light degradation. Top lids shall be furnished with a worm-gear locking bolt with a large 5-sided brass nut. The lid shall be rated for AASHTO H 20 highway loading plus impact not to exceed 20,000 pounds and shall be tested in accordance with AASHTO M306 without any damage or permanent deformation. Meter pit lids shall have the words Triview Metropolitan District Meter cast or imprinted on them.

- B. The inner frost lid shall be molded of high-density polyethylene. The frost lid shall be 12-inch diameter and at least 1/8-inch thick. The frost lid shall be dish-shaped with a recess that is 2-inches to 3-inches deep with three to five 1/4-inch diameter drainage holes located around the edge of the recessed area. There shall be a 1/4-inch wide notch the full width of the top lip and a lifting tab that projects 2-inches inward with a 9/16-inch or larger hole.

4. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models
Concrete Meter Pits	
Copeland Precast, Inc.	
Oldcastle Precast	
Forterra Precast	
Plastic Meter Pit – Potable	
Carson Industries (Oldcastle Enclosure Solutions)	0024-48B Body B-W 2 MsHL (Triview Metropolitan District)
Sigma Corporation	RMP202448-FB-DW
Plastic Meter Pit – Nonpotable	
Carson Industries (Oldcastle Enclosure Solutions)	0024-48B Body B-P 2 MsHL (Triview Metropolitan District)
Sigma Corporation	RMP202448-FB-DW

Meter Pit Dome Assembly	
Manufacturers	Models
Bingham & Taylor	IFLW20DWM
EJ	00842004
Sigma Corporation	MBSW3DTH-35
Star Pipe Products	MB1014W

Composite Meter Pit Lid	
Manufacturers	Models
EJ	Composite Lid Triview Metropolitan District Model (1200 Series)
Nicor, Inc.	Composite Lid 125SDENI

Composite Meter Pit Extensions (Off-Grade)	
Manufacturers	Models
Potable	
Carson Industries (Oldcastle Enclosure Solutions)	0020-7 B EXT B-W, 0020-15 B EXT B-W, 0020-22 B EXT B-W
Sigma Corporation	RMP20- EXT12-DW
Nonpotable	
Carson Industries (Oldcastle Enclosure Solutions)	0020-7 B EXT B-P, 0020-15 B EXT B-P, 0020-22 B EXT B-P
Sigma Corporation	RMP20- EXT12-DW

*Material Specification – 25
Meter Pits, Domes, and Lids*

Material Specification – 26

WAX TAPE MATERIAL

1. GENERAL

Wax tape material shall be manufactured in accordance with the following requirements:

The wax tape coating system shall be 3-part, cold-applied consisting of primer, wax tape, and tape outerwrap in accordance with NACE RP0375 and AWWA C217.

The wax tape coating system is for coating DI pipe, flanges, couplings, valves, and appurtenances in manholes and vaults that are not equipped with a sump pump.

2. MATERIALS

A. Primer:

- 1) Description: Blend of petrolatums, plasticizers, and corrosion inhibitors having a paste-like consistency.
- 2) Approved materials: Trenton Wax-Tape Primer or Denso Paste.
- 3) Properties:
 - a) Color: Brown.
 - b) Pour point: 37.8°C to 43.3°C (100° to 115°F).
 - c) Flash point: 76.7°C (350°F).
 - d) Coverage: 0.41 L/M² (1 gallon/100 sq. ft.).

B. Wax Tape:

- 1) Description: Plastic-fiber felt, saturated with a blend of petrolatums, plasticizers, and corrosion inhibitors forming a tape-coating that is easily formable over irregular surfaces.
- 2) Approved materials: Trenton Wax-Tape #1 or Densyl.
- 3) Properties:
 - a) Color: Brown for potable water; purple for recycled water.
 - b) Saturant pour point: 46.1°C to 48.9°C (115°F to 125°F).
 - c) Thickness: Minimum 46-mils.
 - d) Tape width: 6-inches.
 - e) Dielectric strength: 170 V/mil.

C. Mastic:

- 1) Description: Cold-applied, self-adhesive, moldable, and self-supporting petroleum and polymer based mastic for sealing and filling metal substrates, irregular shaped fittings, couplings, and other areas difficult to yield a smooth surface.
- 2) Approved materials: Trenton Fill Pro PM-GP or Denso Densyl Mastic.
- 3) Properties:
 - a) Color: Brown.
 - b) No cure time required.
 - c) Application temperature: 0°F to 110°F.
 - d) Flashpoint: 76.7°C (350°F).

D. Tape Outerwrap:

- 1) Description: PVC plastic with three 50-gauge plies wound together as a single sheet.
- 2) Approved materials: Trenton Poly-Ply or Denso Poly-Wrap.
- 3) Properties:
 - a) Color: Clear for potable water; purple for recycled water.
 - b) Thickness: 1.5-mils.
 - c) Dielectric strength: 2,000 V/mil.
 - d) Tape width: 6-inches.
 - e) Water absorption: Negligible.

3. APPROVED MANUFACTURERS

Denso North America
The Trenton Corporation

Material Specification – 26
Wax Tape Material

Material Specification – 27

FLANGED IN-LINE BASKET STRAINER

1. GENERAL

Flanged in-line basket strainers shall be fabricated from CI in accordance with ASTM A 48, Class 35B with the following additional requirements or exceptions. Strainers shall be approved by the NFPA and/or Underwriters Laboratories and used for turbine meters where required by these Standards. Unless approved in advance by the Meter Inspector, the strainer shall be the same brand as the meter.

2. FLANGES

Flanges shall be sized and drilled in accordance with ANSI B16.1, Class 125. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA C207.

3. COVER PLATES

Strainers shall be provided with a removable, bolted top cover plate for the inspection and removal of the basket and debris. A 3/4-inch drain valve and a 3/4-inch vent valve shall be provided on the bottom and the top, respectively.

4. BASKETS

Strainer baskets shall be fabricated from stainless steel alloy UNS S31600 or high impact plastic and have a net open area of at least four times the nominal size of the pipe in which the strainer is installed. The basket shall be easily removable from the strainer for periodic inspection and maintenance.

5. WORKING PRESSURE

Strainers shall be designed for a working pressure of 150 psi. Maximum head loss shall be 4 psi at maximum rated flow capacity.

6. INSTALLATION

Spacing between the strainer and the meter is critical to the accurate measurement of water for billing purposes. Strainers shall be installed in accordance with the meter Manufacturer's installation guidelines. Only strainers designated for bolt-on design shall be directly connected to the water meter. Recommended or required lengths of straight pipe before and after the strainer shall be observed.

7. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District, if requested.

8. APPROVED MANUFACTURERS

Badger Meter, Inc.
Neptune Technology Group

Material Specification – 27
Flanged In-Line Basket Strainers

Material Specification – 28

CONCRETE VAULTS

1. GENERAL

Materials used to construct the vault shall be in accordance with [MS-20](#) and [MS-21](#). Manholes, reducing sections, ladder rungs, and traffic lids shall be precast in accordance with ASTM C 478 with the following additional requirements or exceptions. If Triview Metropolitan District requires future access, the vaults shall be cast with a removable lid section. The vault and the individual components thereof (i.e., the lid, the walls, and the base slab) shall be adequately designed to handle applicable loads. Concrete vault design calculations shall be provided to Triview Metropolitan District .

2. TRAFFIC LIDS AND ROOFS

Traffic lids and roofs shall be designed for AASHTO H 20 loading. The roof slab shall be a minimum of 8-inches thick. The opening through the roof shall be 36-inches in diameter. Additional reinforcement shall be added around the opening at 45-degree angles to the edges and shall extend a minimum of 2-feet beyond the opening. However, when the placement of the lid precludes this extension, the ends of the reinforcing bars shall be standard 180-degree hooks.

If a removable lid is required, it shall be cast in sections in which the individual weight does not exceed 7,500 pounds, assuming the reinforced concrete weighs 150 pounds per cubic foot. Approved engineered lifting embeds shall be provided in the sections for lifting and shall be perpendicular to the face of the lid surface. Embeds shall not displace any of the required reinforcement nor shall they protrude from either face of the roof. Embeds shall be placed in such a manner that when lifting cables are being used there is an equal distribution of weight on the cables.

3. WALLS

All four walls on cast-in-place vaults shall be cast in one monolithic and continuous placement. Corners shall have added reinforcement. The walls shall be doweled into the floor. Precast vault walls shall be connected by a plate and bolt type arrangement. Precast walls shall be appropriately secured to the floor slab. The minimum wall thickness shall be 5-inches with the reinforcement being at least one-inch from the inner face of the vault.

4. BASE SLAB

Slabs shall be cast-in-place or precast unless precast base sections are shown or specified. The Manufacturer may cast vaults wherein the base slab is integral with the wall sections, except for butterfly valve assemblies.

5. APPROVED MANUFACTURERS

Copeland Precast, Inc.
Forterra Precast
Lindsay Precast
Oldcastle Precast
Rinker Materials

Material Specification – 28
Concrete Vaults

Material Specification – 29

JOINT RESTRAINTS

1. GENERAL

Mechanical joint restraints shall be manufactured of DI in accordance with ASTM A 536 with the following additional requirements or exceptions.

Mechanical joint restraints shall be incorporated into the design of a follower gland. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts in accordance with AWWA C111 and C153.

2. DESCRIPTION

The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges that are designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized the same as tee-head bolts, shall be used to ensure the proper actuating of restraining devices. When the nut is sheared off, a standard hex nut shall remain.

3. PRESSURE RATING

The mechanical joint restraint device shall be as listed as follows:

Type of Pipe	Size (Inch)	Pressure Rating (psi)	Safety Factor
DI	3 to 16	350	2
	20 to 36	250	2
PVC	Various	Equal to that of the pipe being used	2

4. MATERIAL

The mechanical joint restraint gland and wedge assembly shall be manufactured from DI in accordance with ASTM A 536, Grade 65-45-12. Wedges shall be heat treated to a minimum of 370 BHN. Rubber gaskets shall be vulcanized styrene butadiene rubber (SBR) in accordance with AWWA C111. Tee-head bolts shall be manufactured from a high strength low alloy steel known in the industry as Cor-Ten, Usalloy, or Durabolt.

5. APPROVED MANUFACTURERS AND MODELS

Mechanical Joint Restraint – PVC Pipe		
Manufacturers	Models	Size (Inch)
EBAA Iron, Inc.	Megalug 2000 PV Series	4 to 20
The Ford Meter Box Company	UFR 1500R	4 to 6
	UFR 1500	4 to 20
Romac Industries	RomaGrip	4 to 20

Mechanical Joint Restraint – PVC Pipe		
Manufacturers	Models	Size (Inch)
Sigma Corporation	One-Lok SLCE Series	4 to 20
SIP Industries	EZ Grip	4 to 20
Smith Blair	Cam-Lock	4 to 20
Star Pipe Products	StarGrip Series 4000	4 to 20
	StarGrip Series 4000G2	4 to 12
Tyler Union	TufGrip	4 to 20

Mechanical Joint Restraint – DI Pipe		
Manufacturers	Models	Size (Inch)
EBAA Iron, Inc.	Megalug 1100 Series	3 to 20
The Ford Meter Box Company	UFR Series 1400	3 to 20
Romac Industries	RomaGrip	3 to 20
SIP Industries	EZ Grip	3 to 20
Sigma Corporation	One-Lok SLDE Series	3 to 20
Smith-Blair	Cam-Lock	3 to 20
Star Pipe Products	StarGrip 3000 Series	3 to 20
Tyler Union	TufGrip	3 to 20

Bell-Spigot Restraint – PVC Pipe		
Manufacturers	Models	Size (Inch)
Diamond Plastics Corporation	Diamond Lok-21	4 to 20
EBAA Iron, Inc.	Series 1500 TD	4 to 12
	Series 1500	4 to 12
	Series 2800	14 to 20
The Ford Meter Box Company	Ford 1390	4 to 20
JM Eagle	Eagle Loc 900	4 to 16
North American Pipe	C900/RJ	4 to 20
	C900/RJIB Certalok	6 to 12
Romac Industries	ALPHA Coupling, Flange Coupling, and End Cap	4 to 12

Bell-Spigot Restraint – PVC Pipe		
Manufacturers	Models	Size (Inch)
SIP Industries	EZ Grip PTP	4 to 20
Sigma Corporation	PV-Lok PWP	4 to 20
Star Pipe Products	Series 1100	4 to 20

Bell-Spigot Restraint – DI Pipe		
Manufacturers	Models	Size (Inch)
American	Fast-Grip Gasket	4 to 20
	Flex-Ring Joint	4 to 20
EBAA Iron, Inc.	Megalug 1700 Series	4 to 20
	Series 1500 TD	4 to 12
The Ford Meter Box Company	UFR Series 1455	4 to 20
Gripper Gasket LLC	Boltless Restraint	3 to 20
McWane Ductile	Sure Stop 350	4 to 20
Romac Industries	ALPHA Coupling, Flange Coupling, and End Cap	4 to 12
Sigma Corporation	One-Lok SLDEH Series	3 to 20
Star Pipe Products	StarGrip 3100P Series	3 to 20
U. S. Pipe and Foundry Company	Field Lok Gasket	4 to 20
	TR Flex	4 to 20

Bolt-Through Mechanical Joint Restraint		
Manufacturers	Models	Size (Inch)
In Fact Corporation	Foster Adaptor	3 to 20
Star Pipe Products	Series 100 MJ x MJ Adapter	4 to 12

Hydrants and Valve Restraint – DI Pipe	
Manufacturer	Model
Mueller	Aquagrip Restraint Device

Material Specification – 29
Mechanical Joint Restraint

Material Specification – 30

BOLTED SLEEVE-TYPE COUPLINGS

1. GENERAL

Bolted sleeve-type couplings shall be manufactured in accordance with AWWA C219 with the following additional requirements or exceptions.

2. SERVICE

Bolted sleeve-type couplings may be installed on CI, DI, and PVC pipe. Components shall be suitable for exposure to chloraminated water.

3. SIZES OF COUPLINGS

This Specification covers bolted sleeve-type couplings in 3-inch through 20-inch nominal diameters.

4. COATING

End rings and the center sleeve shall be coated in accordance with AWWA C210 or C213 with a minimum DFT of 12-mils.

5. BOLTS

Bolts and heavy hex nuts shall be fabricated from high strength low alloy steel known in the industry as Cor-ten, Usalloy, or Durabolt. The Manufacturer shall supply information as to the recommended torque to which the bolts shall be tightened.

6. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

7. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models	Size (Inch)
Dresser	38 and 138	3 to 20
The Ford Meter Box Company	Style FC1	4 to 12
JCM Industries	241 and 242	3 to 16
Romac Industries	XR501	4 to 12
Smith-Blair	411	3 to 20

*Material Specification – 30
Bolted Sleeve-Type Couplings*

Material Specification – 31

SUPERVISORY CONTROL AND DATA ACQUISITION

1. GENERAL

SCADA equipment listed in this Specification needs to be approved by Triview Metropolitan District.

2. PLC FOR CONTROL SYSTEMS

PLC for control systems needs to be preapproved by Triview Metropolitan District's Process Control Section.

3. PRESSURE TRANSMITTERS

Pressure transmitters shall be Rosemount 3051S Series with 4 mA to 20 mA transmitter output, an LCD display, and NSF/ANSI 61 certified when required.

4. CONTROL ENCLOSURES

Control enclosures shall be Hoffman enclosures.

5. FLOW TRANSMITTERS

Flow transmitters shall be Rosemount differential pressure transmitter model 3051S Series with 4 mA to 20 mA transmitter output, an LCD display, and NSF/ANSI 61 certified when required. Two transmitters are required for flow indications. The high range transmitter shall be calibrated to 25% of the maximum design flow rate.

6. INTRUSION ALARMS

The limit switches for intrusion alarms shall be heavy duty precision turret head type. The limit switch assembly shall be enclosed in a die cast zinc standard box that is oil-tight and watertight with DPDT snap action, silver alloy type contacts. The turret head shall be a standard pretravel spring return with Viton shaft seals on the lever arm; the plunger and wobble stick boots shall be made of neoprene. The lever arm shall be operable in clockwise and counter-clockwise directions.

7. WATER ON THE FLOOR ALARMS

Water on the floor alarms shall not contain mercury. The float shall be SPDT and the alarm shall be wired normal closed.

8. PRESSURE SIGHT GAUGES

Pressure sight gauges shall be industry general service Grade 1A, 1.0% F.S. accuracy, 12-inch diameter face, epoxy painted aluminum case, AISI Type 316 stainless steel drawing C bourdon tube and socket, 1/4-inch NPT bottom piping connection, calibrated zero to maximum operational psi.

9. TERMINAL BLOCKS

Terminal blocks shall be Phoenix Controls UK 6, UK 6-FSI/C, UK 4-TG, and UK 5-MTK-P/P; din rail-mount with disconnect. Knife, plug, or lever fuse disconnects preferred.

10. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. A copy of the certification shall be provided to Triview Metropolitan District, if requested.

*Material Specification – 31
Supervisory Control and Data Acquisition*

Material Specification – 32

FIRE HYDRANT METERS

1. GENERAL

Fire hydrant meters shall be manufactured in accordance with AWWA C701 with the following additional requirements or exceptions.

2. DESCRIPTION

The meter housing shall be aluminum with straightening vanes, strainer, fire hose couplings, and a gate valve positioned after the meter or required BFP assembly.

3. REGISTERS

Registers shall be straight read, permanently sealed, magnetic drive, and 100 U. S. gallon sweep.

4. MEASURING ELEMENT

The measuring element shall be easily removable for required maintenance.

5. INSTALLATIONS

The installation of a fire hydrant meter requires the installation of a Triview Metropolitan District approved BFP assembly. The meter and the BFP assembly shall be completely supported.

Fire hydrants that are used and subsequently damaged by a Contractor will be repaired by Triview Metropolitan District at the expense of the Contractor.

6. APPROVED BACKFLOW PREVENTION ASSEMBLY MANUFACTURERS

An approved USC FCCCHR BFP assembly RP shall be installed with fire hydrant meters and a gate valve.

7. BACKFLOW PREVENTION

BFP assemblies shall be manufactured in accordance with AWWA C510 and C622 and shall meet USC FCCCHR specifications.

8. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372, and a copy of the certification shall be provided to Triview Metropolitan District, if requested.

9. APPROVED METER MANUFACTURERS AND MODELS

Manufacturers	Models
Badger Meter, Inc.	Model FHM Fire Hydrant Meter
Neptune Technology Group	Fire Hydrant Meter

Material Specification – 33

MANHOLE RINGS, COVERS, AND RISERS

1. GENERAL

Manhole rings, covers, and risers shall be manufactured in accordance with the following requirements.

2. MATERIALS

Manhole rings, covers, and risers shall be made of grey CI in accordance with ASTM A 48, Class 35B or DI in accordance with the requirements of ASTM A 536, Grade 65-45-12.

Composite manhole covers shall be made of a fiber-reinforced polymer with 45% to 70% fiber reinforcement utilizing a thermoset resin matrix. Composite material shall withstand harsh corrosive environments and provide protection against ultraviolet radiation. The surface of the covers shall be non-skid. A locking mechanism suitable to Triview Metropolitan District shall be provided.

3. DESCRIPTION

Manhole rings, covers, and risers shall be heavy duty rated for AASHTO H 20 highway loading and shall be designed, manufactured, and tested in accordance with AASHTO M306.

4. FINISH

The horizontal seating and vertical facing surfaces common to the ring and cover shall be machine finished to ensure nonrocking and full bearing for the entire width and circumference of the bearing surface to permit interchangeability with castings of the same design. The vertical face common to the ring and cover shall be beveled.

5. LABELING

Covers shall be labeled with the name or symbol of the Manufacturer, country of origin, and date of manufacture to be located at the Manufacturer's option. In addition, the cover shall contain the owner's name, Triview Metropolitan District, in 1 1/2-inch high lettering that is centered and recessed on the exposed face.

6. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. A copy of the certification shall be provided to Triview Metropolitan District, if requested. The report shall include material data that is traceable to the originating foundry, traceable test bars that match, the name of the Manufacturer, and the date of the pour.

7. APPROVED MANUFACTURERS

Composite
EJ

CI and DI
D&L Foundry
Deeter Foundry, Inc.
EJ
Neenah Foundry Company
Sigma Corporation
Star Pipe Products

*Material Specification – 33
Manhole Rings, Covers, and Risers*

Material Specification – 34

TUNNELING MATERIALS

1. GENERAL

Pipe casing shall be manufactured in accordance with the following requirements.

2. CASING MATERIAL

Pipe casing shall be smooth wall welded steel cylinder fabricated in accordance with AWWA C200. It shall be round, straight, and free from defects or damage due to improper manufacturing or handling with a minimum yield strength of 35,000 psi.

Pipe casing shall be designed by the Pipe Manufacturer with sufficient wall thickness to resist the loads applied. The ID shall be at least the diameter shown on Drawings. External loading shall be AASHTO H 20 highway or railroad loading plus jacking load, E-80 railroad loading. Pipe and bulkheads shall not have exterior or interior coatings. Grout ports shall be 2-inch standard pipe half couplings attached to the casing pipe by welding, fitted with threaded galvanized iron plugs, and set on 4-foot centers.

3. CASING JOINTS

Welded joints shall have ends beveled for field welding, be butt welded with complete joint penetration welds around the entire circumference of the pipe, and be formed and accurately manufactured so that when pipes are placed together and welded they form a continuous casing with a smooth and uniform interior surface.

Interlocking joints shall be Permalok, see the Approved Manufacturers section herein.

4. CASING SPACERS

Casing spacers shall be carbon steel or stainless steel, bolt on style type with a shell made of at least two halves. The bands shall be 14 gauge at a minimum; the risers shall be 10 gauge at a minimum, and the coating shall be fusion-bonded epoxy or heat fused PVC.

The four runners shall be 11-inches long at a minimum and manufactured of high abrasion resistant, low coefficient of friction, glass filled polymer. Runner heights shall be set to center the carrier pipe in the casing.

5. COMPOSITE SLEEVE CASING SPACERS

Composite sleeve casing spacers shall be a 3-part system consisting of a unidirectional fiberglass sleeve, high strength filler, and adhesive.

A. Unidirectional Fiberglass Sleeve:

- 1) Fiberglass and polyester/vinyl ester resin.
- 2) 0.065-inch per layer 0.500-inch non-conductive PVC liner – 8-layer system.
- 3) 11.50-inch width.

B. Filler:

- 1) Compressive strength: Greater than 8,000 psi.

C. Adhesive:

1) LAP shear strength: Greater than 1,200 psi.

6. CASING END SEALS

Provide preformed end seals designed to prevent entry of water or loss of material from casing. The end seals shall be made of 1/8-inch thick 60 durometer EPDM or neoprene rubber. Wrap around seals shall overlap the casing pipe by 2-inches and shall be held on with AISI 304L stainless steel worm gear clamps held together with mastic strips to seal the edges. Custom pull-on end seals shall be seamless with vulcanized edges.

7. CARRIER PIPE

Carrier pipe, 16-inch and 20-inch, shall be welded steel pipe. Carrier pipe, 12-inches and smaller, shall be fusible PVC in accordance with MS-2 or integrally restrained joint PVC in accordance with MS-29.

DI carrier pipe, 12-inches and smaller, shall be Class 52 with flexible restrained joints and its use will be determined by Triview Metropolitan District .

8. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. A copy of the certification shall be provided to Triview Metropolitan District , if requested.

9. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models
Pipe Casing Joints	
Permalok Corporation	Permalok Interlocking Pipe Joining System
Casing Spacers	
Advance Products and Systems, Inc.	SI-12
BWM Company	SS-12
CCI Pipeline Systems	
Pipeline Seal and Insulator, Inc.	C12G
Composite Sleeve Casing Spacers	
Clock Spring Company, L.P.	
End Seals	
Advance Products and Systems, Inc.	AC, AW
Pipeline Seal and Insulator, Inc.	C, W

*Material Specification – 34
Tunneling Materials*

Material Specification – 35

CONCRETE MANHOLES

1. GENERAL

Concrete manhole riser sections, cone sections, flat covers, grade rings, grade beams and flat base slabs shall be in accordance with ASTM C 478 and [MS-20](#) with the following additional requirements or exceptions.

2. BASE BEAMS

Manhole base beams shall be constructed of precast, reinforced concrete 12-inches wide by 9-inches deep by 8-feet long. Reinforcement shall consist of three evenly spaced No. 5 reinforcing bars and No. 4 reinforcing bars at 12-inch centers transversely.

3. BASE SLABS

Manhole base slabs shall be cast-in-place or precast and designed to uniformly support the earth load and any other reasonable loads that may occur. The minimum slab thickness shall be 6-inches. The minimum reinforcement shall consist of No. 4 reinforcing bars placed 12-inches on center, each way. Concrete shall be in accordance with [MS-20](#); concrete reinforcement shall be in accordance with [MS-22](#).

4. COREHOLES AND BLOCKOUTS

Openings through the manhole riser shall be cored or cast-in with blockouts. Breakouts and doghouse openings are not allowed.

5. JOINT SEALANT

Joint sealant shall be preformed, flexible plastic gasket in accordance with ASTM C 990. It shall be packaged in extruded pre-formed rope shapes of proper size to completely fill the joint when completely compressed. The material shall be protected by a suitable, renewable 2-piece wrapper that may be removed as the material is applied to the joint without disturbing the other wrapper.

6. MANHOLE STEPS

Manhole steps shall be comprised of No. 4, grade 60 deformed reinforcing bar encased in a polypropylene copolymer plastic with a tread width of 14-inches. The steps shall be M. A. Industries No. PS2-PF Double Face.

7. APPROVED MANUFACTURERS

Copeland Precast, Inc.
Eagle Precast
Forterra Precast
Lindsay Precast
Oldcastle Precast
Rinker Materials
Vaughn Concrete Products

*Material Specification – 35
Concrete Manholes*

Material Specification – 36

FLANGED JOINT ACCESSORIES

1. GENERAL

Flanged joint accessories include all-thread studs, nuts, gaskets, insulating sleeves and washers, and steel washers.

2. ALL-THREAD STUDS AND NUTS

All-thread studs shall be in accordance with ASTM A 193, Grade B7. Nuts shall be heavy hex in accordance with ASTM A 194, Grade 2H. The studs shall extend through the nuts by 1/4-inch.

3. GASKETS

Flange gaskets shall be 1/8-inch thick, unsegmented compressed fiber with a blend of synthetic fibers, fillers, and elastomeric binders suitable for potable water service. Ring gaskets shall be used for non-insulated flange connections. Full-face gaskets shall be used for insulated flange connections.

Approved Manufacturers	Models
Durlon	8600
Garlock	3200
KLINGERSil	C-4324, C-6400
Leader	940

4. INSULATING SLEEVES AND WASHERS

Insulating sleeves and washers shall be one-piece when the flange bolt diameter is 1 1/2-inch or smaller and shall be made of acetyl resin or minlon. For flange bolt diameters larger than 1 1/2-inch, insulating sleeves shall be high density polyethylene, minlon, G-10, or acetyl resin and insulating washers shall be acetyl resin, phenolic, or G-10.

5. STEEL WASHERS

Steel washers shall be circular, carbon steel in accordance with ASTM F 436.

*Material Specification – 36
Flanged Joint Accessories*

Material Specification – 37

DISMANTLING JOINTS

1. GENERAL

Dismantling joints are telescoping flanged fittings that can be lengthened or shortened to facilitate the assembly and disassembly of pipe runs. The assembly consists of a flanged coupling adapter, a flanged by plain end piece with associated gasket, nuts, and bolts. The minimum assembly tolerance shall be 2-inches.

2. SERVICE

Dismantling joints may be installed on DI, steel, and PVC pipe.

The working pressure for dismantling joints is 150 psi, unless otherwise specified. Components shall also be suitable for exposure to chloraminated water.

3. SIZES

This Specification covers dismantling joints in 3-inch through 20-inch nominal diameters.

4. MATERIAL

- A. Carbon steel for the outer body and inner body shall be in accordance with AWWA C200.
- B. Carbon steel for the flanges shall be in accordance with AWWA C207.
- C. Carbon steel for the end ring shall be in accordance with AWWA C219.
- D. DI for the outer body, inner body, flanges, and end ring shall be in accordance with ASTM A 563, Grade 65-45-12.

5. GASKET

Rubber gasket material shall be in accordance with AWWA C219.

6. FLANGES

Flanges shall be machined to a flat face with a serrated finish in accordance with AWWA C207. Carbon steel flanges shall be in accordance with AWWA C207, Class D. DI flanges shall be in accordance with ANSI B16.1, Class 125. Hollow-back or segmented flanges are not acceptable.

7. RESTRAINT MECHANISM

Dismantling joints shall be restrained flange to flange using tie-rods. Tie-rods shall be all-thread studs in accordance with ASTM A 193, Grade B7. Restraining gland systems are not acceptable.

8. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 10-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

9. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

10. APPROVED MANUFACTURERS AND MODELS

Manufacturers	Models
Romac Industries	DJ400
Smith-Blair	975
JCM Industries	309 with tie-rods

Material Specification – 37
Dismantling Joints

Material Specification – 38

Resilient Seated Insertion Valves

1. GENERAL

Resilient seated insertion valves shall be designed and manufactured in accordance with AWWA C515, as applicable, with the following additional requirements or exceptions.

2. SERVICE

Valves shall be suitable for frequent operation and for long periods of inactivity. Valves shall operate with flows in either direction and shall provide zero leakage past the seat; minimum working pressure for all sizes shall be 250 psi. Components shall be suitable for exposure to chloraminated water.

3. SIZES

This Specification covers resilient seated insertion valves in 4-inch through 12-inch nominal diameters.

4. VALVE DESCRIPTION

Valves shall be iron body, resilient seated insertion valves with non-rising stems. Construction of the resilient wedge shall comply with AWWA C515 requirements. If the resilient seats are bonded to the gates, the gates shall be completely encapsulated with the material, except for guide tabs or slots. Valve bodies shall be designed to allow for the lifting of the valves by the bonnet flange, gland flanges, or other appurtenances.

Valves shall be supplied with 2-inch square wrench nuts. Valves shall open clockwise.

5. INSTALLATION

Valves shall be installed with the stem positioned vertically in buried horizontal water lines without gearing, bypasses, rollers, or tracks. Valve bonnet shall be installed below frost line. Valve installation shall result in full host pipe coupon removal by Manufacturer certified installers in accordance with the Manufacturers installation manuals.

6. VALVE STEMS

Valve stems shall be made of bronze in accordance with ASTM B 763, Copper Alloy No. C99500; stainless steel in accordance with ASTM A 276, Type 304, Type 316, or AISI 420; or copper alloy in accordance with ASTM B 98, Copper Alloy No. C66100/H02. The stem seal shall consist of three O-rings.

7. BOLTING MATERIAL

The bonnet gland bolts and nuts shall be in accordance with ASTM F 593, Type 304 stainless steel or electro-plated with zinc or cadmium. The hot-dip galvanized process is not acceptable.

8. END CONNECTIONS

Mechanical joint components shall be in accordance with AWWA C111 with tee-head bolts and hexagon nuts fabricated from a high-strength, low alloy steel known in the industry as Cor-Ten, Usalloy, or Durabolt.

Accessories for the mechanical joint shall consist of the gasket, gland, and fasteners

and shall be furnished and packaged separately from valves. Each package shall be labeled in a manner that provides for proper identification and the number of units listed per package or bundle.

9. SPLIT RESTRAINT DEVICES

Split restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting AWWA C110.

Mechanical joint restraint shall be in accordance with AWWA C600. Set screw pressure point type restraint hardware is not permitted.

10. TESTING

Chemical and modularity tests shall be performed with three test bars poured per production shift per UL and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.

Each valve, after shop assembly, shall be operated and hydrostatic tested in accordance with AWWA C515.

11. COATINGS

Ferrous surfaces, except machined or bearing surfaces, shall be prepared in accordance with SSPC SP10. These surfaces shall then be coated with liquid epoxy in two or more uniform coats or with fusion-bonded epoxy to a minimum DFT of 8-mils in accordance with AWWA C550. Machined flange faces shall be shop-coated with a rust-preventive compound; they shall not be painted or coated with the same coating as the body.

12. QUALITY CONTROL

The Manufacturer shall submit a written statement that the inspection and all specified tests have been completed and that results comply with the requirements of these Standards. Components in contact with potable water shall be certified to comply with NSF/ANSI 61, and a copy of the NSF/ANSI 61 certification shall be provided to Triview Metropolitan District , if requested.

13. APPROVED MANUFACTURERS

Manufacturers	AWWA C515	Size (Inch)
TEAM Industrial Services	X	4 to 12

*Material Specification – 38
Resilient Seated Insertion Valves*

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Note: These drawings are provided for standardization purposes only. They represent minimum design standards that may require upgrading for specific applications.

&	AND	CONT	CONTINUE, CONTINUOUS
L	ANGLE	CORP	CORPORATION
@	AT	CPLG	COUPLING
°	DEGREE	CTR	CENTER
OC	DEGREE CELSIUS	CTRL	CONTROL
"F	DEGREE FAHRENHEIT	CU	CUBIC, COPPER
ili	DIAMETER	D	DEPTH
±	PLUS/MINUS	DBL	DOUBLE
AASHTO	AMERICAN ASSOCIATION of STATE HIGHWAY and TRANSPORTATION OFFICIALS	DC	DOUBLE CHECK VALVE, DIRECT CURRENT
ABPA	AMERICAN BACKFLOW PREVENTION ASSOCIATION	DCDA	DOUBLE CHECK DETECTOR ASSEMBLY
AC	ASBESTOS-CEMENT PIPE, ALTERNATING CURRENT	DET	DETAIL
ACS	ACCESS	DFT	DRY FILM THICKNESS
ADDL	ADDITIONAL	DI	DUCTILE IRON
ADH	ADHESIVE	DIM	DIMENSION
ADJ	ADJUSTABLE	DIST	DISTANCE, DISTRIBUTED, DISTRICT
AFBMA	ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION	DR	DRAIN, DOOR, DRIVE, DRAWER
WATER, DOMESTIC	WATER	DW	TRIVIEW METROPOLITAN DISTRICT
AG	AIR-GAP	DWG	DRAWING
AHJ	AUTHORITY HAVING JURISDICTION	DWL	DOWEL
AHR	ANCHOR	E	EAST, ELECTRIC
ALUM	ALUMINUM	EA	EACH
AMR	AUTOMATIC METER READING (SYSTEM)	EL	ELEVATION
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	ELB	ELBOW
APPD	APPROVED	ELEC	ELECTRIC, ELECTRICAL
ASC	AUTOMATIC SPRINKLER CONNECTION	EMERG	EMERGENCY
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS	EQ	EQUAL
ASSE	AMERICAN SOCIETY OF SANITARY ENGINEERING	ERT	ENCODER-RECEIVER- TRANSMITTER
ASSY	ASSEMBLY	ESMT	EASEMENT
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	ETC	ET CETERA
AV	AIR VALVE	EW	EACH WAY
AVE	AVENUE	EXIST	EXISTING
AWG	AMERICAN WIRE GAUGE	EXP	EXPOSED, EXPANSION
AWS	AMERICAN WELDING SOCIETY	EXP JT	EXPANSION JOINT
AWWA	AMERICAN WATER WORKS ASSOCIATION	EXT	EXTERIOR, EXTEND, EXTENSION
BF	BLIND FLANGE	FD	FLOOR DRAIN
BFP	BACKFLOW PREVENTION	FDTN	FOUNDATION
BFV	BUTTERFLY VALVE	FH	FIRE HYDRANT
BLDG	BUILDING	FIN	FINISH
BLVD	BOULEVARD	FIPT	FEMALE IRON PIPE THREAD
BM	BEAM	ft.	FLOW LINE
80	BLOWOFF	FLEX	FLEXIBLE
BOT	BOTTOM	FLG	FLANGE
BP	BACKPRESSURE	FLR	FLOOR
BRG	BEARING	FMCT	FIRELINE METER AND COMPOUND TORRENT
BS	BACKSIPHONAGE	FPT	FEMALE PIPE THREAD
BSP-40	BLACK STEEL PIPE, SCHEDULE 40	FT	FOOT, FEET
BSP-80	BLACK STEEL PIPE, SCHEDULE 80	Fy	YIELD STRENGTH
BSTC	BOLTED SLEEVE TYPE COUPLING	G	NATURAL GAS
BTWN	BETWEEN	GA	GAGE, GAUGE
BV	BALL VALVE	GALV	GALVANIZED
C	CHANNEL	GND	GROUND (ELECTRICAL)
C&G	CENTERLINE	GV	GATE VALVE
CAD	CURB AND GUTTER	GVL	GRAVEL
CB	COMPUTER AIDED DRAFTING	HOPE	HIGH DENSITY POLYETHYLENE
CB	CATCH BASIN	HEX	HEXAGONAL
CBI	CONTAINED BY ISOLATION	HGL	HYDRAULIC GRADE LINE
CF	CUBIC FEET	HMWPE	HIGH MOLECULAR WEIGHT POLYETHYLENE
CHFR	CHAMFER	HORIZ	HORIZONTAL
CHKV	CHECK VALVE	HS	HIGH STRENGTH
CI	CAST IRON	HSS	HOLLOW STRUCTURAL SECTION
CJ	CONSTRUCTION JOINT	HT	HEIGHT
CLR	CLEAR, CLEARANCE	HVY	HEAVY
CLSM	CONTROLLED LOW STRENGTH MATERIAL	HYD	HYDRANT, HYDRAULIC
CNR	CORNER	Hz	HERTZ
CO	CLEANOUT, CARBON MONOXIDE	IBC	INTERNATIONAL BUILDING CODE
CONG	CONCRETE	ID	INSIDE DIAMETER
COND	CONDUIT	IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
CONN	CONNECT	IN	INCH, INCHES



TRIVIEW METROPOLITAN DISTRICT

STANDARD DRAWING ABBREVIATIONS

Scale: NONE

Date: May 2018

INSTL	INSTALL, INSTALLATION	PVB	PRESSURE VACUUM BREAKER
INSUL	INSULATE, INSULATION	PVC	POLYVINYL CHLORIDE
INT	INTERIOR	PVMT	PAVEMENT
INV	INVERT	R	RADIUS
IP	IRON PIPE	RD	ROAD
IRR	IRRIGATION	RDCR	REDUCER
ISA	INSTRUMENT SOCIETY OF AMERICA	REINF	REINFORCED, REINFORCING, REINFORCE JT
	JOINT	REQD	REQUIRED
KB	KICKBLOCK	RES	RESISTOR
KSI	KIPS PER SQUARE INCH	RH	RIGHT HAND
kVA	KILOVOLT AMPERES	RND	ROUND
L	LENGTH	ROW	RIGHT-OF-WAY
LAB	LABORATORY	RPDA	REDUCED PRESSURE DETECTOR ASSEMBLY
LOC	LOCATION, LOCATE	RP	REDUCED PRESSURE PRINCIPLE
LONG	LONGITUDINAL	S	SOUTH
LP	LIGHT PANEL	SAE	SOCIETY OF AUTOMOTIVE ENGINEERS
mA	MILLIAMPER	SAN	SANITARY SEWER
MATL	MATERIAL, MATERIALS	SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
MAX	MAXIMUM	SCHED	SCHEDULE
MECH	MECHANICAL	SD	STORM DRAIN, SUPPLY DUCT
MEE	MACHINED EACH END	SEC	SECONDARY, SECONDS
MFD	MANUFACTURED	SECT	SECTION
MFR	MANUFACTURER	SHT	SHEET
MH	MANHOLE	SLV	SLEEVE
MIN	MINIMUM, MINUTE	SPA	SPACE, SPACING
MIP	MALE IRON PIPE	SPEC	SPECIFICATIONS, SPECIFIED
MJ	MECHANICAL JOINT	SPRT	SUPPORT
MOA	MACHINED OVER ALL	SQ	SQUARE
MS	MILD STEEL	SST	STAINLESS STEEL MSS
	MANUFACTURERS STANDARDIZATION SOCIETY	ST	STREET
	OF THE VALVE AND FITTINGS INDUSTRY	STA	STATION MID
	MOUNTED	sm	STANDARD
MTG	MOUNTING	STL	STEEL
MTL	METAL	STRM	STORM SEWER
N	NORTH	STRUCT	STRUCTURE, STRUCTURAL
N/A	NOT APPLICABLE	SWV	STOP AND WASTE VALVE
NC	NORMALLY CLOSED	SYMM	SYMMETRICAL
NEC	NATIONAL ELECTRICAL CODE	TEMP	TEMPERATURE, TEMPORARY
NEMA	NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION	THO	THREAD, THREADED
		THK	THICKNESS
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION	TOP	TOP OF PIPE NO
	NUMBER, NORMALLY OPEN	TYP	TYPICAL
NPT	NATIONAL PIPE THREAD	UBC	UNIFORM BUILDING CODE NSF
	NATIONAL SANITATION FOUNDATION	UMC	UNIFORM MECHANICAL CODE
OC	ON CENTER	UPC	UNIFORM PLUMBING CODE
OD	OUTSIDE DIAMETER	USC FCCCHR	UNIVERSITY OF SOUTHERN CALIFORNIA
OPNG	OPENING		FOUNDATION FOR CROSS CONNECTION CONTROL
OSHA	OCCUPATIONAL SAFETY AND HEALTH		AND HYDRAULIC RESEARCH
	ADMINISTRATION	V	VOLT
PC	POINT OF CURVATURE	VB	VALVE BOX
PE	PLAIN END, POLYETHYLENE PIPE	VERT	VERTICAL
PI	POINT OF INTERSECTION	W	WEST, WATER
Pl	PROPERTY LINE	W/	WITH
PL	PLATE (STEEL), PLACE	W/O	WITHOUT
PLYWD	PLYWOOD	WOG	WATER-OIL-GAS
PRESS	PRESSURE	WRA	WATER REDUCING AGENT
PRV	PRESSURE REGULATING VALVE	WSC	WATER SERVICE CONTRACTOR
PSF	POUNDS PER SQUARE FOOT	WSP	WORKING STEAM PRESSURE
PSI	POUNDS PER SQUARE INCH	WTR	WATER
PT	POINT OF TANGENCY, POST TENSIONED	WWF	WELDED WIRE FABRIC
PUD/PBG	PLANNED UNIT DEVELOPMENT/PLANNED BUILDING GROUP	XFMR	TRANSFORMER
		YD	YARD



TRIVIEW METROPOLITAN DISTRICT

STANDARD DRAWING ABBREVIATIONS

Scale: NONE

Date: May 2018

