

Chapter 17 Water Service Connections

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Chapter 17 WATER SERVICE CONNECTIONS

This chapter of the Design Standards and Guidelines (DSG) presents standards and guidelines for designing Seattle Public Utilities (SPU) water service connections. SPU manages both permanent and temporary water service connections to its water system. The primary audience for this chapter is SPU engineering staff. DSG standards appear as underlined text.

17.1 KEY TERMS

Abbreviations and definitions given here follow either common American usage or regulatory guidance.

17.1.1 Abbreviations

Abbreviation	Term
AVB	atmospheric vacuum breaker
AREMA	American Railway Engineering and Maintenance-of-Way Association
AWWA	American Water Works Association
DC	detector check
DR	Director's Rule
DCVA	double check valve assembly
DSG	Design Standards and Guidelines
DSO	Development Services Office
LOB	line of business
psi	pounds per square inch
PVBA	pressure vacuum breaker assembly
RPBA	reduced pressure backflow assembly
ROW	right-of-way
SDCI	Seattle Department of Construction and Inspections
SDOT	Seattle Department of Transportation
SMC	Seattle Municipal Code
SPU	Seattle Public Utilities

Abbreviation	Term
WAC	Washington (State) Administrative Code
WOSM	Water Operations System Maintenance

17.1.2 Definitions

Term	Definition
combination service	A 4-inch or larger water service that measures all water conveyed through the service, regardless of whether for domestic use or for fire suppression.
connection	A water service that measures all water conveyed through the service, regardless of whether the use is for domestic, irrigation, or fire suppression.
customers	Parcel owners, developers, or their agents.
detector check (DC) fire service	These services supply only fire flow. They have a single DC meter to show whether any water was used in the meter during the recording period.
design engineer	Engineer who works on production of design drawings, technical specifications, calculations, and technical memoranda for any design discipline or specialty. Primarily SPU staff but may include consultants for large or specialty projects.
design guidelines	Advice for preparing an engineering design. They document suggested minimum requirements and analysis of design elements to produce a coordinated set of design drawings, specifications, or life-cycle cost estimates. Design guidelines answer what, why, when, and how to apply design standards and the level of quality assurance required.
design standards	Drawings, technical or material specifications, and minimum requirements needed to design a particular improvement. A design standard is adopted by the department and generally meets the functional and operational requirements at the lowest life-cycle cost. It serves as a reference for evaluating proposals from developers and contractors. For a standard: the word must refer to a mandatory requirement. The word should is used to denote a flexible requirement that is mandatory only under certain conditions.
developer	A property owner, or a property owner's designee, who is building a structure to be supplied with water service on at least one legal parcel and will oversee the project and communicate with SPU and other interested parties.
direct service area	The retail service area served by the SPU water distribution system as defined by the most current SPU Water System Plan.
distribution water main	A water main that is not a feeder main or a transmission main and is defined as a standard distribution main, suitable distribution main, or obsolete distribution main.
domestic service	These services supply only potable or drinking water for domestic uses (i.e. not for fire flow).
domestic water service header	A 2-inch copper pipe, less than 120 ft in length, supplying up to three 1-inch domestic water services or up to six 3/4-inch domestic services.
feeder main	A water main, usually 12 inches in diameter or larger, that conveys water from a transmission main, pump station, or storage facility to distribution mains.
large service	Any water service larger than 2 inches in diameter.

Term	Definition
master meter	A metered water service from an SPU-owned water main, serving more than one legal parcel or unit lot when a homeowner's association exists for the on-property distribution and submeters.
parcel	A unit of land that is created by a partitioning of land.
right-of-way	Land with an easement for public travel.
small service	Any water service 2 inches in diameter or smaller.
supply feeder	A water main that conveys water from one pressure zone through areas served by other pressure zones.
tap exclusion zone	A location where a distribution water main may not be tapped for water services.
transmission pipeline	A large diameter pipe, usually 36 inches in diameter or larger, that supplies water to the SPU direct service area and wholesale customers.
water availability certificate	A document that confirms that SPU water infrastructure exists to supply a new development.
water availability certificate preparer	SPU staff person who administers the water availability certificate process and responds to customer water service requests.
water service	A system of pipes and related infrastructure that supplies and measures the flow of water from a distribution water main to a private water system.
water service plan	SPU plan that includes meter size, type, location, parts list, and tap information in plan view and profile.

17.2 GENERAL INFORMATION

SPU is the City of Seattle (City) department responsible for providing both temporary and permanent water services to new and redevelopment projects.

The City ensures that a level of service is met for each water service connection, as established in SPU's 2019 Water System Plan:

- [Plan Summary](#)
- [2019 Water System Plan – Volume I](#)

The Washington State Department of Health (DOH) requires that the Water System Plan be updated every six years.

17.2.1 SPU Policy

The Washington Administrative Code (WAC) establishes the following minimum standards in pounds per square inch (psi) for SPU water service pressure, measured at the water meter:

- 20 psi for the existing distribution system during normal operations
- 30 psi for new distribution system construction

The following codes and policies direct water services as follows:

- [Chapter 21.04](#): Water Rates and Regulations – September 29, 2020
- [CS-105](#): Cross-Connection Control Program – May 18, 2006
- [WTR-436.1](#): Connection Charge - May 1, 2019
- [WTR-440](#): Requirements for Water Service - Jan. 1, 2021
- [WTR-450](#): Changes to Existing Water Services - June 23, 2021
- [FIN-220.1](#): Customer Charges – Oct. 1, 2018
- [FIN-220.2](#): Development Charges – July 1, 2021
- [FIN-220.3](#): Water Quality Analysis Laboratory Charges - Jan. 1, 2021
- [FIN-220.4](#): Real Property Charges – Jan. 1, 2019

For SPU policies on water supply, including water mains, refer to [DSG Chapter 5, Water Infrastructure](#).

17.2.2 Types of Water Services

The following types of water services are available from SPU:

- Small domestic services, such as single-family residences and small irrigation systems.
- Large domestic services, such as industrial, commercial, and apartment or condominium buildings.
- Detector check (DC) fire services, for fire protection systems.
- Combination meter services for both domestic and fire, typically for large buildings.

SPU maintains approximately 205,000 water service connection. Table 17-1 below lists the approximate number of each type of water services managed by SPU.

Table 17-1
Water Services Managed by SPU

Service Type	Approximate Count	% of Total
Small domestic	197,300	96.1
Large domestic	1,100	0.5
DC fire services	5,400	2.6
Combination	1,600	0.8
Total	205,400	100.0

17.2.2.1 Small Domestic, DC Fire Service, and Irrigation (Single 2-Inch or Smaller)

Small domestic, DC fire, and irrigation services use single 2-inch or smaller water service connections. Small domestic and DC fire service connections **may** require review by SPU Plan Review staff if located in the Central Business District, a City-designated construction hub, or an arterial.

Meter boxes for small domestic, DC fire, and irrigation water service connections require a smaller footprint while vaults are required for other water service types.

17.2.2.2 All Other Water Services (Larger than 2 Inches)

For SPU water services other than small services, the SPU Development Services Office (DSO) and by the Water line of business (LOB) must complete a plan review. These other services include multiple meters, large domestic and large DC fire services, and combination meters. City Standard Plans apply under most circumstances for these water services.

The vaults for these other water services are large and should be located, when possible, with the access hatch in the planting strip portion of the right-of-way (ROW). Rotating vaults 90 degrees is acceptable. The design engineer may be required to redesign the connection if the standard water service plans cannot be applied.

[Appendix 17A - Standard Water Service Plans](#) presents standard drawings for small and large water services.

17.2.3 DSG Design Resources

SPU standard water and fire service plans and details must be followed unless an alternative is approved by SPU Engineering. These standard plans and details are not part of the City Standards Plans and Specifications and are available only in the DSG:

- DSG standard drawings for water service connections ([Appendix 17A - Standard Water Service Plans](#))
- Water service in or near a natural drainage system ([Appendix 17A - Standard Water Service Plans](#))
- Water service connection plan and profiles examples ([Appendix 17B - Example Plans for Water Service](#))

17.3 GENERAL REQUIREMENTS

Water service connections to SPU water facilities must meet City, King County, Washington state, and federal standards. This section highlights **only** requirements for water service connections. For similar industry standards for other water system features, see [DSG Chapter 5, Water Infrastructure](#).

Water and fire service design must follow American Water Works Association (AWWA) design manuals. Table 17-2 lists relevant AWWA design manuals for water service connections.

Table 17-2
AWWA Design Manuals for Water Services

Designation	Title	Edition
M6	Water Meters: Selection, Installation, Testing, and Maintenance	Fifth
M14	Recommended Practice for Backflow Prevention and Cross-Connection Control	Third
M22	Sizing Water Service Lines and Meters	Second
M28	Rehabilitation of Water Mains	Second
M31	Distribution System Requirements for Fire Protection	Third
M41	Ductile-Iron Pipe Fittings	Second
M44	Distribution Valves: Selection, Installation, Field Testing, and Maintenance	Second

17.3.1 Regulations

This section describes **only** fire service requirements and backflow prevention specific to water service connections. See [DSG Chapter 5, Water Infrastructure](#), for all City, Washington state, and federal regulations for other water service requirements.

17.3.1.1 Fire Service Requirements

The Seattle Fire Department (SFD) requires a fire service for certain types of structures. These fire service requirements are based on the Seattle Fire Code. The fire code establishes requirements for when fire protection systems are required, where the services may be located, and minimum criteria for size of service and fire flow demands. It is the customer's responsibility to review the fire code and contact the SFD to obtain those requirements.

For SPU projects located outside the City, contact the local fire department or fire district. Table 17-3 lists the contact information for fire jurisdictions located outside of the City.

Table 17-3
Contact Information for Fire Jurisdictions

Fire Jurisdiction	Area Served	Main Telephone Number
Shoreline Fire Department	City of Shoreline	206-533-6500
King County Fire District No. 2	Cities of Burien and Normandy Park, North Highline area	206-242-2040
King County Fire District No. 20	Skyway area	206-772-1430

Information for determining fire requirements and sizing fire services can be found in the Seattle Fire Code and AWWA M22 Design Manual. Chapter 9 of the Seattle Fire Code identifies which

types of structures require a particular type of fire protection system (e.g., sprinkler, fire alarm, or chemical).

Tip: *While the design engineer should be familiar with fire code requirements, do not attempt to respond to customer queries on fire service. Instead, direct the applicant to the SFD Fire Marshal's Office.*

17.3.1.2 Backflow Prevention (Cross Connection Control)

A *cross connection* is any actual or potential physical connection between a public water system and the consumer's water system/customer plumbing and any source of non-potable liquid, solid, or gas that could contaminate the potable water supply by backflow. Backflow devices may be required based on the *type of facility* with the water service connection (e.g., hospital, laboratory, or sewage pump station) or by the *specific water use* (e.g., fire service, irrigation, or soda machine).

A. Requirements

Under state law (WAC 246-290-490) and Seattle Municipal Code (SMC 21-04.070), SPU is responsible for protection of the public water system from cross connections and may require backflow protection on the customer's service line or within the customer's plumbing system. Under the plumbing code, Public Health Seattle-King County, a public health department jointly managed by the City and King County, has authority for building plumbing and cross-connection control within that plumbing. SPU and Public Health Seattle-King County operate under a memorandum of understanding for coordination for preventing and controlling cross connections.

B. Roles and Responsibilities

The following is the general process for backflow prevention:

1. SPU utility service inspectors in the Water LOB set the requirements for backflow prevention based on state law, City policy, and industry standards.
2. Utility service inspectors review building design and inspect buildings under construction to ensure that these requirements are met. Inspectors then communicate any deficiencies to the Contractor.
3. Water Service customers purchase, install, own and test backflow devices. SPU inspects backflow device installations and tracks testing of assemblies on private projects.

Where water is provided to an SPU facility, a utility service inspector is responsible for setting the backflow prevention requirements and SPU is responsible for installing, operating, and maintaining the backflow device.

C. Types of Devices

The type and location of the backflow prevention devices depends on the degree of hazard of the cross connection. SPU determines the type during plan review or in the field if changes occur in design.

The following are backflow prevention devices (also referred to as backflow assemblies):

- Air gaps
- Reduced pressure backflow assembly (RPBA)
- Double check valve assembly (DCVA)
- Atmospheric vacuum breaker (AVB)
- Pressure vacuum breaker assembly (PVBA)

For more information on backflow prevention reference the resources in DSG section 17.6.

17.4 PLAN REVIEW AND DESIGN

17.4.1 Water Service Connection

This section briefly summarizes the current process for obtaining a water service connection from SPU. For specific information, refer to [DSG Chapter 18, Development Services](#).

17.4.1.1 Roles

The following are the key departmental roles for setting up accounts and installing water services:

- **SPU DSO Plan Review staff** is the lead for the following:
 - [Water availability certificate application process](#)
 - Plan review of large [water services](#)
 - Location of services on water main extensions (refer to [Standard Specifications and Plans](#))
- **SPU [Development Services](#) Project Coordinators** are the lead for all new service connections, applying and obtaining a Street Use Permit from Seattle Department of Transportation (SDOT), if required, and account setup.
- **SPU Operations and Maintenance Staff (Operations)** is the lead for installing the new water service to the property line (edge of ROW). **SPU DSO Plan Review staff** acts in an advisory role if there are conflicts found in the field with the standard water service plans.
- **Seattle Department of Construction and Inspections (SDCI)** is the lead for all development that occurs on private property.
- **SPU DSO and Utility Services Inspections staff** review and inspect installation of the water service from the right-of-the-way to the building.
- **Seattle Department of Transportation (SDOT) staff** are the lead for all development that occurs in the City right-of-the-way. All work conducted by Operations to install water services should be coordinated with SDOT.

17.4.1.2 Application Process

Visit [Water Service](#) for information on the application process.

17.4.2 Water Availability Certificate

Generally, if a parcel has frontage to an unsuitable water main, SPU policy requires system improvements, including water main extensions, valving, and/or hydrant installation. The water availability certificate preparer may consult with the Water LOB lead, Water Operations System Maintenance (WOSM) Division, and/or DSO engineering staff to determine the exact location and extent of the system improvements required by SPU's water availability policy.

SFD or the local fire department/district may require additional improvements that are not included on the water availability certificate.

17.4.3 Plan Review of Water Service Connections

This section describes critical items that SPU Plan Review staff should look for when reviewing a new water service connection plan. The section also includes useful information for designing a special connection when the standard water service plans cannot be applied.

17.4.3.1 Water Service Plan Review Submittal

A DSO project coordinator should discuss the requirements for submitting a water service plan and coordinate with the customer on the type and size of service needed. The customer submits a service installation plan and profile to the DSO project coordinator, who circulates the submittal to the DSO engineer and Operations for review. The SPU plan reviewer then consolidates comments, and the DSO project coordinator transmits them to the customer.

17.4.3.2 Reviewing Water Service Plans

Engineering plan review for water services is a five-step task:

1. Review water availability certificate requirements and service type.
2. Review plan submittal.
3. Check that a standard water service plan can be applied.
4. Check for conflicts.
5. If needed, modify the standard water service plan and redesign the plan with the customer.

Each task is described in detail below.

A. Review the Water Availability Certificate Requirements and Service Type

If a water main extension, upgrade, or other system improvement is required, identify the requirement in the water availability certificate.

New services connected to a water main improvement should be reviewed and installed under the Water Main Extension Plan.

B. Review the Plan

The SPU plan reviewer should check that all the requirements for the water service plan have been included and shown on the drawings. The design engineer is responsible for

researching utility locations (e.g., water mains, gas, and cable) and showing them on the plan.

The following sections are additional checks for water service plan submittals.

1) **Water Main and Connection Location**

New water services may only be supplied from suitable mains fronting the parcel to be served. Suitability and frontage are determined by the DSO with consultation from the Water LOB. Suitable mains include both distribution mains and feeder-distributor mains meeting current design standards for distribution mains. Small-diameter obsolete mains (galvanized steel mains 2 inches and smaller) or steel/concrete cylinder feeder mains 16 inches or larger in diameter are not suitable for new taps. Cast iron or ductile iron feeder mains may be converted to feeder-distributor mains through the installation of line valves with the approval of the Water LOB.

If service size is the same size as the main, the SPU Plan Reviewer should consult the water availability certificate for adequate pressure and flow. To do this, these services must be a tee cut in and the main must be isolated or shutdown (this is not a typical tap).

A water main must have adequate frontage to a parcel to supply it for new service. Frontage is defined as an adjacency of at least one of the parcel boundaries to a ROW containing a suitable water main and is subject to the following requirements:

- The water service must connect to the parcel perpendicularly.
- The water main and parcel must be located within the same water pressure zone.
- The tap location must not be located inside a tap exclusion zone.
- The water main must not have tap restrictions preventing it from supplying the side of the street where the parcel is located.
- The water service must not cross a divided roadway.
- The tap location must not be located on the intersection side of line valves.
- The tap location must not be located between horizontal or vertical angle points.
- The tap location must not be located under or inside a roadway structure.

If no frontage of a parcel or unit lot abuts an existing standard water main, a standard water main should be extended to cross the full frontage of the property, and a portion of the adjoining street and/or alley, if any. SPU may identify alternative system improvements (e.g., line valves) that will convert a feeder main to a feeder-distributor main suitable for new taps.

DSO should request a site-specific cost estimate from the Water LOB crew scheduling representative for services larger than 8 inches in diameter.

2) Water Meter Vault Location

Standard drawings for water services are shown in [Appendix 17A - Standard Water Service Plans](#).

Meter boxes (for smaller services) or meter vaults (for larger domestic and combination services) must be installed in a location with safe access for SPU field staff. The clearances for Water LOB vaults are shown on Standard Plan 314B.

The standard location for meter vaults is the planting (or furniture) strip, with meter vault hatches located outside of the sidewalk. The designer can rotate meter vaults 90 degrees to facilitate installation, but analysis of additional head loss through the horizontal bends is the designer's responsibility.

If a meter vault is to be located on private property, the customer must apply for an easement procured through legislation by Real Property Services, with a corresponding standard charge. Installation of a meter vault in the roadway is non-standard and requires approval from the Water LOB.

3) Other Design Considerations

Other design considerations include:

- Soil conditions supporting the vault structure.
- Critical areas, such as steep slopes.
- Hazardous materials issues, such as gases in vaults or contaminated soils.
- Vault flooding or water following service piping trenches and damage to customer property (i.e., water from the vault following along the service line and seeping into the building).
- Bridges and fire service:
 - SPU will install a fire service for a bridge structure at or below the bridge grade up to the bridge structure.
 - SPU will **not** install any piping on a bridge structure. The owner of the structure must do this.
- Owners must install their own building plumbing starting at the union point (the point of connection between the SPU-owned water service and a customer's piping).
- Non-SPU fire hydrants must be painted red.

If there could be problems with shutting down the main to perform a tap, contact Water LOB crew scheduling representative. They will check the area and identify any customers that require continuous service. The shutdown may need to be scheduled around customer work hours, or temporary services may need to be provided if the main cannot be shut down. See DSG section 17.5 for sizing temporary water services.

Wherever possible, water services should be located away from natural drainage systems or green stormwater infrastructure facilities. If crossing a swale is the only available option, small services must be installed in casings. Water meters may not be placed in swales.

C. Standard Meter Plan

Per SMC Section 21.04.060(D), SPU may limit the size and number of service connections for any separate parcel. Generally, SPU allows only one domestic service per residential parcel. SPU generally allows multiple domestic and fire services for large commercial parcels to meet water needs.

When reviewing the large water service plan submitted by the customer, the design engineer must do the following:

- Check that the size of footprint for the vault matches the standard water service plan and required valves are shown.
- Check that an isolation valve is located between any two fire services that serve one building if they are on the same main line.
- Water service crossings under railroads (e.g., light rail) are required to be in pipe casings. For more detailed information, see American Railway Engineering and Maintenance-of-Way Association ([AREMA requirements](#)).

D. Utility Conflicts

When location and special considerations have been evaluated with the standard water service plan, the design engineer must check for utility conflicts, access conflicts, and minimum clearance requirements. The design engineer should either move or rotate the vault to avoid utility conflicts. If that is not possible, the design engineer should modify the standard water service plan. Table 17-4 lists standard clearance requirements between water system elements and other items in the ROW.

**Table 17-4
Standard Clearance Requirements**

Standard Clearance Requirements	
Utility clearances	Standard Plans 286A and 286B and Standard Specifications 1-07.17 and 7-11
Meter vault	<ul style="list-style-type: none"> • Located where it will not block traffic and parked cars • Large (4 inches and larger) services in vaults Minimum of 2 feet of clearance between the top of the vault and the bottom of the sidewalk or pavement. Allows conduits to pass over vault
Standard clearances	Standard Plan 030: <ul style="list-style-type: none"> • Trees - 5 feet • Traffic, light, and power poles (standard style) - 6 feet • Traffic, light, and power poles (Chief of Seattle Base Style) - 6.5 feet
Railroad	Minimum depth 5 feet, 6 inches from the top of the railroad rail to the top of the pipe casing

E. Modification to Standard Water or Fire Service Plan

During plan review or construction of the service connection, an unusual circumstance or conflict may arise that prevents strict adherence to the standard water service plan. The following is a general procedure for modifying a connection:

1. If a combination meter will not fit in the locations available, the plan reviewer may require splitting the service into a separate fire service and a separate domestic service. Coordinate directly with DSO and the customer.
2. SPU has authority to place a water service in a location different than the standard location to avoid a hazard or to meet railroad requirements (e.g., in a street, on private property with an easement, and in corner of a parcel).
3. SPU can make a short connection run and union and require the customer to install a longer connection to their building that may extend out into the right-of-the-way.
4. Redesigning the water meter vault should be a last resort. If there are no apparent solutions, evaluate the following in the order shown:
 - a. Consider moving the bypass outside the vault (leave valves in vault) and burying.
 - b. Eliminate the valve upstream of the meter if there is a valve in the road:
 - i) Remove bypass if there is more than one water service to the building.
 - ii) Consider moving valves or dismantling joint outside of vault and direct burying the meter. Requires a dig-up if there are any future problems.
 - iii) If access is the issue, consider increasing the size of the vault.

17.5 SIZING TEMPORARY WATER SERVICE FOR CONSTRUCTION

Temporary water service may be required during construction. Consult the Seattle Fire Code requirements to determine whether the temporary main must provide sufficient water for fire flow. Check the water use trends and records for the last two to five years (available from Geographic Information Systems [GIS]). After reviewing water use records, follow the design guidelines for sizing water service lines in the AWWA M22 Design Manual. It includes instructions on how to size the service to meet fire flow requirements.

Because the construction period tends to be short, and the risks relatively low if there are water outages, the design engineer should investigate the need to provide fire flow capacity as a temporary service. The design engineer should consult with SFD, which may choose to institute a fire watch (i.e., stand watch to ensure no fire occurs during the water outage) as an alternative.

17.6 RESOURCES

Documents

- [AREMA Railway Crossing Requirements](#)
- AWWA Design Manual M22 Meter Sizing
- [WAC 246-290-490](#)
- Recommended Practice for Backflow Prevention and Cross-connection Control (M14) AWWA
- Cross-connection Control Manual, AWWA Pacific Northwest Section
- Manual of Cross-Connection Control, Foundation for Cross-connection and Hydraulic Research, University of Southern California

Websites

[DOH cross-connection information](#)

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