

Water Design and Construction

2.1 Introduction: Design Responsibility and Applicability of Requirements

The design and construction requirements for water distribution mains and related appurtenances included in this Manual are applicable for any development located within the City of Auburn (including the 5-mile planning jurisdiction) that intends to obtain water services from the Water Works Board of the City of Auburn (AWWB) upon successfully meeting all of the requirements of the AWWB for obtaining such services.

Developers are cautioned that the AWWB is not the only water supplier for the City of Auburn. There are certain areas of the City of Auburn that are served by other water suppliers. Please contact the WRM Department for information about the location of these areas that are being served by the Loachapoka Water Authority (LWA), the Beauregard Water Authority (BWA), or Opelika Utilities (OU). Specific information regarding the design requirements for developments in areas served by the LWA, the BWA, or OU can be obtained by contacting those water authorities.

The Water Resource Management (WRM) Department of the City of Auburn shall enforce the requirements included in this Manual on behalf of the AWWB. Distribution systems, within the City of Auburn, that are privately maintained or are not supplied by the AWWB shall not be required by the WRM Department to meet all of the design standards included in this Manual for water distribution systems. Any standards, included in this Manual, which are required by a federal or state regulatory authority, or any applicable local plumbing or fire codes shall be required and enforced by those specific authorities.

All developments inside the City of Auburn shall be required to meet the City's fire flow requirements in accordance with the currently adopted fire code. Fire flow requirements for each development will be specifically detailed and enforced by the Public Safety Department Fire Division. The WRM Department will assist the Public Safety Department Fire Division during the development review process in determining if adequate flow is available to meet those specified requirements. Consequently, all developments inside the City of Auburn shall submit fire flow calculations, where required by either department, in accordance with the standards provided in Section 2.3.3 of this Manual.

This Manual is intended to provide general guidance and minimum criteria for the design and construction of water facilities for development. However, the sole responsibility for the design is that of the engineer for the development.

Generally, this Manual is intended to be used for the typical subdivision and small-scale commercial development. The typical subdivision development would be a development that needs no more than a 12-inch water main. Developments that need water services in excess of this size are not considered typical developments. Although this Manual can be used for general guidance for other than typical developments, requirements for these developments

will be handled on a case-by-case basis. A Utility Installation Flow Chart for site plan development projects and residential subdivision development projects is included in Appendix C of this Manual.

The engineer is encouraged to meet with and discuss each development with the WRM Department prior to the submittal of the plans for review.

Any costs attributable to the extension of the water distribution system to serve a single development shall be the responsibility of the developer.

2.2 General Considerations

2.2.1 Existing Water Facilities

All existing water facilities that are located within the project area or that will be affected by the development must be located, identified, and shown on the plans. It is the responsibility of the engineer to have any and all utilities located and shown accurately on the plans.

If, during construction, any utilities are discovered that were not shown on the plans, the WRM Department shall be notified immediately. The construction on any area of the project affected by the discovered utility may be halted and the plans may need to be revised and resubmitted for review at the discretion of the WRM Department.

Any existing water mains or services, currently maintained by the AWWB, shall be evaluated by the WRM Department to determine if they can be reused for development when a construction plan or site plan submittal is required for the development. Any existing water service that will be reused for a development must be brought to current standards of the AWWB.

Any water service to be abandoned on a development site or ROW adjacent to the development site shall have the connection terminated at the main, unless otherwise approved by the WRM Department. Services terminated at the main shall be severed at the connection point and the connection shall be closed at the corporation stop or sealed as necessary by the installation of a sleeved section, restrained plug, or other approved method. Services shall not be crimped, clamped, or improperly sealed for permanent abandonment. Failure to locate and show all water services on the construction plans does not negate the requirement to properly abandon water services at the main. The contractor shall also be required to locate and identify all services prior to construction.

2.2.2 Proposed Water Facilities

The plans submitted for review shall show all proposed water services, including all water mains, service lines, meters, backflow protection devices, vaults, isolation valves, hydrants, fire department connections, blow-off valves, air release valves, pressure reducing valves, fittings, thrust restraint, and any other appurtenances associated with the water system. All pipe diameters, material, locations, and pertinent features shall be identified clearly on the plans. The plans also will include the number of meters required and the types of meter (i.e., positive displacement, turbine, compound, or fire service assembly) as well as the types of backflow protection device (i.e., standard double check, testable double check, or reduced pressure). The final determination of the type of meter and backflow protection device required will be made by the WRM Department during plan review, however, guidance has been provided in this Manual for properly selecting those devices.

2.2.3 System Demand Analysis

The WRM Department will verify water availability and treated water capacity to serve a development in the AWWB distribution system with the assistance of the developer and engineer, where necessary. All developments are required to provide accurate fixture counts,

for the estimation of water demand, in the Application for Water and Sewer Service (Appendix B) that shall be submitted at the time of plan submittal.

The WRM Department will perform a system demand analysis for developments that will be served by the AWWB distribution system to determine if the AWWB has the availability and capacity to serve the development.

Any upgrades to the existing water facilities necessary to provide adequate service to the development typically would be the responsibility of the developer. If the existing infrastructure, in the opinion of the WRM Department, is not sufficient to supply the quantity of water needed for the development, the developer may be required to participate in or to fully fund any necessary offsite infrastructure upgrades to obtain AWWB service. The amount of developer participation will depend on the amount of contiguous developable area that may be served by the expansion and the corresponding need of the AWWB-approved capital improvement plan. Developer participation in infrastructure improvements or expansions may be detailed in the Development Agreement, where required.

Once a development, that is to be served water by the AWWB, has been reviewed and approved by the DRT, the AWWB will reserve treated water capacity for the development, and the development will be allowed to connect to the AWWB distribution system as shown on the approved plans until said DRT approval expires, which is typically 18 months from the date of approval. Once DRT approval has expired, reserved capacity shall subsequently expire and the WRM Department will reevaluate the AWWB's capacity to serve the development when the plans are resubmitted for review and approval in accordance with the DRT requirements in this Manual. Reserved capacity will also be reviewed by the WRM Department prior to any requested extension of DRT approval, including preliminary plat or conditional use extension requests as they affect the DRT approval period. Reserved capacity for master development plans that will be brought to DRT in phases shall be detailed in the development agreement with a mutually agreeable time frame specified for future phases.

The developer will be responsible for coordinating with the applicable water service providers for developments not served by the AWWB to determine if adequate water supply is available.

2.3 Submittal Requirements

2.3.1 Overall Water Main Layout

The design engineer shall submit a complete set of design plans for review. The submitted plans shall be a complete set, comprehensive in all details of the design. The requirement to submit a set of design plans that are of a complete design shall not prevent an engineer from meeting with the WRM Department and submitting a “preliminary” design for recommendations and preliminary comments from the WRM Department. However, the WRM Department will only review and provide written comments on a completed set of design plans that are submitted for review, typically through the DRT process.

The submitted set of plans shall include the following:

- Overall water main layout of entire development
- Detailed plan sheets including all valves, main sizes, fittings, bends, hydrants, thrust restraints, and appurtenances with all features labeled
- All existing and proposed water facilities labeled and clearly differentiated
- Water main profiles (where required)
- Fire-flow calculations (where required)
- All standard details that are required
- Any unique details or notes relevant to the project
- All standard notes
- Grading plan indicating both the existing and the proposed contours
- Location of all other utilities adjacent to or crossing water mains

Additional requirements for the plans submitted for review are included in the City of Auburn Site Development Plans Submittal Checklist and the Subdivision Construction Plans Submittal Checklist (Appendix B). When the individual development is part of a larger Master Development Plan, the engineer may be required to submit an “overall water layout” for the entire development for review.

2.3.2 Water Main Profiles

Water main profiles are generally not required for the plans for a typical subdivision. However, the engineer must show the water main in the street or sewer profiles where the water main will cross any storm pipes, creeks, sewer lines, or any other obstruction. Profiles will be required for Alabama Department of Transportation (ALDOT) utility permits. Complete water main profiles are required for the installation of water mains 12 inches in diameter and larger.

All necessary water main profiles shall show and clearly label the existing and finished grades where the water main is to be located, NOT the centerline of the road, which typically varies from the shoulder elevation. All fittings, valves, hydrants, air release valves (ARVs), and other

necessary appurtenances shall be shown at their proposed stations and elevations in both plan and profile views. Water main profiles shall take into account the maximum vertical deflections in determining where any vertical bends are required.

2.3.3 Fire-Flow Calculations

All developments currently within or that annex into the City are required to meet fire-flow demands as specified by the Public Safety Department Fire Division. The WRM Department will assist the Public Safety Department Fire Division in reviewing all fire-flow calculations to determine if adequate supply is available for the development. The engineer shall provide fire-flow calculations, upon request by either department, demonstrating the ability to meet the fire-flow requirements listed in the currently adopted International Fire Code (IFC), the Insurance Services Office's (ISO's) Fire Suppression Rating, and any applicable local code revisions at the time of the development submittal. In certain areas where availability of fire-flow demand for a particular development can be sufficiently demonstrated through existing infrastructure and is evident to both the Public Safety Department Fire Division and the WRM Department, a fire-flow calculation submittal may not be required.

2.3.3.1 Minimum Requirements

Under the IFC standards, the minimum fire-flow requirement for one- and two-family dwellings not exceeding 3,600 square feet (ft²) shall be 1,000 gallons per minute (gpm) for 1 hour. The minimum fire-flow requirement for dwellings having a fire-flow area in excess of 3,600 square feet shall not be less than 1500 gpm for 2 hours or as specified in the IFC in Table B105.1. All developments are required to meet the fire-flow with a residual pressure of 20 psi for the specified duration. The actual requirements for flow and duration that must be demonstrated are dependent on the size of the development as detailed in the IFC Appendix B and will be reviewed on a case-by-case basis by the Public Safety Department Fire Division.

In all cases, consideration must be given to the average domestic demand simultaneous to any fire-flow event.

2.3.3.2 Submittals

The fire-flow calculations shall be submitted to the WRM Department and the Public Safety Department Fire Division for review prior to DRT approval of the development. At a minimum, the calculations submitted shall include the following information, where applicable:

- A water distribution model of the internal development network, detailing all demand nodes. All hydrants and fire protection systems shall be properly identified and listed as demand nodes. Total domestic and irrigation demand shall also be estimated and input into the model.
- A list of assumptions, datum, or inputs used in determining the distribution model. This shall include any necessary information regarding the supply source and external distribution to the site when applicable.
- A schematic drawing of the distribution network with all demand nodes clearly labeled and identified.

- A table summarizing the output of the model for each fire-flow demand node that details, at a minimum, the following information:
 1. Static pressure (psi) at each fire-flow demand node in the system
 2. Flow (gpm) at each fire-flow demand node during a fire-flow event
 3. Residual pressure (psi) at each fire-flow demand node during a fire-flow event
 4. Modeled fire-flow duration at each fire-flow demand node
- If multiple adjacent hydrants are required to meet the fire-flow demand, a list of scenarios shall be included summarizing the infrastructures ability to meet the projected demands.
- Design information and flow model for all external distribution system improvements necessary to serve the development.

2.3.3.3 Fire Flow Information

Coordination with the water service provider will be required for any detailed fire-flow information, assumptions, fire hydrant flow data, or distribution system expansions that are necessary for a development. All flow tests for fire flow calculation submittals shall be accompanied by a representative of the WRM Department or the Public Safety Department Fire Division, and all fire hydrant flow data collected must be copied to the WRM Department for record-keeping purposes. Any existing flow data used for fire flow calculations may need to be verified if, in the opinion of the WRM Department, the data are erroneous.

2.4 Water Design and Layout

2.4.1 Water Main Location

The preferred location for the water main is on the north and east sides of the streets. If the specific design requirements do not allow for the water mains to be placed on the north and east sides of the street, the other utility companies must be notified by the engineer prior to DRT approval. The water main shall be laid generally at minimum cover.

The water main typically should be located in a public ROW, approximately 5 feet behind the curb, where possible, to provide for ease of access for maintenance and repairs. The water main shall be located in an area free from surface obstructions (signs, walls, utility poles, structures, ponds, water features, canopy trees, etc.) that, in the opinion of the WRM Department, would make maintenance or repairs to the water main more difficult. Water mains shall be a minimum of 15 feet from all habitable structures at minimum cover. Water mains with greater depths of cover may require additional separation from the habitable structures, as deemed appropriate by the WRM Department.

There are situations in which a water main cannot be placed entirely on the public ROW. In such situations, dedicated easements and property restrictions will be required to provide for future maintenance and repair of the water lines.

Generally, water lines shall not be allowed to be installed down lot lines or across the back of properties where access to the water lines would be restricted. However, there may be circumstances where it would be in the best interest of the WRM Department to allow such installations. Generally, this would be to provide for redundancy of the water system or to provide improved network circulation. Such installations will be handled on a case-by-case basis with the recommendation, or approval by the WRM Department. Where such installations are allowed, the water line will be required to be installed in a steel casing in a dedicated easement of proper width. The length of the casing shall extend at a minimum from building line to building line, plus the width of any utility easements. Valves will be required at both ends of the casing to provide for ease of maintenance.

2.4.2 General Design Considerations

The water distribution system shall be designed to provide for the delivery of potable water to the customers and, at the same time, to provide adequate water supply for fire protection considerations.

Typically, the domestic water component for a particular connection is small when compared to the fire-flow requirement for the area of the distribution system. The fire protection requirements will dictate the minimum size of the water main.

Particular requirements for fire protection can be found in the appropriate sections of this Manual, but the design intent is to provide adequate water pressure and supply for both fire protection and potable water consumption while not allowing the water pressure to fall below 20 psi at any point in the distribution system.

The maximum velocity in the public water distribution main during a fire-flow event shall be limited to 10 feet per second (fps) at the connection of the private fire line or fire hydrant service connection. If requested by the WRM Department, fire-flow calculations shall be provided for review in accordance with Section 2.3.3 of this Manual. When using the Hazen-Williams equation to calculate flow through a proposed water system, a roughness “C” coefficient of 140 shall be used for all new ductile iron pipe.

Generally, water mains shall be installed on a grid pattern with multiple connections (loops) to the water system. The intent of the grid pattern is to facilitate circulation and to provide redundancy in the water system. The minimum size water main to be used for grids in the distribution system is 6 inches. Additional connections may be required for a development if, in the opinion of the WRM Department, it is in the best interest of the public to promote circulation or to provide redundancy.

The design engineer shall take into account both the immediate needs of the current development and also the future needs of contiguous areas, and provide for ease of future expansion of the distribution system. This typically would be provided by the installation of additional valves at the end of the distribution system and/or additional connection points for additional developments. In such situations, the developer shall provide adequate easement to the property line for any future water main extensions.

All fittings, both horizontal and vertical, shall be shown on the plans, along with the type of thrust restraint required at each fitting location. Fittings shall be minimized in the design by utilizing pipe deflection for directional changes, where possible. A maximum 5 degree deflection angle is allowed at each joint for 12 inch and smaller diameter ductile iron pipe. The radius of curvature can be decreased by using shorter lengths of pipe, where necessary.

All water lines, 4 inches in diameter and larger, shall be Pressure Class 350, Ductile Iron pipe, conforming to the AWWB’s material specifications. All water lines 2 inches in diameter and smaller shall be Type K Copper, conforming to the AWWB’s material specifications.

2.4.3 Water Main Sizes

Water main sizes within the AWWB distribution system shall typically be 4, 6, 8, 10, or 12 inch diameters, as applicable. The sizing of a water main for a particular development will be based on several considerations, as follow:

- The AWWB’s overall water transmission and distribution needs.
- Fire-flow requirements for the development (i.e., residential or commercial)
- Size of individual development and need for redundancy and circulation mains
- Need to provide for development of contiguous areas

Every development will be evaluated individually to determine the required sizing of the water main. The developer shall be required to install appropriately sized water mains that will provide optimal service to all existing AWWB customers and proposed AWWB customers inside the development. The AWWB must approve all proposed water main sizes and has the right to require increased main sizes where a direct benefit will be provided to the development and the distribution system. Where increased main size is necessary only to serve future

development of contiguous areas and provides no direct benefit to the immediate development, the developer may request the AWWB to participate in construction of the larger main. Such instances will typically require the AWWB to bid both size mains and receive contribution from the developer equal to the lowest competitive and competent bid price of the smaller main. This aspect will be discussed with the developer during the review phase.

The minimum water main size allowed for a typical subdivision development shall be 6 inches. The water main size shall be reduced to 4 inches in the case of a cul-de-sac past the last fire hydrant, because of water age and water quality issues, but shall in no case exceed 500 feet in length. The minimum water main size for a commercial, industrial, or high density residential development shall be 8 inches.

2.4.4 Water Main Connections

All connections to existing mains within the AWWB's distribution system must be approved and properly permitted by the AWWB before they can be made. Connection permits can be acquired from the WRM Department. The permit application is available on the City's website and shall be submitted electronically. At least 48 hours should be accounted for review and approval of all connection permits by the AWWB, regardless of size. Prior to submitting the permit application, a plan for all water main connections shall be submitted to the WRM Department for review and approval if not included in a previous DRT submittal.

Developments that are required to submit plans to the DRT, in accordance with the standards included in this Manual, shall receive DRT approval prior to receiving approval for a water main connection. All connections to existing mains shall be done in the presence of a City inspector or a representative of the AWWB. The Water Main Connection Permit will be provided to the appropriate AWWB representative or City inspector by the WRM Department upon approval for the authorization of the connection.

Connections to existing water mains shall be designed for the greatest operational flexibility of the water system while maintaining the least disturbance to the existing customers as possible during installation. In most cases the WRM Department will require main connections, 4" and greater in diameter, to be a new ductile iron tee fitting cut into the existing main. In some special circumstances a ductile iron or stainless steel tapping sleeve and valve may be utilized with prior approval of the WRM Department. The WRM Department will require a tee to be cut into the system in the case of high-pressure areas (greater than 100 psi), or where the connection requires valves to be installed on the existing water main. Connections requiring an outage to existing commercial or industrial customers shall be done after normal hours of operation of the affected customers. Connections requiring an outage to existing residential customers only shall be done during off peak usage hours. All scheduled outages shall be coordinated with the AWWB at least 7 days in advance.

Any connection to the existing services shall be detailed completely on the plans and shall identify all fittings and line sizes. All applicable standard details shall be included with the plans. Although this Manual presents standard details applicable to most projects, the design engineer must provide any additional details, drawings, or other information that may be required to describe the work. Multiple water feed connections may be required by the WRM Department to enhance circulation and to provide for service redundancy, which would reduce the inconvenience to the public in the event of a water main break or water main shutdown.

The following connection fittings shall be used when tapping an existing water main in the AWWB distribution system, where approved:

- Stainless-steel tapping sleeve and gate valve – Required for all taps 4 inches and larger in diameter where a cut in tee is not installed.
- Ductile iron tapping sleeve (full body) and gate valve – Required for all “size-on-size” taps (i.e., 6 inch tap to a 6 inch main line) where a cut in tee is not installed.
- Double strap tapping saddle and gate valve – Required for all 2 inch diameter taps
- Direct tap and corporation stop valve – Required for all 1 inch diameter taps

One-inch-diameter taps shall not be placed at a spacing less than 12 inches, and taps larger than 1 inch shall not be placed at a spacing less than 36 inches.

Service line connections to the AWWB distribution system shall typically be 1, 2, or 4 inch diameters, as applicable. The AWWB does not allow 3 inch diameter connections, fractional diameter sizes (i.e., $\frac{3}{4}$ inch, 1 $\frac{1}{2}$ inch, etc.), or connections smaller than 1 inch in diameter. In cases where the proposed meter size does not correspond to an approved service line diameter, the service line shall be increased in size to the next approved service line diameter. Each metered service shall have only one connection to the distribution main and in no case shall the connection and service line diameter be smaller than the diameter of the meter. Manifold connections of smaller diameter service lines are not allowed for an individual service. Where larger service lines are required, the diameters shall correspond with the typical water main sizes.

2.4.5 Cover Requirements

2.4.5.1 Minimum Cover

The minimum cover over the water main shall typically be measured from the top of the water main to the top of the finished grade elevation above the water main. Water main design in cut sections of a roadway shall take into account adequate depth to provide service across the roadway with the specified minimum cover for the service line under the pavement. Table 2-1 provides the minimum depth of cover based on water main and/or service size.

TABLE 2-1
Minimum Cover
WRM Department Design and Construction Manual, Auburn, Alabama

Size of Pipe	Minimum Cover
8 inches and smaller	30 inches
10 inches and larger	36 inches

It is the responsibility of the engineer to ensure that all existing water mains maintain the minimum cover on a site being developed. If the existing grade is to be lowered over an existing water main, the existing water main will have to be lowered or replaced so that the minimum cover requirements are met.

2.4.5.2 Maximum Cover

Typically, the water main will be installed with the minimum cover. There may be situations, however, where the water main needs to be installed deeper. Such situations may include obstructions, adjacent to roadways in cut sections, or when approaching a creek or road crossing.

The maximum depth of cover for a water main shall be limited to no more than 8 feet of cover. This maximum depth requirement is necessary to allow for maintenance on the water main with standard rubber tire excavation equipment. The 8-foot maximum cover shall not apply when the water main is installed in a casing. Consideration shall be given, however, for maintenance concerns and access to the ends of the water main at the casing.

Special depth consideration also must be taken into account where vaults are to be installed. The maximum depth of cover where a water main enters a vault typically will be limited to no more than 4 feet of cover to minimize the depth of the vault.

It is the engineer's responsibility to ensure that all of the existing water mains do not exceed the maximum cover on a site being developed. If the existing grade is raised over an existing water main, the water main shall be raised as necessary to maintain the appropriate maximum depth of cover.

2.4.6 Utility Crossings

All utility facilities and lines shall be shown on the plans. Any locations where the water mains cross beneath storm sewer or sanitary sewer pipelines or other obstructions shall be shown on the plans. All utility crossings shall be laid out so that they are centered on a section of pipe, providing the maximum spacing between the joints and the crossing.

Water lines generally will be installed so that they would cross over the top of the storm sewer and sanitary sewer pipes. There may be certain circumstances where this is not feasible. These situations will be handled on a case-by-case basis. To provide for future maintenance of the water lines, the installation of a steel casing may be required when the water mains are not accessible and pass beneath another pipeline.

2.4.6.1 Separation from Sanitary Sewer

Water mains shall be designed so that they are separated from sanitary sewer lines by 10 feet horizontally and 18 inches vertically. The distance shall be measured from the outside-of-pipe to the outside-of-pipe. Where proper horizontal or vertical separation cannot be attained, refer to Section 3.4.7 of this Manual.

2.4.6.2 Separation from Storm Sewer

Water mains and storm sewer utilities shall be designed to maintain a minimum separation of 24 inches horizontally and 6 inches vertically to allow for maintenance. The minimum separations are intended to be a guideline for determining the proposed location of water mains in relation to storm sewer utilities only where unavoidable constraints exist. Greater-than-minimum separation shall be accounted for and provided in most cases where necessary easement or ROW space is available. Typically, water mains shall be located greater than 36 inches horizontally from all storm sewer utilities. Crushed stone backfill shall be used where

the vertical separation between the utilities is less than 2 feet. In no case will a water main be allowed inside a storm sewer structure.

2.4.7 Road Bores and Casings

Road borings for water mains will typically be required in lieu of open-cut trenching methods when crossing existing paved streets in the City of Auburn or when crossing a county, state, or federal highway or railroad. This determination will be made on a case specific basis by the City's Public Works Department and/or the appropriate ROW authority, where applicable.

Where road borings are required, they shall typically be a traditional jack-and-bore construction method using a steel casing. Where possible, the steel casing shall extend at least 5 feet beyond the edge of the roadway or planned roadway widening, but shall in no case continue within 5 feet of a water main connection, fitting, or valve. Directional drilling methods may also be allowed by the WRM Department in certain situations for the installation of new water mains and services.

All bores for water service connections shall be aligned and delivered precisely to the location shown on the construction plans to minimize additional fittings required at the main connection. The existing water main shall be excavated as part of the receiving pit prior to setting up the bore to determine the necessary depth for a front-side connection to the main. Back-side connections will not be allowed, unless approved by the WRM Department. All other utilities shall be located and potholed, where necessary, prior to performing the bore. Where open-cut trenching methods are allowed across an existing paved street for new water mains and services, the repair shall be made in accordance with the standards of the appropriate ROW authority.

Steel casings also may be required if, in the opinion of the WRM Department, the water mains are located in an area that would make maintenance on the water main difficult or impractical. Installing water mains in such areas will be at the discretion of the WRM Department, and will only be allowed where it is in the best interest of the distribution system. Steel casings shall be sized according to the carrier pipe size with appropriately sized spacers to center the pipe in the encasement. The pipe joints shall be restrained using external restraint mechanisms or locking gasket restraints for retrieval of the pipe from the encasement. The ends of the encasement shall be sealed with brick and mortar or with a rubber boot and double stainless steel bands to prevent water from entering the casing. Encasements shall be installed per the AWWB Standard Detail No. 212 (Appendix A).

2.4.8 Thrust Restraint Devices

Thrust restraint will be required for all water lines 4 inches or larger where unbalanced forces exist. This shall include all ends of main locations where plugs or caps are installed, all changes in size or direction where fittings such as reducers, tees, horizontal bends, vertical bends, etc., are installed, and where the water main is installed in close proximity to a filled slope.

The engineer is ultimately responsible for the design of the restraint devices for the water main. This Manual provides guidance and recommended minimums for the length of restraint required, but it is the responsibility of the design engineer to verify that this information is valid and applicable for the specific installation.

All thrust restraint devices shall be indicated on the plans. Any additional information or unusual circumstances or conditions concerning the restraint design shall be discussed with the WRM Department.

2.4.8.1 Restrained Joint Devices

The preferred method of thrust restraint is through the use of externally restrained joint devices such as Mega-Lug or approved equal in lieu of concrete blocking.

Tables 2-2 through 2-5 provide the minimum linear footages of restraint required past the fittings using Mega-Lug restraint devices, according to the Restraint Length Calculator Version 5.5 provided by EBAA Iron, Inc., with the following assumptions: Type 3 trench conditions as defined in American Water Works Association (AWWA) C150, minimum cover over the pipe, worst-case soil conditions (ML or CH, granular fill), safety factor of 1.5, and a maximum working pressure of 100 pounds per square inch (psi) (hydrostatically tested to 200 psi). These tables are intended as a guide and are subject to evaluation for each site-specific condition. Additional restraint design will be required where the working pressures exceed 100 psi, where trench conditions vary, or where alternate thrust restraint mechanisms are approved. If the site conditions on all or part of a development are different from the assumptions used in these tables, the lengths of restraint can be modified, as beneficial to the development, with the submittal of a restraint design by the engineer to the WRM Department for approval. All alternate thrust restraint designs shall include detailed drawings and list all assumptions used, along with providing any necessary supporting documentation for those assumptions (i.e., geotechnical report, main profile, etc.).

All thrust restraint shall be adequately calculated by the engineer and clearly detailed on the plans. The exact linear footage of restraint shall be shown at each location and shall be measured from the flange of the fitting that is being restrained.

Where restraint listed in Tables 2-2 through 2-5 is less than a full joint of pipe, unless otherwise directed by the WRM Department, a minimum of one full joint of pipe shall be restrained on both sides of the fitting.

TABLE 2-2

External Thrust Restraint for Bends and Dead Ends (Linear Feet of Restraint Required on each Side of the Fitting along the Main Line)

WRM Department Design and Construction Manual, Auburn, Alabama

Main Size, Inches	Dead End, or (Valve)	Fitting			
		90°	45°	22.5°	11.25°
4	42	28	12	6	3
6	58	39	16	8	4
8	76	50	21	10	5
10	77	51	21	10	5
12	91	59	25	12	6

TABLE 2-3

External Thrust Restraint for Cut-In Tees on Existing Mains (Linear Feet of Restraint Required along the Branch Line Only)

WRM Department Design and Construction Manual, Auburn, Alabama

Branch Size, Inches	Existing Main Size				
	4	6	8	10	12
4	42	39	37	34	31
6	61	58	55	52	49
8	82	79	76	73	69
10	-	98	94	91	87
12	-	118	114	111	106

TABLE 2-4

External Thrust Restraint for Tees on Proposed Mains (Linear Feet of Restraint Required along the Branch Line in Addition to 20-feet of Restraint on Both Sides of the Tee along the Main Line)

WRM Department Design and Construction Manual, Auburn, Alabama

Branch Size, Inches	Main Size				
	4	6	8	10	12
4	14	1	1	1	1
6	41	30	20	9	1
8	67	57	48	38	29
10	-	79	71	62	53
12	-	102	94	86	77

TABLE 2-5

External Thrust Restraint for Reducers (Linear Feet of Restraint Required on the Large Side of the Reducer)

WRM Department Design and Construction Manual, Auburn, Alabama

Large Side, Inches	Small Side				
	4	6	8	10	12
6	30	-	-	-	-
8	55	32	-	-	-
10	74	56	31	-	-
12	92	77	57	31	-

2.4.8.2 Concrete Blocking

For water main sizes less than 12 inches, concrete thrust blocking may be approved on a case-by-case basis by the WRM Department where it can be demonstrated that external restrained joints are not feasible for the particular application. Concrete blocking shall only be allowed in

areas where there is no interference with other utilities or where obstructions are not present that would limit the effectiveness of the thrust restraint.

Where approved, concrete for thrust restraint shall be a minimum of Class B, 2000-psi design mix. The thrust bearing sides of all concrete blocking shall be poured against firm undisturbed soil and the non-thrust bearing sides shall be formed at a 45 degree angle to the undisturbed soil. Concrete blocking shall be designed for the appropriate directional restraint and bearing area in accordance with the AWWB Standard Detail No. 202 and 204 (Appendix A).

All mechanical joint fittings shall be wrapped in plastic prior to pouring thrust restraint blocking and concrete shall not be poured over any joints, to maintain accessibility to the joints for repairs. Calcium chloride shall not be used to accelerate the curing process of the concrete due to its corrosive properties. All concrete blocking shall be given a curing time of not less than 5 days prior to filling the main and performing a hydrostatic pressure test.

2.4.9 Water Valves

Isolation valves will be required by the WRM Department on all public water mains as necessary for the appropriate operation and maintenance of the distribution system. Isolation valves shall be located in a manner that minimizes disturbance to customers during maintenance or repair operations.

The spacing requirements presented in this Manual are to be considered maximums; the WRM Department may require additional valves due to unusual circumstances or the need to minimize the disruption to the distribution system.

Any new connection to the water system shall include valves to isolate the new connection. Typically, isolation valves shall be installed on all pipe segments extending from tees and crosses (i.e. three valve make-up at all tees and four valve make-up at all crosses), unless otherwise approved by the WRM Department. Valve make-ups at intersections shall typically be located outside the paved roadway unless additional fittings or bends will be required due to the water main alignment. All valve make-ups at tees or crosses shall be installed in close proximity to the tee or cross, and shall not be spread across the intersection.

Valves shall be installed on each side of all creek crossings, major street crossings, or other obstructions so that the water main can be taken out of service for maintenance with the least disruption to the public. In a typical subdivision where the water mains are extended to serve each successive development, a valve will be required at the end of each successive development phase so that the water main can be extended without requiring a shutdown.

Generally, isolation valves shall be installed at the maximum intervals shown in Table 2-6 for typical subdivision developments.

TABLE 2-6
 Maximum Valve Spacing
WRM Department Design and Construction Manual, Auburn, Alabama

Water Main Size	Maximum Valve Spacing
4 inches	400 feet
6 inches	600 feet
8 inches	800 feet
10 inches	1,000 feet
12 inches	1,200 feet

However, this spacing may be increased for transmission mains, with no service connections, where an isolation valve is to be installed after every other fire hydrant. The maximum valve spacing allowed for transmission mains is twice that required for fire hydrant spacing, which is detailed in Section 2.4.12.2 of this Manual.

All proposed isolation valves shall be resilient wedge gate valves unless otherwise approved. Each underground gate valve shall be provided with a cast iron valve box to house and protect the valve stem. All valve boxes installed in unpaved areas shall have a concrete collar installed. If a precast collar is used, the annular space between the valve box and the concrete collar shall be grouted. Ductile iron or cast iron pipe shall not be used as valve box extension unless approved. Polyvinyl chloride (PVC) should never be used as a valve box extension.

All plans shall include the statement that only the AWWB or personnel authorized by the AWWB may operate valves inside the AWWB distribution system, where service has been activated.

2.4.10 Air Release Valves

Air release valves (ARVs) will be required on all distribution system expansions where water mains are extended to serve outlying developments, or where necessary for operating the distribution system. Each ARV installed shall be sized according to the site-specific conditions, and the engineer shall provide design calculations to the WRM Department for review.

2.4.10.1 Automatic Air Release Valves

There are three general types of automatic ARVs that are used in water distribution systems:

- Standard ARVs (small orifice valves): Designed for the slow release of air during normal pipeline operations.
- Air/Vacuum Valves (large orifice valves): Designed to release large amounts of air during filling operations, and to admit large amounts of air during draining (in case of a main break).
- Combination Air Vacuum/ARVs (small and large orifices): Designed to perform both functions of small and large orifice ARVs.

The primary types of automatic ARVs used in the AWWB's distribution system are standard small orifice ARVs for the slow release of air during normal pipeline operations. Generally, automatic ARVs will not be required in a typical subdivision installation because of the number of connections that accomplish this goal. Automatic ARVs typically are required when a water main is extended a long distance to serve a new development, typically over 1000 feet. ARVs may also be required where considerable grade change exists where few customer connections are present.

If automatic ARVs are required, they shall be installed at all high points and at a distance between ARVs not to exceed 1,500 feet. The high points shall be field verified during construction to ensure appropriate placement, and the ARVs shall be installed on a level section of pipe equidistant between the joints. The pipe should continually slope between ARVs.

Automatic ARVs shall be sized and located in accordance with the design criteria provided in the AWWA Manual M51, *Air-Release, Air/Vacuum, & Combination Air Valves*, and shall be installed in accordance with the AWWB Standard Detail No. 234 (Appendix A).

Air/vacuum and combination valves typically are not allowed in the AWWB distribution system unless specified by the WRM Department.

2.4.10.2 Manual Air Release Valves

Manual ARVs, which also are referred to as blow-off valves, are designed to manually release air during the process of filling a main. These ARVs typically are required at the ends of mains where a fire hydrant is not available to flush the main, at high points in the main, or as necessary for filling and pressure testing a main. Manual ARVs shall be extended to a curb where possible, or to a standard meter box if the end of the main is not adjacent to a curb location.

Manual ARVs shall be installed in accordance with the appropriate AWWB Standard Details (Appendix A), as applicable.

2.4.11 Pressure-Reducing Valves

The engineer is responsible for determining the static water pressure at the connection point to the water system.

The City maintains different pressure zones across the distribution system. Information regarding these pressure zones is available from the WRM Department.

The engineer is responsible for evaluating the normal operating pressure of the system and determining if a pressure-reducing valve (PRV) is needed. For a normal single-family residential customer, a PRV is recommended when the static pressure at the connection point is more than 70 psi. If a PRV is installed, it must be installed behind the meter in a separate box, located on the customer's property. This PRV is owned and maintained by the customer. Any PRV installed must be installed in accordance with the local plumbing codes.

Developments in areas where static pressures exceed 100 psi may be required to install a large diameter PRV on the public main entering the development at the discretion of the WRM Department. The PRV shall be manufactured by Ames, Watts, Cla-Val, or an approved equal

and shall be installed in an approved concrete vault. The pressure set point shall be determined by the WRM Department.

2.4.12 Fire Hydrants

2.4.12.1 Location

Fire hydrants are required on all public mains for public safety and for maintenance of the distribution system. Fire hydrants shall be located in unobstructed and accessible locations that minimize the potential for damage to vehicles or injury to pedestrians while facilitating adequate fire protection and distribution maintenance use. Fire hydrants shall be located based on the currently adopted International Fire Code (IFC) Appendix C, any applicable local code revisions at the time of the development submittal, and any recommendations of the Public Safety Department Fire Division and/or the WRM Department.

Fire hydrants shall not be physically or visually obstructed from the travel way. Landscaping, fences, signs, structures, and any other movable or immovable impediments will not be allowed where they may be considered a hindrance in the opinion of the AWWB or the Public Safety Department Fire Division. No vertical landscaping taller than 6 inches will be allowed within 5 feet of a fire hydrant.

2.4.12.2 Spacing

Under the IFC standards, the maximum spacing for fire hydrants in developed areas where structures needing fire protection will exist shall be 500 feet, with a maximum distance of 250 feet from any point on the road frontage to a fire hydrant. The actual maximum spacing requirements for fire hydrants within a development depend on the fire-flow requirements, as detailed in IFC Appendix C, and will be reviewed on a case-by-case basis by the Public Safety Department Fire Division.

Fire hydrants also will be required within 125 feet of any Fire Department Connection for private sprinkler systems.

On transmission mains, where hydrants are not needed for the protection of structures, the maximum spacing for fire hydrants can be extended to 800 feet. All fire hydrant locations must be approved by the Public Safety Department Fire Division and the WRM Department.

2.4.12.3 Installation

Fire hydrants shall be three-way assemblies with two, 2 ½-inch hose connection nozzles and one, 4 ½-inch steamer connection nozzle. Each fire hydrant set shall be connected using a 6-inch mechanical joint anchoring tee assembly and shall have its own isolation valve. Generally, in-line valves on the main line supplying the fire hydrant shall be positioned so that no more than two fire hydrants are taken out of service when a water main is shut down and in accordance with the valve spacing standards in Section 2.4.9. Fire hydrants shall be installed plumb, and to the appropriate "bury" line on the riser providing 18 inches from the ground to the steamer nozzle. The steamer nozzle should face the curb, edge of pavement, or travel way. The outsides of all fire hydrants shall be painted with yellow high-gloss machinery enamel when installed.

Fire hydrants shall be specifically designed and installed in accordance with AWWA Specification C502, the AWWB Standard Specifications, and AWWB Standard Detail No. 214

(Appendix A). Any fire hydrants installed in state highway ROWs shall also be in accordance with any applicable ALDOT standards.

2.4.13 Fire Protection and Fire Lines

A fire line is defined as a connection to the public water system that serves sprinklers, private fire hydrants, standpipes, and fire pumps, primarily to provide water for fire protection. Any fire line connection to the public water system will be protected against backflow into the public water system with the appropriate backflow protection device in accordance with Section 2.4.15 of this Manual.

The design engineer is completely responsible for the design of the private fire line. The City's Public Safety Department will review private fire protection systems for compliance with all applicable fire protection codes.

The potable water connection may be taken off the same connection as the fire line in the event that the main is on the opposite side of the street and would require a long side tap, provided that the appropriate backflow protection and a separate isolation valve are installed.

AWWB's responsibility for maintenance of a fire line will stop at the isolation valve for the fire line, typically where the connection is made to the distribution system. The maintenance of fire line vaults and associated backflow prevention assemblies will be the responsibility of the property owner.

Backflow protection will be required prior to all Fire Department connections, including master metered private systems where the fire-flow is metered, to prevent contamination of the potable water distribution system.

2.4.14 Water Meters

All service connections to the AWWB shall be equipped with an appropriate type and size meter for the proposed development prior to the required backflow protection device. Isolated fire line connections, which are not required to install line size meters, shall be required to install a detector check backflow assembly, which includes a low-flow meter to ensure that water is not being used through the connection except for fire protection use. All existing and proposed water meters shall be clearly shown and detailed on the plans. All meters shall be installed per the manufacturer's instructions.

2.4.14.1 Type

The WRM Department will determine what type of meter is needed for an individual customer. This determination will be made based on information collected and submitted during the plan review process. For customers other than single-family residential, the type of meter shall be indicated on the plans. Meters shall be manufactured by Neptune Technology Group and shall be equipped with Neptune R-900 Pro Read Registers. As a guide, the four main types of meters are presented in Table 2-7, along with an example of a typical installation.

TABLE 2-7
 Meter Selection
WRM Department Design and Construction Manual, Auburn, Alabama

Meter Type	Neptune Model	Application	Examples
Positive Displacement	T-10	Low to medium flows	Individual Residences, Small Commercial, Irrigation
Compound	Tru/Flo	Varying low to high flows	Apartment Complexes, Large Commercial
Fire Service Assembly	Protectus III	Varying low to high flows	Combined fire and domestic water systems

2.4.14.2 Location

Meters shall be located at the edge of the easement or ROW in an accessible location. Site grades, main location, service line location, and site layout shall be considered when determining the meter location for a site. Meters shall not be located in traffic areas, sidewalks, or within 10 feet of any structure, and shall not be covered, hidden, or obstructed by landscaping or any other movable or immovable objects.

All meters shall be installed in a meter box or vault per the applicable AWWB standard detail. Meter boxes shall be installed flush with the surrounding grade.

2.4.14.3 Meter and Service Line Sizing

The engineer is responsible for properly sizing the water meter and service line for the customer. Design criteria provided in the AWWA Manual M22, *Sizing Water Service Lines and Meters*, the currently adopted International Plumbing Code (IPC), and any applicable local code revisions at the time of the development submittal shall be considered when properly sizing service lines and meters.

Water meters shall be sized, at a minimum, for the peak instantaneous demand based on the fixture unit values assigned by the IPC for the specific type of development. Service line sizing shall take into account all demand needs and all pressure and friction losses due to elevation change and service length. Service lines shall be designed to provide sufficient capacity to serve each lot fronted by the service line, including each meter and fire system connection. Service lines shall not be smaller in diameter than the proposed meter size. Table 2-8 provides the maximum number of ¾-inch and 1-inch meters that are allowed on a given service line size.

When installing multiple meters on a single property, the AWWB will allow up to two standard ¾-inch meters in a standard meter box using a branch connector, per the AWWB Standard Detail No. 244 (Appendix A). Only one standard 1-inch meter will be allowed in a standard meter box.

TABLE 2-8
 Maximum Number of ¾-inch and 1-inch Meters Allowed by Service Line Size
WRM Department Design and Construction Manual, Auburn, Alabama

Service Line Size, Inches	¾ Inch Meters	1 Inch Meters
1	2	1
2	8	4

The WRM Department requires all fixture unit data to be submitted with the plans for initial review on the Water Demand Table located on the Application for Water and Sewer Service (Appendix B), and will review the meter and service line sizing criteria according to the information provided. The WRM Department will use the project information submitted to determine a minimum meter size required and meter type to ensure the optimal reading accuracy of the meter for the intended use. It is the engineer's responsibility to provide accurate information and to determine the suitability of a particular meter size for the development. The AWWB and the WRM Department do not assume any responsibility or liability for the sizing of meters for a particular customer.

2.4.15 Backflow Protection Devices

Backflow protection devices will be required for all private connections to the AWWB distribution system. The backflow protection devices will be installed at the edge of the ROW or easement for all connections and shall be immediately behind all meters. The exact type of backflow protection device will be determined based on information submitted during the plan review.

All required backflow protection devices shall be noted on the plans and installed according to the applicable AWWB Standard Detail (Appendix A).

2.4.15.1 Authority

The AWWB, as a water purveyor under state regulations, is required to meet the Cross Connection Control Requirements under the Water Supply Program administered by ADEM. Specifically, Chapter 335-7-9 of the ADEM Administrative Code establishes the minimum requirements for public water systems.

The AWWB adopted an updated Backflow Prevention and Cross-Connection Control Policy effective January 1, 2011 in compliance with ADEM regulations. The Backflow Prevention and Cross-Connection Control Policy establishes the minimum water service requirements for necessary protection of the AWWB's water distribution system.

2.4.15.2 Purpose

As required by ADEM, a public water system shall be designed, installed, maintained, and operated in such a manner as to prevent contamination from being introduced through any water service connection in the system.

2.4.15.3 Backflow Protection

Every new connection to the water system will have some type of backflow protection installed at the time service is established.

Each service connection shall be protected against a backflow incident. The exact type of backflow protection will be determined based on the degree of hazard of a backflow incident from the customer's premises, not the likelihood of a backflow incident occurring.

The device also will be determined based on the potential consequences of a backflow incident. A backflow incident may be considered to be a "pollutant" issue, wherein the introduction of the material is mainly an aesthetic issue. For the purposes of the backflow protection, a pollutant is defined as, "A foreign substance, that if permitted to get into the public water system, will degrade its quality so as to constitute a moderate hazard, or impair the usefulness or quality of the water to a degree which does not create an actual hazard to the public health but which does adversely and unreasonably effect such water for domestic use."¹

The consequences of a backflow incident also could be considered to be a "health" issue. Backflow incidents that are considered a "health" issue would involve the introduction of a contaminant that would be considered dangerous to the public. For the purposes of the backflow protection, a contaminant is defined as, "A substance that will impair the quality of the water to a degree that it creates a serious health hazard to the public leading to the poisoning or spread of disease." These types of backflow incidents are considered to be the most serious types of backflow incidents. As such, they require the highest degree of backflow protection.

The recommended protection for specific categories of customers was developed from the AWWA Manual M14, *Backflow Prevention and Cross-Connection Control*.

2.4.15.4 Types of Backflow Protection

Each new application for new water service shall include the AWWB Backflow Protection Information Form (Appendix B). This form will be reviewed to determine the specific type of backflow protection device required.

Each type of backflow protection device identified shall meet all applicable local plumbing codes.

The general types of backflow protection devices are presented below:

- Dual Check Valve (DCV): Minimum type of protection required; this type is automatically installed for each new residential connection or service connection that is 1 inch in diameter and smaller which does not present a specific health or pollutant hazard to the system as identified by the AWWB. This device consists of two internally loaded check valves. DCVs are not testable backflow prevention assemblies.
- Double Check Backflow Assembly (DCBA): Level of backflow protection typically required for "pollutant" type hazards and as a minimum protection for any connection larger than 1 inch.

¹Definitions from EPA Cross-Connection Control Manual, EPA Office of Drinking Water, 1989

- Reduced Pressure Backflow Assembly (RPBA): Highest degree of backflow protection. Required for “health” or “contaminant” types of hazards.

Isolated fire line connections, which are not required to install line size meters, shall be required to install a detector check backflow assembly, which includes a low-flow meter to ensure that water is not being used through the connection except for fire protection use.

2.4.15.5 Double Check Backflow Assemblies

Description

DCBAs consists of two internally loaded check valves installed between two resilient-seated gate valves with properly located resilient-seated test cocks as shown in Figure 2-1.

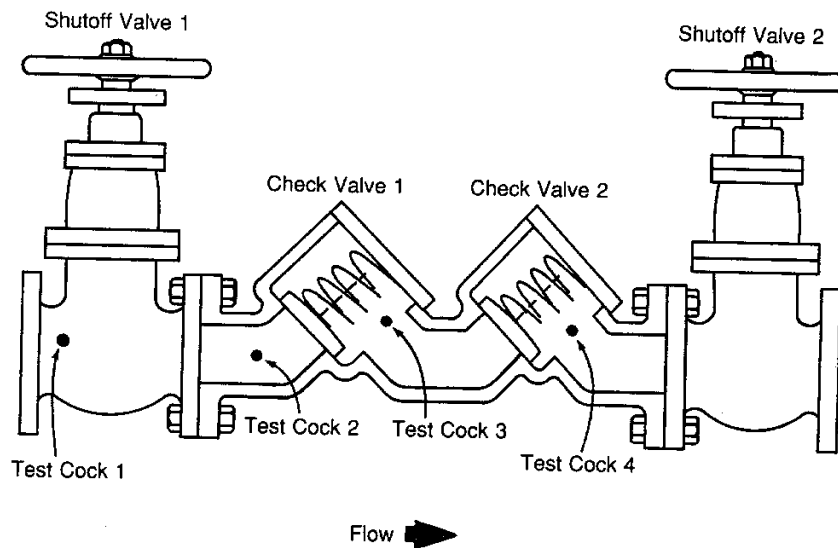


FIGURE 2-1
Double Check Backflow Assembly (DCBA)
AWWA Manual M14, *Backflow Prevention and Cross-Connection Control*

Facilities Requiring DCBAs.

DCBAs that meet all of the applicable plumbing codes will be required to be installed when the potential backflow consequences would constitute a “pollutant” hazard.

The DCBA device shall meet AWWA C510-97 (latest revision) and be approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California, as well as all local plumbing codes.

The WRM Department will evaluate each facility on its own unique set of circumstances for the type of backflow protection required. The following list has been developed as a general guide for the type of facilities requiring DCBAs:

- Connections to other approved public potable water systems (e.g., LWA, BWA, and OU)
- Connections larger than 1 inch
- Multistoried building without booster pumps
- Fire lines and fire hydrants with no chemical addition capability

Installation.

DCBAs shall be installed in a vault in accordance with this Manual and with the applicable AWWB Standard Detail (Appendix A). DCBAs shall be manufactured by Ames, Watts, or an approved equal.

DCBAs shall not be equipped with a bypass connection unless a completely redundant DCBA system is installed.

2.4.15.6 Reduced Pressure Backflow Assemblies**Description**

RPBAs consists of two independently acting check valves together with a hydraulically operating, mechanically independent pressure-differential relief valve installed between two resilient-seated gate valves with properly located resilient-seated test cocks as shown in Figure 2-2.

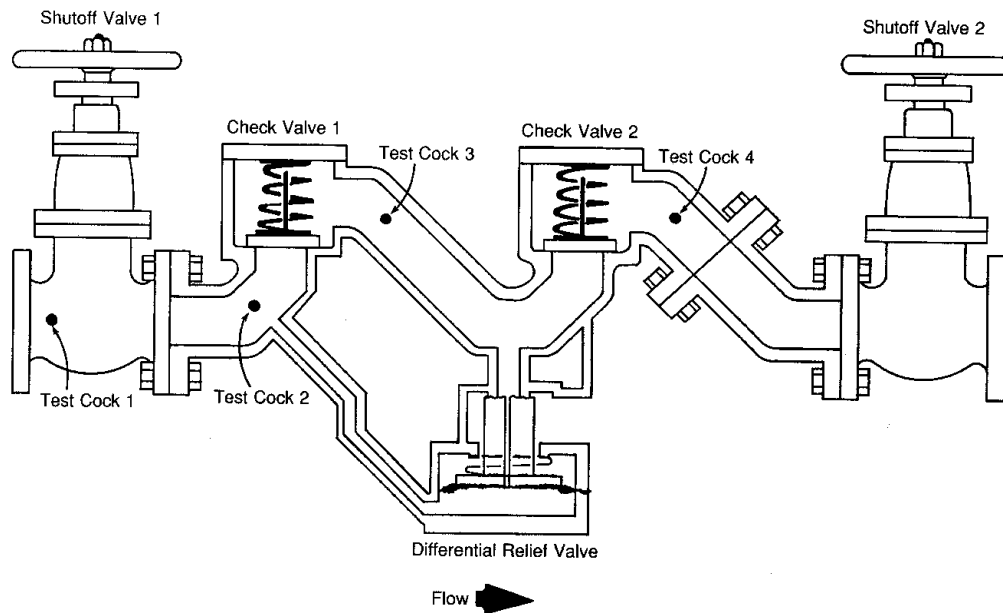


FIGURE 2-2
Reduced Pressure Backflow Assembly (RPBA)
AWWA Manual M14, *Backflow Prevention and Cross-Connection Control*

Facilities Requiring RPBA's.

RPBA's that meet all applicable plumbing codes will be required to be installed when the potential backflow consequences would constitute a "health" hazard due to the introduction of a "contaminant" into the water system.

The RPBA device shall meet AWWA C511-97 (latest revision) and be approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California, as well as all local plumbing codes.

The WRM Department will evaluate each facility on its own unique set of circumstances for the type of backflow protection required. The following list has been developed as a general guide for the type facilities requiring RPBA's:

- Car washing facilities
- Multistoried buildings with booster pumps
- Commercial laundries
- Sewer treatment plants and sewer pump stations (private or public)
- Hospitals or medical centers
- Veterinary facilities
- Mortuaries
- Laboratories
- Premises with restricted access
- Facilities with cooling systems connected to the water system
- Food and beverage processing facilities
- Chemical plants using water
- Metal plating plants
- Petroleum processing or storage facilities
- Radioactive material processing plants/nuclear reactors
- Premises with fire lines and/or private fire hydrants with potential chemical addition (i.e., foamite systems, antifreeze addition, close proximity to auxiliary water supply)
- Premises with an auxiliary water supply for domestic or irrigation services
- Premises using "reclaimed" water
- Facilities with complex piping
- Any premises that, in the opinion of the WRM Department, constitutes a "health hazard" should a backflow incident occur

Installation.

RPBA's shall be installed in an insulated aboveground enclosure in accordance with the AWWB Standard Detail No. 218 (Appendix A). RPBA's shall not be installed in a vault below grade due to the contamination hazard that exists if the relief valve becomes submerged. RPBA's shall be manufactured by Ames, Watts, or an approved equal.

RPBA's shall not be equipped with a bypass connection unless a completely redundant RPBA system is installed.

2.4.15.7 Initial Testing and Certification

If a backflow protection device is required *other* than a standard DCV, the backflow protection device must be tested by a certified tester upon installation in accordance with the AWWB's Backflow Prevention and Cross-Connection Control Policy. The test report indicating that the device is functioning correctly shall be submitted on the AWWB Backflow Testing and Certification Form (Appendix B) prior to a certificate of occupancy being issued and service being activated.

2.4.15.8 Inspection Program

Once installed, the backflow protection devices shall be inspected following the AWWB's Backflow Prevention and Cross-Connection Control Policy requirements. Any deficiencies found must be corrected or the water service will be discontinued, per Chapter 335-7-9 of the ADEM Administrative Code.

2.4.16 Concrete Vaults

Concrete vaults are to be used for any service connection larger than 1 inch that houses meter assemblies, PRVs, testable double check backflow assemblies (TDCBAs), and/or any other water related appurtenances that are not recommended by the manufacturer for direct-bury applications. Concrete vaults also are required for multiple meter pits, where more than six standard ¾-inch meters or more than three standard 1-inch meters are to be installed for a commercial or multi-family development.

2.4.16.1 Installation

Vaults shall be sized and arranged according to the appropriate AWWB Standard Detail (Appendix A) for the purpose for which they are intended. All vaults must be inspected and approved by the AWWB prior to being placed in the ground.

Vaults shall be installed level to ensure proper drainage and the surrounding grade shall be modified where necessary to accommodate drainage. The top of the vault shall be between 2 to 6 inches above finish grade. Vaults shall be placed at an adequate distance from any other utility lines or structures to allow safe excavation for any needed repairs. Vaults shall not be located in traffic areas or sidewalks.

Vaults shall be no more than 6 feet deep and shall have no additional pre-cast riser sections added without prior approval by the AWWB.

2.4.16.2 Concrete

Concrete vaults may be pre-cast or cast-in-place. The concrete shall be Class "A" steel reinforced in accordance with the Standard Specifications. Service connections larger than 2-inch diameter will require the use of two separate pre-cast vaults to house the meter and backflow assembly due to the size of the appurtenances.

2.4.16.3 Hatch

The hatches on all vaults shall be aluminum construction rated for a minimum of 300-pounds per square foot (psf) loading. All hardware installed shall be ASTM Type 316 stainless steel. The frame and cover shall be cast into the concrete and shall be flush with the top of the concrete. The hatch shall span the entire length and width of the vault to provide maximum opening

access to the interior of the vault. The hatch shall be equipped with compression springs, an automatic hold-open arm, a water-tight slamlock device, and a removable key wrench.

2.4.16.4 Piping

All piping and assemblies should be centered in the vault. The vault shall be of adequate size to allow a minimum of 1-foot spacing around all appurtenances and between paralleling appurtenances, where possible, for maintenance and repair. All appurtenances installed inside a vault shall be approved by the AWWB prior to the vault being placed in the ground.

2.4.16.5 Drainage

All vaults are required to have positive drainage through a floor drain to grade or to a storm sewer collection system. The drain shall be a minimum 3 inches in diameter and cast into the floor. The floor of the vault shall be sloped to drain to the opening. The drain shall be adequately screened to prevent debris from clogging the drain. No sidewall drains are permitted. The vault shall be placed on no. 57 stone or larger at a minimum depth of 6 inches.

If it is demonstrated that positive drainage cannot be acquired, approval may be given by the WRM Department on a case-by-case basis to construct a "false bottom" of no. 57 stone or larger. The volume of the stone under the vault shall then be greater than or equal to the volume of the vault, and shall be at a minimum 12 inches deep and extend a minimum of 24 inches from all sides of the vault.

If adequate volume is unavailable below the vault to construct a "false bottom" drainage system, or conditions are such that the vault will not be able to adequately drain the appurtenances shall be placed in an aboveground enclosure according to Section 2.4.17 of this Manual. In no case shall a sump pump be installed for the purpose of providing drainage to a vault.

2.4.17 Aboveground Enclosures

Aboveground enclosures are to be used for the installation of reduced-pressure backflow assemblies (RPBAs) or where drainage conditions prevent the installation of a vault below grade.

2.4.17.1 Installation

Aboveground enclosures shall be constructed of concrete, reinforced aluminum, or fiberglass. Access shall be provided through doors and/or a hinged lid for testing and maintenance purposes. The enclosures shall be lockable to protect against vandalism and tampering. The enclosure shall have drain openings sized to accommodate the maximum discharge under the most severe conditions. Discharge points shall be protected against intrusion of wind, debris, and animals. The enclosures shall be insulated to prevent freezing of the appurtenances. The enclosures shall be installed on concrete slab with a minimum thickness of 4 inches, and shall be in accordance with the recommendations of the enclosure manufacturer.

Enclosures shall be manufactured by Hydrocowl, Hot Box, Lok Box, or an approved equal and shall be installed in accordance with the AWWB Standard Detail No. 218 (Appendix A).

2.4.18 Right-of-Way Permits for Utility Crossings

When the development requires the installation of new AWWB water services across a ROW not owned by the City, such as an ALDOT ROW, railroad ROW, or other utility ROW, the engineer will be required to prepare appropriate utility permit applications for submittal to the utility for review and approval. The engineer shall submit a draft of the appropriate utility permit application and plans directly to the WRM Department for review. Upon approval by the WRM Department, the engineer shall submit six (6) copies of the permit application and plans to the WRM Department for submittal to the appropriate permitting authority.

The developer shall be responsible for any applicable permitting fees. The necessary fees shall be submitted with the permit application to the WRM Department. The WRM Department will provide the necessary bond for the utility.

No work can begin on any ROW until the appropriate utility permit has been submitted and approved by the permitting utility. Typically, all required utility permits for a project shall be identified and the permit application shall be submitted well in advance of the DRT plan submittal to provide sufficient review time for the permitting utility. The WRM Department will not grant DRT approval until the approved application has been submitted to the permitting utility. A Grading and Utility Permit cannot be acquired from the City of Auburn until all required utility permits are received and approved by the permitting utility.

2.4.19 Water Easements

Generally, the water main shall be installed within the public ROW. There may be situations, however, where the water main must be installed on private property. These will be considered on a case-by-case basis.

Where required, water main easements shall be wide enough to allow for maintenance of the water line to remain completely within the easement. A minimum easement width of 20 feet typically will be required. Additional easement width may be required due to depth and/or where water mains are proposed adjacent to habitable structures.

Any easements must be properly dedicated to the AWWB or the City prior to any customers being connected to the water line. Easements may be dedicated by plat or by a separate document. Easements for water mains and appurtenances shall typically be dedicated to the City of Auburn as "Drainage and Utility Easements" unless otherwise approved. Additional information for easement requirements is presented in the General Section of this Manual.