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SECTION 8

WATER DISTRIBUTION SYSTEMS

8.1 PURPOSE

This section establishes the minimum standards and technical design criteria for water distribution systems within the Board's service area. Adherence to these standards will expedite review and approval of plans. Hydraulic design principles presented herein represent acceptable procedures not necessarily to the exclusion of other sound and technically supported design procedures. Any departure from these design requirements should be brought to the attention of the Board's engineer and discussed prior to submission of plans for approval. Such departure shall be documented and justified.

8.2 DEFINITIONS/ABBREVIATIONS

Where the following words, terms, or abbreviations (or pronouns in place of them) are used in this Section, the intent and meaning shall be interpreted as follows:

1. Approval – Approval of Plans – A review by the Board's Engineer of Plans, stating the plans are in substantial compliance with the Board's specifications.
2. And/Or - An option of the Board's Engineer or representative.
3. ASCE – American Society of Civil Engineers.
4. ASTM – American Society for Testing and Materials.
5. AWWA – American Water Works Association.
6. Board – The Water Works and Sanitary Sewer Board of the City of Montgomery, or its authorized representative.
7. Board's Attorney – The law firm and/or attorney hired and/or retained by the Board.
8. Board's Engineer – The regular employed staff engineer of the Water Works and Sanitary Sewer Board.
9. Contractor – The individual, partnership, firm, corporation, or any acceptable combination thereof contracting for the performance of the prescribed work.
10. Corporation Cock – A special brass valve designed for insertion in the water mains to which can be attached the service line of the owner.

11. Curb Cock - A special brass valve designed for the installation between the service line and owner's plumbing, and to be used only by the Board for conveniently turning water on and off.
12. Developer – The party or parties paying for the installation of the water main and appurtenances.
13. Developer's Engineer – The professional engineer (licensed in the state of Alabama) employed by the Developer who is responsible for the submission of engineering plans and project development.
14. Distribution System – The pipes, mains, valves, fittings and other related appliances through which water is transmitted to customers of the Board.
15. Easement – A right to use or control the property of another for designated purposes.
16. Inspector – The Board's authorized representative assigned to make detailed inspection of contract performance.
17. Job Site – The location of the project where water mains and appurtenances are to be installed.
18. Mains – The pipe in the street, easement, avenue or alley, extending parallel or nearly parallel to the line of property abutting thereon.
19. Owner – The person who has legal or equitable title to any premises.
20. Paving – The surface of a street, or treatment thereof.
21. Right of Way – A general term denoting lands, property or interest therein, usually in a strip, acquired for or devoted to transportation purposes.
22. Service Main – The temporary supply pipe installed on streets where no standard water main exists.
23. Standard Drawings – Drawings approved for repetitive use, showing details to be used where appropriate.
24. Street – Every way or place of whatever nature, whether within or without the corporate limits of the City of Montgomery, open to the use of the public, including streets, alleys, highways, park, or other road, and all public places.
25. Tap – A corporation cock, valve, or fitting, installed in the main of the Board to which can be connected a private water lateral for water service.
26. Water Lateral – The pipe fittings and equipment in a street connected to a main used to conduct water to any premises.
27. Water Service – The furnishing or supplying of water through the Board's water system for the residential, commercial, industrial, or fire protection uses, or the readiness to furnish water for said purposes.

28. Water System – The Board’s distribution system, located in the City and in territory contiguous thereto, and supplying the City and citizens thereof with water service, together with any extension and additions thereto hereafter made.

8.3 GENERAL LOCATION CRITERIA

8.3.1 WATER MAIN LOCATION

Whenever possible water mains in subdivision construction projects shall be located in the street right-of-way. Water main extension projects located along State right-of-ways, however, are to be located in dedicated water easements. If the Board’s engineer determines that it is not practical to locate the water main in the street right-of-way, then the main shall be located in an easement dedicated solely for the water utility service.

8.3.1.1 Installation in Right-of-Way

Whenever possible water mains shall be located in pavement 5 feet from the back of curb on the South side and East side of the street. The water mains shall maintain a consistent alignment with respect to the center line of the road. This distance shall be clearly indicated on the design drawings submitted for review and approval. Reference standard drawings for the typical location and layout of water mains within the right-of-way.

8.3.1.2 Installation in Dedicated Easement

All water mains located outside of dedicated rights-of-way shall be centered within a minimum 15-foot easement. In such cases, no water main shall be located within 7 1/2 feet of any structure. At the Board’s discretion, additional easement widths and/or water main/structure separation shall be provided when the pipe size or depth of cover so dictates.

If a water main is located adjacent to a road right-of-way, a minimum 10-foot easement may be provided upon the review and approval of the Board’s engineer. If a 10-foot easement is granted adjacent to the road right-of-way, the main shall be positioned such that there is a minimum of 5 feet from center line of pipe to edge of easement, opposite road right-of-way. Water mains shall not be placed under retention ponds, tennis courts, or other structures, unless approved by the Board.

8.3.1.3 Installation Down Lot Lines

In general, water mains shall not be located along side or rear lot lines of properties. Water mains along a lot line may be allowed on a case by case basis provided that such a configuration will result in improved network circulation. In such cases, the water mains shall be placed in a steel encasement pipe within a prescribed water easement. At a minimum, the encasement pipe shall extend from the front to the rear building lines of the property. A valve shall be required on each side of the encasement to isolate and allow removal of the pipe.

8.3.2 WATER LATERAL LOCATION

The Board's inspector shall provide direction for the layout of tap locations using his best judgment. Typically, service taps and laterals shall be located in the middle of the lot. Lot corners and back of curb must be staked before the water laterals are laid. Each individually platted lot shall have its own lateral. Electronic water lateral markers shall be used to indicate location of each lateral.

8.3.3 FIRE HYDRANT LOCATION

8.3.3.1 General

All fire hydrants shall be located as shown on the plans. The hydrants shall be located in such manner as to provide complete accessibility and also in a manner that the possibility of damage from vehicles or injury to pedestrians will be minimized. All hydrants shall stand plumb with the pumper nozzle facing the curb and the bury line of the hydrant at the finished grade.

Fire hydrants shall be set to conform to AWWA Standard C600. Hydrants shall be set to match the established grade, with the lowest nozzle at least 12 in. above the ground or as specified. Traffic-model hydrants, which are designed to fail at the ground line on vehicle impact, shall be installed so that the breakaway flange is not less than 2 in. or more than 6 in. above the established grade.

Fire hydrants installed in state highway right-of-ways shall be in accordance with any Department of Transportation requirements. All fire hydrants shall be connected to the main in the manner shown in the Water Standard Detail Sheet. Also, where present, the retaining chains and swivel clips for the fire hydrant port caps must turn freely. The chains must be untangled and the swivel serving the cap must operate without hindrance.

8.3.3.2 Location and Spacing

The Montgomery Fire Department is the final authority regarding number of hydrants and their spacing. The following guidelines may be used to locate the hydrants required.

Fire hydrants shall be located, within right-of-way of the proposed street approximately 1 foot from the right-of-way line. The center of the hydrant shall be set not less than 3' or more than 6.5' from back of curb. Hydrants shall typically be located on the side of the street or intersection that does not conflict with storm sewer piping or sidewalks. Hydrants shall be placed at lot lines, or in general to minimize potential conflict with future building plans.

8.3.3.3 Single-Family Residential

The spacing between hydrants in a residential area should not exceed 450 feet along public streets or approved fire routes. Fire routes shall be as defined by the Montgomery Fire Department. In a cul-de-sac a fire hydrant should not be more than 350 feet from the last lot.

8.3.3.4 Multi-Family Residential/Commercial

The spacing between fire hydrants in a commercial area should not exceed 300 feet along public streets or approved fire routes. Fire routes shall be as defined by the Montgomery Fire Department.

8.3.4 VALVE LOCATION

Valves shall generally be located on property lines and/or right-of-way lines and at the radius points (in asphalt pavement) of intersections.

8.3.4.1 Commercial and Residential Areas

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards can be limited during repairs. Valves shall be located at every intersection of a grid and at not more than 800-foot intervals in commercial, industrial and high-density residential areas.

As a general rule, valves shall be spaced along a main a minimum distance in feet of main diameter in inches times 100 (i.e., a 6 inch main would need a valve every 600 feet).

8.3.4.2 Cul-de-sac

Isolation valves are required at the intersection of the beginning of a cul-de-sac.

8.3.4.3 Dead End Street

Valves shall be required at the end of each dead end street or road which could be extended in the future. The valve at a dead end shall be properly restrained in order to allow the future extension without disruption of service. Valves on the end of a main at a property line shall be secured by a dead-man and rodding or the addition of several lengths of main and blocking behind the plug. No taps or service laterals will be allowed between said valve and plug (this will prevent service disruptions when the main is extended).

8.3.4.4 Rural areas

Where systems serve widely scattered customers and where future development is not expected, the valve spacing may be increased from those outlined herein but shall not exceed 1500-foot intervals. Appropriate valving shall also be provided at all areas where water mains intersect to ensure effective isolation of water lines for repair, maintenance, or future extension.

8.3.5 METER AND VAULT/METER BOX LOCATION

Meters shall be centered in the vault or meter box to allow for reading and ease of removal or maintenance. Large meters, where possible, shall be set within the street R.O.W. If this is not possible, then the meter shall be set as close to the street or road R.O.W. as possible and a water easement shall be obtained.

8.3.6 AUTOMATIC FLUSHING HYDRANTS

The Board's Engineer shall require automatic flushing hydrants in locations where sufficient flows are not present at the time of development to maintain an adequate disinfectant residual in the public main. These devices shall be installed, operated, and maintained until such time as the progress of the development achieves the flows necessary to maintain an adequate disinfectant residual.

8.4 DESIGN CRITERIA

Water distribution systems shall be designed to satisfy the ultimate tributary population's domestic/commercial water demand and fire protection requirements for the area under consideration.

8.4.1 FIRE FLOW REQUIREMENTS

It is the responsibility of the Developer's Engineer to coordinate with the local authorities having jurisdiction to ensure that fire flow requirements are met.

8.4.2 DESIGN CALCULATIONS

If requested by the Board, the Developer's Engineer shall submit signed, sealed, and dated design calculations along with the construction plans for the water distribution projects. Calculations shall show the water mains having sufficient hydraulic capacity to transport peak hourly flows and the combination of maximum daily flow and fire flows while meeting the requirements of this Section. Peak hour, maximum daily flows shall not exceed 10 ft./sec anywhere in the Board's system.

8.4.3 PRESSURE AND FRICTION LOSS

All water mains shall be designed in accordance with this Section. The system shall be designed to maintain a minimum pressure of 20 psi at all points in the distribution system under all conditions of flow. Higher pressures may be required at commercial, industrial and high-density residential areas. The normal working pressure in the distribution system should be approximately 55 psi, but in no case less than 40 psi on the downstream side of a meter/backflow preventer. For pressures greater than 75 psi, the design engineer may need to take special provisions (e.g. pressure reducing valves).

Friction losses through water mains shall be based on the Hazen and Williams formula. In the use of Hazen and Williams formula, the value for "C" shall be 120 for ductile iron pipe and 130 for PVC pipe. "C" values greater than 130 shall not be allowed.

8.4.4 DIAMETER

Only 4", 6", 8", 10", and 12" diameter water mains shall be permitted (larger sizes shall be considered on case-by-case basis). Four (4) inch water mains shall be permitted only in cul-de-sac areas with a maximum length of 500 feet of pipe. As a minimum, six (6) inch diameter gridded or looped systems shall be required in low-density residential projects. In

commercial, industrial, and high-density residential areas, eight (8) inch minimum gridded or looped mains shall be required. Larger size mains shall be installed if required to allow the withdrawal of the required fire flow while maintaining the residual pressure specified.

Fire protection water mains shall be installed as follows:

No fire main servicing a fire hydrant (public or private) shall be less than six (6) inches in diameter.

For systems containing mains less than eight (8) inches in diameter, the Board may require the design engineer to submit a complete hydraulic analysis of the system. This submittal does not relieve the design engineer of responsibility for his design. He shall be responsible for ensuring that all elements thereof that supply water to hydrants and/or building fire protection systems can supply the required fire flow without exceeding the prescribed velocity.

8.4.5 ALLOWABLE DEFLECTION OF PIPE JOINTS

8.4.5.1 Ductile Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, bends shall be furnished to provide angular deflections within the limit set forth.

8.4.5.2 PVC Pipe

The maximum allowable deflection shall be as given in AWWA C900 and AWWA C909. If the alignment requires deflection in excess of the above limitation, bends shall be furnished to provide angular deflections within the limit set forth.

8.4.6 FLANGED PIPE

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

8.4.7 FIRE HYDRANTS

8.4.7.1 Installation

A 6" Mechanical Joint (M. J.) hydrant connection shall be provided using a hydrant valve anchoring tee with integrally cast standard M.J. gland on 6" plain end branch. When possible, fire hydrant extensions shall be by the same manufacturer as the fire hydrant. Traffic-model hydrants, which are designed to fail at the ground line on vehicle impact, shall be installed so that the breakaway flange is not less than 2 in. or more than 6 in. above the established grade.

8.4.7.2 Leaders

Unless specifically stated on the construction plans, fire hydrant leaders shall match the main it originates from (PVC leaders on PVC mains, DI leaders on DI mains).

8.4.7.3 Obstacle Clearance

For fire fighting capability, fire hydrants shall be located a minimum of 40 feet from the structure to be protected.

Where a public hydrant is located in a congested area, a minimum fifteen foot clearance shall be provided and maintained from the hydrant ports and any obstacle (i.e. utility poles, fencing, landscaping, or similar obstruction). Such clearance is required in order to minimize the potential for damage to the surrounding property during periodic flow testing or flushing.

8.4.8 DEAD ENDS

In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical, as determined by the Board. Where dead-end mains occur, the main shall be reduced to a four (4) inch diameter pipe after the last fire hydrant in an effort to reduce the potential for stagnant water.

8.4.9 MAIN TERMINUS EXTENSIONS

At the terminus of a main to be extended, the engineer shall install an isolation valve and a sufficient amount of piping to restrain the valve. Where conditions allow, the contractor shall lay up to the valve, and extend out of the valve, with full joints of pipe (roughly 18-20 ft. joints). The valve shall be restrained to the pipe through the use of mechanical restraint devices as called for in section 8.4.15 (Thrust Restraint).

8.4.9.1 DI Pipe

The table below lists the minimum length of DI piping required to restrain the isolation valve for various sizes of main.

SIZE OF PIPE	MINIMUM LENGTH OF PIPING REQUIRED TO RESTRAIN ISOLATION VALVE
4" – 8"	1 JOINT OF PIPING (APPROXIMATELY 20 FT.)
10"	2 JOINTS OF PIPING (APPROXIMATELY 40 FT.)
12"	3 JOINTS OF PIPING (APPROXIMATELY 60 FT.)
>12"	AS DIRECTED BY THE BOARD ENGINEER

8.4.9.2 C900 and C909 Pipe

Unlike DI pipe, PVC installation requires a significantly larger gap to remain in the bell upon installation. This gap, if not accounted for, can provide the necessary void space to allow movement of the valve/pipe and un-seat the gasket creating a leak. The installation contractor must restrict this potential movement in the PVC pipe bell through the use of restraint

mechanisms. The table below lists the minimum length of PVC piping required to restrain the isolation valve for various sizes of main.

SIZE OF PIPE	MINIMUM LENGTH OF PIPING REQUIRED TO RESTRAIN ISOLATION VALVE
4" – 8"	1 JOINT OF PIPING ON BOTH SIDES OF VALVE (APPROXIMATELY 40 FT.)
10"	1 JOINT OF PIPING ON BOTH SIDES OF VALVE (APPROXIMATELY 40 FT.)
Greater than or equal to 12"	AS DIRECTED BY THE BOARD ENGINEER

8.4.10 SEPARATION OF WATER AND SEWER MAINS

Water mains that are laid in the vicinity of existing or proposed pipelines designated to carry wastewater shall meet the horizontal and vertical separations as follows.

Extreme care should be exercised when designing water mains at or near certain sites such as sewage treatment plants or industrial complexes. No water pipe shall pass through or come in contact with any part of a sanitary sewer manhole.

8.4.10.1 Horizontal Separation

NORMAL CONDITIONS: Water mains shall be located at least 10 feet horizontally from gravity and/or force mains carrying wastewater. The distance shall be measured from inside edge of pipe to inside edge of pipe.

UNUSUAL CONDITIONS: When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a pipe carrying wastewater provided that the bottom of the water main is at least 18 inches above the top of the sewer pipe and the water main is laid in a separate trench or on an undisturbed earth shelf.

8.4.10.2 Vertical Separation

NORMAL CONDITIONS: Water mains shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer.

UNUSUAL CONDITIONS: When construction conditions prevent a vertical separation of 18 inches as described herein above, the sewer pipe shall be constructed of ductile iron pipe centered a minimum of 10 feet in both directions from point of crossing.

8.4.11 WATER MAIN/SEWER CROSSING

Whenever possible, water mains shall cross above sewer mains unless the previously described upgrades are enacted. Adequate structural support for both the water main and sewer mains shall be provided to prevent excessive deflection of joints and settling. 10-foot horizontal separation of water mains and storm drains is required, otherwise upgrade water main as previously specified until separation is regained.

8.4.12 WATER MAIN/STORM WATER CROSSING

Whenever possible, water mains are allowed to cross over drainage pipes as long as minimum 30" of cover from top of pipe to the finish grade (i.e. top of back of curb) is maintained. Where it is not possible to go over top of drainage pipe and maintain the required cover, the water main is to go under drainage pipe either by breaking the pipe gently at each joint or by utilizing mechanically restrained offset fittings. Thirty inches to forty-two inches (30"-42") of cover from top of pipe to the finish grade is to be maintained up to and immediately after water main/drainage pipe crossing. No water main shall pass through or come in contact with a storm drain pipe or manhole unless a pre-approved, engineer designed, conflict structure is utilized.

Water mains that cross under storm piping 24" inches in diameter and larger shall be steel encased a minimum of 8 ft or as required on drawings. The encasement will allow Board personnel to access and perform repairs on the water main without undermining the storm piping. When crossing under storm piping less than 24" in diameter, steel encasement will not be required, but pipe bedding (min 6-inches) and pipe zone material shall be gravel as defined in Section 8.5.33, Backfill, and extended to 1-ft above the top of pipe/encasement.

8.4.13 LATERALS*8.4.13.1 General*

With the exception of cul-de-sacs, laterals shall, if at all possible, run perpendicular to the water main. Each individually platted lot shall have its own lateral. Unless otherwise indicated by the approved construction drawings, laterals shall be located in the center of the proposed lot and be buried with an electronic locator.

8.4.13.2 Laterals on Ductile Iron Mains

All new installations of 2-inch diameter and smaller water laterals may be copper or plastic material as specified herein.

8.4.13.3 Laterals on PVC Mains

Due to the accelerated corrosion of copper laterals on PVC mains (electrolysis), all new installation of PVC mains (C900 or C909) shall require the use of a plastic lateral material.

8.4.13.4 Plastic Laterals

All plastic laterals shall be installed with locating wire strung along the length of the lateral from corporation stop to curb stop. The lateral shall be buried with an electronic locator below the curb stop. It shall not be removed when house side plumbing is connected to the lateral.

8.4.14 YOKING WATER METERS

A yoke may be installed on a lateral if an additional service is required for a single platted lot. A yoked lateral shall in no case cross a platted lot line. A yoke may be installed only if the existing lateral does not have the maximum number of meters (listed below by size of lateral) already present. Yoke design/construction shall be reviewed on a case by case basis. The Board’s inspector shall provide final approval of yoke design during construction.

LATERAL PIPE SIZE (INCHES)	MAXIMUM NUMBER METERS SERVED	
	¾” METERS	(OR) 1” METERS
¾	2	
1	3	
1 1/2	6	3
2	8	4

8.4.15 THRUST RESTRAINT

Plugs, caps, tees, and vertical or horizontal bends, on waterlines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust restraints where unbalanced forces exist. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or restrained joint piping and fittings. The preferred method for restraint is the use of internal restraint methods specified. The use of bell harnesses and concrete blocking will be reviewed on a case-by-case basis.

8.4.15.1 Mechanically Restrained Pipe and Fittings

Mechanically restrained joints shall be installed at **all connections, any bend, tee, fire hydrant, and dead end valve** as specified on the plans. Where possible, the contractor shall plan his work to provide a complete joint of pipe (roughly 20 ft) into and out of these connections. The design engineer shall calculate and clearly call out on the plans the restrained length of pipe in order to accomplish the desired goal.

8.4.15.2 Thrust Blocks

Thrust blocks may be used in locations where other utilities are not present and obstructions do not interfere with thrust blocking. In such cases, blocks must be constructed per Standard Drawings and be inspected by the Board’s personnel prior to pouring.

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 3,000 psi after 28 days. Unless otherwise directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust shall be poured against forms. The area of bearing shall be as illustrated in the standard detail drawing. Blocking shall be placed/poured so that the fitting joints will be accessible for repair. **Note: Calcium chloride additives are not allowed in deadmen due to their corrosive properties on threaded rods and piping.**

Where any section of a water line is provided with concrete thrust blocking, the hydrostatic tests shall not be made until at least 24 hours after installation of the concrete thrust blocking, unless otherwise approved by the Board's inspector.

8.4.16 OPERATION OF EXISTING WATER DISTRIBUTION FACILITIES

Unless prior approval has been obtained, the operation of ANY valve on the existing public distribution system shall be restricted to the Board's personnel ONLY.

8.4.17 TRENCH PREPARATION

8.4.17.1 General

It is the responsibility of the contractor to maintain a safe working environment and comply with OSHA Code of Regulations Part 1926 (latest revision).

8.4.17.2 Excavation

A trench shall be opened so that the pipe can be installed to the alignment and depth required. It shall be excavated only so far in advance of pipe laying as necessary. The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing support for the pipe on undisturbed ground. Bell holes shall be provided at each joint to permit jointing to be made and inspected properly.

During excavation, if ashes, cinders, muck or other organic material considered unstable is uncovered at the bottom of the trench at subgrade, it shall be removed and replaced with approved material for a depth not less than 12 inches. This material shall be tamped in layers of 6 inches to provide a uniform and continuous bearing characteristic of that area's soil condition. Where the bottom of the trench at subgrade consists of unstable material to such a degree that it cannot be removed and replaced with an approved material to support the pipe properly, a suitable foundation shall be constructed. Excavated material shall be piled in such a manner that it will not endanger work, obstruct natural watercourse, sidewalks or driveways.

Fire hydrants and valve boxes or other utility controls shall be left unobstructed and accessible at all times. Street gutters shall be kept clear or other satisfactory provisions made for street drainage. All surface materials, which are suitable for reuse in restoring the surface, shall be kept separate from the excavated materials.

8.4.17.3 Sheeting and Bracing

Open cut trenches shall be sheeted and braced as required by OSHA Code of Regulations Part 1926 (latest revision) and as may be necessary to protect life, property, or the work. Trench bracing may be removed after the backfilling has been completed or has been brought up to such an elevation as to permit its safe removal. A trenching box may be used in place of sheeting and bracing as long as said box is in compliance with above referenced OSHA Code.

8.4.18 DEWATERING

Water shall not be allowed in the trench at any time. An adequate supply of well points, headers and pumps, all in first class operating condition, shall be used to remove the ground water. The use of gravel (angular stone/57 stone) and pumps shall also be an acceptable means of removing the water on a case by case basis as approved by the Board. At no time shall any pumps emit an unacceptable noise level or the contractor will be required to shut down pumping operations.

The trench shall be excavated no more than the available pumping facilities are capable of handling. The discharge from pumps shall be routed to settling basins or other acceptable erosion and sedimentation control devices prior to discharging to natural or existing drainage channels or storm sewers. Any and all permits required for Dewatering are the responsibility of the Contractor and shall be obtained prior to commencement of construction.

The Board reserves the right to require the submittal of a dewatering plan in instances where complexity of the project dictates. When requested, the plan shall be designed and stamped by a licensed engineer.

8.4.19 PIPE LINE CONSTRUCTION

8.4.19.1 Pipe Laying

All water mains, service lines and appurtenances shall be installed as specified in these technical provisions and in accordance with the approved Plans and appropriate standard detail sheets as provided herein.

The bottom of the trench shall not be excavated below the specified grade. If undercutting occurs, the bottom of the trench shall be brought up to the original grade with approved material, thoroughly compacted as directed by the Board's Engineer and/or his representative.

Before placing pipe into the trench, the outside of the spigot and the inside of the bell shall be wiped clean and dry, free from oil and grease. Every precaution shall be taken to prevent foreign material from entering the pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe.

All mechanical joints shall be made up in strict accordance with the manufacturer's specifications. Gaskets shall be evenly seated, the gland placed in position with the bolts, and evenly tightened.

All slip joints shall be made up in strict accordance with the manufacturer's specifications. The bell shall be carefully cleaned and lubricated before the gasket is inserted.

After placing a length of pipe in the trench, the spigot end shall be centered in the bell, the pipe forced home, and brought to correct alignment.

Water mains shall be installed with a minimum cover of 30" and a maximum cover of 42". On streets with curb and gutter, cover depth will be determined from top of pipe to the top of back of curb as indicated on the plans. On streets without curb and gutter, cover depth will be determined from ditch bottom, edge of pavement, or as shown on approved plans. Exception to stated depth requirement include those portions of water main within casings or those portions that go over or under storm drains, sanitary sewers or other utilities as shown on plans.

In those cases where depth differences are extreme or other circumstances prevent the use of offset fittings, properly restrained M.J. 45° bends can be used in conjunction with pipe. Alignment and depth of pipe will be spot checked during construction and/or "As-built" inspections.

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other approved means. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

8.4.19.2 Electronic Location Marker/Warning Tape

After the placement of pipe zone material on any PVC pipeline construction, the contractor shall place a color coded electronic marker at each bell, fitting, tee, valve, cap, and buried appurtenance. Electronic location markers shall not be placed deeper than 3 feet below grade. In addition to the electronic markers, warning tape shall be placed along the entire length of construction.

8.4.19.3 Backfilling

All backfilling material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks, stones or other material which is considered unsuitable. Materials that are considered unsuitable must be disposed of offsite in compliance with all pertinent codes of City, State, County, and Federal regulatory agencies. The Contractor shall not backfill any fitting, thrust block, restrainer gland, valve, hydrant assembly and/or meter/backflow assembly until such appurtenances have been inspected in place by a designated representative of the Board. All such inspections shall be scheduled two (2) working days in advance.

8.4.19.4 Valves and Fittings

All valves and fittings shall be set and joined to the pipe in the proper location as specified in the plans. A roadway valve box shall be provided for every valve. This valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve. The Board must give approval for all valves deeper than 48" prior to installation. The box cover should be flush with surface of the finished pavement or grade level as specified in the plans.

8.4.19.5 Tapping Valves

All tapping valves shall be supported by a valve pad to prevent any potential torque on main.

8.4.19.6 Beveled Geared Valves

Due to the size, weight, and location of the center of gravity for Ductile Iron beveled geared valves, all such valves shall be supported by a valve pad poured in place to prevent any potential torque the center of gravity may have on the water main.

8.4.19.7 Valve Box Collars

Valve box collars shall be pre-cast round concrete, 24" diameter for areas with curb/gutter and poured-in-place, 36" diameter for regular areas without curb/gutter. The design of the collar shall be such that the pad can be easily adjusted as settlement occurs keeping the top of the valve box from standing above the face of the valve box collar.

8.4.20 WATER MAIN ABANDONMENT

Water main scheduled to be abandoned on a project shall be completely removed and the void left behind shall be filled with compacted fill. If approved by the Board's Engineer, water main can be abandoned in place by capping the pipe with mechanical end caps to permanently seal the ends of the abandoned pipe.

8.4.21 ENCASEMENT REQUIREMENTS

8.4.21.1 General

Encasement is required when crossing all State highways, railroad, and some County and City roadways which have excessive traffic flow or other critical situations (such as protecting building foundations). Whenever possible, encasement and mains shall cross the roadway and/or railroads, perpendicular to the roadbed. A valve will be required on each side of the encasement to allow isolation and removal of the pipe. In all cases the agency requiring the encasement shall have the final approval of the engineering design. Unless specifically stated on the plans, pipe installed in encasements shall be Ductile Iron.

8.4.21.2 Encasement Pipe

Pipe to be installed under pavement where open trenching is not permitted shall be installed through steel casing, which has been jacked and/or bored. Casing shall extend beyond the toe of slope or edge of pavement a minimum of 3 feet, whichever is greater. Encasement welds shall be continuous, full-penetration welds in accordance with API Standard 1104, current edition.

8.4.21.3 Encasement Spacers

DI Pipe

Water mains shall be pushed or pulled through the encasement piping on spacers placed no more than 10 feet apart. A minimum of two spacers/runners per joint of pipe shall be required. The spacer shall have a clearance range of 1 to 1.5 inches between the spacer and the inside of the encasement piping. Spacers shall be required in the first foot of each end of the encasement.

PVC Pipe (C900 and C909)

Water mains shall be pushed or pulled through the encasement piping on spacers placed no more apart than 6 feet apart. A minimum of three spacers/runners per joint of pipe shall be required. The spacer shall have a clearance range of 1 to 1.5 inches between the spacer and the inside of the encasement piping. Spacers shall be required in the first foot of each end of the encasement.

8.4.21.4 Encasement Ends (End Seals)

All casing ends shall be sealed with neoprene end seal designed for the size pipe/casing. End seal shall be a seamless, pullover type with any associated hardware or accessories constructed of either Grade 304 or 316 stainless steel. No rigid end seals will be allowed. The following products have been approved for installation:

MANUFACTURER	PRODUCT
Advanced Product and Systems, Inc.	Model AC Pull-on
Cascade Waterworks Mfg. Co.	Style CCES
GPT Industries	Model C Custom Pull-on

8.4.22 CROSS CONNECTION CONTROL

The water purveyor (Board) shall require the consumer, at the consumer's expense, to install an approved backflow prevention assembly. The selection, location, and installation of the device shall be based on the Board's "Cross-Connection and Backflow Prevention Policy" (latest revision).

8.4.23 METER VAULTS

Vault installations shall be constructed such that the maximum depth of the vault floor is no more than 6 feet deep from top of vault doors. Should site conditions require the vault to be installed at a greater depth, specific written approval from the Board shall be required prior to installation.

8.5 MATERIAL REQUIREMENTS

8.5.1 INSPECTIONS OF MATERIALS

All materials delivered to the job site will be new and of domestic origin (unless specifically noted otherwise). All materials are subject to inspection by the Board’s representative. Any materials found during inspection or during the progress of the work to be defective or not meeting specifications shall be rejected and removed from the job site without delay. Materials and/or work not inspected by the Board’s representative prior to installation shall be uncovered by the Contractor at his expense in order to verify compliance. Copies of the Packing List shall be furnished on demand.

8.5.2 MATERIALS MANUFACTURER

Like items on a project shall be of same manufacturer. The Contractor will not be allowed to mix like items from different manufacturers on a project (i.e. American Darling hydrants and M&H hydrants or Ford brass pieces with McDonald brass pieces).

8.5.3 PIPE

8.5.3.1 Ductile Iron Pipe

Ductile iron pipe shall be in accordance with latest edition of ANSI A21.50/AWWA C150 and A21.5/AWWA C151. Push-on and restrained joint pipe shall have a minimum rated working pressure of 350 psi. All buried pipe shall be pressure class as follows:

SIZE (INCHES)	PRESSURE CLASS
4 – 12	Class 350
>12	As Directed by Engineer

Pipe wall thickness shall be as specified in above referenced AWWA latest edition. Restrained joint ductile iron pipe shall be required in situations that the Board deems necessary.

All ductile iron pipe shall be cement-lined and seal-coated in accordance with ANSI/AWWA Standard C104/A21.4. All ductile iron pipe for underground installation shall be coated on the outside with a 1-mil thick bituminous material applied as recommended by the pipe manufacturer. The following products have been approved for installation:

MANUFACTURER	PRODUCT
American Cast Iron Pipe Co.	Fastite Joint Pipe
McWane Ductile	Tyton [®]
U.S. Pipe and Foundry	Tyton Joint [®]

8.5.3.1.1.1 Restrained Joint Ductile Iron Pipe

Restrained joints shall be in accordance with ANSI/AWWA C151/A21.5 and C104/A21.4 standards. Joints shall utilize stainless steel elements spaced around the gasket. Gasket shall be colored (i.e. yellow, blue, or red) for easy identification. The following restrained joint products are accepted for installation:

MANUFACTURER	PRODUCT
American Cast Iron Pipe Co.	Fastite Joint Pipe with Amarillo Fast-Grip [®] Gasket
McWane Ductile	Tyton [®] with Sure Stop 350 [®] - Blue Gasket
U.S. Pipe and Foundry	Tyton Joint [®] with Field-LOK 350 [®] - Red Gasket

8.5.3.2 Polyvinyl Chloride (PVC) Pipe

8.5.2.2.1 Pipe

PVC Pipe shall be in accordance with ANSI/AWWA C900 or C909. Push-on and restrained pipe shall have a minimum rated working pressure of 235 psi and be provided in ductile iron outside diameter. Pipe wall thickness shall be as specified in the above referenced AWWA standard, latest edition. Pipe color shall be blue from manufacturer. Restrained joint pipe shall be required where the Board deems necessary. The following products have been approved for installation:

MANUFACTURER	PRODUCT
Diamond Plastics Corporation	AWWA C900
JM Eagle	AWWA C900 / AWWA C909
North American Pipe Corporation	AWWA C900
Vulcan Plastics	AWWA C900

8.5.3.2.1.1 Restrained Joint PVC Pipe

Restrained joints shall be in accordance with ASTM D3139 and ANSI/NSF Standard 61. Joints shall integrate into bell either the Bulldog™ Restraint System or the Certa-Lok Restrained Joint with ANSI/AWWA C900 PVC pipe. The following restrained joint products are accepted for installation:

MANUFACTURER	PRODUCT
Diamond Plastics Corporation	Diamond LOK 21®
JM Eagle	Eagle LOC 900™
North American Pipe Corporation	Certa-Lok® Restrained Joint Integral Bell

8.5.4 LATERALS

8.5.4.1 Copper Tubing

Copper tubing, ¾” through 2”, shall conform to ASTM B88, type K, annealed. All connections are to be of the flare type.

8.5.4.2 Plastic Tubing

Plastic tubing, ¾” through 2”, shall be cross-linked polyethylene piping produced to copper tube size (CTS) outside diameter. The tubing shall be manufactured in accordance with AWWA C904 and be suitable for use by both AWWA C800 compression joint fittings and ASTM F2080 brass compression-sleeve fittings. The tubing shall meet or exceed the requirements of ASTM F876 for chlorine resistance, when tested in accordance with ASTM F2023. Plastic tubing shall be REHAU’s Muncipex (PEXa) crossed linked polyethylene or approved equal.

8.5.4.3 *Locating Wire*

All plastic laterals shall be marked using a solid underground, blue, No 10 AWG insulated copper wire buried with the laterals, but never deeper than 4' below finished grade and connected to corporation stop and curb stop.

8.5.5 **ELECTRONIC UTILITY MARKERS**

All PVC pipe installations shall require electronic utility markers to be buried at every bell, valve, tee, fitting, cap, reducer, and any buried appurtenance. The markers shall be color coded for its use (blue for water). Markers shall be centered above the pipe at the edge of the pipe zone but not buried any deeper than 3 ft. Markers shall be 3M EMS Ball Marker 1403-XR.

8.5.6 **WARNING TAPE**

In addition to the electronic utility markers required above, all PVC pipe shall require underground warning tape buried above the electronic utility markers. Tape shall be blue, detectable, 6-inch minimum width, heavy gauge, 5 mil minimum overall thickness polyethylene tape with metallic core, and shall read "Caution, Buried Water Line Below."

8.5.7 **FITTINGS**

8.5.7.1 *Ductile Iron Fittings*

8.5.7.1.1 Fittings (3 through 12 inch)

All fittings shall be ductile iron mechanical joint for use with previously specified ductile-iron and PVC pipe. Cast ductile-iron fittings 3-inch through 12-inch shall be pressure rated at 350 psi minimum. All fittings shall conform to ANSI/AWWA C110/A21.10 and/or ANSI/AWWA C153/A21.53 (latest editions). All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline. Fittings of either domestic or foreign manufacture from SIP, Star, Sigma, and Tyler/Union will be acceptable.

8.5.7.1.2 Compact Fittings

Compact fittings will be allowed for all diameters.

8.5.7.1.3 Coatings and Linings

All fittings shall be cement-lined and seal-coated in accordance with ANSI/AWWA C104/A21.4 or shall be fusion bond epoxy coated and lined in accordance with ANSI/AWWA C116/A21.16-98. Epoxy coated fittings are preferred.

8.5.7.1.4 Certificates

If requested, the material supplier and/or contractor shall furnish to the Board certifications that all fittings comply with the following requirements:

- Fittings are of the material specified (furnish physical and chemical certifications if applicable).
- Fittings shall be capable of withstanding, without bursting, hydrostatic tests of three times the rated water working pressure. The results of the specified tests (AWWA Standards) shall be retained for one year, and shall be available to the purchaser at the foundry.
- Fittings shall be cast and machined at one foundry location to assure quality control and provide satisfactory test data.
- Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer's identification, country where cast, and number of degrees or fraction of the circle.
- Ductile-iron fittings shall have the letter "D.I." or "Ductile" cast on them. Cast letters and figures shall be on the outside body of the fitting and shall have dimensions no smaller than those shown in ANSI/AWWA C110 and C153.

8.5.7.2 Fittings (Less than 3 inch)

Fittings less than 3 inch shall be cast brass or bronze.

8.5.8 VALVES

8.5.8.1 Resilient Wedge Gate Valves (3" - 12")

Gate valves on water mains size 3" to 12" in diameter shall incorporate resilient wedge gates with mechanical joint ends. All gate valves shall be of domestic origin and shall meet or exceed AWWA C-515 or C-509. Resilient wedges shall be of natural or synthetic rubber and be bonded or mechanically attached to the gate using stainless steel hardware and shall be rated at a working pressure of 200 psi.

The interior and exterior of the valve body shall be fusion-bonded epoxy coated in accordance with AWWA C-550 (latest edition) in order to provide a corrosion resistant seat, applied in a manner to withstand the action of line fluids and operation of the sealing gate under long-term service. Valve seats shall seal by compression only. Valves shall be supplied with 2" square operating nuts and shall be designed to provide a bubble or bottle tight seal regardless of direction of flow. Opening shall be in the counterclockwise direction.

The following resilient wedge gate valves are accepted for installation:

MANUFACTURER	AWWA SPECIFICATION	MODEL NO.
American Flow Control	C515	Series 2500
M&H	C515	Style7561 – 7571 - 7068
Clow	C515	Model 2638
M&H	C509	Style 4067
Mueller	C509	A-2360
Clow	C509	F-6100

8.5.8.2 Resilient Seat Gate Valves (2")

All 2" gate valves located below grade must be ductile iron resilient wedge meeting or exceeding AWWA C515 standards latest edition. All 2" gate valves shall have a standard 2" operating nut and standard FPT openings. No bronze/brass type gate valves will be accepted in underground applications.

MANUFACTURER	SIZE	MODEL NO.
American Flow Control	2"	2500
Mueller	2"	A-2362

8.5.9 BACKFLOW PREVENTION DEVICES

Backflow devices shall meet the requirements of the Boards Cross-Connection and Backflow Prevention Policy (latest version), ANSI/AWWA C510-89, and be approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California. Devices not listed must be reviewed and accepted as an "equal" by the Board's Engineering department prior to installation. The following devices have been accepted for installation by the Board:

OS & Y gate valves shall be flange by flange or flange by groove with groove end to backflow device only.

8.5.9.1 Double Check Valve Assembly (DCVA)

MANUFACTURER	SIZE RANGE	MODEL NO.
Ames	2 ½” through 10”	2000ss
FEBCO	2 ½” through 10”	LF850 Master Series
Watts	¾” through 10”	LF007, LF709 & 774 Series
Apollo/Conbraco	¾” through 2”	4ALF – 100 Series A2F
Apollo/Conbraco	2½” through 10”	4ALF –100 LBF Series
Wilkins	3” through 10”	350
Wilkins	¾” through 2”	950XLT

8.5.9.2 Double Check Detector Assembly (DCDA)

MANUFACTURER	SIZE RANGE	MODEL NO.
Ames	2 ½” through 10”	3000ss
Ames	2 ½” through 10”	Colt Series LFC300N
FEBCO	2 ½” through 10”	LF856
Apollo/Conbraco	2½” through 10”	DCDA 4ALF-600
Watts	¾” through 10”	LF709 & 774 DCDA Series
Wilkins	3” through 10”	350DA

8.5.9.3 Reduced Pressure Principle Backflow Prevention Assembly (RPBA)

MANUFACTURER	SIZE RANGE	MODEL NO.
Ames	2 ½” through 10”	4000ss
FEBCO	¾” through 2”	LF860
Watts	¾” through 10”	LF009, LF909 & 994 Series
Apollo/Conbraco	¾” through 2”	40LF-200 T2
Apollo/Conbraco	2½” through 10”	4ALF-200
Wilkins	3” through 10”	375
Wilkins	¾” through 2”	975XL

8.5.9.4 Reduced Pressure Detector Assembly (RPDA)

MANUFACTURER	SIZE RANGE	MODEL NO.
Ames	2 ½” through 10”	5000ss
FEBCO	¾” through 10”	LF866 Master Series
Apollo/Conbraco	2½” through 10”	4ALF700
Watts	2½” through 10”	909RPDA & 994RPDA
Wilkins	3” through 10”	375DA

8.5.10 BACKFLOW ASSEMBLY ENCLOSURES

The enclosure shall be of concrete, reinforced aluminum, or fiberglass construction, providing access through doors and/or hinged lid for testing and maintenance purposes. The enclosures shall have drain opening for Reduced Pressure Principle devices and sized to accommodate maximum discharge under the most severe of conditions. The discharge points shall be protected against intrusion of wind, debris, or animals. The enclosure shall be provided with a means of permanent anchor and “lockable” access doors and/or lid to prohibit vandalism. Fire protection systems indicating valves shall be provided with heavy duty chains and padlocks to secure valves in the open position. The enclosure shall be constructed, insulated, or heated such as to ensure against freezing. Enclosures listed in the table below have been approved for installation. Use of enclosures that are not listed in the table but meet the specification as stated in this paragraph is not allowed without specific written authorization by the Board’s Engineer.

PRODUCT NAME	MANUFACTURER
HydroCowl	HydroCowl Inc. Nashville, TN
Hot Box	Hot Box Jacksonville, FL
Lok Box	Hot Box Jacksonville, FL
AquaShield	AquaShield, North Little Rock, AR
9200 Concrete Box & Lid	Hughes Supply, Inc.
65 H Concrete Box	Hughes Supply, Inc.
4400 Vault w/ 8944 AL lid	Hughes Supply, Inc.
6’x4”x41/2” Concrete Vault w/8964 AL lid	Hughes Supply, Inc.
FAB-CON 6X8 VAULT/USF FAB LID	FAB-CON, LLC
FAB-CON 4X6 VAULT/USF FAB LID	FAB-CON, LLC
CPS 6x4	CPS, INC

CPS 8X5	CPS, INC
SS130-30604F	Bartow Precast
SS130-30805F	Bartow Precast
SS130-31006F	Bartow Precast
Throckmorton Precast	48" WX 72"L
Throckmorton Precast	60" WX 96"L

8.5.11 ELECTRONIC MARKERS/LOCATORS

Electronic markers located at each lateral stub out shall be Scotch Mark Electronic Marker System manufactured by 3M. Markers shall be Mid-Range Marker Model No. 1257. Markers shall remain at stub out locations after connection to service by plumber.

8.5.12 VALVE BOXES

Cast iron valve boxes shall be provided for all valves installed underground. The valve boxes shall be adjustable to fit the depth of earth cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. The valve boxes shall be manufactured of cast iron and shall be of the two piece design, screw type, including a bottom section and top section with lid cover. Valve boxes of either domestic or foreign manufacture will be acceptable.

The casting shall be manufactured of clean, even grain, gray cast iron with a minimum tensile strength of 21,000 psi. It shall be smooth, true to pattern, free from blowholes, sand holes, projections and other harmful defects. The seating surface of both the lid cover and the top section shall be cast so that the cover will not rock after it has been seated, and will fit tightly with no play. The Board reserves the right to require a certification of compliance from the manufacturer.

Valve box must be an integral unit that is telescopic and adjustable. Extension pieces, if required, shall match the material of the main. Valve box lids shall have the word WATER cast on the top. All valve boxes located outside of roadway pavement shall have concrete pad (two foot or three foot diameter) placed around the box at finished grade level.

8.5.12.1 Valve Box Collars

Valve box collars shall be minimum 24" in diameter, pre-cast concrete, and be reinforced using 9 gauge wire or #3 rebar. The top of the collar shall have a hole with a diameter of 10" and the hole will be tapered through the pad giving it a final bottom diameter of 9 1/2" allowing the valve box to freely move should the collar settle. The collar shall have minimum 4" thickness at center and tapering to 2" at the outer edge. Precast concrete collar shall be Fabcon Precast or approved equal.

8.5.13 TAPPING SLEEVES

8.5.13.1 Restrainable Tapping Sleeves

D.I. Mechanical Joint: Ductile iron sleeves shall be mechanical joint, designed for a pressure rating of 200 psi and conforming to ANSI/AWWA C110/ A21.10. Cement lining shall be in accordance with ANSI/AWWA C104/A21.4. Sleeve shall be coated with asphaltic varnish.

MANUFACTURER	MODEL NO.
U.S. Pipe	Model T-9
American Flow Control	Model 2800-C/Series 1004
M&H Tyler/ Union	1574
JCM	414, Epoxy Coated, Stainless Steel Bolts
Mueller	H-615
Romac	FTS425 (Drawing B3738-A)

8.5.13.2 Non-Restrainable Tapping Sleeves

Tapping sleeves that will not be restrained to shall have an 18-8 Type 304 stainless steel body, flange, bolts, nuts, and washers. Sleeve shall be furnished with a 3/4" test plug in the test outlet. Branch shell shall have a minimum thickness of 12 gauge, and back shell shall be a minimum of 14 gauge. Sleeve shall have a full circumferential gasket and a branch gasket with double O-Ring, hydraulic lip, and a T-304 stainless steel ring insert bonded within.

MANUFACTURER	MODEL NO.
JCM	432
Ford	Style FTSS
Cascade	Style CST-EX
Dresser	Style 630

8.5.14 TAPPING VALVES

8.5.14.1 Tapping Valves (4" thru 12")

Tapping valves for 4"-12" taps shall be cast iron or ductile iron resilient seating meeting AWWA C509 or C515 with a minimum working pressure of 200 psi. Valves shall be full port opening to accept full-size shell cutters. Valves shall be Non Rising Stem (NRS) with a 2" square nut. The following tapping valves are approved for use.

MANUFACTURER	MODEL NO.
American Flow Control	2500-1
M&H	4751 / 7571
Mueller	T-2362
Clow	F6114 (2638, 2640)

8.5.15 ENCASEMENTS

8.5.15.1 Encasement Pipe

Where water main borings are required, the encasement pipe shall conform to the requirements of ASTM A53 or A139, Grade B steel piping (for sizes 24” and smaller). The encasement shall be set straight and true to grade as indicated on the construction plans. Upon installation, each end will be sealed to prevent soil movement into the void space of the encasement pipe. Thicknesses listed herein are minimum requirements. Borings under railroads or State highways shall meet their respective permit requirements.

Encasement size and thickness shall be as indicated below:

DIAMETER OF WATER MAIN (INCHES)	MINIMUM CASING DIAMETER (INCHES)	MINIMUM CASING THICKNESS (INCHES)	ASTM / AWWA STANDARD
4	12	.25	ASTM A53
6	14	.25	ASTM A53
8	16	.25	ASTM A53
10	18	.25	ASTM A53
12- 14	24	.25	ASTM A53
14 or larger	As approved by Board	As approved by Board	As approved by Board

8.5.15.2 Encasement Spacers

Encasement spacers shall be as manufactured by Cascade Water Works Inc., Advanced Products and Systems Inc., The BWM Company, or Pipeline Seal and Insulator Inc. Spacers for 4” –12” piping shall be stainless steel with 8” wide bands as shown on the applicable details. Spacers for piping larger than 12” shall be reviewed on a case by case basis.

8.5.16 FIRE HYDRANTS

8.5.16.1 Requirements

All hydrants shall conform to AWWA C502 (latest edition), and have the following characteristics:

- 4 1/2" main valve opening
- One 4 1/2" steamer nozzle (NST)
- Two 2 1/2" hose nozzles (NST)
- Bronze main seat threading surfaces
- 6" bottom connection (shoe), mechanical joint with accessories
- Operating nut – 1 1/4" National Standard Pentagon Nut
- Bury – 4 feet (or height to eliminate extension)
- Open – left
- Brass to Brass – seating

8.5.16.2 Extensions

Whenever possible, fire hydrant extensions shall be by the same manufacturer as the fire hydrant type used.

8.5.16.3 Coating/Paint

All public hydrants, as designated on the plans, shall be painted with a yellow, epoxy coating to a thickness of 3 mil. Private hydrants, as designated on the plans, shall be painted with a white epoxy coating. All coatings shall be factory applied.

Hydrants approved for installation include:

MANUFACTURER	MODEL NO.
American Flow Control	American Mark 73
Kennedy	Model #K-81A
M&H	129
Clow	Medallion F2545
Mueller	Super Centurion 250

8.5.17 AUTO FLUSH HYDRANTS

Auto Flush Hydrants shall be installed to manufacturer's recommendations with positive drainage (either surface or subsurface) to prevent localized saturating of soils and/or flooding. Approved Auto Flush Hydrants for installation include:

MANUFACTURER	MODEL NO.
Kupferle	#9700
Kupferle	#9800
Hydro Guard	HG-6
Hydro Guard	Longneck Standard
Hydro Guard	Direct Discharge Unit

8.5.18 CORPORATION STOPS

8.5.18.1 Corporation Stops (3/4" and 1")

Corporation stops, 3/4" and 1" sizes, shall be ground key (plug) designs conforming to ANSI/AWWA C800. The stops shall have AWWA/CC taper threaded inlets and a male coupling threaded outlet with an inside driving thread.

The following devices have been accepted for installation:

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		VALVE	INLET	OUTLET
Ford	F 200-3	3/4"	3/4"	3/4"
Mueller	H-9971	3/4"	3/4"	3/4"
A.Y. McDonald Mfg	Model 3120	3/4"	3/4"	3/4"
Ford	F 200-4	1"	1"	1"
Mueller	H-9991	1"	1"	1"
A.Y. McDonald Mfg	Model 3120	1"	1"	1"

8.5.18.2 Corporation Stops w/ Service Saddle (1 1/2" and 2")

Corporation stops, 1 1/2" and 2" sizes, shall be ball corporation designs conforming to ANSI/AWWA C800. The stops shall have AWWA/CC taper threaded inlets and a female iron pipe thread outlet. Corporation stops, sizes 1 1/2" and 2", shall not be directly tapped onto the main. Corporation stops, sizes 1 1/2" and 2", shall be tapped onto mains through the use of an approved service saddle.

The following devices have been accepted for installation:

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		VALVE	INLET	OUTLET
Ford	FB 1600-6	1 ½"	1 ½"	1 ½"
Mueller	B-20045	1 ½"	1 ½"	1 ½"
A.Y. McDonald Mfg	Model 3148B	1 ½"	1 ½"	1 ½"
Ford	FB 1600-7	2"	2"	2"
Mueller	B-20045	2"	2"	2"
A.Y. McDonald Mfg	Model 3148B	2"	2"	2"

8.5.18.3 Corporation Stops w/ Tee (1 ½" and 2")

Corporation stops, 1 ½" and 2" sizes, shall be ball corporation designs conforming to ANSI/AWWA C800. The stops shall have AWWA/CC taper threaded inlet and a female iron pipe thread outlet. Corporation stops with iron pipe thread inlet are not allowed. Corporation stops, sizes 1 ½" and 2", shall be directly tapped into the tee from the manufacturer.

See previous section 8.5.18.2, Corporation Stops w/ Service Saddle (1 ½" and 2"), for approved devices accepted for installation with a tee.

8.5.19 SERVICE SADDLE/SLEEVE (¾" THRU 2")

All ¾" thru 2" taps on existing pipe shall be made through the use of approved service saddles/sleeves.

All ¾" thru 2" taps on PVC pipe, whether on new or existing pipe, shall be made through approved service saddles/sleeves. The service saddle/sleeve will have a body with an AWWA/CC threaded outlet, seal, and suitable means for attachment to the main meeting the requirements of ANSI/AWWA C900. The service saddle/sleeve shall be designed to provide a drip tight connection when used as a service connection to the main.

The following service saddles/sleeves are approved for use:

¾" –1" Service Saddles/Sleeves for use on Ductile Iron Pipe

MAIN SIZE	SADDLE/SLEEVE
4"-30"	Ford 202 BS, Mueller BR 2 S, McDonald 3845, JCM 438

1 1/2" - 2" Service Saddles/Sleeves for use on Ductile Iron Pipe

MAIN SIZE	SADDLE/SLEEVE
Less than or equal to 14"	Ford 202 BS, Mueller BR 2 S, McDonald 3845, JCM 438
Greater than 14"	JCM 438

3/4" -2" Service Saddles/Sleeves for use on C 900 and C909 PVC Pipe

MAIN SIZE	SADDLE/SLEEVE
4"-12"	Ford 202 BS, Mueller BR 2S, McDonald 3845

3/4" -2" Service Saddles/Sleeves for use on Class PVC Pipe

MAIN SIZE	SADDLE/SLEEVE
4"-12"	Ford S 70 Series, Mueller H-13000 Series, McDonald 3801

8.5.20 CORPORATION STOP QUARTER BENDS

8.5.20.1 Copper Tubing Installation

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		CORP SIZE	INLET	OUTLET
Ford	L102-33	3/4"	3/4"	3/4"
Mueller	15490	3/4"	3/4"	3/4"
A.Y. McDonald Mfg	Model 4777	3/4"	3/4"	3/4"
Ford	L102-44	1"	1"	1"
Mueller	15490	1"	1"	1"
A.Y. McDonald Mfg	Model 4777	1"	1"	1"
Ford	L28-66	1 1/2"	1 1/2"	1 1/2"
Mueller	15530	1 1/2"	1 1/2"	1 1/2"
A.Y. McDonald Mfg	Model 4779M	1 1/2"	1 1/2"	1 1/2"
Ford	L28-77	2"	2"	2"
Mueller	15530	2"	2"	2"
A.Y. McDonald Mfg	Model 4779M	2"	2"	2"

8.5.20.2 Plastic Tubing Installation (Compression Fittings with Anode)

Fittings shall be manufactured in compliance with ANSI/AWWA C800 (latest revision), certified to NSF/ANSI 61 and NSF/ANSI 372. Fittings shall provide a landing point (Anode) to allow for locating wire connection. All compression fitting connections shall be made with a stainless stiffener inserts. Locating wire shall be landed at the anode and attached to the tubing at regular intervals. Wire and tubing shall be in close proximity.

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		CORP SIZE	INLET	OUTLET
Ford	L104-33-TW-Q-NL	¾"	¾"	¾"
Mueller	H-1549207N	¾"	¾"	¾"
A.Y. McDonald Mfg	Model 74777QA	¾"	¾"	¾"
Ford	L104-44-TW-Q-NL	1"	1"	1"
Mueller	H-1549207N	1"	1"	1"
A.Y. McDonald Mfg	Model 74777QA	1"	1"	1"
Ford	L84-66-TW-Q-NL	1 ½"	1 ½"	1 ½"
Mueller	H-1553107N	1 ½"	1 ½"	1 ½"
A.Y. McDonald Mfg	Model 74779MQA	1 ½"	1 ½"	1 ½"
Ford	L84-77-TW-Q-NL	2"	2"	2"
Mueller	H-1553107N	2"	2"	2"
A.Y. McDonald Mfg	Model 74779MQA	2"	2"	2"

8.5.21 CURB ADAPTER QUARTER BENDS

8.5.21.1 Copper Tubing Installation

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		CORP SIZE	INLET	OUTLET
Ford	L28-33	¾"	¾"	¾"
Mueller	15530	¾"	¾"	¾"
A.Y. McDonald Mfg	Model 4779M	¾"	¾"	¾"
Ford	L28-44	1"	1"	1"
Mueller	15530	1"	1"	1"
A.Y. McDonald Mfg	Model 4779M	1"	1"	1"
Ford	L28-66	1 ½"	1 ½"	1 ½"
Mueller	15530	1 ½"	1 ½"	1 ½"
A.Y. McDonald Mfg	Model 4779M	1 ½"	1 ½"	1 ½"
Ford	L28-77	2"	2"	2"
Mueller	15530	2"	2"	2"
A.Y. McDonald Mfg	Model 4779M	2"	2"	2"

8.5.21.2 Plastic Tubing Installation (Compression Fittings with Anode)

Fittings shall be manufactured in compliance with ANSI/AWWA C800 (latest revision), certified to NSF/ANSI 61 and NSF/ANSI 372. Fittings shall provide a landing point (Anode) to allow for locating wire connection. All compression fitting connections shall be made with a stainless stiffener inserts. Locating wire shall be landed at the anode and attached to the tubing at regular intervals (wire and tubing shall be in close proximity).

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		CORP SIZE	INLET	OUTLET
Ford	L84-33-TW-QNL	¾"	¾"	¾"
Mueller	H-1553107N	¾"	¾"	¾"
A.Y. McDonald Mfg	Model 74779MQA	¾"	¾"	¾"
Ford	L84-44-TW-QNL	1"	1"	1"
Mueller	H-1553107N	1"	1"	1"
A.Y. McDonald Mfg	Model 74779MQA	1"	1"	1"
Ford	L84-66-TW-QNL	1 ½"	1 ½"	1 ½"
Mueller	H-1553107N	1 ½"	1 ½"	1 ½"
A.Y. McDonald Mfg	Model 74779MQA	1 ½"	1 ½"	1 ½"
Ford	L84-77-TW-QNL	2"	2"	2"
Mueller	H-1553107N	2"	2"	2"
A.Y. McDonald Mfg	Model 4779MQA	2"	2"	2"

8.5.22 CURB STOPS

8.5.22.1 Curb Stops (¾" through 1")

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		CORP SIZE	INLET	OUTLET
Ford	B11-333W	¾"	¾"	¾"
Mueller	B-20283	¾"	¾"	¾"
A.Y. McDonald Mfg	6101W	¾"	¾"	¾"
Ford	B11-444W	1"	1"	1"
Mueller	B-20283	1"	1"	1"
A.Y. McDonald Mfg	6101W	1"	1"	1"

8.5.22.2 Curb Stops (1 ½" through 2")

Curb stops for 1 ½" and 2" services shall be bronze gate valves with non-rising stems and solid wedges. Gate valves shall be installed in meter boxes and not directly buried.

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		TYPE	SIZE	OUTLETS
NIBCO	T-113	Gate	1 ½"	Threaded
Milwaukee	105	Gate	1 ½"	Threaded
American Valve	3/3F	Gate	1 ½"	Threaded
NIBCO	T-113	Gate	2"	Threaded
Milwaukee	105	Gate	2"	Threaded
American Valve	3/3F	Gate	2"	Threaded

8.5.23 STRAIGHT PIPE COUPLINGS (¾" THROUGH 2")

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		TYPE	SIZE	OUTLETS
Ford	C22-33	Flare by Flare	¾"	¾"
Mueller	H-15400	Flare by Flare	¾"	¾"
A.Y. McDonald Mfg	4758	Flare by Flare	¾"	¾"
Ford	C22-44	Flare by Flare	1"	1"
Mueller	H-15400	Flare by Flare	1"	1"
A.Y. McDonald Mfg	4758	Flare by Flare	1"	1"
Ford	C22-66	Flare by Flare	1 ½"	1 ½"
Mueller	H-15400	Flare by Flare	1 ½"	1 ½"
A.Y. McDonald Mfg	4758	Flare by Flare	1 ½"	1 ½"
Ford	C22-77	Flare by Flare	2"	2"
Mueller	H-15400	Flare by Flare	2"	2"
A.Y. McDonald Mfg	4758	Flare by Flare	2"	2"

8.5.24 METER COUPLINGS

8.5.24.1 Straight Meter Coupling

Straight meter couplings of standard length shall be used at the inlet and outlet of all ¾" through 1" meter sets to allow for the easy removal of meters.

MANUFACTURER	CATALOG NO.	DESCRIPTION		
		BODY STYLE	THREAD SIZE	COUPLING LENGTH
Ford	C38-23-2.5	A	¾"	2 ½"
Mueller	H-10890	NA	¾"	2 ½"
A.Y. McDonald Mfg	4620	NA	¾"	2 ½"
Ford	C38-44-2.625	A	1"	2 5/8"
Mueller	H-10890	NA	1"	2 5/8"
A.Y. McDonald Mfg	4620	NA	1"	2 5/8"

8.5.24.2 Bronze Meter Flange

Bronze meter flanges shall be used at the inlet and outlet of all 1 ½" and 2" meter sets to allow for ease removal of meters.

MANUFACTURER	CATALOG NO.	DESCRIPTION
Ford	CF31-66	1 ½" Meter Flange x 1 ½" Female Iron Pipe Thread
A.Y. McDonald Mfg	610F	1 ½" Meter Flange x 1 ½" Female Iron Pipe Thread
Ford	CF31-77	2" Meter Flange x 2" Female Iron Pipe Thread
A.Y. McDonald Mfg	610F	2" Meter Flange x 2" Female Iron Pipe Thread

8.5.25 MECHANICAL RESTRAINT

8.5.25.1 Wedge Action Restrainer Gland

8.5.25.1.1 General

Restraint for standardized mechanical joint fittings shall be incorporated in the design of the follower gland and shall impart multiple wedging action against the pipe, increasing its resistance as the pressure increases. Restraining glands shall be manufactured of high strength ductile iron conforming to ASTM A536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53.

8.5.25.1.2 Restraint of D.I. Fittings to D.I. Pipe

Ductile Iron gripping wedges shall be heat treated within a range of 370 to 470 BHN.

NOMINAL PIPE SIZE	EBAA IRON "MEGALUG" SERIES 1100		FORD "UNI-FLANGE" SERIES 1400		RATED PRESSURE
	SERIES NO.	NUMBER OF WEDGES	CATALOG NO.	NUMBER OF WEDGES	
4"	1104	2	UFR1400-D-4-U	2	350
6"	1106	3	UFR1400-D-6-U	3	350
8"	1108	4	UFR1400-D-8-U	4	350
10"	1110	6	UFR1400-D-10-U	6	350
12"	1112	8	UFR1400-D-12-U	8	350
14"	1114	10	UFR1400-D-14-U	10	350
16"	1116	12	UFR1400-D-16-U	12	350

8.5.25.1.3 Restraint on D.I. Fittings to C900 PVC Pipe

NOMINAL PIPE SIZE	EBAA IRON SERIES 2000 PV		FORD "UNIFLANGE" SERIES 1500		
	SERIES NO.	NUMBER OF WEDGES	CATALOG NO.	NUMBER OF RESTRAINED SEGMENTS	PRESSURE RATING
4"	2004	4	UFR1500-C-4-U	4	235
6"	2006	6	UFR1500-C-6-U	6	235
8"	2008	6	UFR1500-C-8-U	6	235
10"	2010	8	UFR1500-C-10-U	8	235
12"	2012	8	UFR1500-C-12-U	8	235

8.5.25.1.4 Restraint of D.I. Fittings to C900 PVC Pipe

NOMINAL PIPE SIZE	EBAA IRON SERIES 19MJ00				
	SERIES NO.	THRUST BOLT QUANTITY			
4"	19MJ04	2			
6"	19MJ06	2			
8"	19MJ08	4			
10"	19MJ10	4			
12"	19MJ12	4			

8.5.25.1.5 Bell Stop for C900 PVC Pipe

To assure the proper assembly of an AWWA C900 PVC joint and prevent "over-insertion" of the spigot into the bell, the use of bell stops may be required. The bell stop shall be manufactured of ductile iron conforming to ASTM A536. The bell stop shall be coated with a corrosion inhibiting coating. The device shall allow for pipe expansion and contraction. The

combination of the two shall be the Series 5000 MEGA-STOP™ Bell Protection System, as manufactured by EBAA Iron, Inc., or approved equal.

NOMINAL PIPE SIZE	EBAA IRON SERIES 5000			
	SERIES #	RATED "PUSH" LOAD (LBF)		
4"	5004	10,000		
6"	5006	10,000		
8"	5008	10,000		
10"	5010	10,000		
12"	5012	10,000		

8.5.26 METERS

During the plan review process, the engineer will establish the type of meter (displacement, turbine, or compound) to be used. All meters are to be installed as per standard drawings provided herein.

8.5.26.1 Displacement Type

Displacement type meters shall conform to ANSI/AWWA C700. Registers shall be straight-reading and shall read in 1000 gallon increments U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with ANSI/AWWA C707. Meters shall comply with the accuracy and capacity requirements of ANSI/AWWA C700.

8.5.26.2 Turbine Type

Turbine type meters shall conform to AWWA C701. The meters shall be provided with integral strainer built into the inlet and test port located at the outlet end. Where integral strainer and test port are not available, the Contractor shall provide a manufacturer approved strainer installed immediately upstream of the meter. The main casing shall be bronze with stainless steel external fasteners. Registers shall be straight-reading type and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with ANSI/AWWA C707. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

8.5.26.3 Compound Type

Compound type meters shall conform to ANSI/AWWA C702. The main casing shall be bronze with stainless steel external fasteners. The main casing shall be tapped for field testing purposes. Registers shall be straight-reading type and shall read in U.S. gallons.

Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with ANSI/AWWA C707. Meters shall comply with the accuracy and capacity requirements of ANSI/AWWA C702.

8.5.26.4 Large Meters (3" and Larger)

All large meters, 3 inches and larger, shall be purchased by the developer or his contractor and shall be Sensus, Badger, or Board approved equivalent. Meter shall register flow in 1,000 gallon increments and be installed with a correctly wired and programmed Neptune R900 Meter Interface Unit (MIU). Installation of the MIU shall be in the vault's lid per the manufacturer's recommendation and performed in such a manner as not to void the warranty on the vault, meter, or lid. Upon installation, the contractor shall follow the manufacturer's recommendations for testing the MIU and provide testing information (MIU ID number and corresponding meter ID number) to the Board.

8.5.26.4.1 Fire Series Meters

Meters that serve fire suppression systems, 3" and larger, shall be Sensus Omni F2 Series, Badger Recordall Fire Series, or Board approved equivalent.

8.5.26.4.2 Positive Displacement, Compound, and Turbo

Large positive displacement, compound, and turbo meters (3" and larger), shall be Sensus, Badger Recordall, or Board approved equivalent.

8.5.26.5 Small Meters (2" and Smaller)

The Board shall furnish all water meters up to and including 2" at previously published rates.

For small meters installed in backflow vaults for detection purposes (3/4" detector check meters), the Contractor shall obtain a meter from the Board at published rates. The Contractor shall then install the meter along with the required Meter Interface Unit (MIU). Installation of the MIU shall be in the vault's lid per the manufacturer's recommendation and performed in such a manner as not to void the warranty on the vault, meter, backflow, or lid. Upon installation, the contractor shall follow the manufacturer's recommendation for testing the MIU and provide testing information (MIU ID number and corresponding meter ID number) to the Board.

8.5.27 METER BOXES

Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid. Boxes set in sidewalks, not subject to vehicular traffic, shall use concrete covers with cast iron lids. For meter sizes (1 1/2" – 2") plastic boxes and lids shall be used in unpaved areas or grass areas not

subject to vehicular traffic. For meter sizes ¾” –1” concrete boxes with metal lids shall be used in paved areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

8.5.28 VAULTS

Meter vaults shall be pre-cast, reinforced concrete structures designed to withstand anticipated loads consisting of dead load, live load, impact load, water table hydrostatic load, and miscellaneous loads. Use of alternative products shall be considered by the Board on a case by case basis. The following precast units are pre-approved for use in the Board’s system:

MANUFACTURER	MODEL	DIMENSIONS		
		INSIDE	OUTSIDE	WALL THICKNESS
Hughes Supply, Inc.	4400V	46”W X 46”L	56”W X 56”L	5”
Hughes Supply, Inc.	6400V	48”W X 72”L	60”W X 84”L	6”
Hughes Supply, Inc.	8500V	60”W X 96”L	72”W X 108”L	6”
CPS, Inc.	CPS 6 X 4	48”W X 72”L	60”W X 84”L	6”
CPS, Inc.	CPS 8 X 5	60”W X 96”L	72”W X 108”L	6”
FAB-CON, LLC		48”W X 72”L	60”W X 84”L	6”
FAB-CON, LLC		60”W X 96”L	72”W X 108”L	6”
Bartow Precast	SS130-30604F	48W X 72”L	60”W X 84”L	6”
Bartow Precast	SS130-30805F	60”W X 96”L	72”W X 108”L	6”
Bartow Precast	SS130-31006F	72”WX120”L	84”WX 132”L	6”
Throckmorton Precast		48” WX 72”L	60”W X 84”L	6”
Throckmorton Precast		60” WX 96”L	72”WX108”L	6”

8.5.29 VAULT LIDS

Access doors shall be through frame, pedestrian loading (300psf), double door. Door leafs shall be ¼ inch thick Aluminum floor plate reinforced to 300 psf live load. The frame shall be extruded aluminum channel with a continuous integral anchor flange. The access door shall be equipped with a flush aluminum drop handle, which does not protrude above the cover and an automatic hold open arm. Hinges shall be all stainless steel with tamper proof stainless steel bolts and nuts, and be removable for maintenance after the access door is cast or grouted in place. Access door shall have a non-slip surface with mill finish. The following precast units are pre-approved for use in the Board’s system:

MANUFACTURER	MODEL	DIMENSIONS		
		OPENING	OVERALL SIZE	PLATE THICKNESS
U.S.F. Fabrication, Inc.	TPD	48" X 48"	56" X 56"	¼"
Bilco	JD-2AL	48" X 48"	56" X 56"	¼"
U.S.F. Fabrication, Inc.	TPD	72" X 48"	56" X 80"	¼"
Bilco	JD-3AL	72" X 48"	56" X 80"	¼"
U.S.F. Fabrication, Inc.	APDR	72" X 48"	57" X 81"	¼"
U.S.F. Fabrication, Inc.	APDR	80" X 96"	70" X 105"	¼"

8.5.30 POLYETHYLENE WRAP

Due to the corrosive nature of soils in and around the Board's service area, all ductile iron pipe, fittings, bends, valves, threaded rods, and eye bolts shall be polyethylene wrapped in accordance with ANSI/AWWA C105/A21.5. Wrapping shall be a 3 layer, linear low-density polyethylene (LLDPE), enhanced with a corrosion inhibitor and biocide, manufactured by V-Bio™.

Installation of polyethylene should extend a minimum of 2-ft past the fitting, bend, valve, or other appurtenance and be sealed tight against pipe (ductile iron, PVC, etc.) on both ends. For ductile iron pipe installation, provide a minimum of 12-inch overlap on each adjacent section of polyethylene wrap.

8.5.31 VACUUM AND AIR RELIEF VALVES

Vacuum and air relief valves shall be of the size and type shown and shall release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float. Valves will be reviewed on a case-by-case basis. In general, valves shall be APCO, CRISPIN, or VAL-MATIC.

8.5.32 ALL THREAD RODS AND EYE BOLTS

All thread rods shall be threaded ¾ inch Grade 304 stainless steel rods manufactured according to ASTM F593. Tensile strength shall be a minimum of 84 ksi. Yield strength shall be minimum of 42 ksi. Stainless steel nuts and washers to match and shall be according to ASTM F594. Eye Bolts shall be Grade 304 stainless steel with matching washers and nuts.

8.5.33 BACKFILL

8.5.33.1 Gravel

Coarse aggregate (gravel) shall be white or very light colored gravel, limestone, marble, or granite, subject to the approval of the Board. Gravel shall be crushed angular stone

conforming to No. 57 stone as provided for in Section 801 “*Coarse Aggregate*” of ALDOT’s standard specifications.

8.5.33.2 Crusher Run

Crusher run shall consist of 100 percent crushed aggregates conforming to the requirements of Section 825.02 Type A “*Crushed Aggregate Base Materials*” of ALDOT’s standard specifications.

8.5.33.3 Sand

Sand shall be local “washed” material consisting of grains of hard, predominantly quartz or other hard rock, including friable, loosely bound deposits of sandstone conglomerate. The sand shall be free from lumps of clay, loam, organic matter, or other foreign material. Sand shall meet the requirements of Section 826 .02 (b) “*Local Sand and Sand Gravel for Miscellaneous Construction Use*” of ALDOT’s standard specifications.

8.5.33.4 Pit Run/Clay Gravel

Pit run (clay gravel) shall be local material consisting of grains of hard, predominantly quartz or other hard rock, including friable, loosely bound deposits of sandstone conglomerate. The coarse aggregate and sand shall be free from lumps of clay, loam, organic matter, or other foreign material. Pit run shall meet the requirements of Section 826 .02 (c) “*Local Sand and Sand Gravel for Miscellaneous Construction Use*” of ALDOT’s standard specifications.