

SECTION 600 WATER SUPPLY FACILITIES

<u>SECTION</u>		<u>PAGE</u>
SECTION 600	WATER SUPPLY FACILITIES.....	600-1
610.00	System Design and layout.....	600-4
610.01	General.....	600-4
610.02	Design Flow Requirements.....	600-4
610.03	Operating Pressure Requirements.....	600-4
610.04	Sizing of Distribution Mains.....	600-5
610.05	Fire Protection Systems.....	600-6
610.06	Cross-Connection Control and Backflow Prevention.....	600-7
610.07	Pressure Reducing Stations.....	600-14
610.08	Storage Facilities.....	600-15
610.09	Distribution System Layout.....	600-15
620.00	Service lines, firelines, meters, and appurtenances.....	600-18
620.01	General.....	600-18
620.02	Layout of Service Lines.....	600-18
620.03	Separate Trenches.....	600-21
620.04	Pumps.....	600-22
620.05	Tanks.....	600-22
620.06	Connections for Water.....	600-22
620.07	Taps and Saddles.....	600-23
620.08	Size.....	600-24
620.09	Pipe Material.....	600-25
620.10	Curb Stops, Valves, and Valve Boxes.....	600-25
620.11	Meters.....	600-25
620.12	Outside Meter Setting.....	600-26
620.13	Meter Bypass Lines.....	600-26
620.14	Abandonment or Removal of Service Lines and Tap Cuts.....	600-27
630.00	Materials.....	600-27
630.01	General.....	600-27
630.02	Size of Mains.....	600-28
630.03	Pipe Classes.....	600-28
630.04	Selection of Pipe.....	600-28
630.05	Pipe Fittings.....	600-29
630.06	Line Valves.....	600-32
630.07	Pressure Regulating Valves.....	600-32
630.08	Tapping Valves and Sleeves.....	600-32
630.09	Check Valves.....	600-33
630.10	Stop and Waste Valves.....	600-33
630.11	Valve Boxes.....	600-33

630.12	Valve Reference Marker Posts.....	600-33
630.13	Water Meters.....	600-33
630.14	Meter Appurtenances	600-34
630.15	Meter Pits and Lids for ¾ and 1-Inch Meters	600-36
630.16	Meter Vaults for Meters 1 ½-Inch and Larger	600-36
630.17	Concrete Structures	600-37
630.18	Steel Reinforcement for Concrete.....	600-37
630.19	Manholes.....	600-37
630.20	Manhole Base Slabs and Base Beams.....	600-38
630.21	Sump Pits for Vaults and Manholes.....	600-38
630.22	Vent Pipes	600-38
630.23	Fireline Connection to Mains.....	600-39
630.24	Service Lines.....	600-39
630.25	Corporation Stops	600-39
630.26	Curb Stop Service Boxes	600-39
630.27	Corrosion Protection Systems	600-40
630.28	Kickblocks	600-40
630.29	Protective Concrete Pads over Pipe	600-41
630.30	Casing Pipe	600-41
630.31	Carrier Pipe	600-41
630.32	Miscellaneous Metalwork and Piping.....	600-41
630.33	Air and Vacuum Valves.....	600-42
640.00	Pipe Installation.....	600-42
640.01	Approval by the City of Brighton	600-42
640.02	Handling of Materials	600-42
640.03	Preparation and Inspection of Pipe and Fittings for Installation	600-43
640.04	Pipe Joint Lubricant	600-43
640.05	Cutting and Fitting of Pipe.....	600-43
640.06	Pipe Alignment and Grade.....	600-43
640.07	Deviation Occasioned by Other Structures	600-44
640.08	Temporary Bulkheads and Pneumatic Plugs.....	600-44
640.09	Frost	600-44
640.10	Ductile Iron Pipe	600-45
640.11	Polyvinyl Chloride Pressure Pipe.....	600-46
640.12	Installation of Valves	600-48
640.13	Installation of Valve Boxes.....	600-48
640.14	Installation of Fittings	600-48
640.15	Installation of Tapping Saddles.....	600-48
640.16	Fire Hydrants.....	600-49
640.17	Fireline Connections	600-50
640.18	Kickblocks	600-50
640.19	Concrete Structures	600-51
640.20	Reinforcing Steel for Concrete Structures	600-53
640.21	Joint Restraint Devices	600-54
640.22	Connections to City of Brighton System.....	600-55
640.24	Chlorination	600-58

640.25	Hydrostatic Testing	600-59
640.26	Acceptance and Release for Taps.....	600-60
640.27	Blowoff Assembly	600-60
640.28	Sewer Crossings	600-61
640.29	Horizontal Directional Drilling	600-62
640.30	Pipe Bursting.....	600-63
650.00	MATERIAL SPECIFICATIONS	600-0
650.01	General.....	600-0

610.00 System Design and layout

610.01 General

All water distribution systems shall comply with the requirements of the STANDARDS AND SPECIFICATIONS for water main and service line construction and may include special criteria established by the City for the overall hydraulics of the water utility system. Special criteria shall be outlined at pre-design meetings scheduled, as determined necessary, by the Directors. The requirements set forth in the latest edition of the City of Brighton Board Engineering Standards shall apply for information omitted in these STANDARDS AND SPECIFICATIONS.

610.02 Design Flow Requirements

The design of the water distribution system shall be based on the following: UNIT WATER DEMANDS FOR FUTURE LAND USE

Land Type	Avg. Day Demand	Max. Day/Avg. Day FLOW RATIO	MAX. HR./MAX. DAY FLOW RATIO
Residential	145 GPCD*	3.05	1.9
Commercial	1651 GPD/Acre	2.00	1.9
Industrial	1651 GPD/Acre	1.32	1.9
Park	3060 GPD/Acre	2.85	1.9

*Gallons Per Capita/Day

Fire flows may be calculated from more than one hydrant, providing the hydrants used are directly accessible to all possible fire locations in the area served. Fire flows, per Brighton Fire Rescue District, shall be:

- A. Available fire flow must be 20 psi residual minimum.
- B. Minimum fire flow (2 hour duration) for any newly developed areas:
 - 1. 1 and 2 family units 1,500 gpm
 - 2. Multi-family units 1,500 gpm
 - 3. Institutional development 2,000 gpm
 - 4. Commercial development 2,500 gpm
 - 5. Industrial development 3,500 gpm

Note: above fire flow requirements may be increased due to type of construction and size of building, per direction of the Fire Marshall.

610.03 Operating Pressure Requirements

All areas shall be designed to provide a maximum static head of two hundred fifty four (254) feet (one hundred ten [110] psi) and a minimum static head of ninety two (92) feet (forty [40] psi).

Distribution systems shall also be designed to maintain a twenty (20) psi residual pressure during required fire flow. The maximum pressure drop from static head to either fire flow or peak residential flow shall not exceed thirty (30) psi.

Fire hydrant flow tests must be performed in order to determine existing system pressures. Flow testing must be performed by licensed and insured testing companies and shall be accompanied by City Personnel when operating valves and hydrants on City water mains. The Brighton Fire Rescue District and the Utilities Department shall review flow data and comment on system pressures, and safety factors that are applied.

610.04 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 8 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 no less than 20 psi in the localized area of interest. The City reserves the right to size mains to accommodate future needs.

New mains shall be 8, or 12 inch as set by the City. If approved by the City in writing, mains smaller than 8-inches may be used in some cul-de-sacs without a fire hydrant. Dead-end mains in cul-de-sacs will be evaluated to determine if the appropriate number of services exist to maintain water quality turnover.

Fire flow evaluations with one side of the loop out of service (i.e., worst case scenarios) are a normal part of the distributions system's main size evaluation. Consideration will be given wherever water quality problems are caused by an upsizing of the main. Exceptions to looping are subject to the City's discretion and additional requirements. The City will analyze the water system for developing areas to determine their adequacy. Parallel mains are not allowed.

610.05 Fire Protection Systems

610.05.01 Fire Hydrants

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, or reducers shall not be used in the fire hydrant branch line unless specifically approved in writing by the Utilities Director. Under no circumstances shall any size or manner of tap be made on a fire hydrant branch line.

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 the Utilities Director.

Redundant hydrant installation and the unnecessarily high density of fire hydrants should be avoided where existing hydrant function would be duplicated. These types of hydrant requests will be reviewed by the City and approved at its discretion. The review will be based on the number of fire hydrants in close proximity, hydraulic analysis, and correspondence with Greater Brighton Fire Authority.

610.05.02 Fire Hydrant Spacing

In single-family residential areas, fire hydrants shall be spaced a maximum of five hundred(500) feet apart as measured along street curb line and at an overall spacing that will average not less than one hydrant to two hundred thousand (200,000) square feet accessible to the fire hydrant throughout an individual subdivision. Fire hydrant locations shall be approved by Brighton Fire Rescue District.

In business, industrial, and high-density residential areas, hydrants shall be spaced not greater than three hundred feet (300) apart or as approved by Greater Brighton Fire Authority.

610.05.03 Fire Lines

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

The fireline 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 the Utilities Director.

Multiple fire protection appurtenances, including any combination of fire hydrants and firelines 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 firelines are required.

The property owner shall maintain all fire lines extending from the valve on the City watermain. Valves on newly constructed fire lines shall be located on the tee at the main line. Fire lines are to be used exclusively for fire protection. Domestic water taps and/or irrigation taps shall not be allowed on the fire line. Fire lines valve boxes will have "FIRE" printed on the valve lid instead of "WATER".

610.06 Cross-Connection Control and Backflow Prevention

610.06.01 Cross-Connection Control

The City is responsible for protecting its public water system from contamination due to backflow occurrences through water service connections (i.e. cross-connections). The City needs assistance and the cooperation of the public and Developer and/or Applicant to ensure this responsibility is met. The City can request access to property or facility, per the authorities granted in Brighton Municipal Code, to conduct an on-site cross-connection control survey.

A properly designed air-gap is the most effective method of protecting the public water supply from high hazard cross-connections. When an air-gap cannot be used, a reduced pressure (RP) backflow protection assembly (BFPA) or double check (DC) BFPA shall be installed. Please see below for specific requirements.

Failure to comply with the installation and annual testing requirements may result in suspension of service per Brighton Municipal Code.

610.06.02 Approved BFPA

Manufactured in accordance with AWWA C510 and C511 and meeting USC FCCCHR specifications.

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
<https://fccchr.usc.edu/list.html>

610.06.03 Requirements for Approved USC FCCCHR BFPA Installations Based on the Degree of Hazard

610.06.03.01 A commercial/industrial domestic service line tap

Requires an approved RP acting as containment 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.

610.03.03.02 A commercial/industrial fireline service tap

Installed as a wet pipe with the use of chemical additives or pumps requires an approved RP BFPA to be installed on the fireline downstream from the tapping valve and immediately upon entry into a heated part of the building 5 feet (maximum) from the wall or floor before any connections.

Installed as a wet or dry pipe system without the use of chemical additives or pumps, requires a DC BFPA to be installed on the fireline downstream from the tapping valve and 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 firelines downstream from the designated containment BFPA for any purpose other than fire protection (additional protection may be required).

610.06.03.03 An irrigation-only service line tap

Requires an approved RP BFPA to be installed on the irrigation water service line 5 feet downstream from the meter pit; the line must be above ground before any connections.

Branch lines and taps are not allowed on dedicated irrigation water service lines for domestic (potable) use.

610.06.03.04 A drinking fountain domestic service line tap

Requires an approved DC BFPA to be installed on the domestic water service line depending on manufacturer's specifications for proposed model:

1. Above ground, 5 feet downstream from the meter pit in a properly securable BFPA box, either standard or heated depending on need.

610.06.03.05 A multi-family domestic service line tap (common tap serving three or more residential units)

Requires an approved RP or DC BFPA acting as containment if:

1. the premises contains a community pool served off the same domestic service line tap;
2. the premises contains mechanical rooms;

the premises has a common boiler with chemical injection; or
3. The residential units and the property they are constructed on are NOT individually owned;
4. The City identifies any other hazard or cross-connection requiring control on the premises.

The BFPA 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.

610.06.03.06 A single-family domestic service line tap with a Dual Water Supply Agreement

It is at the sole discretion of City of Brighton’s Cross- Connection Control Section to determine that existing auxiliary water supply poses a high risk to City of Brighton’s potable distribution system. The installation of a RP BFPA will 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 City of Brighton’s Cross-Connection Control Section to approve the proposed BFPA installation. The approved BFPA may not be removed, relocated, or altered without approval by City of Brighton.

610.06.05.01 Exemptions

Single-family residential customers are exempt from City of Brighton’s cross-connection control requirements unless the premises is served by an auxiliary water supply (e.g., raw water, a well, a lake, a pond, or a ditch) or has a dedicated city metered service line for irrigation only. Auxiliary water supply conditions require a Dual Water Supply Agreement to be in effect between City of Brighton and the Property Owner. Multi-family residential customers are exempt from City of Brighton’s cross-connection control requirements if each unit has an independent service line.

For questions or concerns related to cross-connection control, please contact City of Brighton’s Cross-Connection Control Section.

610.07 Pressure Reducing Stations

PRV installations are used to control pressures within the distribution systems. When main extensions 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. The City will make pressure settings and field adjustments.

610.08 Storage Facilities

610.08.01 Installation

Water Storage facilities are allowed for the storing of water from City of Brighton's water system where specifically authorized and approved in writing by the Utility Director.

610.08.02 Cleaning and Drainage

Storage facilities shall have built in provisions for draining as well as access and provisions for cleaning including a suitable source of water. The cleaning and drainage facilities shall be subject to the City's approval.

610.08.03 Electronic Monitoring Equipment

The City may require the installation of SCADA equipment for storage facilities of the type specified by the City.

610.09 Distribution System Layout

610.09.01 General

Mains shall be installed in dedicated public streets. Main layout shall be of such grade, alignment, curvature, and other characteristics as to permit installation and maintenance in the usual manner.

The condition under which such an exception is allowed will be determined on a case-by-case basis. Only easements in accordance with the terms of the City standard easement form and these Standards will be accepted. Easements granted for water mains near the perimeter of a lot or property line must abut the lot or property line to provide for future domestic and/or fire protection service from the water main to the adjoin lot or property, except as specifically approved in writing by the Utilities Director.

Distribution systems shall be design so that no critical pipes exist. A critical pipe is any length of pipe, excluding private services, that when damaged, shut off, or otherwise taken out of service, does not isolate any development, subdivision, complex or other water using use.

610.09.02 Location (Typical)

Water mains will typically be located five feet (5') north or east of the centerline of the street unless otherwise approved by the Directors.

At street intersections, valves will be located at tees or cross with 5' of separation between valves. Fire hydrant gate valves shall be placed at swivel tee. All fire hydrants shall have a restrained connection directly to the tee off the main (see the Standard Drawings).

In all instances, the water mains shall extend to the boundary line of the property or subdivision served. A main serving one lot shall extend the entire way across the frontage for that lot. Mains serving a subdivision shall extend to the center of boundary streets, to boundary lines or to the outside of paved areas as may be noted on the accepted plans.

610.09.03 Pipe Deflection

Deflection of PVC pipe and Ductile Iron pipe may be achieved by deflection according to manufacturer's recommendations only. Changes in direction greater than allowable deflection of waterline pipe shall require bends.

610.09.04 Minimum Depth

All pipe shall be installed with a minimum of four feet six inches (4'-6") of cover from finished grade of street to the top of the pipe barrel. Trenching, backfilling and compacting shall be completed in accordance with Section 350.00, Trenching, Backfilling and Compacting, of these STANDARDS AND SPECIFICATIONS.

610.09.05 Fire Hydrants

Fire Hydrants shall be installed within public streets or in easements. When the City 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 ten (10) feet if the length of the easement is twenty-five (25) feet or less. Fire hydrant easements shall have a minimum width of 30 feet when the length of the easement is more than twenty-five (25) feet. The easement shall extend a minimum of five (5) feet beyond the center of the hydrant.

Fire hydrants shall only be installed at locations authorized by the Brighton Fire Rescue District.

610.09.06 Line Valves

Valves shall be placed with a maximum spacing of five hundred (500) feet in all distribution mains and lateral lines. Valves shall also be placed to insure that only one hydrant will be out of service in

the event of a line break.

Tees shall require three (3) valves. Crosses shall require four (4) valves. For a succession of short blocks perpendicular to the direction of the distribution main and without residential or commercial services between, one or more intersection(s) shall have the valve in that direction omitted, but must maintain the five-hundred (500) foot maximum spacing requirement. Valves shall also be placed at each end of a line running through an easement on private property, on each side of a major creek or channel crossing, and on each side (at property lines extended) of a distribution line that provides service to a hospital, school or large industrial user.

610.09.07 Air Relief Valves

Air relief valves shall be installed at each high point in all distribution mains and at high points of lateral lines. Air relief valves shall be sized and located appropriately.

Air relief valves shall be installed in precast manholes or vaults fitted with air vents open to the atmosphere and in accordance with the Standard Drawings.

610.09.08 Blow-off Valves

Provisions shall be included in the design to allow for the flushing of distribution mains and lateral lines at any low point in the system, or at any point noted on the accepted plans. The blow-off assembly shall be installed perpendicular to and on the downhill side of the main or line and shall drain to the nearest gutter line or drainage channel. The blow-off assembly standpipe must have a threaded end to accept a fire house coupling. The top of the standpipe shall be between four to six inches (4"-6") below grade in accordance with the Standard Drawing.

Permanent dead ends shall be provided with a permanent blow-off or fire hydrant and temporary dead ends such as phasing within developments, shall have temporary blow-offs (See Standard Details).

620.00 Service lines, firelines, meters, and appurtenances

620.01 General

Water is conveyed from mains to consumers by service lines and their associated appurtenances. Except for fireline services, water delivered to customers must be metered. In the context of these Standards, the service line includes pipe, fittings, and appurtenances that belong to the Developer and/or Applicant that are used to convey and measure water from the distribution system to the consumer for domestic, industrial, or irrigation use. The service line extends from the corporation stop or tee on the water main to the first valve inside the premises after the water meter or BFP, if

present. Water pipe beyond service lines shall be controlled by local plumbing codes.

620.02 Layout of Service Lines

620.02.01 General Layout

The service line shall be arranged to provide convenient access to the curb stop and meter pit or vault for meter reading, operation, and maintenance. Wherever possible, the pit or vault shall be accessible from a paved street or the City 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 water meter pit or vault shall be located in a landscaped area that is 2 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 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 the City 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.

In urban landscaped areas, stop boxes and meters may be placed in paved walkways with prior written approval from the Utility Director. Stop box and meter pit or vault lids shall be carefully adjusted to match the finished surface of the paved walk.

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, fireline, or other permanent obstruction. The distance shall be measured from the outside wall of the valve box or the meter pit or vault.

620.02.02 Location

The premises to be served shall have a minimum frontage of ten (10) feet on the street or easement containing the water main to be tapped. The main shall extend a minimum of eight (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.

620.02.03 Setbacks

The service line, to a point five (5) feet past the meter pit or vault, shall be a minimum of five (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 five (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.

620.02.04 Alignment

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. The tap, stop box, and meter pit or vault, shall be in a straight line.

620.02.05 Cul-de-Sacs

If service is requested for lots at the end of a cul-de-sac, 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.

620.02.06 Depth of Service Line

Service lines shall be installed 4 1/2 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 Developer and/or Applicant is responsible for the lowering or relocation of the service to maintain cover between 4 1/2 and 6 feet.

620.02.07 Identifications Tags

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 by 4 inches, 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 assigned service address and the building identification, if appropriate; the bottom line shall display the City tap number. The tag shall have white letters engraved in a solid color. Tags for domestic services shall be blue, irrigation-only services shall be green, recycled water services shall be purple, and firelines shall be red.

620.02.08 Paved Areas

Care shall be taken to ensure that service lines do not enter the property at a driveway or 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 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 Utilities Director.

Special construction details shall be required and curb stops shall be placed under road boxes instead of curb boxes.

620.02.09 Deviations

The Utilities Director may authorize deviations to the service line standards contained in this Section. Deviations shall be requested in writing by the Applicant or the Applicant's authorized representative. Each request shall be considered on a case-by-case basis and shall 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 Utilities Director.

620.02.10 Stub-ins

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 Developer and/or Applicant that installs a stub-in does so with the understanding that it shall be the responsibility of the Developer and/or Applicant 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 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.

620.02.11 Compaction

Backfill material around service lines, stop boxes, and meter settings shall be carefully compacted in accordance with the requirements of Section 300.

620.03 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 ten (10) feet. However, a service line may be placed in the same trench with other pipe when:

- A. The adjacent foreign pipe is ductile iron.
- 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.

620.04 Pumps

Pumps are not allowed for the sole purpose of decreasing the size of the tap/meter and service line.

620.05 Tanks

Tanks are not allowed for the sole purpose of decreasing the size of the tap/meter and service line.

620.06 Connections for Water

620.06.01 Small Taps, 2-inches and smaller

Connections for domestic, irrigation, or fire service taps that are 2-inches and smaller will be made by the Contractor and witnessed by a Utilities Inspector. 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 Developer and/or Applicant.

Taps shall be made only after satisfying the following conditions:

1. The main has been released by City of Brighton following the completion of the conditions and tests of inspections.
2. Appropriate fees and charges have been paid to the City of Brighton.
3. Underground utilities near the tap are marked.
4. Tapping materials are on-site.
5. Front property corners are clearly staked and the service address visibly posted.
6. Water main valves are marked or staked.
7. Safety equipment and procedures are in place including trench shoring.
8. The service line, curb stop, meter pit, and meter yoke are installed and ready for connection to the corporation stop.
9. The tapping location on the main is excavated and the water main surface is exposed and clean.

620.06.02 Large Taps, 3-Inches and Larger

Service connections to the main for service lines 3-inches and larger shall be made by a tee connection. Domestic service taps 3-inches and larger may be installed by the Contractor and witnessed by a Utilities Inspector. For the City installed connections, the Contractor shall excavate the ditch and around the water main exposing it on all sides. The City will provide and install the tapping saddle, 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.

620.06.03 Insulators

Domestic service lines of dissimilar metals shall be electrically insulated by means of City of Brighton approved insulating fittings or gaskets. Care shall be taken to properly install corporation stops and provide enough slack in the service lines to protect against pullout.

620.06.04 Tapping Polyethylene Encased Pipe

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 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 Section 300.

620.06.05 The Spacing of Service Taps

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.

620.07 Taps and Saddles

Tapping saddles with a tap size of 2-inches and smaller for ductile iron and asbestos-cement pipe shall consist of a bronze body with two bronze straps. Saddles for PVC pipe shall be single strap bronze saddle.

Existing steel mains that are 20-inches in diameter or smaller shall be tapped using a method approved by City of Brighton.

620.08 Size

620.08.01 General

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.

The tap, corporation stop, meter, and that portion of the service line between the corporation stop and 5 feet past the meter shall be the same size. The service line may be increased in size to the next approved larger diameter beginning 5 feet downstream of the meter. 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 feet per second 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 backflow prevention or 30 psi and a minimum residual pressure of 20 psi at the building beyond any backflow prevention under peak domestic demand flow. Additional fire flow demand and service sizing shall be the responsibility of the Developer and/or Applicant or the Developer and/or Applicant's Professional Engineer.

620.08.02 Multi-Family Buildings

In addition to the general requirements, the minimum tap size for domestic service shall be based on the number of units in the building:

Units	Tap Size (Inches)
1-2	3/4
3-5	1
6-25	1 1/2
26-50	2

These estimates are for minimum estimated tap, service, and meter sizing. Actual sizing should be based on flow that is calculated from an accredited Fixture Unit Count methodology that varies dependent on the actual number of fixtures within each unit and within the overall building supplied. Buildings with more than 50 units will be evaluated on an individual basis. In special circumstances, City of Brighton may require a larger minimum tap size. Additional flow demands required to meet NFPA 13R shall be evaluated by the Developer and/or Applicant or the Developer and/or Applicant's Professional Engineer and services sized accordingly.

620.08.03 NFPA 13D Residential Sprinkler Services

For residential services meeting NFPA 13D, the tap, corporation stop, meter, and that portion of the service line between the corporation stop and 5 feet past the meter shall be the same size. The 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 Developer and/or Applicant.

620.08.04 Irrigation Service

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

620.09 Pipe Material

Pipe material is dependent on the size of the service line:

- A. Seamless Copper Tube: Shall be used for service lines 3/4 through 2-inches
- B. Ductile Iron Pipe: Shall be used for service lines 3 inches and larger.

620.10 Curb Stops, Valves, and Valve Boxes

A curb stop or gate valve of the same size as the service line shall be installed on every service line.

Buried valves and curb stops shall be equipped with a cast iron valve box and large oval base. When a 3/4 or 1-inch curb stop is placed in paved areas, a roadway box shall be used.

Compression fittings at the curb stop may be used on pipe that is less than 2-inches in diameter.

620.11 Meters

620.11.01 General

Meters shall not be installed until the proposed installation is approved, and the meters tested and numbered by City of Brighton.

Service meters are used to record usage by the retail customer. Master meters are used by wholesale customers and supply water to service meters. Other temporary meters exist in the system for testing and measuring water usage from fire hydrants.

Accuracy, sensitivity, durability, low pressure loss, life-cycle cost, ease of use, and low cost of maintenance are important characteristics of meters. As such, City of Brighton will determine acceptable meter manufacturers and models.

Meter installations will be inspected by City of Brighton upon completion of the installation and prior to backfilling.

620.11.02 Size of Meter

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 that is smaller than 3/4-inch shall not be installed unless it is to serve as a replacement for an existing small meter.

In cases where the full capacity of a previously used service pipe is not required, City of Brighton 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.

620.12 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 meters 1-inch and smaller shall be installed with the meter spuds located 18 inches below the meter pit lid to facilitate maintenance and replacement. The meter shall sit vertically with the meter register 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 must be approved in advance in writing by the Utility Director.

620.13 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 inside setting. Bypass lines shall contain an independent control 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 City of Brighton. Bypass lines for 1 1/2 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.

620.14 Abandonment or Removal of Service Lines and Tap Cuts

It may become necessary to remove or abandon a service line or stub-in due to redevelopment, and changes in water requirements for the premises or to relocate a service due to changes in the configuration of the premises. An abandoned or relocated service line shall have the tap cut at the main to ensure that it cannot be used to remove water from the system. Service line tap cuts shall be witnessed by a City of Brighton Inspector. Tap cuts shall be coordinated through the Utility Department. Taps that are 3-inches and larger shall require water plans for review. Service lines must be metered until disconnected from the main in the presence of a City of Brighton Inspector.

620.14.01 Services, 2-inch and smaller

The service 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 City of Brighton's Water Shop for a final test and reading. The meter may not be used again in the City of Brighton 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.

620.14.02 Services, 3-inch and Larger

The service 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 City of Brighton's Water Shop for a final test and reading. The meter may not be used again in the City of Brighton 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.

630.00 Materials

630.01 General

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 City of Brighton system.

Approved Developers and/or Applicants shall provide the materials necessary for installation when mains are extended; City of Brighton will not supply materials. Acceptance of the materials or the waiver of an associated inspection shall in no way relieve the Approved Developer and/or Applicant from the responsibility of furnishing materials that meet the requirements of the Materials Specifications.

New water industry products or materials will be tested if, in the opinion of the Utilities Director, a product or material has some merit. City of Brighton will establish the criteria for the testing and evaluation of products. City of Brighton reserves the right to accept or reject any product or material regardless of test results.

630.02 Size of Mains

The size of mains shall be in accordance with Section 610.04. Standard acceptable nominal diameters of distribution mains are 8 and 12-inches. Standard acceptable nominal diameters of transmission mains are 16 and 20-inches. Standard acceptable nominal diameters for conduits are 24-inches and larger.

630.03 Pipe Classes

City of Brighton 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, 6, 8, 12 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:

Ductile Iron (DI)	Special Thickness Class 50 (6, 8, 12, 16, and 20-inch) Special Thickness Class 51 (3, 4, 24-inch)
-------------------	--

Plastic (PVC)	C 900 DR 14 (4-inch through 12-inch) C 905 DR 18 (16-inch through 24-inch) C 909 Pressure Class 305 (4-inch) C 909 Pressure Class 235 (6, 8, and 12-inch)
---------------	--

630.04 Selection of Pipe

In general, the selection of the type of pipe shall be left to the discretion of the Professional Engineer in charge of the design. However, City of Brighton 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 Section 630.03. Special comprehensive studies of applicable laws, regulations, and detailed engineering calculations shall be submitted by the Approved Developer and/or Applicant to City of Brighton 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 Approved Developer and/or Applicant to City of Brighton. Resistivity surveys shall utilize the Wenner four-pin method.

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 severe, 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 Section 640.23 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 City of Brighton.

When a metallic pipe must 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 City of Brighton's approval.

630.05 Pipe Fittings

630.05.01 Joints

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 will be allowed under specific situations with City of Brighton's approval.

Fittings shall be furnished with mechanical joint ends. The use of wyes is prohibited. Fittings shall be fusion bonded epoxy coated.

630.05.02 Closure Fittings

Bolted sleeve-type couplings, in accordance with AWWA C219, shall be of a gasketed, sleeve-type with a diameter that properly fits the pipe. 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 (Inches)	Center Sleeve Thickness (Inches)	Center Sleeve Width (Inches)
4	0.250	5
6	0.250	5
8	0.250	5
12	0.375	7
16	0.375	7
20	0.375	7
24	0.375	7

Ductile iron 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 together or where pipe is connected to fittings or valves of different materials, great care shall be taken to ensure the proper ring, insulating gasket, or adapter is selected.

630.05.03 Miscellaneous Pipe Fittings

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 City of Brighton's approval. Written requests for the approval of deviating items shall be made in advance

through City of Brighton.

630.05.04 Mechanical Joint Restraint Devices

The harnessing of joints may be accomplished by the use of one of the mechanical joint restraint systems or by the use of one of the several proprietary joint restraint systems supplied by pipe manufacturers. Proprietary systems will require City of Brighton'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 shown on 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 City of Brighton or switch to a metallic pipe. The use of rods and clamps on PVC pipe are not allowed.

630.06 Line Valves

Line valves shall be resilient seat gate valves. Valves shall be the same size as the main and shall open counter-clockwise. Valves with operators that open clockwise shall not be used unless they are required by, or approval is obtained from, City of Brighton.

630.07 Pressure Regulating Valves

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

They shall be sized so that the velocity through the valve at maximum demand does not exceed 25 feet per second. 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 are 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.

630.08 Tapping Valves and Sleeves

Tapping valves and sleeves shall be used concurrently to tap an existing main that is in service and under pressure 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.

Connections to the main that are 2-inches and smaller shall be made by a corporation stop that is the same size as the service line.

Connections to mains that are larger than 2-inches shall be made with an existing tee (cutting a tee into a dewatered line if permitted by City of Brighton) or a tapping valve and a tapping sleeve. 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 are used that are larger than 2-inches, 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.

630.09 Check Valves

A check valve permits flow in one direction only; it closes when the flow stops so reversal cannot occur. They are required for meter installations 1 1/2-inches and larger where there is no BFPA downstream. Check valves are not a substitute for BFPAs; however, they may be omitted from the meter installation in cases where a BFPA is within 150 feet of the meter.

630.10 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.

630.11 Valve Boxes

Buried gate valves that are 12-inches and smaller shall be provided with a 6-inch cast iron 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. The top section of the valve box shall be acceptable for use with a butterfly valve.

630.12 Valve Reference Marker Posts

When valves are installed where adequate physical reference points are not available, as determined by City of Brighton, a valve reference marker post may be required.

630.13 Water Meters

Water meters used in City of Brighton's system shall be preapproved in accordance with the approved manufacturer and model. City of Brighton 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. City of Brighton may change the type of meter at any time based on the water usage patterns of the Developer and/or Applicant.

630.13.01 Magnetic Drive Displacement Meters

Displacement meters 5/8 through 3-inch, known as nutating-disc or oscillating piston meters, they are positive in action. The pistons and 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, and commercial applications requiring a 3-inch or smaller service and for irrigation services 1 1/2-inches and smaller. The 1-inch and smaller magnetic drive displacement type water meter shall be furnished with a cast iron frost bottom.

630.13.02 Compound Meters

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- inches, except for irrigation and certain industrial uses where flow rates are relatively constant.

630.13.03 Turbine Meters

Turbine meters are designed to measure primarily large, fairly constant flows and should 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-inches and larger for certain industrial applications with relatively constant, high flows; they are not for domestic use.

630.13.04 Fireline-Type Meters

Fireline-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 City of Brighton. Single family residences and duplexes with a limited number of sprinkler heads may be exempt from this requirement.

630.14 Meter Appurtenances

630.14.01 Valves For Use with Meters:

Valves for 2-inch and smaller meters 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. **Outside settings, 1-inch or smaller:** Install a curb stop 2 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. **Outside settings, 1 1/2 or 2-inch:** Install a curb stop 2 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. **Detector check valve assemblies on 2-inch and smaller firelines:** Install a curb stop 2 to 5 feet before the DC vault. The DC setting shall include angle valves or ball valves on the inlet and outlet sides of the meter. Valves for the 5/8 or 3/4-inch meter on the DC shall be included in the meter-mounting kit from the DC manufacturer. The DC is required in addition to a required BFPA.

Valves shall be in accordance with AWWA C800.

630.14.02 Meter Couplings:

Meters 1 1/2-inches and larger shall be installed with a coupling to allow for the removal of the meter without disturbance to the pipe.

630.14.03 Coppersettors:

A coppersetter is a metal pipe frame that is inserted in the copper service line piping to support and convey water to the meter. Coppersettors for meter sizes that are 1-inch and smaller shall include a lockable angle valve on the meter inlet. Coppersettors for meter sizes that are 1 1/2 and 2-inch shall include lockable angle valves or ball valves on the meter inlet and outlet and a lockable ball valve on the bypass.

630.14.04 Valve and Meter Supports

Meter supports shall be a solid concrete block as shown on 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.

630.14.05 Electrical Continuity

To ensure safety, meter settings shall provide for electrical continuity in the event the meter is removed from the setting. For meters that are 2-inches and smaller, 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. For larger meters and for installations where a coppersetter is not used, there shall be an electrical continuity wire or strap connecting the pipe on either side of the meter setting.

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.

630.15 Meter Pits and Lids for ¾ and 1-Inch Meters

Meter settings for ¾ 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 have two doghouse cutouts that are 3 inches wide by 4 inches high and 180 degrees apart to accommodate 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. 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.
- B. A cast iron 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.
- C. The cap-type meter pit top lid shall be constructed of cast iron 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. Lids shall be capable of withstanding HS-20 traffic loading. Composite lids shall withstand an H20 traffic loading applied to a 9-inch square plate with no permanent deformation. Covers shall be available in various colors as required by City of Brighton; they shall have City of Brighton 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.
- D. The inner frost lid shall be high-density polyethylene.

630.16 Meter Vaults for Meters 1 ½-Inch and Larger

Meter vaults shall be precast concrete from approved manufacturers. Cast-in-place vaults may be used in special circumstances with prior approval of the structural design by City of Brighton. 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 by the use of sealants, membranes, or other approved methods. Access manholes shall be adjusted to be flush with the finished landscape grade or surrounding pavement.

630.16.01 Circular Vaults for 1 1/2 and 2-Inch Water Meters:

Vaults shall be 48 inches in diameter and of sufficient depth to extend below the 4 1/2 to 6 feet bury depth 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. Vaults shall sit on reinforced concrete manhole beams when subject to traffic loads.

630.16.02 Rectangular Vaults for Water Meters Larger than 2-Inches:

Vaults to be used for water meters larger than 2-inches shall be of a size and configuration in accordance with the Standard Drawings and approved by the Utility Director. Vaults shall be precast concrete from an approved manufacturer; however, vaults may be cast-in-place with prior approval of the structural design by City of Brighton. Vaults shall be designed to support the street fill and HS-20 traffic loading in accordance with AASHTO Standards. Meter vault lids shall be cast iron manhole covers with a 24-inch lid set into a 36-inch outer diameter ring.

630.16.03 Manhole Steps

Meter vaults shall include copolymer manhole steps cast into the side of the vault evenly spaced at 12 inch centers, maximum.

630.17 Concrete Structures

Structures shall be designed to support applicable loads. Design calculations, drawings, and contract specifications shall be submitted to City of Brighton for review.

Concrete used in structures shall be Class A.

630.18 Steel Reinforcement for Concrete

Steel reinforcement shall be deformed bars or welded steel fabric.

630.19 Manholes

Manholes and reducing sections shall be precast concrete.

Manhole rings and covers shall have the following additional requirements:

- A. The 24-inch manhole rings and covers shall be City of Brighton, Colorado Standard pattern and constructed of cast iron or an approved composite material.

- B. The 24-inch cast iron manhole cover shall weigh approximately 165 pounds. The 24-inch cast iron ring shall weigh approximately 240 pounds.
- C. The 24-inch recessed manhole covers for meter vaults shall be cast iron City of Brighton Standard pattern with one or two recesses that are approximately 7 inches in diameter by 3/4 inches deep with a 2 inch hole for the mounting of an AMR device through the lid. The lid shall be cast with the words City of Brighton 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 pounds. The cast iron 36-inch ring weighs approximately 280 pounds.
- E. Composite manhole covers for meter vaults shall be constructed of fiber reinforced polymer. They shall be furnished with a locking mechanism that prevents the lid from popping from its frame under traffic conditions and cast with the words City of Brighton Meter on the top. Composite covers shall retain traffic load rating and other performance characteristics between minus 60°F and 160°F. Composite manhole covers for meter vaults shall meet or exceed the requirements for cast iron manhole covers and shall fit equally well in cast iron or composite frames. Composite covers shall weigh less than 50 pounds and be available in a variety of colors as specified by City of Brighton.

630.20 Manhole Base Slabs and Base Beams

Manhole base beams shall be constructed of precast, reinforced concrete.

630.21 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 City of Brighton.

A gravity drain line or sump pump shall be used in conjunction with a sump where telemetry equipment is to be installed. 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. A cast-in-place floor shall incorporate a monolithic sump pit.

630.22 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.

The above ground vent pipe shall be 6-inch nominal diameter black steel pipe in accordance with ASTM A 53. The vent screen shall be a 3/4-inch No. 9-F11 flattened, expanded galvanized metal screen. The below ground vent pipe shall be 6-inch, Schedule 40 PVC with glued joints. A PVC glued joint by standard pipe thread female adapter shall be used to connect the steel pipe to the PVC pipe at ground level. This adapter is not needed where the residential vent pipe assembly is used. PVC pipe is not allowed for 8 foot above ground risers.

630.23 Fireline Connection to Mains

Firelines that supply sprinklers shall be sized by the Brighton Fire Rescue District and the persons responsible for the structure. City of Brighton will not size firelines.

630.24 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. The only acceptable material is seamless Type K soft copper pipe for 3/4 to 2-inch service lines. Ductile iron 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. Unless otherwise approved by the Utility Director, 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.

630.25 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, and large butterfly valve installations as shown on the Standard Drawings. Corporation stops are made in 3/4, 1, 1 1/2, and 2-inch sizes.

630.26 Curb Stop Service Boxes

Curb stop service boxes, or stop boxes, shall be cast iron, Buffalo type. The bottom part, shaped like an inverted U, shall straddle the service line and have a flanged bottom to support itself.

630.27 Corrosion Protection Systems

Cast iron and ductile iron pipes and fittings shall be protected against corrosion.

630.27.01 Polyethylene Encasement Material

Polyethylene wrap shall be used on metallic pipe fittings, rods, and appurtenances.

Flat Width Tubing (Inches)	For Use With: (Pipe Diameter in Inches)
24	4, 6, and 8
30	12
36	16
52	20 and 24

Harness rods shall be covered by 4 inch flat width polyethylene tubing. The entire joint shall be covered by a cigarette-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.

630.27.02 Insulators

Insulators shall be installed at the outlet end of the corporation stop.

630.27.03 Pipe Joint Bonding

In areas where the soil resistivity is 1000 ohm centimeters or less and metallic pipe must be used, joints shall be bonded with #4 solid copper wire. Cadwelds shall be covered by an approved method.

630.27.04 Wax Tape

Wax tape ductile iron pipe and fittings that shall be subject to submersion in manholes and vaults not equipped with sump pumps.

630.28 Kickblocks

Concrete kickblocks shall be sized for working pressure plus water hammer surge pressures, and soil bearing capacity. Standard shapes and sizes of kickblocks are shown on the Standard Drawings.

Kickblocks shall be constructed of Class B concrete or of a premeasured, sacked industrial mix such as Sakrete or Dri-mix. Ready-mixed concrete mixes shall be approved by City of Brighton.

630.29 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 will be subject to City of Brighton's approval.

630.30 Casing Pipe

Installation of mains through City of Brighton ROW, or the ROW or easements of others, such as highways, railroads, etc. may require casing pipes to facilitate the installation of the main. The casing pipe may be required by the permitting agency or by City of Brighton. 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, City of Brighton will specify the casing material. Such crossing will be subject to City of Brighton's approval to avoid conflicts in requirements or standards between City of Brighton and the persons or agency granting permission to cross. Final approval of the boring and casing methods and materials shall be obtained from City of Brighton prior to construction. When a bore is not required to cross interference, City of Brighton may require the installation of the main under the interference.

630.31 Carrier Pipe

Carrier pipe shall be fusible PVC or CertainTeed Certa-Lok PVC pipe.

630.32 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 City of Brighton'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 Denver, Colorado, except for metal with shop applied coating approved by City of Brighton.

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 City of Brighton. 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 City of Brighton.

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.

630.33 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 City of Brighton. 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 line valves where the conduit slopes away from the valve, or as determined by City of Brighton.

640.00 Pipe Installation

640.01 Approval by the City of Brighton

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

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

640.02 Handling of Materials

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 City of Brighton. Any pipe or fittings not acceptable to City of Brighton shall be removed immediately from the jobsite. Pipe handling equipment and pipe handling methods shall be approved by City of Brighton.

640.02.01 Pipe Storage

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.

640.03 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 particular care.

640.04 Pipe Joint Lubricant

Joint lubricant shall be supplied by the pipe manufacturer and approved by City of Brighton. Joint lubricant shall be non-toxic, water soluble, and certified to meet NSF/ANSI Standard 61.

640.05 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 City of Brighton.

NOTE: Power-driven saws with abrasive discs (masonry blades) shall not be used for dry cutting or beveling asbestos-cement 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 asbestos-cement pipe wherever cutting is necessary.

640.06 Pipe Alignment and Grade

In pipe laying, the intent is to lay to set line and grade within a tolerance of plus or minus 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 City of

Brighton. Cover over the pipe can be, in unusual circumstances, a minimum of 3 feet and a maximum of 10 feet if approved by City of Brighton.

Any changes in alignment and grade shall be authorized by City of Brighton 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 City of Brighton.

640.07 Deviation Occasioned by Other Structures

Whenever obstructions not shown on plans interfere to such an extent that an alteration in plans is required, City of Brighton will have the authority to determine the best method of correction. City of Brighton'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 Developer and/or Applicant shall pay the costs for changes.

640.08 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 shall be approved in writing by the Utilities Director.

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

Bulkheads and/or pneumatic plugs shall be thoroughly cleaned and disinfected with 100 mg/l calcium hypochlorite or sodium hypochlorite (chlorine) 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).

640.09 Frost

Pipe or appurtenant structures shall not be installed upon a foundation into which frost has penetrated or at any time when City of Brighton 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.

640.10 Ductile Iron Pipe

640.10.01 Push-on Joint

Immediately before joining two lengths of ductile iron 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.

640.10.02 Mechanical Joint

Before joining mechanical joint ductile iron fittings to ductile iron 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 City of Brighton. 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 ductile iron 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.

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.

640.10.03 Bolted Sleeve-Type Couplings

When installing bolted sleeve-type couplings, care shall be taken to ensure the connecting pipe ends, couplings, and gaskets are clean and free of dirt and foreign matter with special attention given to the contact surfaces of the pipe, gaskets, and couplings. These 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.

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 bolts shall be tightened approximately the same amount. Diametrically opposite nuts shall be tightened progressively and evenly. Final tightening shall be done to the coupling manufacturer's specifications with a torque-limiting wrench.

640.11 Polyvinyl Chloride Pressure Pipe

640.11.01 Elastomeric Gasket Joint

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 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 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.

640.11.02 Pipe Storage

Pipe stored outside and exposed to sunlight for more 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.

640.11.03 Handling of Pipe in Cold Weather

PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling PVC pipe during cold weather.

640.11.04 Underground Location and warning Tape

Install 6 inch wide detectable aluminum foil plastic backed tape indicating that a buried water line is installed 12 to 18 inches below surface grade. Tape shall be blue and manufactured by Thortec.

640.11.05 Tracer Wire and Warning Tape Installation

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. Contractor shall test tracer wire before construction acceptance is issued while City utility inspector is present. A three (3) inch wide, detachable warning tape shall be installed above all pipe, for the purpose of warning of location of buried pipeline. Color of warning tape is to correspond to the type of utility it is warning about, per Utility Notification Center of Colorado (UNCC).

640.11.06 Electronic Marker Devices

Electronic location markers shall consist of devices having a passive inductive device capable of reflecting a specifically designated impulse frequency, unique to the utility being installed. Devices shall be color-coded in accordance with the American Public Works Association's Utility Location and Coordinating Council Standards.

Marker devices shall be installed approximately 6-inches over the point to be located, and a minimum of 6-inches from any metal object. However, depth of burial shall not be less than 2 ½ feet nor more than 6-feet. Devices shall be hand backfilled to 1-foot above the device to prevent movement or damage.

Electronic Marker Devices shall be installed at the following locations:

1. At valves, one foot north or west of the valve over the main line.
2. At flanged outlets on concrete cylinder pipes

3. At bends, 22 ½ degree or larger
4. At capped or plugged ends
5. At tees over the main line.
6. For single services, over the main line at the service tap.
7. For double services, over the main line halfway between the service taps.

640.12 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.

Valves shall be located at the point on the main that would be intersected by the street property line if extended. Any deviations shall be at City of Brighton's discretion.

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

640.13 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 City of Brighton. Valve boxes shall be plumb and raised to the proper elevation.

640.14 Installation of Fittings

Where PVC pipe is inserted into cast iron or ductile iron 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 when installed during a main repair.

640.15 Installation of Tapping Saddles

A tapping saddle is used to make a wet connection to an existing main without taking the main out of service. A tapping saddle and tapping valve are not a substitute for a property line valve. A valve box shall be installed with the tapping valve.

Tapping saddles may be installed side-by-side when specifically approved in writing by City of Brighton. A 12 inch space shall be provided between adjacent saddle plates. In an intersection, two tapping saddles may be used to run lines out of both sides of the pipe if the alignment of the pipe is kept straight in its run out of the saddles. Tapping saddles used for domestic services and firelines 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 saddles, side-by-side or back to back, as a substitute for a cross is prohibited. A 6-inch tap on a 6- inch main and an 8-inch tap on an 8-inch main are allowed whereas a 12-inch tap on a 12-inch main is not allowed.

640.16 Fire Hydrants

640.16.01 Installation

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.

Each hydrant shall be connected to the street main by a 6-inch branch line. The branch line shall be ductile iron pipe only. 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.

640.16.02 Hydrant Drainage

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 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 cubic yard. The rock shall be a well graded gravel, cobble, or brick sized crushed rock.

640.16.03 Hydrant Protection from Corrosion

The ductile iron 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 manner in which 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.

640.17 Fireline Connections

Fireline connections shall be restrained ductile iron pipe. The fireline connection shall have a valve 2 to 5 feet from the property line that is on the street side of the property line. The fireline connection shall be protected from corrosion. Requests for residential fireline connections shall be submitted with the plans to City of Brighton for approval.

640.18 Kickblocks

The following standard shall apply to kickblocks:

640.18.01 Installation

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 shown on 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, or 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 City of Brighton Inspector unless inspection is waived prior to the placement.

640.18.02 Formwork for Kickblocks

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 be inspected and approved by City of Brighton.

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.

640.18.03 Kickblock Curing Time

Newly placed concrete shall be allowed to set undisturbed for a minimum of 24 hours.

640.18.04 Compaction of Fill Over Kickblocks

Backfill may be placed over kickblocks once 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.

640.19 Concrete Structures

640.19.01 Formwork

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 City of Brighton. 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.

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. City of Brighton 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.

640.19.02 Mixing and Placing

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 job site to bring the slump within 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.

Concrete that has partially hardened or been contaminated by foreign materials is 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 making adjustments in 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 follow 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 follow the recommended practices of ACI 305. The cooling or warming of plastic concrete mixtures shall not be undertaken without City of Brighton's approval.

640.19.03 Consolidation

Concrete shall be thoroughly consolidated with internal vibrators as recommended in ACI 309. City of Brighton will 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.

640.19.04 Finishing

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 light broom finished to Class A tolerance in accordance with ACI 301.

The wetting of concrete surfaces during slab finishing operations is not permitted. Concrete finishing operations shall not be performed while there is water on the surface.

640.19.05 Construction and Contraction Control Joints

Construction joints not indicated on plans must be approved by City of Brighton. 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 shall be subject to City of Brighton's approval.

640.19.06 Curing and Protection

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 City of Brighton.

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

640.19.07 Surface Repair

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

640.20 Reinforcing Steel for Concrete Structures

640.20.01 Installation

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 must be approved in writing by City of Brighton. 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, or 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.

640.20.02 The Placing and Reinforcing Steel

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 the City of Brighton. 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 City of Brighton'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, it shall not be less than 3 inches.
2. Where concrete is exposed to weather or exposed to the ground but placed in forms, it shall not be less than 2 inches for bars more than 5/8 inch in diameter and 1 1/2 inches for bars 5/8 inch diameter or less.
3. In formed surfaces not in contact with the ground or exposed to weather, it shall not be less than 3/4 inch.

640.21 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. Fireline connections.

- C. Domestic line connection 3-inches and larger
- D. Vertical bends.
- E. Reducers
- F. Vertical and horizontal offsets
- G. Horizontal bends, line 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 the City.
- K. When the City 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.

640.22 Connections to City of Brighton System

640.22.01 Connections

Connections to City of Brighton's system shall be in a neat and workmanlike manner. City of Brighton will be present during the construction of connections. Connections are subject to City of Brighton's approval. Only one connection to the existing system will be permitted until the conditions and tests outlined in Section 640.26 are met.

City of Brighton does not guarantee the water tightness of its valves on existing facilities. If existing valves leak, City of Brighton 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 City of Brighton unless the water supply is protected as required against actual or potential cross connections. Water service to premises will be discontinued by City of Brighton if a required BFPA 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. Please see Section 610.06 for more information on Cross-Connection Control and Backflow Prevention.

640.22.02 Operation of Valves

When connecting to City of Brighton's system, it may be necessary to operate existing City of Brighton valves. Valves on City of Brighton's system that must be operated to make a connection will be operated only by appropriate City of Brighton personnel. The Contractor shall give City of Brighton 48 hours' notice to arrange for the operation of valves. Both the Contractor and City of Brighton will be present when valves are operated.

640.22.03 Interruption of Service

The installation of a connection that requires the closing of existing valves may cause an outage of water to existing City of Brighton customers. Affected customers shall be notified by the Contractor in writing 48 hours in advance of service interruptions. The notices shall be delivered by hand to each resident. If an occupant cannot be contacted, the written notice shall be left at the door.

The Brighton Fire Rescue District shall be notified 48 hours 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 Brighton Fire Rescue District.

A normal outage shall be a maximum of 4 hours. If an outage is to be greater than 4 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 4 hours will be subject to review by City of Brighton 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 shall be approved in writing by City of Brighton.

640.23 Corrosion Protection Systems

640.23.01 Dissimilar Materials

Cathodic protection and insulation shall be installed as required by City of Brighton. Particular care shall be taken to insulate between dissimilar materials.

640.23.02 Insulating Joints

Wherever it is necessary to join pipe of dissimilar metals, a method of insulating against the passage of electrical current, approved by City of Brighton shall be provided. Special care shall be exercised during installation to prevent electrical conductivity across joints. After the insulating joint installation is complete, City of Brighton 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.

640.23.03 Polyethylene Encasement Material

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 the bedding material; it is not intended to be a completely airtight and watertight enclosure.

A 2 inch wide 10 mil thickness polyethylene pressure-sensitive tape 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 City of Brighton 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 City of Brighton. Damage to the pipe wrap caused by tapping the main will be repaired by City of Brighton.

Main extensions and private pipe extensions shall be chlorinated in accordance with AWWA C651 and the requirements of the local health authority having jurisdiction prior to acceptance by City of Brighton. The chlorinating agent and the method of application shall be approved by City of Brighton.

The chlorination of the finished pipeline shall be done prior to hydrostatic testing. Before filling the pipe with water, the pipe shall be cleaned and free of debris to the satisfaction of City of Brighton. City of Brighton will not provide labor or material for disinfection to Approved Applicants for the installation of mains under private contract.

Chlorine tablets may be used for disinfection in 12-inch and smaller pipes. 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 pipes, 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 50milligrams/liter*			
Pipe Length (Feet)	Pipe Diameter (Inches)		
	6	8	12
13 or less	2	2	5
18	2	3	6
20	2	3	7
*Based on 3 ¾ 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 is considered a low risk discharge. For more information on CDPHE's low risk discharges, please visit <https://cdphe.colorado.gov/clean-water-policies>. The permit requires dechlorination, consumptive use, or land applications prior to discharge. Care shall be taken in flushing the pipeline to prevent property damage, erosion and danger to the public. Discharges of water from blowoff assemblies or other appurtenances shall be contained or discharged in a manner approved by City of Brighton. Such discharges shall not go directly to the sanitary sewer. The discharges may be permitted to enter the City's storm drainage system with prior approval and adherence to the CDPHE low risk discharge guidance.

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 done by the local health authority having jurisdiction or their designated representative.

Newly installed water mains and firelines shall be hydrostatically 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.

City of Brighton shall be notified 24 hours in advance of testing. Testing shall be made in the presence of City of Brighton.

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 must be certified and approved by City of Brighton. The use of barrels, sanitary or otherwise, to supply water for hydrostatic testing is prohibited.

City of Brighton will furnish the calibrated meter for testing but will not supply the pump. 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 water. The test pressure of 150 psi shall then be applied to the pipeline by means of a 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, City of Brighton will require a tap to purge the line. The location and the size of the tap to be used is at City of Brighton's discretion.

While the test pressure is maintained, 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. Leakage is not allowed through the bonnet of the line valve. A valve leaking through the bonnet may be repaired in place or removed and replaced. Cutting and replacement of pavement as well as excavation and backfilling may be necessary when locating and repairing leaks discovered during pressure testing.

After visible leaks are stopped, the full test pressure shall be maintained for 1 continuous hour. Allowable leakage for each section between line valves shall not exceed the following leakage rates for 4 through 20-inch distribution and transmission mains:

Allowable Leakage Per Hour	
Pipe Size (Inches)	Gallons Per 1,000 Feet of Pipe
4	0.33
6	0.50
8	0.66
12	0.99
16	1.32
20	1.66

Should testing show a leakage rate in excess of the rates shown, the pipeline will not be accepted. The pipeline shall be repaired, rechlorinated, and retested until it meets test requirements.

640.26 Acceptance and Release for Taps

A main will be accepted by City of Brighton and released for taps when the following conditions are met:

- A. **Installation:** The main and appurtenances are installed to the satisfaction of City of Brighton and pertinent notes and measurements made.
- B. **Tests:** The following tests are passed and the test outcomes provided to City of Brighton:
 1. A chlorination test and any other tests required by the local health authority having jurisdiction.
 2. A compaction test indicating the trench backfill meets City of Brighton requirements performed under the direction of a PE.
 3. A hydrostatic test.
 4. A valve and valve box inspection.

640.27 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- inches. Under special conditions, such as a long run with only a few taps, a nonstandard blowoff larger than 2- inches may be required.

The standard required blowoff for 16-inch and larger ductile iron pipe shall be a 6-inches.

640.28 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 the course of installation, as described below, or as otherwise directed by City of Brighton.

When the sewer is 15-inches or less in diameter and crosses over the 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 ductile iron 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 City of Brighton 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 greater than 15-inches in 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 addition, when water mains or associated piping cross under a sewer, the bedding material shall be replaced around the sewer to a point at least 1 foot above the top of the sewer pipe for sewers 15- inches in diameter and smaller, and to at least springline for sewers larger than 15- inches in diameter. 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.

640.29 Horizontal Directional Drilling

With the approval of City of Brighton, Horizontal Directional Drilling (HDD) may be used as a method of installing PVC or ductile iron distribution 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 City of Brighton a pilot bore plan with the vertical scale of 1" = 2' and horizontal scale of 1" = 20'. 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.

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 City of Brighton. City of Brighton will 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 outside diameter 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 inside diameter 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 or polyethylene encasement, as required for the particular type of carrier pipe, shall be adequately secured to the pipe prior to the pull-back operation. The Contractor should follow the manufacturer's recommendations regarding the installation of polyethylene encasement, which includes making the final overlap opposite to the direction of the pull. 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 pullback, 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 City of Brighton based on electronic walkover system readings showing the actual location, horizontally and vertically, of the installation.

640.30 Pipe Bursting

Pipe bursting may be used as a method of replacing distribution mains with the written approval of City of Brighton. 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.

640.30.01 Equipment

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 must maintain automatic thrust and pull-back and be capable of pulling from either side of the bursting head system.

640.30.02 Pipe

Pipe utilized for pipe bursting shall be fusible PVC pipe.

640.30.03 Installation

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 City of Brighton.

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 greater 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 City of Brighton, 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.

650.00 MATERIAL SPECIFICATIONS

650.01 General

City of Brighton shall follow the Denver Water Material Specifications except as noted herein.