

**CITY OF SNOHOMISH
Snohomish, Washington**

ORDINANCE 2211

**AN ORDINANCE OF THE CITY OF SNOHOMISH, WASHINGTON,
READOPTING ENGINEERING DESIGN AND CONSTRUCTION
STANDARDS; AMENDING DESIGN AND CONSTRUCTION
STANDARDS FOR SANITARY SEWERS AND WATER DISTRIBUTION
UTILITIES; AND REPEALING RESOLUTION 1096**

WHEREAS, pursuant to Ordinance 1708, the Snohomish City Council implemented a permitting system controlling certain activities within public rights-of-way and utility easements within the City of Snohomish (“City”); and

WHEREAS, Ordinance 1708 requires assurance for the performance and maintenance of activities conducted within City rights-of-way; and

WHEREAS, in 2004 the City Council adopted Resolution 1096 adopting Public Works Design and Construction Standards; and

WHEREAS, the City Engineering Division prepared new proposed design and construction standards for sanitary sewer and water distribution utilities to reflect current industry standards; and

WHEREAS, the proposed design and construction standards for sanitary sewer and water distribution utilities were reviewed, commented on, and recommended by the City’s Planning Commission at the Commission’s meeting on June 2, 2010; and

WHEREAS, the City Council finds that the standards previously adopted for sanitary sewer and water distribution utilities need to be expanded and updated to reflect current industry standards; and

WHEREAS, the City Council finds that the establishment of standard construction design elements for sanitary sewer and water distribution utilities provides consistency and minimum requirements for these utilities; and

WHEREAS, the City Council also finds that it is appropriate and in the best interest of the City to enact an ordinance, rather than a resolution, to formally adopt both the revised design and construction standards for sanitary sewer and water distribution utilities and the other engineering design and development standards previously adopted by Resolution 1096; and

WHEREAS, the City Council finds that it is in the best interest of public health, safety, and welfare to enact this ordinance to adopt both the revised design and construction standards for sanitary sewer and water distribution utilities and the other engineering design and development standards previously adopted by Resolution 1096 to encourage safety, convenience, efficiency, pleasant appearance, and economical maintenance of these utilities; and

WHEREAS, the City has complied with the requirements of the State Environmental Policy Act, RCW Chapter 43.21C (SEPA), by adopting a determination of non-significance for

the adoption of the proposed revisions to the City's Engineering Design and Development Standards; and

WHEREAS, at a public meeting on March 1, 2011, the Snohomish City Council reviewed and considered both the revised design and construction standards for sanitary sewer and water distribution utilities and the other engineering design and development standards previously adopted by Resolution 1096;

NOW, THEREFORE, THE CITY COUNCIL OF THE CITY OF SNOHOMISH, WASHINGTON DO ORDAIN AS FOLLOWS:

Section 1. The attached Design and Construction Standards for Sanitary Sewers and Water Distribution Utilities are hereby adopted by the City of Snohomish relating to these utilities within the City of Snohomish. A copy of said Standards shall be kept on file in the Public Works Department or office of the City Clerk for public inspection and copying.

Section 2. The Engineering Design and Construction Standards, other than Design and Construction Standards for Sanitary Sewers and Water Distribution Utilities, that were previously adopted by the City through Resolution 1096 are hereby readopted by the City of Snohomish. A copy of said Standards shall be kept on file in the Public Works Department or office of the City Clerk for public inspection and copying.

Section 3. The City Engineer shall be responsible for the administration and application of the Design and Construction Standards adopted by this ordinance.

Section 4. The City Engineer is hereby authorized to modify these Design and Construction Standards to the extent it is necessary to ensure that the designs and/or the materials to be used or supplied are compatible with existing City utilities and facilities, of comparable durability, and/or consistent with good engineering practice. The City Engineer may require a party desiring to use other design and/or materials to demonstrate that the proposed design and/or materials are compatible with existing City utilities and facilities, of comparable durability, and/or consistent with good engineering practice. The City Engineer is further authorized to take such reasonable steps as may be necessary to determine whether the proposed design and/or materials are suitable. The City Engineer's determination of suitability shall be final.

Section 5. No Special Duty Created:

a. It is the purpose of this ordinance to provide for the health, welfare, and safety of the general public, and not to create or otherwise establish or designate any particular class or group of persons who will or should be especially protected or benefitted by the terms of this ordinance. No provision or term used in this ordinance is intended to impose any duty whatsoever upon the City or any of its officers, elected officials, agents, or employees for whom the implementation or enforcement of this ordinance shall be discretionary and not mandatory.

b. Nothing contained in this ordinance is intended to be, nor shall be construed to create or form the basis for, any liability on the part of the City or its officers, agents, and employees for any injury or damage resulting from the failure of any premises to abate a nuisance or to comply with the provisions of this ordinance or be a reason or a

consequence of any inspection, notice, or order, in connection with the implementation or enforcement of this ordinance, or by reason of any action of the City related in any manner to enforcement of this ordinance by its officers, agents, or employees.

Section 6. Effective March 28, 2011, Resolution 1096 is repealed and superseded by this ordinance.

Section 7. The revised Engineering Design and Construction Standards for Sanitary Sewers and Water Distribution Utilities adopted by this ordinance shall be effective and shall apply as of March 28, 2011.

Section 8. The Engineering Design and Construction Standards adopted by this ordinance shall supersede all previously adopted City of Snohomish Engineering Design and Construction Standards.

Section 9. Severability. If any section, subsection, sentence, clause, phrase, or word of this ordinance should be held to be invalid or unconstitutional by a court of competent jurisdiction, such invalidity or unconstitutionality thereof shall not affect the validity or constitutionality of any other section, subsection, sentence, clause, phrase, or word of this ordinance.

Section 10. Effective Date. This ordinance shall take effect and be in force five (5) days after its passage, approval and publication as provided by law.

PASSED by the City Council and **APPROVED** by the Mayor this 15th day of March, 2011.

CITY OF SNOHOMISH

By: _____
KAREN GUZAK, MAYOR

Attest:

By: _____
TORCHIE COREY, CITY CLERK

Approved as to form:

By: _____
GRANT K. WEED, CITY ATTORNEY

Date of Publication: _____

Effective Date: _____
(5 days after publication)

ENGINEERING STANDARDS

SECTION 5

WATER DISTRIBUTION

5-1 DESIGN

5-1.01 GENERAL

Extension or modification to the City's water system shall be made strictly in accordance with the construction plans prepared in accordance with these Standards, the Snohomish Municipal Code, and the City's Water Comprehensive Plan, and approved by the City Engineer. Additionally, all construction of water system extensions shall conform to these Standards, applicable American Water Works Association (AWWA) Specifications and the current WSDOT/APWA Standard Specifications.

These Standards do not include design of the City's general facilities such as wells, pump stations, in-ground reservoirs, storage tanks, or treatment plant. The City's general facilities require special design and will be reviewed and approved by the City Engineer on a case-by-case basis.

5-1.02 HYDRAULIC REQUIREMENTS

Distribution System Pressure

All water mains shall be sized following a hydraulic analysis based on flow demands and pressure requirements. Per the DOH design manual current edition, during fire suppression events, the water system must be able to provide 20-psi minimum pressure at ground level at all points throughout the distribution system. The water system must be able to provide this minimum pressure under fire-flow conditions plus the MDD rate when all equalizing and fire flow storage is depleted (WAC 246-290-230(6)). The required working pressure in the City of Snohomish distribution system should be approximately 40 to 80 psi, not less than 30 psi when all equalizing storage is depleted, and not greater than 90 psi due to the age and condition of the current infrastructure. Higher pressures in unusual circumstances shall be submitted to the City Engineer for review. Individual pressure reducing valves (PRV) are required when the static pressure at the service level exceeds 60 psi.

Distribution System Velocities

Per the DOH design manual current edition, "DOH recommends a maximum velocity of no more than 8-feet per second (fps) under PHD conditions, unless the pipe manufacturer specifies otherwise. Maximum velocities greater than 8 fps may occur under fire flow conditions, for short main sections, or piping in pump and valve station facilities. Engineers should conduct a hydraulic transient (water hammer) analysis for distribution piping designed to exceed 10 fps during PHD or fire flow conditions (Walski et al. 2003; AWWA 2004)."

Distribution System Fire Flow

Fire flow requirements shall be determined by the City Fire Marshall. The available fire flow will be determined by the City Engineer using the water system hydraulic model.

5-1.03 WATER MAIN EXTENSION

Residential

Water main extensions shall be required when a parcel does not front an existing water main. All residential water main extensions shall be extended to a point 10 feet beyond the farthest property corner where practical as determined by the City Engineer. In addition, water mains shall be installed through all internal streets and looped to all adjacent mains that will, in the City Engineer's opinion, extend past or through the property in the future; and stub to the property line where it is likely that they will be needed to connect to future mains. Depending on the property size, shape and the Water Comprehensive Plan, the City may require mains to be constructed on more than one, and up to all, sides of the property. The City Engineer may also require that extra service lines be installed to be used for sampling stations.

If a proposed water main extension is located in 2 or more pressure zones, the City Engineer may require installation of pressure reducing stations, isolation valves, check valves, and/or booster pump stations.

Dead-end mains shall be kept to a minimum by making appropriate looping and tie-ins whenever practical in order to provide increased reliability of service, assist with water quality and reduce head loss.

If a water main extension directly benefits multiple property owners, a latecomer reimbursement agreement in accordance with SMC Chapter 15.17 may be appropriate.

Non-Residential Properties

Water main extensions shall be required when a parcel does not front an existing water main. All non-residential water main extensions shall be extended to a point 10 feet beyond the farthest property corner where practical as determined by the City Engineer, and/or stub or connect to present and future mains or as directed by the City Engineer. The City Engineer may also require that extra service lines be installed to be used for sampling stations.

If the proposed water main extension is located in 2 or more pressure zones, the City Engineer may require installation of pressure reducing stations, isolation valves, check valves, and/or booster pump stations.

Dead-end mains shall be kept to a minimum by making appropriate looping and tie-ins whenever practical in order to provide increased reliability of service, assist with water quality and reduce head loss.

If a water main extension directly benefits multiple property owners, a latecomer reimbursement agreement in accordance with SMC Chapter 15.17 may be appropriate.

5-1.04 WATER MAIN LOCATION

Water mains and appurtenances should be installed within the right-of-way of public streets and roads. Water mains may be installed within City easements across private properties. Water mains within public right-of-way shall be located on the north and east sides of the centerlines. Water mains shall be in the shoulder of the roadway for rural roads, and approximately 6 feet from the street centerline for urban streets. See Standard Plan 322.

The City Engineer may approve exceptions to this requirement in order to minimize the cutting and replacing of pavement, to avoid conflicts with other underground utilities, to permit sanitary sewers to be installed on the “low side” of streets, or for other appropriate reasons. As nearly as practical, mains shall be installed on a particular street with the distance from the property line and/or centerline varied as little as possible. Water mains shall not be located under or behind parking lanes, curbs, gutters, or sidewalks. Valve boxes shall be located outside the normal wheel track whenever possible.

If there is an easement across a paved area on private property, the water main shall be installed in the driving lanes (not under parking stalls).

Water mains may be laid along road/street curves by using bends. Pipe joint deflection may be allowed upon approval by the City Engineer but the deflection shall not exceed one half of the manufacturer’s recommended deflection.

5-1.05 HORIZONTAL SEPARATION

Water mains shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer, storm drain, and septic tank and/or absorption field. The distance shall be measured edge to edge. If the City Engineer determines it is not practical to maintain a 10 foot separation, the City Engineer may approve deviation on a case-by-case basis using criteria from the Washington State Department of Ecology (DOE). Such deviation may include installation of the water main closer to a sanitary sewer provided that the water main is laid in a separate trench or on undisturbed earth shelf located on one side of the sanitary sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. Water service connections and side sewers shall have minimum horizontal clearance of 10 feet unless otherwise approved by the City Engineer.

Minimum horizontal clearances from water mains:

Utility	Minimum Horizontal Clearance in feet
Cable	5
Gas	5
Power	5
Telephone, Fiber Optic	5
Storm Drain	10
Sanitary Sewer	10
Septic Tanks/Drainfields	10

5-1.06 VERTICAL SEPARATION

Wherever practical, water mains shall cross other utilities at right angles. If this is not practical as determined by the City Engineer, the crossing angle shall be maintained between 45 and 90 degrees. Water mains crossing sanitary and storm sewers shall be laid to provide a minimum vertical clearance of 18 inches between the outside of the water main and the outside of the sewer. Where a water main crosses sanitary and storm sewers, one full length of water pipe shall be used with the pipe centered over the sewer for maximum joint separation. When the above conditions cannot be met and in accordance with applicable DOE criteria, the City Engineer may approve a variance, but shall require that the sewer be constructed of ductile iron pipe and be pressure tested before being activated, and/or be encased.

Minimum vertical clearances from water mains:

Utility	Minimum Vertical Clearance in feet
Cable	1
Gas	1
Power	1
Telephone, Fiber Optic	1
Storm Drain	1.5
Sanitary Sewer	1.5

When it is not practical to maintain this minimum separation between the water main and sanitary and storm sewers, the vertical clearance may be less than 6 inches and Ethafoam pads are required. The water main may also be encased per Section 5.1.11 Steel Casing.

5-1.07 SETBACK DISTANCE FROM BUILDINGS

Water mains shall be located a minimum of 5 feet from covered parking, 10 feet minimum from building and retaining walls. A 20 foot wide minimum easement shall be provided for a water main between buildings.

5-1.08 WATER MAIN SIZING

Transmission mains and specific areas outlined in the City's Water Comprehensive Plan require 12 inch or larger water mains.

When serving fire hydrants and for local distribution mains in residential areas, 8 inch or larger pipe is required.

6 inch pipe shall not be used as part of the distribution system except as fire hydrant runs not longer than 50 feet.

5-1.09 PIPE MATERIAL

Water mains shall be cement mortar lined ductile iron pipe (DIP) Class 52 unless otherwise approved by the City Engineer.

5-1.10 PIPE FITTINGS

Pipe shall be furnished with mechanical joints or rubber gasket push-on joints (Tyton joint only) unless flanged joints or restrained joints are required. Horizontal or vertical bends shall be used when joint deflection would exceed one-half of the pipe manufacturer's recommended maximum deflection. Restrained joints are required on all hydrant runs, steep slopes, non-bearing soils and in other conditions as determined necessary by the City Engineer.

5-1.11 STEEL CASING

Ductile iron pipe shall be encased in a steel casing when crossing: (1) under rockeries over 5 feet high; (2) under retaining wall footings over 5 feet wide; and (3) under reinforced earth retaining walls (both wall and reinforcing material). Casings shall extend a minimum of 5 feet past each edge of the structure, or a distance equal to the depth of pipe, whichever is greater. Minimum vertical clearance between the bottom of the wall or footing and top of the pipe or casing shall be 2 feet. The pipe trench at the casing shall be backfilled with gravel backfill material when the vertical clearance is less than 3 feet.

Ductile iron pipe shall be encased in a steel casing when crossing under a railroad or State/County highway. Casings and carrier pipe shall be installed in accordance with applicable other local, State, and/or Federal laws and/or regulations. In the case of railroad crossings, the project shall also comply with regulations established by the railroad company.

The carrier pipe shall be supported by casing spacers. Casing spacers shall be placed under the carrier pipe to ensure approximate centering within the casing pipe and to prevent damage during installation. See Standard Plan 522.

Steel casings may also be required when water mains cross creeks or wetlands.

5-1.12 COVER DEPTH

A cover depth of 3 feet above the top of water mains shall be maintained if possible. The cover depth shall not be less than 3 feet or more than 5 feet without the approval of the City Engineer.

If the water main is within the State or County right-of-way, the cover depths shall be in accordance with the State or County requirements.

5-1.13 SLOPES

Where the longitudinal slopes are 20% or greater, all pipe joints shall be restrained. Anchor blocks shall be used in conjunction with joint restraint where slopes are 20% or greater. Timber baffle/hill

holders shall be required on unpaved slopes that exceed 20%. Maximum spacing between the holders shall be 18-foot on center with a minimum of 1 holder for each pipe length.

5-1.14 POLYETHYLENE ENCASEMENT

The City Engineer may require that ductile iron pipe and fittings be protected by 8-mil polyethylene encasement in areas of severely corrosive soils or in accordance with AWWA/ANSI C105/A21.5.

5-1.15 CONCRETE BLOCKING

When using horizontal and vertical concrete blocking, show locations and type of blocking on the plans as shown on Standard Plans 505 and 506. Concrete blocking is required on all fittings including restrained joint fittings.

An 8 inch pipe at a vertical bend shall be restrained a minimum of 36 feet (2 joints) from each side of a bend. A 12 inch or larger pipe at a vertical bend shall be restrained a minimum of 54 feet (3 joints) from each side of a bend. No change in horizontal direction or diameter shall occur within 36 feet of the vertical bend. Special blocking or joint restraint designs may be required for poor soil, conflicting utility, etc.

5-1.16 ASBESTOS CONCRETE PIPE CROSSING

When a proposed water main crosses existing asbestos concrete (A.C.) pipe, the City shall require removal and replacement of the A.C. pipe with ductile iron pipe at the expense of the person or entity responsible for the water main project. The A.C. pipe removal and disposal shall be performed in accordance with all applicable Puget Sound Clean Air Agency (PSCAA) requirements, including but not limited to obtaining a permit from PSCAA for the removal work, and other applicable State and/or Federal laws and regulations. A permit from PSCAA to perform the A.C. pipe removal is required prior to construction drawing approval. Ductile iron pipe crossings shall be connected to the existing A.C. main with Romac extended range transition couplings.

5-1.17 VALVES

Sufficient valves shall be provided on water mains so that interrupted service and sanitary hazards will be minimized during repairs. Valves shall be located at no more than 300 foot intervals in commercial, industrial and multi-family areas and at no more than one block or 600 foot intervals in other areas. At water main intersections, valves shall be placed on 4 legs at each cross and 3 legs at each tee (unless tapping an existing water main). The valves shall be spaced so that no more than one fire hydrant is removed from service with any separate main shut down.

An auxiliary valve shall be installed on each hydrant run at the tee. A valve shall be installed on a water main at each end of an easement for the main. Additional valves may be required for area isolation and unidirectional flushing. Valves on water mains shall, where practical, be located within paved area of the street. A valve box or chamber shall be provided for every valve.

Generally valve sizes shall be the same as the water main. All valves 12 inch and smaller shall be resilient seated gate valves unless minimum cover cannot be achieved. If minimum cover cannot be achieved a butterfly valve shall be installed. All valves larger than 12 inch shall be butterfly type if approved by the City Engineer. When butterfly valves are installed, the operation nuts shall be on the north or east sides of the water mains. If a valve is installed in gravel or unpaved area, a concrete pad shall be set around each valve box at finished grade per Standard Plan 512.

5-1.18 FIRE HYDRANTS

Fire hydrants shall be installed for buildings where water is served by the City. The final number of hydrants and their locations shall be approved by the City Fire Marshal.

The maximum spacing of fire hydrants serving single-family dwellings or duplex dwellings on individual lots shall be 600 feet and not more than 300 feet from the front property line of the main body of a lot. Required distances shall be measured along the normal fire department hose laying route.

Fire hydrants serving multi-family and commercial lots shall be located not more than 300 feet on center and shall be located so that at least one hydrant is located within 150 feet of all structures or uses. Fire hydrants shall not be closer than 50 feet from multi-family or commercial buildings. On arterial streets without residential access, maximum hydrant spacing shall be 600 feet.

Any hydrant run exceeding 50 feet in length shall be 8 inches in diameter unless otherwise approved by the City Engineer. The joints of hydrant runs shall be restrained. No domestic or fire sprinkler service shall be tapped on any hydrant run. Fire hydrants shall be installed at the ends of each dead end line more than 300 feet in length. Said fire hydrants may be removed to conform to standard spacing requirements when the main is again extended with the City's approval. Hydrant valves shall be no more than one pipe length and no closer than three feet from the hydrant it serves. Fire hydrant installation is shown in Standard Plan 507.

5-1.19 COMBINATION AIR VACUUM RELIEF VALVES

Combination air vacuum relief valves as shown in Standard Plan 511 shall be installed on high points of new water mains where the elevation difference between the high point and the next low point exceeds one (1) pipe diameter, or as otherwise required by the City Engineer. The air valves shall be located outside the traveled portion of the roadway, preferably behind the curb or sidewalk and within the public right-of-way and the public utility easement. If possible, the water main profile shall be adjusted to eliminate the use of the air valves.

5-1.20 BLOW-OFFS

Each dead-end main shall be provided with a fire hydrant if flow and pressure are sufficient or with an approved flushing hydrant or a blow-off assembly shown in Standard Plan 510 for flushing purposes. Flushing devices shall be sized to provide flows that will give a velocity of at least 2.5 feet per second in the water main being flushed. No flushing device shall be directly connected to any sewer. Blow-off assemblies shall be located outside the traveled portion of the roadway, behind the curb or sidewalk, and within the public right-of-way or public utility easement.

A 2 inch blow-off assembly shall be required for testing and disinfection of new water mains, where hydrants are not available.

5-1.21 CONNECTION TO EXISTING SYSTEM

Connections to existing water mains 8 inches and larger shall be via a wet tap shown in Standard Plan 513 unless cut-in is required by the City Engineer in order to install additional valves.

Connections to existing water mains smaller than 8 inch diameter shall be made by cutting in a tee, unless otherwise approved by the City Engineer.

5-1.22 EASEMENTS

All water mains, valves, fire hydrants, meters, sampling stations, air vacuum relief valves, blow-offs, and other appurtenances not in public right-of-way shall be within public utility easements designated on submitted plans to provide the City with permanent access to these mains and appurtenances, as well as easements for future line connections, as required. Unless otherwise approved by the City Engineer, the easement for the water mains shall be 20 feet in width and 10 feet on all sides of the pipe lines, a minimum of 5 feet on each side of fire hydrants and other appurtenances (such as meters, sampling stations, air/vacuum valves, blow-offs, etc). Easements shall be fully executed and recorded with the Snohomish County Auditor prior to project acceptance by the City. The form of easement documents shall be subject to the approval of the City Attorney. Easement drawings and legal description shall be included as exhibits to each easement.

If off-site easements are required on properties not owned by the party responsible for the project, the responsible party shall acquire the easements at his/her expense before construction plans will approved by the City Engineer.

5-1.23 SERVICE CONNECTIONS

Service connections, including saddle, service line, meter box and appurtenances, shall be installed as part of the construction of all new water system extensions. A fire sprinkler meter per City Standards shall be provided if required by the City Fire Marshal. All service connections must be protected by a Washington State Department of Health (DOH) approved backflow prevention assembly in accordance with WAC 246-290-490. See Standard Plans 501 through 504a.

For residential developments, meter boxes shall be located in front of the lot to be served unless otherwise approved by the City Engineer. Meter boxes shall be close to the property line, behind the sidewalk, in a landscape area within public right-of-way or public utility easement, but not in paved areas such as sidewalk or driveway. An easement shall be established and recorded for placement of the water service if the required location is outside of the right-of-way or established public utility easement. Meters for two neighboring lots shall be installed near the common lot line to ease meter reading. Meters located close to driveways shall use boxes with traffic rating. The distance from the water main to the meter box shall not exceed 50 feet unless otherwise approved by the City Engineer. Meters shall be located in or as close to the public right-of-way as possible. Service lines shall be perpendicular to the water main if possible. See Standard Plan 502 for single family services and 503 and 504 for multi-family or commercial.

For commercial and multi-family developments, meters shall be located behind the back of a curb or sidewalk and not behind parking space or other obstructions. Meters shall be located for ease of reading.

Minimum allowable service lines from mains to meters shall be 1 inch for a single family residential buildings and 2 inch for multi-family or commercial buildings. All duplexes, triplexes and fourplexes must have separate services and meters for each unit. Multifamily buildings with five or more units must have separate services and meters for each building. Irrigation and fire sprinkler systems shall also be served by separate services and meters unless otherwise approved by the City Engineer. Each irrigation and fire sprinkler system shall be equipped with an approved backflow preventer. A minimum pressure of 30 psi at the meter shall be maintained when service is flowing at anticipated maximum flow rates. If friction losses will cause the pressure at the building to drop below the minimum, the service line size shall be increased to an appropriate size to maintain the required minimum pressure level.

The standard meter size is $\frac{5}{8}$ inch x $\frac{3}{4}$ inch for a single family residential house. Non-residential services and meter sizes (minimum $\frac{5}{8}$ inch x $\frac{3}{4}$ inch) shall be determined by the engineer or architect per the current Uniform Plumbing Code and subject to the approval of the City Building Official, and the plans shall show the locations and sizes of the services and meters.

Static service pressures at ground floor elevation shall be determined at all lots/buildings to ensure compliance with system pressure standards. Plans shall identify lots/buildings where the builder/owner will be required to install individual pressure reducing valve (PRV) when service pressures exceed 60 psi. A PRV shall be located on the customer side of the meter, outside of the public right of way, and a minimum of 3 feet from the water meter box.

5-1.24 EXISTING WATER MAIN ABANDONMENT

Existing water mains that are out of service shall be removed or abandoned as required by the City Engineer. If water mains are to be abandoned, the ends of the abandoned water mains shall be plugged by filling with Class 2500 concrete for a minimum length of 12 inches.

5-1.25 PRESSURE REDUCING STATIONS

If the proposed water project shall be located in two or more pressure zones, pressure reducing stations may be required by the City Engineer.

5-1.26 CROSS-CONNECTION CONTROL

The City strictly prohibits interconnection of other water supplies with the City's water system.

A backflow prevention device is required for all irrigation systems, fire sprinkler systems, commercial service connections and other water uses which may cause contamination of the City water system. Approved backflow prevention assemblies shall meet the requirements of the WAC 246-290-490 ("Cross Connection Control Regulation in Washington State"), and the recommendations of the PNWS-AWWA Cross Connection Control Manual and the City of Snohomish Cross Connection Control Program. The types of backflow prevention devices to be used for a specific project shall be determined by the City's Cross Connection Specialist.

Fire sprinkler system connections to the City's water system shall be owned and maintained by the property owner, beginning immediately at the valve where the fire sprinkler system connects to the City's water main.

The backflow prevention assembly on fire sprinkler system connections shall be located as close to the serving water main as possible, either on the owner's property or in an easement.

5-1.27 PRIVATE WELLS

To receive water services from the City, the property owner shall either:

(1) decommission the existing well(s) in accordance with WAC 173-160-381. The owner shall provide a copy of the decommission report to the City Water Division.

OR

(2) physically separate all domestic water supply piping from well(s) piping and permanently cap all terminations so that the two systems cannot be intertied. A double check valve (DCV) assembly shall be installed at the water meter and annual DCV testing requirements shall be met and reports submitted to the City's Water Division.

However, if the property is undergoing development such as, but not limited to, platting or subdivision, all well(s) shall be decommissioned in accordance with WAC 173-160-381 and a copy of the decommission report shall be delivered to the City Water Division.

5-2 MATERIAL

5-2.01 GENERAL

All materials shall be new and undamaged. The same manufacturer of each item shall be used throughout the work. All materials not specifically referenced shall comply with applicable sections of ANSI, ASTM, AWWA or the current WSDOT/APWA Standard Specifications and approved by the City Engineer.

When specific manufacturers or models are specified in these Standards, no substitutions will be allowed without prior approval by the City Engineer. If required by the City Engineer, the Contractor shall furnish certification from the manufacturer of the materials being supplied that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the reference Standards.

5-2.02 DUCTILE IRON PIPE

Ductile iron pipe shall be Class 52 (Tyton joint only) and cement mortar lined unless otherwise specified and shall conform to AWWA/ANSI C151/A21.51. Standard thickness of cement mortar lining shall be in accordance with AWWA/ANSI C104/A21.4.

5-2.03 HIGH DENSITY POLYETHYLENE PIPE

High density polyethylene (HDPE) pipe shall conform to AWWA C900.

5-2.04 WATER SERVICE PIPE

Water service pipe shall be Driscopipe CTS Class 200 Hi-Mol Poly pipe. Driscopipe shall conform to ASTM D-27370SDR9 (PE3408). CTS 110 SS liners for polypipe shall be used.

5-2.05 FITTINGS AND JOINTS

All fittings for ductile iron pipe shall be ductile iron compact (short body) fittings conforming to AWWA/ANSI C153/A21.53 and shall be cement mortar lined conforming to AWWA/ANSI C104/A21.4.

Joints shall be mechanical joints or rubber gasket push-on joints (Tyton joints only) unless flanged joints or restrained joints are required and shown in the plans. Pipe with push-on joints shall be suitable for use with mechanical joint fittings. Ductile iron pipe fittings shall have a pressure rating of 350 psi for push-on or mechanical joint fittings and 250 psi for flange joint fittings drilled in accordance with AWWA/ANSI C111/A21.11, unless otherwise noted.

Rubber gaskets for push-on joints (Tyton joint only) or mechanical joints shall be in accordance with AWWA/ANSI C111/A21.11. Gasket material for flanges shall be neoprene, Buna N, chlorinated butyl, or cloth inserted rubber.

5-2.06 RESTRAINED JOINTS

Where restrained joints are required, they shall be either bolted or boltless design, flexible after assembly, and can be disassembled without special tools. Any device utilizing round point set screws shall not be permitted. All couplings installed underground to connect ductile iron pipe shall be manufactured of ductile iron.

Restrained joints shall be Meg-A-Lug Series 1100, TR Flex, Grinnell 595 shackle clamp, or approved equal.

5-2.07 COUPLINGS

Flexible coupling and transition coupling cast components shall be ductile iron. Bolts and nuts shall be in accordance with ASTM A536-80, Grade 65-45-12. Bolts shall be high strength, low alloy steel track head bolts with national course rolled thread and heavy hex nuts. Gaskets shall meet AWWA/ANSI C111/A21.11 composition specifications.

5-2.08 BOLTS AND NUTS

Bolts, nuts and washers used for securing fittings shall be of similar materials. Steel bolts shall meet the requirements of ASTM A307 or ASTM F568 for carbon steel or ASTM F593 or ASTM F738 for stainless steel. Nuts shall meet the requirements of ASTM A563 for carbon steel or ASTM F594 or ASTM F836 for stainless steel. Iron bolts and nuts shall meet the requirements of ASTM A536, grade 65-45-12.

5-2.09 GATE VALVES

All gate valves shall be resilient seated gated valves conforming to the latest revision of AWWA C509 or C515. All gate valves shall be epoxy coated and turn counter clockwise to open. All gate valves shall have ANSI flanges or mechanical joints ends.

Buried gate valves shall be non-rising stem suitable for installation with the type and class of pipe being installed. Operating stems shall be equipped with standard 2 inch operation nut, and O-ring stem seals.

5-2.10 BUTTERFLY VALVES

Butterfly valves shall be used only when adequate cover cannot be achieved with gate valves.

5-2.11 VALVE MARKER POSTS

Valve marker posts shall be Carsonite blue plastic markers and labeled "WATER" or approved equal. See Standard Plan 509.

5-2.12 VALVE BOXES

Valve boxes shall be installed on all buried valves. Ears (lugs) on all valve boxes shall be placed in alignment with the pipe. The box and lid shall be cast iron, two piece slip type. The cover shall have the word "WATER" cast in the upper surface. Valve boxes, lids and extensions shall be East Jordan Ironworks deep style lid. All castings shall be coated with asphaltic varnish.

A valve operating nut extension shall be furnished and installed on all valves where the finished grade is more than 36 inches above the valve operating nut. Extensions are to be a minimum of 12 inches long with only one extension per valve. The operating nut extension shall extend into the top section of the valve box. See Standard Plan 512.

5-2.13 VALVE VAULTS

Valve vaults shall be dimensioned and sized for valve removal and replacement. Vaults shall be furnished in pre-cast concrete sections with sufficient strength to withstand H-20 traffic loading together with access frames and covers.

5-2.14 COMBINATION AIR VALVES

Combination air valves shall be designed to operate with potable water under pressure to permit discharging a surge of air from an empty line when filling and relieve the vacuum when draining the system. The air valves shall also release an accumulation of air when the system is under pressure. This shall be accomplished in a single valve body designed to withstand a pressure of 300 psi.

The body and cover shall be cast iron conforming to ASTM A48, Class 30. Floats shall be stainless steel conforming to ASTM A 240 and designed to withstand 1,000 psi. Seats shall be Buna N rubber. Internal parts shall be stainless steel or bronze. Combination air valves shall conform to AWWA C512. Air valves shall have double concrete meter boxes Fogtite 2T with solid steel lid. See City of Snohomish Standard Plan 511.

5-2.15 BLOW-OFF ASSEMBLIES

Blow-off assemblies shall be as shown in Standard Plan 510.

5-2.16 FIRE HYDRANTS

Fire hydrants shall be 5 ¼ inch MVO “Traffic Model” type with approved breakaway features, and meet or exceed the requirements of AWWA C502 as well as have the following:

- 1) A standard 5 inch Storz pumper port and two 2½ inch NST side ports, all opening by turning counter clockwise with 1½ inch operating nut;
- 2) Be painted with two coats of hi-gloss equipment yellow enamel paint, with the distance from the foot valve stenciled on the hydrant; and
- 3) A 5 inch Storz adaptor.

Fire hydrants shall be M&H 929 Reliant, Mueller Super Centurion 250 only or AVK Series 2780 Nostalgic.

5-2.17 TAPPING SLEEVES

Tapping sleeves shall be used in lieu of cut-in tees except as otherwise approved by the City Engineer. Tapping sleeve valves shall be epoxy coated and resilient seat. Acceptable sleeves include:

Pipe Material	Type of Tapping Sleeve
Ductile Iron or Cast Iron Pipe	Epoxy Coated Fabricated Steel
Asbestos Cement	Fabricated Stainless Steel Full

5-2.18 SADDLES AND CORPORATION STOPS

Service saddles shall be ROMAC, Ford or equal and shall have stainless steel double straps. See Standard Plans 501 and 502.

Corporation stops shall be the ball valve type and shall be Ford or Mueller. Corporation stops for use with the saddle shall be of bronze in accordance with AWWA Standard C800 with AWWA IP inlet by compression outlet.

5-2.19 METER BOXES

Meter boxes used for meters, sampling stations, and blow-offs shall be high density polyethylene meter boxes with solid ductile iron hatches with 2 inch touch read hole manufactured by Mid States Plastics, Inc., or an equivalent as approved by the City Engineer. Refer to Standard Plans 501 and 502 for sizes and part numbers.

5-2.20 PRESSURE REDUCING STATION

Any pressure reducing station for a specific project shall be designed by a qualified, licensed engineer. The design shall be submitted to the City Engineer for approval. A typical pressure reducing station is shown in Standard Plan 520.

5-2.21 REDUCED PRESSURE BACKFLOW ASSEMBLY

All reduced pressure backflow assemblies (RPBA) shall be as listed on the most current edition of the "Approved Backflow Prevention Assemblies" published by DOH. The assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks. The RPBA shall be installed in an above ground enclosure. The enclosure shall be Hot Box, or an equivalent as approved by the City Engineer. See Standard Plans 517 through 519.

5-2.22 DOUBLE CHECK VALVE ASSEMBLY

All double check valve assemblies (DCVA) shall be as listed on the most current edition of the "Washington State Approved Backflow Prevention Assemblies" published by DOH. The assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks. See Standard Plans 514 through 516.

5-2.23 STEEL CASING

Steel casing shall be black steel pipe conforming to ASTM A53. Casing shall be as specified in Standard Plan 522.

5-2.24 CASING SPACERS AND END SEALS

Casing spacers and end seals shall be sized for pipe being installed and shall be manufactured by Advance Products & Systems, Cascade Waterworks, Pipeline Seal and Insulators Co., or an equivalent as approved by the City Engineer. See Standard Plan 522.

5-2.25 CONCRETE

Thrust blocking, encasement, or slope anchor concrete shall be mixed from materials acceptable to the City Engineer and shall have a 30-day compressive strength of not less than 2,500 psi. See Standard Plans 505 and 506.

The mix shall contain five (5) sacks of cement per cubic yard and shall be of such consistency that the slump is between 1 inch and 5 inches. All concrete shall be mechanically mixed.

5-2.26 BEDDING MATERIAL

Bedding material shall be as specified in Section 9-03.12(3) "Gravel backfill for Pipe Zone Bedding" of the WSDOT/APWA Standard Specifications. See Standard Plan 524.

5-2.27 CONTROLLED DENSITY FILL

Controlled Density Fill (CDF) shall be a mixture of Portland Cement, admixture (optional), FlyAsh, aggregates and water. It shall be proportioned to provide a grout, non-segregating, free flowing, self-consolidating and excavatable material that will result in a non-settling fill which has measurable unconfined compressive strength.

Controlled Density Fill (CDF) shall conform to the requirements of Section 2-09.3(1)E of the current WSDOT/APWA Standard Specifications.

5-3 CONSTRUCTION STANDARDS

5-3.01 GENERAL REQUIREMENTS

All work shall be constructed as shown in the plans and in accordance with these Standards.

Materials shall be installed in compliance with the manufacturer's instructions and specifications, except where a higher quality of workmanship is required by the plans and these Standards.

All work shall also be done in accordance with all applicable Federal, State, County and other local laws and regulations. The Contractor shall arrange for inspection by these agencies and shall submit evidence of their approval if requested by the City.

5-3.02 MATERIAL SUBMITTALS

Material submittals shall be submitted to the City Engineer for approval after the plans are approved for construction.

Five (5) sets of material submittals are required. The City Engineer shall either approve or otherwise indicate the reasons for disapproval. Disapproved submittals shall be resubmitted to the City Engineer for approval.

The City Engineer's review of material submittals covers only general conformance to the plans and these Standards and not for quantity determination. No material quantities shall be verified by the City.

Each "Material Submittal" section shall follow a cover page and state the category of the materials that are submitted for review. Each submittal must have the specific part number(s) checked or highlighted along with its specific purpose. The following shows the preferred order to list the material categories:

- 1) Pipe, Fittings, Pipe Restraints and Casing.
- 2) Valves (Gate Valves, Air Valves, Blow-off, and Valve Boxes).
- 3) Hydrants and Attachments.
- 4) Service Fittings, Service Pipe, Saddles, Ball Valves, Corps, Sleeves, etc.
- 5) Boxes for Meters, Sampling Stations, Blow-offs, and Air Valve Assemblies.
- 6) Cross Connection Control Assemblies (DCDA, RPBA, RPDA, DCVA).
- 7) Bedding Material with Sieve Analysis.
- 8) Other items if required.

5-3.03 PRE-CONSTRUCTION CONFERENCE

The party responsible for the project shall contact the City Public Works Inspector (360-282-3193) to schedule a pre-construction conference after the plans, material submittals, grading, and right-of-way permits are approved. The conference shall include the party responsible for the project, design engineer, and contractor, representatives from the permit agencies, other utility companies, and City staff. An on-site tailgate meeting between the contractor and the Public Works Inspector shall be arranged by the contractor at least 48 hours prior to commencing construction.

5-3.04 CONSTRUCTION SCHEDULE

The party responsible for the work shall provide the City Engineer with the water system extension construction schedule a minimum of five (5) business days prior to start of water system extension construction to arrange staking inspection and to give permitting agencies and customers two (2) business days notice.

5-3.05 EASEMENT

Prior to start of water system extension construction, the party responsible for the project must acquire and record all necessary public utility easements for construction, installation and maintenance of any water mains or facilities not located in the public right-of-way, in City easements, or on the party's property.

5-3.06 PERMITS

The party responsible for a water system extension project shall obtain at their expense all necessary permits from the City and other appropriate State and Local agencies and entities. The party responsible for the work shall provide the traffic control plan prepared by themselves, the design engineer or the Contractor.

5-3.07 HANDLING OF PIPE

All types of pipe shall be handled in a manner that prevents damage to the pipe, pipe lining or coating. Pipe shall be bagged or plugged from the manufacturer or supplier before unloading at the site. Pipe and fittings shall be loaded and unloaded using forks or cable choker in a manner to avoid shock or damage, and under no circumstances shall they be dropped, skidded, or rolled against other pipe. Damaged pipe will be rejected, and all damaged pipe shall be placed apart from the undamaged pipe and shall be removed from the project site within 24 hours.

Pipe shall be stacked in such a manner as to prevent damage to the pipe, to prevent dirt and debris from entering the pipe, and to prevent any movement of the pipe. The bottom tiers of the stack shall be kept off the ground on timbers, rails or other similar supports. Pipe on succeeding tiers shall be alternated by bell and plain end. Timbers of 4"×4" dimensions shall be placed between tiers and chocks shall be placed at each end to prevent movement. Each size of pipe shall be stacked separately.

Threaded pipe ends shall be protected by couplings or other means until the pipe is installed. Dirt or other foreign material shall be prevented from entering the pipe or pipe joints during handling and installation. When pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the City Engineer to ensure cleanliness inside the pipe.

5-3.08 STAKING

Staking shall be performed by or under the direct supervision of a land surveyor licensed in the State of Washington. Two (2) business days notice shall be provided to the City to inspect construction staking before construction begins.

Staking shall be placed in 50 foot intervals and at all fittings on base line or edge of easement with stationing, hub elevations, and cuts to top of pipe.

5-3.09 DEVIATION FROM PLANS

No deviations from the approved plans and these Standards shall be allowed without the City Engineer's approval. Minor changes may be approved by the Public Works Inspector. If major

changes are required, the design engineer shall revise, sign and submit the plans for the City Engineer's approval prior to restart of construction.

5-3.10 INSPECTION AND TESTING

The City Public Works Inspector shall have access to the project site for the purpose of inspections and testing at all times. Proper facilities shall be provided for such access, inspection, and testing.

If any work is covered without approval or consent of the City Public Works Inspector, it must be uncovered for inspection if required by the City Public Works Inspector.

Before a pressure test is to be observed by the City Public Works Inspector, the party responsible for the work shall make whatever preliminary tests are necessary to ensure that the material and/or equipment are in accordance with the plans and these Standards. Written and/or verbal notices of deficiency shall be given to the party responsible for the work. The party responsible for the work shall correct such deficiencies before final project inspection by the City Public Works Inspector.

5-3.11 WATER QUALITY

Water pollution controls shall be implemented and maintained until the project is accepted by the City Engineer. The party responsible for the project shall familiarize themselves with the requirements of DOE and other regulatory agencies having jurisdiction over such matters.

Water with chlorine residual must be dechlorinated using City-approved means and discharged into the environment when the water has zero chlorine residual. Dechlorinated water discharged into the environment shall be done so without causing erosion or impact to the environment. With the approval of the City Engineer, water with chlorine residual may be discharged into the City's sanitary sewer system. Water containing chlorine residual shall not be discharged into the storm drainage system or any waterway.

The oil and chemical storage site for the project shall be approved by the City Engineer and the area shall be diked. There shall be no disposal of waste oil or oil products on the project site. A waste oil disposal tank shall be provided if deemed necessary by the City Engineer.

5-3.12 CONSTRUCTION ON EXISTING EASEMENTS

All work within public utility easements shall be performed in accordance with terms and conditions of the respective easement. Each easement area shall be restored to equal to or better than the condition of the easement area that existed prior to the work. Work shall not be performed within any public utility easement area unless such work is specifically authorized by the City Engineer. The party responsible for the project shall provide advance written notification to and shall coordinate the authorized work with the persons and/or entities owning property that is adjacent to the easement area.

5-3.13 PRE-CONSTRUCTION PHOTOS

Prior to commencement of work, photographs shall be provided to the City that clearly show the conditions of the project site immediately before the anticipated start of the work. Photographs will be obtained as follows:

- 1) 50 foot interval in easements up station and down station.
- 2) Any other locations as directed by the Public Works Inspector.

The photographs shall be 4 inch x 6 inch, color prints, contained in albums, catalogued, and cross-referenced. A digital copy of each photograph shall also be provided to the City Engineer.

5-3.14 UNDERGROUND UTILITIES

The plans shall show the approximate locations of various existing utilities known to the design engineer such as gas lines, water mains, storm drainage, power lines, telephone lines, TV cables, fiber optics, and other obstructions based on information obtained from various sources. The party responsible for the project is responsible to check for interferences and obstructions by inquiry from the different utilities and by underground exploration before commencing excavation.

The party responsible for the project shall request field locating and notify the owners of underground utilities about the scheduled commencement of excavation through the one-call system (1-800-424-5555).

Notice shall be made to owners of underground utilities not less than two (2) business days or more than ten (10) business days prior to scheduled date of commencement of excavation. Test pits, for the purpose of locating underground utilities or structures in advance of the construction, shall be excavated and backfilled. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the City or applicable agency.

Excavation around and under active utilities shall be performed with special care to ensure that utility service is not interrupted. Where it is necessary to cut, move or reconnect any service lines, arrangements shall be made with the respective utility owners.

The party responsible for the work shall coordinate with all utility owners and arrange for the movement or adjustment, either temporary or permanent, of utility conflicts and shall also notify the City, in advance, of any conflicts affecting the work.

The party responsible for the project shall indemnify, defend and hold harmless the City from any claim for damage of utilities and/or disruption to services resulting from project activities/operations. The form of the indemnification agreement shall be subject to the approval of the City Attorney.

5-3.15 TRENCH EXCAVATION

Trench excavation and backfill operations within State right-of-way: All excavation and backfill within the State right-of-way shall adhere to the current *WSDOT/APWA Standard Specifications*.

Trench excavation and backfill operations within County right-of-way: Excavation within Snohomish County right-of-way shall conform first to Snohomish County Road Standards, and secondly to current *WSDOT/APWA Standard Specifications*.

Trench excavation and backfill operations within City right-of-way: Excavation within the City right-of-way shall conform to these Standards.

Clearing and grubbing limits may be established by the City or governing agency for certain areas. Debris resulting from the clearing and grubbing shall be appropriately disposed of in accordance with applicable local and State laws and regulations.

Trenches shall be excavated to the line and grade shown in the plans or as designated by the City Engineer. Higher pressure class pipe or special bedding may be required because of excess trench width.

Unsuitable material below the depth of the bedding shall be removed to the extent approved by the Public Works Inspector and replaced with materials approved by the City Engineer.

The length of trench excavation in advance of pipe laying shall be kept to a minimum and shall not exceed more than 100 feet without prior written approval of the City Engineer.

When trenching operations take place in public right-of-way, the pavement and all other improvements shall be restored as required by the right-of-way permit.

When excavation of rock is encountered, all rock shall be removed to provide a clearance below and on each side of all pipe, valves, and fittings of at least 6 inches for pipe sizes 24 inches or smaller and 9 inches for pipe sizes 30 inches and larger. Material removed shall be replaced with appropriate backfill material, which shall be compacted to 95% standard proctor. See Standard Plan 525.

5-3.16 SHEETING AND SHORING

Sheeting and shoring shall be provided and installed as necessary to protect workers, the work and existing utilities and other properties in compliance with OSHA and WISHA requirements. All sheeting and shoring above the pipe shall be removed prior to backfilling. Sheeting below the top of the pipe may be cut off and left in place. Removal of the sheeting and shoring shall be accomplished in such a manner that there will be no damage to the work or to other properties.

5-3.17 TRENCH DEWATERING

Sufficient pumping equipment shall be provided and maintained on the project site to keep the trench free from standing water. Surface runoff shall not be allowed to flow into the trench. The trench water or other deleterious materials shall not be allowed to enter the pipe at any time. If water is found to be entering the new water main at any time, the water main shall be plugged and all work shall stop until the trench water is completely pumped out or otherwise controlled to the satisfaction of the Public Works Inspector. Any dewatering method used shall be in accordance with the specifications and requirements of the City and DOE.

5-3.18 PIPE BEDDING

Bedding material, when required by the City, shall be as specified in these Standards and the current WSDOT/APWA Standard Specifications. For the type of pipe (rigid or flexible) to be installed, pipe zone bedding is defined as 6 inches below the pipe and around the pipe, and 12 inches above the pipe. Native material may be used for bedding of ductile iron pipe if judged to be suitable by the City Engineer. Gravel backfill for pipe zone bedding shall be select granular material free from wood waste, organic material, and other extraneous or objectionable materials and shall have a maximum dimension of 1½ inches. Pipe zone bedding up to 12 inches over the top of the pipe shall be evenly and carefully placed. Gravel backfill for pipe zone bedding shall be compacted to 95% maximum dry density per ASTM D1557 by approved methods (hand-held tools), so as to provide firm and uniform support for the full length of the pipe, valves, and fittings. See Standard Plan 524.

5-3.19 CONCRETE THRUST BLOCKING

Bends, tees, plugs, reducers, and caps, unless otherwise specified, shall be blocked in accordance with Standard Plans 505 and 506. All poured in place blocking shall have a minimum measurement of twelve inches 12 inches between the pipe and the undisturbed soil. Concrete blocking shall have a minimum of ¼ square foot bearing against the fitting. Blocking shall be adequate to withstand full test pressure as well as to continuously withstand operating pressure under all conditions of service. All concrete shall be 2,500 psi minimum and mechanically mixed.

Blocking shall, unless otherwise shown or directed, be placed so that pipe and fittings will be accessible for repair. Eight-mil polyethylene sheets shall be installed around all fittings and all bolts, nuts, and glands for future dismantling.

In the event of a shut down where time does not permit the proper setting of the concrete blocking, ecology blocks shall be installed with concrete poured around the connection point of the fitting and the blocks with the approval of the Public Works Inspector.

5-3.20 TRENCH BACKFILL AND COMPACTION

Trench backfill shall be done above the pipe zone bedding. All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, frozen soil, or other unsuitable material. Trench backfill material shall be as specified in these Standards and the current WSDOT/APWA Standard Specifications.

Compaction of the backfill shall, at the minimum, be accomplished by mechanical tamper, by vibrating, by rolling, or by a combination of these methods, as approved by the City Engineer. Water settling is not permitted. A testing laboratory acceptable to the City Engineer shall be used to perform on-site density tests to show that the specified density has been obtained. The approval of the compaction method and the achievement of the specified density shall in no way relieve the Contractor of responsibility for all repairs caused by settlement of the backfill prior to acceptance and during the two year period after acceptance of the project.

Prior to backfilling, form lumber and debris shall be removed from the trench. Sheeting used by the Contractor shall be removed just ahead of the backfilling. Backfill shall not be deposited in the trench in any manner which will damage or disturb the pipe or the initial backfill. Care shall be taken to prevent any damage to the pipe or its protective coating. After the initial backfill is placed,

the remaining backfill material shall be placed in successive layers not exceeding 1 foot, (12 inches) in loose thickness, and each layer shall be compacted to the density specified below. Asphalt pavement restoration shall either be by a patch or overlay method as required and noted on the right-of-way permit. When a patch method is used, the trench limits shall be saw cut prior to the final patch.

All pavement cuts shall be made by saw cuts. The saw cuts shall be 1 foot outside the trench width. If the permit requires an overlay, then the Contractor may use a jackhammer for cutting the existing pavement. Grinding may be required.

All trenching shall be backfilled in accordance with Standard Plan 525. All trench backfill materials shall be compacted to 95% maximum dry density, as determined by ASTM D1557.

Native material may be used for backfill upon approval of the City Engineer or the permitting agency.

When the trench is perpendicular to the traveled lane or any driveways, the full depth shall be backfilled with crushed surfacing top course material. When the trench is parallel, the top 4 feet must be backfilled with crushed surfacing top course material. Controlled Density Fill (CDF) may be required by the City Engineer or the permitting agency.

Backfill compaction shall be performed in 8 to 12 inch lifts. Compaction tests shall be performed in 4 foot vertical increments maximum. The test results shall be given to the City Engineer for review and approval prior to paving. Tests shall be performed at maximum intervals of 50 feet along the length of the trench.

If the area is unpaved and not subject to vehicle traffic, the backfill shall be compacted to a minimum of 90% of maximum dry density as determined by ASTM D-1557.

5-3.21 LAYING DUCTILE IRON PIPE

Work shall be accomplished in accordance with AWWA C600 and the manufacturer's recommendations.

Depths of pipe shall conform to approved plans. The typical cover depth of pipe is 36 inches measured from finished grade to top of pipe.

The bottom of the trench shall be finished to grade in such a manner that the pipe will have bearing along the entire length of the barrel. Bolts on mechanical pipe and fittings shall be tightened uniformly with a "Torque" wrench which measures the torque for mechanical joints as follows:

2 inch to 3 inch pipe sizes $\frac{5}{8}$ inch bolts 40 to 60 foot pounds

4 inch to 24 inch pipe size $\frac{3}{4}$ inch bolts 60 to 90 foot pounds

Except where restrained joint systems are required, mechanical or push-on Tyton joints shall be used. Installation of push-on joint pipe shall be in accordance with the manufacturer's instructions.

When it is necessary to deflect pipe from a straight line in either the horizontal or the vertical plane, the amount of joint deflection shall not exceed one half (1/2) of the maximum deflection recommended by the pipe manufacturer. The pipe manufacturer's joint deflection recommendations shall be provided to the City Engineer prior to pipe installation as a part of the Material Submittals.

Where field conditions require deflection or curves not anticipated on the plans, an appropriate plan revision shall be prepared by the design engineer and submitted to the City Engineer for approval.

Whenever it becomes necessary to cut a length of pipe, the cut shall be done in conformance with all safety recommendations of the cutting equipment manufacturer. Cutting shall be done in a safe manner without creating damage to the pipe or cement mortar lining. The cut shall be made by an abrasive pipe saw or an approved pipe cutter.

The outside of slip joint pipes shall be beveled and smoothed so that good connections can be made without gasket damage.

All parts of the pipe ends, couplings, fittings and appurtenances shall be cleaned to remove oil, grit, or other foreign matters from the joints. Care shall be taken to keep the joints from contacting the soil.

5-3.22 POLYETHYLENE ENCASUREMENT

Installation of polyethylene encasement shall be in accordance with the latest AWWA Standard C105. All ductile iron pipe and fittings installed in highly corrosive soils shall be wrapped in a manner approved by the City Engineer except as specifically excluded in the approved plans or in these Standards.

5-3.23 FIRE HYDRANT INSTALLATION

Fire hydrants shall be set as shown in Standard Plans 507 through 509 and AWWA Standard C600. The portion of the hydrants above the ground shall be painted with 2 coats of high gloss equipment yellow paint. The entire hydrant run shall be restrained joint.

All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb or at the City Fire Marshall's discretion, with pumper nozzle facing the curb. Hydrants shall be set to the established grade. Hydrants shall be installed so that the breakaway flange is 2" to 6" inches above finished grade per Standard Plan 507.

When a dry barrel hydrant is set, drainage shall be provided at the base of the hydrant by placing 1½ inches of washed drain rock from the bottom of the trench to at least 12 inches above the drain port opening in the hydrant and to a distance of 2 foot around the elbow. Fire hydrants shall not be located within 10 feet horizontally of a sanitary sewer main or side sewer.

When a hydrant is installed in an unpaved area, a concrete fire hydrant pad shall be installer per Standard Plan 508.

Additional information regarding placement of hydrants can be found in AWWA Manual M17.

When fire hydrants are located in parking lots, or other areas where vehicles may have access, hydrant guard posts shall be installed. Guard posts shall be installed according to the minimum dimensions shown in Standard Plan 509.

Reflective pavement markers for fire hydrants are required.

5-3.24 VALVE INSTALLATION

Prior to installation, valves shall be inspected for approved part/manufacturer's numbers; cleanliness of valve ports, especially seating surfaces, handling damage, and cracks.

When butterfly valves are installed, the operation nuts must be on the north or east sides of the water mains or as directed by the Public Works Inspector.

The valve and valve box shall be set plumb and centered on the valve. Valves 12 inches or larger shall be supported by a concrete block (16 inches x 16 inches x 4 inch solid concrete) on a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

Valves shall be installed in the closed position. Where the valve operating nut is more than 3 feet below finished grade, a valve stem extension conforming to the Standard Plans must be installed. See Standard Plan 512. Tapping valves shall be water tested prior to tapping water main.

A valve box or vault shall be provided for every valve. Valve box top sections shall be adjusted flush with the finished pavement, and in those areas to be excavated for future roadway grades, enough adjustment shall be provided in the valve box to allow the top of the box to be adjusted to the required grade.

Backfill around valves shall be carefully tamped in 6 inch lifts for the full depth of the trench with the valve box in place. A minimum of 2 feet x 2 feet x 4 inch concrete pad shall be provided for a single valve box and a minimum of 4 feet x 4 feet x 4 inch concrete pad shall be provided for multiple valve boxes installed in gravel or unpaved areas as shown in Standard Plan 512.

5-3.25 COMBINATION AIR AND VACUUM RELEASE VALVE

Location of the air/vac shown in the plans is approximate. Air valves shall be set at the high points of the water main. The water main profile may need adjustment so that the high point and air/vacuum valve is installed in a convenient location with the Public Works Inspector's approval. Installation shall be as shown in Standard Plan 511.

5-3.26 BLOW-OFF ASSEMBLIES

Blow-off assemblies shall be installed as shown in Standard Plan 510. A valve marker post shall be installed when the gate valve is installed in unpaved area or as directed by the Public Works Inspector.

5-3.27 VALVE MARKER INSTALLATION

Marker posts shall be set for all valves located in unpaved areas and as directed by the City Engineer except auxiliary hydrant valves. Installation shall be as shown in Standard Plan 509.

5-3.28 SERVICE LINES

New Service Installations

Generally, corporation stops are located at ten o'clock or two o'clock positions on the circumference of the pipe. Taps shall be accomplished by saddle tap only. No direct taps shall be allowed. Taps shall be installed with double strap stainless steel saddles. When more than one tap in an existing cast iron pipe is necessary to deliver the required flow, the taps should be staggered around the circumference at least 12 inches apart (not in line). The service line shall be pressure tested before placing in service. Service installation shall be as shown in Standard Plans 501 through 504a.

Reconnecting Existing Services

Service connections shall be installed as shown in the approved plans and Standard Plans. Service lines shall be installed in paved areas by boring, and under sidewalks and curbs by boring and tunneling. Damages shall be repaired by the Contractor. A 30 inch minimum cover shall be provided on service lines. Service lines shall be installed 90 degrees horizontally to the main to intercept the existing meters. Installed service lines shall be flushed prior to connection to the meter.

Angle ball meter valves, check valves and setters (if required) and boxes shall be installed as shown in the Standard Plans or as directed by the City Engineer.

Existing service connections shall not be transferred to the new mainline until the new mainline has been successfully flushed, disinfected, tested and approved by the Public Works Inspector. When transferring services from the existing mainline to the new mainline, sanitary precautions shall be taken as necessary to protect the potable water supply in both the existing and new mains.

5-3.29 PRESSURE REDUCING STATION

Pressure reducing stations shall be installed as shown in Standard Plan 520, in approved plans, and in accordance with the manufacturer's recommendations. The pressure reducing valves, strainers, pressure relief, pipe and fittings shall be constructed in accordance with the applicable AWWA and Uniform Plumbing Code requirements. Pressure reducing valves 6 inches or larger shall be supported by pipe supports. Supports shall be bolted to the vault floor.

Pressure relief discharge pipe shall be placed in a location that will not be subject to damage or erosion during discharge of water. The pressure reducing valve manufacturer's representative(s) shall be present during the start up of the pressure reducing station.

5-3.30 CONNECTION TO EXISTING WATER MAIN

Points of connection to existing water mains shall be exposed prior to trenching of the new mains, and not less than 48 hours prior to the anticipated connection time. Unless specifically provided for

elsewhere in these Standards, at least five (5) business days notice shall be given to the City Engineer prior to the anticipated connection time. The City Engineer shall be responsible for notifying the City Fire Chief and customers affected by the shut-off. Water main shut-off shall not be scheduled to take place on Fridays, or on the day before a holiday, unless otherwise approved by the City Engineer.

The party responsible for the project shall ensure that existing fittings are in accordance with the approved plans and that the connection will be made in accordance with the plans. If the connection cannot be made in accordance with the plans, the City Engineer shall be so notified. The design engineer shall submit revised plans that provide appropriate connection to the City Engineer for approval.

Connection to the existing water system shall be done only after the new mains are flushed and have passed pressure and purity tests. All connections to the existing water system must be approved by the City Engineer and shall be made in the presence of the City Public Works Inspector. Only authorized City representatives shall operate the valves in the existing water system.

Connections to existing water system may be made under pressure with a tapping machine by determining the size and type of pipe and installing a tapping tee with a tapping gate valve. Tapping tees shall be installed as shown in Standard Plan 513. Work shall not start until all materials, equipment, and labor are ready. The tapping tee and valve shall be installed in a horizontal position so that the valve stem is vertical. Where cut-ins are required in existing pipes, the work shall be conducted so as to minimize the interruption of service. Necessary pipe, fittings and gate valves shall be assembled at the site ready for installation prior to the shut-off of water in the existing main. Once the water main has been shut off, the work shall be promptly completed and shall not be halted until the water main is back in service.

The interiors of all pipe and fittings, particularly couplings and sleeves, to be used in final cut-in connection shall be swabbed or sprayed with a 200 mg/L hypochlorite solution prior to installation.

Flushing shall start as soon as repairs or connections are completed and shall be continued until discolored water is eliminated. Flushing shall be done in the presence of the City Water Quality Control Specialist.

5-3.31 SCHEDULE OF TESTS

The Public Works Inspector and the Water Quality Control Specialist shall be notified at least two (2) business days before a section of water main is ready for inspection and test. The Water Quality Control Specialist shall inspect and observe the hydrostatic test. The City Engineer shall be notified at least two (2) business days prior to purity test and flushing. The party responsible for the project shall be present at the project site when the Water Quality Control Specialist takes water samples. Sufficient manpower and resources shall be provided by the responsible party to accomplish the work in a timely manner. Flushing shall be done under direct supervision of the Water Quality Control Specialist.

5-3.32 HYDROSTATIC PRESSURE TESTS

Water main, appurtenances and service connections shall be tested in sections of convenient lengths under a hydrostatic pressure of 220 psi for 15 minutes.

Pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose, piping, and measuring equipment necessary for performing the test shall be furnished and operated by the party responsible for the project.

Sections to be tested shall normally be limited to a maximum of 1,000 feet. The pipe shall be backfilled sufficiently to prevent movement of the pipe under pressure. Thrust blocking shall be in place for an adequate time for concrete to cure before testing. Where permanent blocking is not required, temporary blocking shall be furnished and installed prior to and removed after testing.

An approved double check valve assembly (DCVA) shall be provided to fill the new water mains for testing and flushing. The new water mains shall be filled and remain under 200 psi to 210 psi pressure for 24 to 48 hours to allow air to escape and the lining of the pipe to absorb water.

The pressure test shall be accomplished by pumping the main up to 200 psi to 210 psi, stopping the pump for 15 minutes, and pumping the main up to the test pressure again. During the test, the section being tested shall be observed to detect any visible leakage.

A clean container shall be used for holding water for pumping up pressure on the main being tested.

The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter. The meter shall be approved by the City Water Quality Control Specialist. Acceptability of the test will be determined as follows: The quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula:

$$L = \frac{SD\sqrt{P}}{266,400} \quad \text{in which,}$$

L	=	allowable leakage (gallons/hour)
D	=	nominal diameter of the pipe (inches)
P	=	test pressure during the leakage test (psi)
S	=	gross length of pipe tested (feet)

There shall not be an appreciable or abrupt loss in pressure during the 15 minute test period. Any visible leakage shall be corrected regardless of the allowable leakage specified above. Should the tested section fail to meet the pressure test successfully as specified, the defects shall be located and repaired and the pipeline retested.

Tests shall be made with the hydrant auxiliary gate valves open and the hydrant valve in the closed position. Once the new line is successfully tested, each valve shall be tested by closing each in turn and relieving the pressure behind it. The mains shall be tested between valves. As possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. This test of the valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The pressure differential across the valve shall not exceed the rated working pressure of the valve.

All service lines shall be flushed prior to contacting the Water Quality Control Specialist for a pressure test. All necessary equipment shall be ready and available for set up but not connected until the Water Quality Control Specialist is present for operation.

Defective materials or workmanship discovered as a result of hydrostatic field test shall be replaced or repaired and the hydrostatic test shall be repeated to the satisfaction of the City Engineer.

5-3.33 DISINFECTION AND FLUSHING OF WATER MAINS

Before being placed into service, new water mains and repaired portions of existing mains shall be chlorinated and a satisfactory bacteriological report obtained. Disinfection of water mains shall be accomplished in accordance with the requirements of the Washington State Department of Health, AWWA Standard C651, and in a manner satisfactory to the City Engineer. Sections shall be disinfected between adjacent valves unless otherwise approved by the City Engineer. All filling and flushing shall be done through a meter with a DCVA provided by the party responsible for the project. Valves shall only be operated by authorized City employees.

Flushing

Where dry calcium hypochlorite is used for disinfection of the pipe, flushing shall be done after disinfection. If a hydrant is not installed at the end of the water main, the Contractor shall provide a tap large enough to develop a flow velocity of at least 2.5 feet per second in the water main.

The flushing period must be approved by the City Engineer. The source water used for disinfection and pressure testing shall be flushed prior to its use to ensure that contaminants or debris are not introduced into the new pipe.

Taps for temporary or permanent release of air, chlorination or flushing purposes shall be provided as a part of the construction of the water mains.

Chlorination

The section to be tested shall be chlorinated so that a chlorine residual of no less than 25 mg/l (parts per million or ppm) remains in the water after standing 24 hours in the pipe. The initial chlorine content of the water shall not be less than 50 mg/l. The forms of chlorine that may be used in the disinfection operations are liquid chlorine and calcium hypochlorite granules.

Liquid Chlorine: Chlorine shall be applied by solution fed at one end of the section with a valve or hydrant at the opposite end open sufficiently to permit a flow through during chlorine application. The chlorine solution shall be fed into the pipeline already mixed by an automatically proportioning applicator to provide a steady application rate no less than 50 mg/l (ppm) chlorine. Hydrants along the chlorinated section shall be open during application until the presence of chlorine has definitely been detected in each hydrant run. When a chlorine concentration of no less than 50 ppm has been established throughout the line, the valves shall be closed and the line left undisturbed for 24 hours.

Dry Calcium Hypochlorite: Calcium hypochlorite conforming to AWWA B300 is available in granular tablet form and must contain approximately 65% available chlorine by weight. This

procedure is allowed only when the extension has been kept clean and dry. If piping has been submerged, or is unclean, refer to AWWA Standard C651.

Granulated chlorine: Dry calcium hypochlorite at 65% - 70% chlorine shall be placed in the pipe to yield a dosage no less than 50 mg/l. The number of ounces of 65% test calcium hypochlorite required for a 20 foot length of pipe equals $0.00843ld$, in which "D" is the diameter in inches (see current WSDOT Standards and Specifications). The main shall be filled with water at a rate to ensure that the water within the main will flow at a velocity no greater than 1 foot per second. Precautions shall be taken to ensure that air pockets are eliminated. When a chlorine concentration of not less than 50 ppm has been established throughout the line, the valves shall be closed and the line left undisturbed for 24 hours. If the water temperature is less than 41 degrees F, the water shall remain in the pipe for at least 48 hours.

After chlorination in accordance with the above, the line shall be thoroughly flushed and water samples taken. Flushing shall be done in a manner that avoids damage to surrounding property and that conforms to these Standards.

5-3.34 FINAL FLUSHING AND TESTING

Following chlorination, chlorinated water shall be flushed from the new water main until the replacement water throughout its length shows an absence of chlorine. In the event chlorine is normally used in the source of supply, the tests shall show a residual not in excess of that normally carried in the water supply system (never to exceed 2 mg/l).

After final flushing and before the new water main is connected to the distribution system, a sample collection test shall be scheduled with the City Engineer a minimum of two (2) business days in advance of test. The number of samples from the source and the number of representative sample points required will be determined by the Water Quality Control Specialist. Appropriate sample taps shall be furnished by the party responsible for the project. No hose or fire hydrant shall be used in the collection of samples.

At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for total coliform bacteria and for heterotrophic bacteria by the heterotrophic plate count (HPC) analysis. The maximum allowable coliform content of the flushed sample shall be zero. The maximum allowable HPC population count in all source samples shall be 80/ml. Any source sample that exceeds a count of 80/ml shall be ruled as an indeterminate test and a new set of source and construction samples for analysis shall be required. The maximum allowable HPC population count from any construction sample shall be no greater than twenty (20) counts above the highest source HPC population count.

Before placing the lines into service, a satisfactory report shall be provided to the Water Quality Control Specialist from the certified laboratory evidencing successful tests on samples collected from representative points in the system extension.

Should the initial test result in an unsatisfactory bacteriological test, additional chlorination using the above procedure shall be repeated until satisfactory results are obtained. Treated water flushed from the mains shall be disposed of in accordance with applicable State and local laws and regulations.

Chlorinated water shall never be flushed into the storm drain or a body of water. This includes lakes, rivers, streams, stormwater drainage systems, and any waters where fish or other natural aquatic life can be expected to be present.

5-3.35 ADJUST EXISTING STRUCTURE TO GRADE

Existing Structure Adjustment

Existing structures, including valve box covers affected by a pavement overlay, or adjustment in surface grade, shall normally be adjusted to grade within three (3) business days after the pavement overlay. The City Engineer may require immediate adjustment if the structure is critical to operations.

Valve Box Adjustment in Paved Areas

Raising the existing valve box shall be accomplished by adjusting the existing top section of the valve box or replacing the valve box. If the valve box base section needs to be extended, a 4 inch diameter cast iron soil pipe shall be installed with the bell end of the soil pipe inserted over the top of the existing valve box base section. The spigot end of the soil pipe shall be located a minimum of 6 inches and a maximum of 9 inches below finished grade. The valve box top section shall be slipped over the soil pipe and adjusted to the final grade. A polyethylene sheet, 8-mil thick, shall be placed between the valve box and soil pipe to prevent metal to metal contact where the sections overlap. In asphalt concrete pavement and overlay areas, excavation of the valve box to be raised shall be accomplished by saw cutting or neat line jack hammering the pavement a minimum of 12 inches around the perimeter of the valve box. The final adjustment of valve boxes shall be done within 24 hours after paving. Paving, repaving, and patching shall be completed within 72 hours.

Valve Box Adjustment in Unimproved Areas

Adjustment of valve box covers located in unpaved areas shall be the same as in paved areas.

5-3.36 ABANDONING FACILITIES

Abandonment of Water Main

Water mains no longer in service shall be removed and disposed of by the party responsible for the project. The water main may be abandoned in place with the approval of the City Engineer. When water mains are abandoned, the ends of the pipe and fittings shall be plugged by filling with Class 2500 concrete a minimum length of 12 inches on each pipe end. The City Engineer may require that the abandoned water mains be filled with sand or cement grout depending on the size, material, and location of the water main.

Removal of Service Lines

Service lines that are no longer in service and associated corporate stops shall be removed and disposed of by the party responsible for the project. Saddles shall be plugged with MIPT brass plugs.

Abandonment of Structures

Abandonment of structures shall be completed only after water facilities have been properly removed and/or abandoned. All valves and valve boxes shall be removed on abandoned valves.

5-3.37 LANDSCAPING AND LAWN REMOVAL AND REPLACEMENT

During the construction and installation of a water distribution system, the party responsible for the project shall minimize the disturbance and damage to any landscaping and lawn within the project area and shall restore the landscaping and lawn area to conditions prior to construction and installation.

5-3.38 BORING UNDER ROOTS

Boring under the root systems of trees that cannot be removed shall be accomplished by excavating a trench or pit on each side of the tree, being careful to avoid root injury, and then hand digging or pushing the pipe through the soil under the tree. The pit walls shall be a minimum of 7 feet from the center of the tree and shall have sufficient depth to lay the pipe at the grade shown on the plan and profile. Trees shall be removed unless otherwise directed by the City Engineer.

5-3.39 BORING AND JACKING

The vertical and horizontal location of existing utilities shall be verified by the party responsible for the project. If required to avoid conflicts and maintain minimum clearances, adjustment shall be made to the grade of the casing.

The pipe shall be bored and jacked where shown on the plans. All obstructions encountered shall be removed or penetrated. If groundwater is found to be a problem during boring operations, all necessary measures shall be taken to control the flow sufficiently to protect the excavation, pipe and equipment so that the work is not impaired. Any pipe damaged during the boring and jacking operation shall be repaired in a manner approved by the City Engineer.

The installation of the bored and jacked pipe shall be done in manner to ensure that no settlement or caving is caused to the above surface. Any such caving caused by the placement of the pipe shall be repaired by the party responsible for the project as directed by the City Engineer.

During the jacking operations, particular care shall be exercised to prevent caving ahead of the pipe which will cause voids outside of the pipe. If voids exist, the party responsible for the project shall drill through the wall of the pipe and fill the voids by pumping cement grout. All voids shall be filled to the satisfaction of the Public Works Inspector.

The carrier pipe shall be installed in the casing as shown in the City Standard Plans. The carrier pipe shall be supported with casing spacers as shown in the Standard Plans. The casing spacers shall conform to these Standards. The material shall be resistant to abrasion and sliding wear. There shall be a minimum of two spacers per length of pipe, and the spacing between spacers shall be as shown in Standard Plan 522. Spacers shall be installed per manufacturer's instructions.

Boring and receiving pits shall be backfilled with select native material approved by the City Engineer and compacted to 95% maximum dry density as determined by ASTM D-1557. A sufficient amount of select backfill material shall be provided to make up for the rejected material.

All disturbed ground shall be restored to its original condition or better.

5-3.40 WORKING WITH ASBESTOS CEMENT PIPE

When working with asbestos cement pipe, the work shall be done in manner that minimizes workers' exposure to asbestos material at or below the exposure limit as prescribed in WAC 296-62-07705 State and Federal Guidelines and Certification and PSAPCA requirements.

5-3.41 ASBESTOS CEMENT WATER MAIN CROSSINGS

Where a new utility line crosses below an existing asbestos cement (A.C.) water main, the A.C. water main shall be replaced with ductile iron pipe to a minimum of 8 feet on either side of the pipe crossing. Where directed by the City Engineer, the trench shall be backfilled with CDF from the bottom of the trench to the bottom of the A.C. main. All DIP crossings shall be constructed using ROMAC extended range transition couplings.

5-3.42 CONTROLLED DENSITY FILL

Controlled Density Fill (CDF) shall be used only by approval of the City Engineer. CDF can be proportioned to be flowable, non-segregating, or excavatable by hand or machine. Desired flowability shall be achieved with the following guidelines:

Low Flowability	below 6 inch slump
Normal Flowability	6 – 8 inch slump
High Flowability	8 inch slump or greater

CDF shall be placed by any reasonable means into the area to be filled. CDF patching, mixing and placing may be started if weather conditions are favorable, when the temperature is at 34 degrees F and rising. At the time of placement, CDF must have a temperature of at least 40 degrees F. Mixing and placing shall stop when the temperature is 38 degrees F or less and falling. Each filling stage shall be as continuous as possible. CDF shall not be placed on frozen ground.

Trench section to be filled with CDF shall be contained at either end of the trench section by bulkhead or earth fill.

When used to support existing A.C. pipe, the flowable CDF shall be brought up uniformly to the bottom of the A.C. pipe, as shown on the plans, or as directed by the City Engineer. Steel plates shall be provided and installed to span the utility trenches and prevent traffic contact with CDF for at least 24 hours after placement or until CDF is compacted or hardened to prevent rutting by construction equipment or traffic.

If CDF is used for trench backfill on ductile iron pipe it shall be encased in 5/8 inch minus crushed rock and services shall be encased in sand.

5-3.43 VAULT INSTALLATION

Vaults for water facilities (pressure reducing stations, valves, water service, flow meters, backflow prevention assemblies, etc.) shall be installed at the locations shown on the plan and as staked. Vaults shall be constructed as shown on the plans, Standard Plans and as directed by the City Engineer.

The excavation shall have a minimum of one (1) foot clearance between the vault outer surface and the earth bank. Foundation gravel or bedding concrete shall be used on top of undisturbed soil to support the vault. The vault shall be plumb and watertight. The access cover shall be seated properly to prevent rocking and shall be adjusted to match the finished grade.

The vault floor shall drain to daylight, or to a location specified on the plans. Gravity drain pipe shall be a minimum of 3 inches in diameter.

Where knockout locations for the pipe do not coincide with the locations of pipe penetrations into the vault, the party responsible for the project shall core drill openings for pipe.

A sump pump shall be required if directed by the City Engineer.

5-3.44 UTILITY CROSSING

If the minimum vertical distance between utility pipes is less than 6 inches and such installations are approved by the permitting agency, a rigid foam pad shall be placed between the pipes. The pad shall be outside diameter O.D. × O.D. × 2.5 inches thick minimum or as required to protect the pipes and O.D. is equal to the outside diameter of the larger pipe. The pad shall be a polyethylene foam plank (Dow Plastics Ethafoam 220), or approved equal. Additional measures may be necessary to ensure system integrity and may be required as evaluated by the permitting agency on a case by case basis.

END OF SECTION

ENGINEERING STANDARDS

SECTION 6

SANITARY SEWER

6-1 DESIGN

6-1.01 GENERAL

These sewer engineering standards (Standards) set forth minimum standards for the planning, design, and construction of sanitary sewer facilities in the City of Snohomish.

Although these Standards are intended to apply to physical development within the City, the standards may not apply for all situations. Compliance with these Standards does not relieve the party responsible for the project of the responsibility to apply conservative and sound professional judgment. These standards are minimum standards and are intended to assist, but not substitute for competent work by design professionals. The City Engineer may require more stringent requirements than would normally be required under these Standards due to special conditions and/or environmental constraints.

6-1.02 SEWER MAIN EXTENSION

Sewer main extensions shall be required when a parcel does not front an existing sewer main. It is the policy of the City of Snohomish that when practical all sewer main extensions shall be extended to a point 10 feet beyond the farthest property corner, or as directed by the City Engineer. The sewer shall be sized for the ultimate development of the tributary area and in accordance with the City's Sewer Comprehensive Plan. The City Engineer may reserves the right to require the installation of a larger size main if it is determined a larger size main is needed to meet future system demand requirements.

Sewer main replacement and upgrade shall be required when the existing sewer main is not adequate for the proposed use. Such criteria used to determine adequacy include but are not limited to age, pipe diameter, material type and overall condition of the existing sewer main. If the proposed development requires a lift station and/or force main upgrade, construction shall be at the expense of the party responsible for the development. Improvements shall be extended from the project to a point where the system is deemed reliable by the City Engineer.

Condominiums, townhomes, duplexes, triplexes and fourplexes with four living units or less shall have separate sewer service lines from each unit to the sewer main. All dwellings that exceed four units shall be reviewed on a case by case basis as to the number of sewer service lines that will be required.

Connections to existing trunk mains that are 12 inches or larger are prohibited unless approved in writing by the City Engineer. Connections to the Cemetery Creek sewer trunk main are prohibited without written approval from the Public Works Director.

If a project directly benefits other property owners, a reimbursement agreement with the City in accordance with SMC Chapter 15.17 may be appropriate.

6-1.03 MANHOLE

Manhole Location

Sewer manholes shall be located such that the center of the frame and cover shall be in the center of the traveled lane or as otherwise directed by the City Engineer.

If sewer main construction requires construction within an easement, the minimum easement width shall be 20 feet. Sewer mains shall be placed in the center of the easement and parallel to the easement lines unless otherwise directed by the City Engineer.

Manholes placed outside of the right-of-way shall maintain permanent unobstructed maintenance vehicle access at all times.

Manholes shall be installed at the end of each sewer main; at all changes in grade, size or alignment; and at all sewer main intersections. The distance between manholes on a sewer main run shall not be greater than 300 feet.

Manhole Diameter

The manhole diameter shall depend on size, location and the number of connections for pipes. The minimum diameter for manholes shall be 48-inches for a maximum pipe size of 12-inches; 54-inches for a maximum pipe size of 24-inches; 72-inches for a maximum pipe size of 36-inches and 96-inches for a maximum pipe size of 48-inches.

The minimum distance between cutout holes is 8-inches for a 48-inch or 54-inch manhole and 12-inches for a 72-inch or 96-inch manhole measured on the inside of the manhole. The cutout hole size shall be equal to the outer pipe diameter plus manhole wall thickness. A minimum access diameter of 24-inches shall be provided. Please reference Standard Plans 604, 606, 607, and 608.

Manhole Depth

The minimum sewer manhole depth shall be 7-feet. When manhole depths exceed 25-feet, the manhole base slabs shall be designed by a professional structural engineer licensed in the State of Washington.

Manhole Inverts

The drop in the invert elevation across a manhole shall typically range from 0.1 to 0.2 feet. The maximum allowable drop in the invert elevation of a manhole shall be 1.0 feet.

When a side sewer connects directly to a manhole, the invert of the side sewer shall be equal to or above the sewer main crown but shall not exceed 18-inches above the invert of the sewer main.

Manhole Covers

Manholes in unpaved areas and easements shall have hinged bolt-locking covers per Standard Plan 613. All manholes in paved areas and sidewalks shall also have standard bolt locking covers.

Cleanouts

Cleanouts in the public sewer system are not an acceptable substitute for manholes. Cleanouts shall be installed on 6-inch private side sewers. Cleanout locations and spacing for private side sewers are governed under Section 6-1.13 of this Section.

6-1.04 SEWER PIPE

Sewer Pipe Sizing

No public gravity sewer main conveying raw wastewater shall be less than 8-inches in diameter. The pipe diameter and slope shall be selected to obtain the greatest practical velocities to minimize settling problems. Oversize sewers will not be approved to justify flatter slopes.

New sewer mains shall be designed so that under complete collection system build out, peak flow including inflow/infiltration (I/I) shall not exceed 50% capacity of the main. Existing sewer mains shall not exceed a peak flow of 75% capacity to preserve capacity requirements of the existing sewer main. Existing sewer mains that will exceed 75% capacity when new flows are introduced shall be replaced and upsized by the party responsible for the development to preserve capacity requirements of the sewer main.

Storm drainage connections to the City sewer system are prohibited outside of the Combined Sewer Overflow area. This area is designated on the City's wastewater system map and may be viewed on the City's website.

Pipe Material

Sewer pipe shall be SDR 35 PVC conforming to ASTM D3034 where invert depths are from 5-feet to 14-feet. When invert depths are shallower than 5-feet or deeper than 14-feet, AWWA C900 PVC pipe shall be used. If the depth exceeds 14-feet on any portion of the pipe segment, the entire segment between manholes shall be C900 including associated side sewers.

Sewer Depth

In general, gravity sewer mains shall be sufficiently deep to receive wastewater from the basements of buildings located in the area to be served by the sewer mains. Gravity sewer mains shall also be constructed sufficiently deep in consideration of future collection system development in the area to serve new construction. The minimum depth of gravity sewer is 5 feet.

Slope

Sewers shall be installed with uniform slope between manholes. All sewers shall be designed and constructed to give mean velocities of not less than 2.0 feet per second when flowing full, based on Manning’s formula. The following are the minimum slopes, however slopes greater than these are desirable.

**Table 6-1
Minimum Pipe Slope by Pipe Diameter**

Sewer Pipe Diameter (inches)	Minimum Slope (% or feet per 100 feet)
4	2.00
6	1.00
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
36	0.05

Maximum sewer main slope shall not induce velocities greater than 10 feet per second under daily peak flows.

Pipe anchor blocks shall be installed where the sewer main slope exceeds 20%. Each pipe length shall have one anchor block spaced at 20-foot on center.

Hill holders shall be required on sewer mains when unpaved slopes exceed 20% grade. Minimum hill holder spacing shall be 20-feet on center.

Alignment

Sewer mains shall be installed with straight alignment between manholes. Curvilinear sewer mains are not permitted in the City of Snohomish.

Change in Pipe Size

Where a smaller sewer pipe joins a larger one, the invert of the larger sewer pipe at the manhole shall be lowered sufficiently to maintain the same energy gradient. An approximate method for securing these results is to place the crowns of both pipes at the same elevation.

6-1.05 STREAM CROSSINGS

Placement and construction of sewer main stream crossings shall be done in accordance with all applicable State and local laws and regulations, including but not limited to obtaining necessary permits from the Washington State Department of Fish and Wildlife and Department of Ecology (DOE).

Sewer systems shall be designed to eliminate or minimize the number of stream crossings. When a sewer main must cross a stream, the crossing shall be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade.

Sewer systems located along streams shall be located outside of the stream bed and sufficiently away from the stream to provide for future possible stream widening and to prevent pollution by siltation during construction. Sewer structures shall not interfere with the free discharge of flood flows of the stream.

The top of all sewers entering or crossing streams shall be at sufficient depth below the natural bottom of the stream bed to protect the sewer line. In general, the following cover requirements shall be met:

1. A minimum of 1-foot of cover above the top of the casing pipe if the sewer pipe is located in rock.
2. A minimum of 5-feet of cover above the top of the casing pipe in all other material.

6-1.06 HORIZONTAL SEPARATION FROM OTHER UTILITIES

Sewer mains shall be installed at least 10-feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, the City Engineer may allow deviation on a case-by-case basis using DOE criteria. Side sewer and water service lines shall have minimum horizontal clearances of 10-feet unless otherwise approved by the City Engineer. The following table lists minimum required horizontal clearances from sewers:

Table 6-2

Horizontal Clearances from Sewer

Utility	Clearance from Sewer (in feet)
Cable	5
Gas	5
Power	5
Storm Drain	5
Telephone, Fiber Optic	5
Water	10

6-1.07 VERTICAL SEPARATION FROM OTHER UTILITIES

Sewers crossing water mains shall be installed to provide a minimum vertical distance of 18-inches between the outside of the sewer and the outside of the water main. The City prefers that the sewer main be installed below the water main. Where a sewer crosses a water main, one full length of water main (18-feet minimum) shall be used with the pipe centered over the sewer for maximum joint separation. When the above conditions cannot be met, the City Engineer may approve a variance, but shall require that the sewer be constructed of ductile iron or C-900 pipe, be encased and be pressure tested prior to activation. Washington State Department of Ecology requirements shall also apply.

Sewers crossing water mains shall be installed to provide a minimum vertical distance of 18-inches between the outside of the sewer and the outside of the water main. The City prefers that the sewer main be installed below the water main. Where a sewer crosses a water main, one full length of sewer main (18-feet minimum) shall be used with the pipe centered over the water main for maximum joint separation. When the above conditions cannot be met, the City Engineer may approve a deviation in accordance with applicable DOE requirements and shall also require that the sewer main constructed of ductile iron or C-900 pipe, be encased and be pressure tested prior to activation.

Table 6-3

Vertical Clearances from Sewer

Utility	Clearance from Sewer (in feet)
Cable	1
Gas	1
Power	1
Storm Drain	1
Telephone, Fiber Optic	1
Water	1.5

6-1.08 STEEL CASING

Sewer pipe shall be encased in a steel or ductile iron casing when crossing under improvements where the ability to remove and replace pipe without disturbance to the improvement is needed. Casings are required when:

1. Crossing under rockeries over 5-feet high;
2. Crossing under retaining wall footings over 5-feet wide;
3. Crossing under reinforced earth retaining walls;
4. Crossing under streams or wetlands; and
5. Crossing under railways and highways.

Casings shall extend a minimum of 5 feet past each edge of the structure, or a distance equal to the depth of pipe, whichever is greater. The carrier pipe shall be supported by casing spacers per Standard Plan 618. The minimum vertical clearance between the bottom of the wall (or footing) and top of the pipe (or casing) shall be 2 feet. The pipe trench at the casing shall be backfilled with gravel backfill material when the vertical clearance is less than 3 feet.

Ductile iron pipe shall be encased in a steel casing when crossing under a railroad or highway where open cut is not allowed. Casings shall extend a minimum of six feet (6') beyond the edges of the right-of-way. The casing pipe and carrier pipe shall be installed in accordance with the applicable Federal, State and local regulations. In the case of railroad crossings, the project shall also comply with regulations established by the railroad company. Casing spacers shall be placed under the carrier pipe to ensure approximate centering within the casing pipe and to prevent damage during installation. Voids between all steel casings and native soil shall be pressure grouted. See Standard Plan 618.

6-1.09 SEWER CONNECTIONS

A side sewer shall be connected to the sewer main with a 6 inch factory tee connection or at a manhole. Where an existing side sewer stub is not available, a ROMAC tapping saddle is required for an existing sewer main. See Standard Plan 603.

All new sewer mains shall connect to existing sewer mains at manholes. If an existing manhole is not available, a new saddle manhole on existing sewer main is required per Standard Plan 605. Existing manhole diameter must be adequate to accommodate the new sewer mains. If the existing manhole is not adequate, the existing manhole shall be upgraded at the expense of the party responsible for the project. If the existing manhole access is less than 24 inches in diameter, and/or concentric cone (manhole over 7 feet deep), the manhole shall be upgraded to include new 24 inch ring and cover and/or eccentric cone. At the connection to the existing sewer system, new sewer connections shall be physically plugged until all tests have been completed and the City Engineer approves the removal of the plugs.

6-1.10 FAT, OIL, AND GREASE SEPARATION

Oil/Water Separator

An oil/water separator is required whenever an industrial or commercial business generates or has the potential to generate fats, oils, or greases exceeding 100 milligrams per liter which will be discharged to the sewer system. An oil/water separation device shall be installed on the private property where the potential industrial or commercial source of the fat, oils, or greases is located by the property owner. Water discharged from any oil/water separator to the sewer system shall not contain more than 100 milligrams per liter of fats, oils or greases.

The oil/water separator shall be covered with removable sections. Access and inspection covers, weighing not more than 30 lbs., with suitable hand holds, shall be installed directly above the inspection "tee" and oil/grit collection compartments.

Only wastewater from floor drains and covered parking areas shall drain to the separator. The location and design shall eliminate the possibility of stormwater reaching the separator.

The separator shall be located within 20 feet from the driveway for access by maintenance vehicles.

A sampling tee shall be located on the outlet with a minimum 18 inch drop below the invert. Access to the separator shall be available for inspection and compliance determination sampling at all times.

When pre-treatment is no longer required, the inlet and outlet pipes shall be permanently plugged, the separation chambers pumped out, and the vault removed, or filled with compacted crushed rock or controlled density fill.

Grease Trap and Interceptor

The size and design of grease traps and interceptors and hydro-mechanical grease interceptors (HGI's) shall conform to the Uniform Plumbing Code and shall be approved by the City Building Official. Traps and interceptors shall be located on private property outside the building within 20 feet of driveway for access by maintenance vehicles. An HGI may be located inside the building, and shall remain privately owned and maintained at the owner's or occupant's expense. A maintenance program must be submitted and approved that includes maintenance, testing requirements and reporting intervals. These facilities shall be available for the inspection by the Building Official at all times.

When pre-treatment is no longer required, the inlet and outlet pipes shall be permanently plugged, the separation chambers pumped out, and the vault removed, or filled with compacted crushed rock or controlled density fill.

6-1.11 EASEMENTS

All public sewer mains, manholes, air valves, lift stations, and other appurtenances not in public right-of-way shall be within public utility easements designated on submitted plans to provide the City with permanent access to these facilities, as well as easements for future sewer extension, as required. Unless otherwise approved by the City Engineer, the minimum width of the easement for sewer mains and appurtenances shall be 20 feet.

Easement areas shall be kept free from obstructions at all times. No structures, driveways or landscaping shall be constructed within the utility easement. Maintenance vehicle access shall be constructed with a suitable driving surface approved by the City Engineer.

Utility easements shall be fully executed and recorded with the Snohomish County Auditor prior to project acceptance by the City. The form of easement documents shall be subject to the approval of the City Attorney. Easement drawings and legal descriptions shall be included as exhibits. If off-site easements are required on properties not owned by the party responsible for the project, the party shall acquire the necessary easements at their own expense before construction plans will be approved by the City Engineer.

6-1.12 SIDE SEWERS

A side sewer stub shall extend from the main line to 10 feet past the edge of the property line. A side sewer stub shall also extend an additional 5 feet beyond any easements including the standard 10 feet utility easement required on lots fronting public right-of-way. Pipe of 6-inches in diameter shall be used within the public right-of-way or easement unless expected flow requires a larger size of line. See Standard Plan 601.

All residential side sewer lines on private property from the end of the 6 inch diameter stub to the building may be a minimum of 4 inches in diameter with a single connection per lot. Condominiums, town homes, duplexes, triplexes and fourplexes with four living units or less shall have separate sewer service lines from each unit to the main.

For a multi-family development four-plex and larger, a side sewer for each separate building is required and must be at least 6-inches in diameter. For side sewers serving more than ten units or serving more than one building, side sewers shall be a minimum of 8-inches in diameter and must be connected to a manhole.

Maximum distances between side sewer clean-outs shall be 100 feet. All side sewer cleanouts on commercial and multi-family developments shall include at grade access with covers per the City Standard Plan 602.

A 6-inch minimum pipe shall be used for all commercial side sewers unless otherwise directed by the City Engineer.

6-1.13 SEPTIC TANKS

Septic systems are generally not allowed. The City Engineer may approve a septic tank system if he/she determines that public sewer service is not available or it is not “practical” to provide public sewer service and the party has obtained the necessary permits from the Snohomish Health District.

6-1.14 PRIVATE GRINDER PUMP

Use of a grinder pump requires approval by the City Engineer and will be evaluated on a case-by-case basis. The party responsible for the project shall demonstrate to the satisfaction of the City Engineer that there is no other feasible means of sewer service available prior to grinder pump approval. The City Engineer may require the applicant to deepen the existing gravity sewer at their expense to eliminate the need for a grinder pump.

The design engineer shall specify pumps with proper flow rate and dynamic head and provide pump curves from the manufacturer to the City Engineer for review and approval. The minimum diameter of the force main shall be 2 inches (Schedule 80 PVC or approved equal). Interior grinder pump systems shall meet the requirements of the current Uniform Plumbing Code. Exterior grinder pumps systems are subject to the approval of the City Engineer.

6-1.15 LIFT (PUMP) STATION

All sewers shall be gravity when possible. Use of lift stations requires approval by the City Engineer and will be evaluated on a case-by-case basis. The City may require the applicant to deepen the existing gravity sewer at their expense to eliminate the need for pumping. The applicant shall demonstrate that there is no other feasible means of sewer service available.

Gravity flow sewer lines shall be used when possible. Use of lift stations requires approval by the City Engineer and will be evaluated on a case-by-case basis. The City Engineer may require the party responsible for the project to deepen the existing gravity sewer at their expense to eliminate the need for pumping. The party responsible shall demonstrate to the satisfaction of the City Engineer that there is no other feasible means of sewer service available prior to lift station approval.

Lift station design parameters are in Appendix 6A of these Engineering Standards.

6-1.16 MONITORING MANHOLE

Monitoring manholes are required for all industrial/commercial applications and other applications as determined by the City Engineer. The monitoring manhole shall be in an accessible location for inspection by City staff at any time and under all weather conditions. The depths of monitoring manholes shall be 4 feet minimum and 8 feet maximum. If the depth is less than 7 feet, a flat top manhole shall be used. Monitoring manholes shall be 48 inch Type I (or larger) with locking rings and covers. The rim elevations of the monitoring manholes shall be set to finished grade or as directed by the City Engineer.

6-2 MATERIAL

All materials shall be new and undamaged. The same manufacturer of each item shall be used throughout the work. All materials not specifically referenced shall comply with applicable sections of ANSI, ASTM, AWWA, the current WSDOT/APWA Standard Specifications and these Standards, and approved by the City Engineer.

When specific manufacturers or models are specified in these Standards, no substitutions will be allowed without prior approval by the City Engineer. If required by the City Engineer, the party responsible for the project shall furnish certification from the manufacturer of the materials being supplied that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the reference standards.

The party responsible for the project shall provide construction material submittals for approval to the City Engineer.

6-2.01 MANHOLES

Manholes shall be constructed of pre-cast sections with confined O-ring rubber gasket joints, and with either a pre-cast base or a cast-in-place base in accordance with the City Standard Plans 604, 605, 606, 607 and 608. Any request to deviate from these details is subject to the review and approval of the City Engineer.

Manholes shall be constructed in accordance with AASHTO M-199 (ASTM C 478) unless otherwise shown on plans and approved by the City Engineer. All pre-cast concrete and reinforced cast-in-place concrete shall be Class 4000. Non-reinforced concrete in channel and shelf shall be Class 3000. Concrete blocks may only be used for final adjustment of the casting to final street grade. Pre-

cast bases shall be furnished with cutouts or knockouts. Knockouts shall have a minimum wall thickness of 2 inches.

Grouting

All structures shall be grouted with non-shrink grout inside, outside, in-between sections and risers and under castings. Jet-Set shall not be used. All structures that are not watertight shall be re-grouted by and at the expense of the party responsible for the work until such structures are watertight.

All base reinforcing steel shall have a minimum yield strength of 60,000 psi and be placed in the upper half of the base with one inch minimum clearance.

6-2.02 MANHOLE RING AND COVER

Ductile iron rings and cast iron rings and covers shall conform to the Standard Plan 612 and Section 9-05.15 of the current WSDOT/APWA Standard Specifications.

Manhole rings shall be gray iron conforming to the requirements of AASHTO M 105 Grade 30B. Manhole covers shall be ductile iron conforming to ASTM A536, GR 80-55-06, East Jordan Iron Works or an equivalent approved by the City Engineer. Rings and covers shall be tested for accuracy of fit and shall be locked down with a 5 5/8 inch stainless steel socket head cap screws. All castings shall have a bituminous coating.

6-2.03 GRAVITY SEWER PIPE & FITTINGS

Sanitary sewer pipe shall be PVC or ductile iron meeting the following requirements unless otherwise directed by the City Engineer:

- 1) Polyvinyl Chloride (PVC) sanitary sewer pipe and fittings shall conform to the requirements of ASTM D-3034 SDR-35 with joints and rubber gaskets conforming to ASTM D 3212. All pipes shall be clearly marked with the data of manufacture. All pipes shall be provided with a reference mark for proper spigot insertion. Joint gaskets shall be fabricated from a compound of which the basic polymer shall be a synthetic rubber consisting of styrene, butadiene, polyisoprene or any combination thereof and shall meet the requirements of ASTM D-3212.
- 2) Ductile iron sewer pipe shall conform to ANSI A-21.51 or AWWA C-151 and shall be epoxy coated, push-on joint (Tyton joints only) or mechanical joint. Cement-lined ductile iron pipe shall not be used for sanitary sewer. The ductile iron pipe shall be Class 52, unless otherwise approved by the City Engineer.
- 3) AWWA C900 PVC pipe shall be pressure class 150 (SDR 18) unless otherwise approved by the City Engineer. Pipe joints shall be manufactured using an integral bell with an elastomeric gasket push-on type joint. Elastomeric gaskets shall conform to ASTM F477. All fittings shall be PVC, compatible with C900 with respect to joint dimensions and physical properties.

6-2.04 SIDE SEWER

Side sewer service lines shall be PVC, ASTM D-3034 SDR-35, with flexible gasket joints. Depths greater than 14 feet shall be AWWA C900 or CL 52 epoxy coated DIP.

6-2.05 SIDE SEWER AND FORCE MAIN TRACER TAPE AND LOCATE WIRE

Utility pipe tracer tape shall be detectable below ground surface and color coded. Tracer tape shall be detectable type, up to 6 inches in width, and buried 24 inches to 48 inches below finished grades. The color of the tape for sanitary sewer shall be green with black printing reading "CAUTION SANITARY SEWER BURIED BELOW". Tracer tape shall be "Lineguard Type II Detectable", or an equivalent approved by the City Engineer. Utility locate wire (10 Ga.) shall be installed on all sewer force mains. All end of spool connections shall be welded and watertight.

6-2.06 PLUGS

Plugs shall be able to withstand all test pressures without leakage. All plugs shall be approved by the Public Works Inspector.

6-2.07 BACKWATER CHECK VALVE

Backwater check valves installed on 4 inch through 8 inch diameter side sewer lines shall be rubber flapper swing type check valves. Flapper shall be constructed from steel reinforced rubber with 45 durometer standard rubber hardness. Valve seat shall be at a 45 degree angle to direction of flow. Flow area through valve shall equal full pipe area. Valve body shall be coated cast iron, East Jordan Ironworks or an equivalent approved by the City Engineer, with flanged ends and bolted over to allow removal of flapper without removing valve from line.

The backwater valve shall be housed in a 48 inch diameter pre-cast concrete valve chamber with concentric 48 inch by 24 inch concentric reducing cone, or concrete meter box, depending on depth. The 24 inch frame and cover shall be marked "SEWER".

6-2.08 STEEL CASING

Steel casing shall be black steel pipe conforming to ASTM A53. Casing thickness shall be 0.250 inch for casing 24 inches or less in diameter and 0.375 inch for casings over 24 inches in diameter.

6-2.09 CASING SPACER

Casing spacers and end seals shall be sized for pipe installation and shall be manufactured by Advance Products & Systems, Cascade Waterworks, Pipeline Seal and Insulators Co., or an equivalent approved by the City Engineer. See Standard Plan 618.

6-2.10 CONTROLLED DENSITY FILL

Controlled Density Fill (CDF) shall conform to the requirements of Section 2-09.3(1) E of the current WSDOT/APWA Standard Specifications.

6-2.11 CONCRETE

Concrete used for pads, thrust blocking, encasement, or slope anchor shall be mixed from materials acceptable to the City Engineer and shall have a 30 day compressive strength of not less than 3,000 psi. The mix shall contain five (5) sacks of cement per cubic yard and shall be of such consistency that the slump is between 1 inch and 5 inches.

6-2.12 BEDDING MATERIAL

Bedding material shall be $\frac{3}{8}$ inch minus manufactured washed pea gravel. Pipe bedding shall be $\frac{3}{8}$ inch minus pea gravel meeting the requirements of Section 9-03.12 of the WSDOT/APWA Standard. Bedding will be to the pipe zone shown on Standard Plan 616.

6-3 CONSTRUCTION

6-3.01 GENERAL REQUIREMENTS

All work shall be constructed as shown in the plans and in accordance with the current WSDOT/APWA Standards and Specifications, and these Standards. Materials shall be installed in compliance with the manufacturer's instructions and specifications, except where a higher quality of workmanship is required by the plans and these Standards. All work shall be in accordance with any applicable Federal, State, and local laws and regulations. The party responsible for the project shall arrange for necessary inspections by these agencies and shall submit evidence of their approval if requested by the City Engineer.

Construction shall not start prior to approval of the construction plans by the City Engineer.

6-3.02 MATERIAL SUBMITTALS

Five (5) sets of material submittals shall be submitted to the City Engineer for approval after the plans are approved for construction. The City Engineer shall either approve or disapprove and state the reasons for disapproval. A new corrected set of material submittals shall be submitted to the City Engineer for approval. Construction shall not proceed until the City Engineer has approved the materials.

The City Engineer's review of material submittals covers only general conformity to the plans and these Standards. The party responsible for constructing the project is responsible for quantity determinations. No quantities shall be verified by the City. Review and approval of material submittals by the City Engineer does not relieve the party responsible for construction of the project from the obligation to furnish required items in accordance with the plans and these Standards.

6-3.03 PRE-CONSTRUCTION CONFERENCE

The Contractor shall contact the Public Works Inspector (360-282-3193) to schedule a pre-construction conference after plans are approved and prior to staking and commencing construction. The pre-construction conference shall include the party responsible for the project, the project engineer, and representatives from the permit agencies, other utility companies, and City

staff. An on-site tailgate meeting between the party responsible for the project and the Public Works Inspector shall be arranged by the party at least 48 hours prior to commencing construction.

6-3.04 CONSTRUCTION SCHEDULE

The party responsible for the project shall provide the City Engineer with the sewer construction schedule a minimum of five (5) business days prior to start of sewer system construction to arrange staking inspection and to give permitting agencies and customers two (2) business days notice. No construction is allowed until the construction plans have been approved.

6-3.05 EASEMENT

Prior to the start of the sewer system construction, the party responsible for the project shall acquire an record all necessary easements for the construction, installation and maintenance of any sewer mains or facilities proposed in the project that will not be located in existing City right-of-way or City easements.

6-3.06 PERMITS

The party responsible for a sewer system extension project shall obtain all necessary permits from the City and other appropriate State and Local agencies and entities at their expense.

6-3.07 TRAFFIC CONTROL PLAN

The party responsible for the project shall submit a traffic control plan prepared by the party responsible for the project or the project engineer to the City Engineer for approval. No work shall commence until a traffic control plan has been approved by the City Engineer.

6-3.08 HANDLING OF PIPE

All types of pipe shall be handled in a manner that prevents damage to the pipe, pipe lining or coating. Pipe and fittings shall be loaded and unloaded using forks or cable choker in a manner that avoids shock or damage. Under no circumstances shall the pipe be dropped, skidded, or rolled against other pipe. Damaged pipe will be rejected, and the party responsible for the work shall immediately place all damaged pipe apart from the undamaged. All damaged pipe shall be removed from the project site within 24 hours.

Pipe shall be stacked in such a manner as to prevent damage to the pipe, to prevent dirt and debris from entering the pipe, and to prevent any movement of the pipe. The bottom tiers of the stack shall be kept off the ground on timbers, rails or other similar supports. Pipe on succeeding tiers shall be alternated by bell and plain end. Timbers of 4 inch × 4 inch shall be placed between tiers and chocks shall be placed at each end to prevent movement. Each size of pipe shall be stacked separately.

Threaded pipe ends shall be protected by couplings or other means until the pipe is installed. Dirt or other foreign material shall be prevented from entering the pipe or pipe joints during handling and installation. When pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the City Engineer.

6-3.09 STAKING

Staking shall be performed by or under the direct supervision of a land surveyor licensed in the State of Washington utilized/hired by the party responsible for the work. Two (2) business days notice shall be provided to the City Engineer to inspect construction staking prior to construction.

The minimum staking of sewer lines shall be as follows unless otherwise directed by the City Engineer:

- 1) Staking location of sewer mains and side sewers every 50 feet with cut or fill to invert of pipe.
- 2) Staking location of all manholes for alignment and grade with cut or fill to rim and pipe inverts.
- 3) Staking front lot corners prior to installation for side sewer tees.

6-3.10 DEVIATION FROM PLANS

No deviations from the approved plans and these Standards shall be allowed without the City Engineer's written approval. If major changes are required, the project engineer shall revise, sign and submit the plans for the City Engineer's approval prior to restart of construction.

6-3.11 INSPECTION AND TESTING

The City Engineer shall have access to the project site for the purpose of inspections and testing at all times. Proper facilities shall be provided for such access, inspection, and testing.

If any work is covered without approval or consent of the City Engineer, it must be uncovered for inspection if required by the City Engineer.

Before a pressure test is to be observed by the City Engineer, the party responsible for the project shall ensure that whatever preliminary tests are necessary to ensure that the material and/or equipment are in accordance with the plans and these Standards are done and successfully completed.

Written and verbal notices of deficiency shall be given to the party responsible for the work. The party responsible for the work shall correct such deficiencies before final inspection by the City Engineer.

The sewer system must successfully pass the pressure test before final project inspection by the City Engineer.

6-3.12 WATER QUALITY

The party responsible for the work is required to implement water pollution control BMPs and maintain these until the project is accepted by the City Engineer. The party responsible for the work shall familiarize themselves with the requirements of the DOE, the current adopted stormwater manual for western Washington, and other regulatory agencies having jurisdiction over such matters.

The oil and chemical storage site for the project shall be approved by the City Engineer and the area shall be diked. There shall be no disposal of waste oil or oil products on the project site. A waste oil disposal tank shall be provided if deemed necessary by the City Engineer.

The party responsible for the work shall submit a Notice of Intent (NOI) to the DOE if applicable. A copy of the NOI form is available at the front counter of City Hall located at 116 Union Avenue or can be obtained at the DOE website.

6-3.13 CONSTRUCTION ON EXISTING EASEMENTS

All work within public utility easements shall be performed in accordance with terms and conditions of the respective easement. Each easement area shall be restored to equal to or better than the condition of the easement area that existed prior to the work. Work shall not be performed within any public utility easement area unless such work is specifically authorized by the City Engineer. The party responsible for the project shall provide advance written notification to and shall coordinate the authorized work with the persons and/or entities owning property that is adjacent to the easement area.

6-3.14 PRE-CONSTRUCTION PHOTOS

Prior to commencement of work, photographs shall be provided to the City that clearly show the conditions of the project site immediately before the anticipated start of the work. Photographs will be obtained as follows:

- 1) 50 foot interval in easements up station and down station.
- 2) Any other locations as directed by the City Engineer.

The photographs shall be 4 inch x 6 inch, color prints, contained in albums, catalogued, and cross-referenced. Digital copies of all photographs shall also be provided to the City Engineer.

6-3.15 UNDERGROUND UTILITIES

The plans show the approximate locations of various existing utilities known to the project engineer such as gas lines, water mains, storm drainage, power lines, telephone lines, TV cables, fiber optics, and other obstructions based on information obtained from various sources. The party responsible for the project shall be responsible to check for interferences and obstructions by inquiry from the different utilities and by underground exploration before commencing excavation.

The party responsible for the project shall request field locates and notify the owners of underground utilities about the scheduled commencement of excavation through the one-call system (1-800-424-5555).

Notice shall be made to owners of underground utilities not less than two (2) business days or more than ten (10) business days prior to scheduled date of commencement of excavation. Test pits, for the purpose of locating underground utilities or structures in advance of the construction, shall be excavated and backfilled. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the City Engineer or the applicable agency.

Excavation around and under active utilities shall be performed with special care to ensure that utility service is not interrupted. Where it is necessary to cut, move or reconnect any service lines, arrangements shall be made with the respective utility owners.

The party responsible for the project shall indemnify, defend and hold harmless the City from any claim for damage of utilities and/or disruption to services resulting from project activities/operations. The form of the indemnification agreement shall be subject to the approval of the City Attorney.

6-3.16 TRENCH EXCAVATION

Trench excavation and backfill operations within State right-of-way: All excavation and backfill within the State right-of-way shall adhere to the current WSDOT/APWA Standard Specifications.

Trench excavation and backfill operations within Snohomish County right-of-way: Excavation within the Snohomish County right-of-way shall conform first to the Snohomish County Road Standards, and secondly to standards set forth by the current WSDOT/APWA Standard Specifications.

Trench excavation and backfill operations within City right-of-way: Excavation within City right-of-way shall conform to these Standards.

Clearing and grubbing limits may be established by the City or governing agency for certain areas. Debris resulting from the clearing and grubbing shall be appropriately disposed of in accordance with applicable State and local laws and regulations.

Trenches shall be excavated to the line and grade shown in the plans or as designated by the City Engineer. Higher strength pipe or special bedding may be required because of excess trench width.

Unsuitable material below the depth of the bedding shall be removed to the extent approved by the City Engineer and replaced with materials approved by the City Engineer.

The length of trench excavation in advance of pipe laying shall be kept to a minimum and shall not exceed more than 150 feet without prior written approval of the City Engineer.

When trenching operations take place in the City right-of-way, the pavement and all other improvements shall be restored as required by the right-of-way permit.

When excavation of rock is encountered, all rock shall be removed to provide a clearance below, on each side of all pipe, and fittings of at least 6 inches for pipe sizes 24 inches or smaller and 9 inches for pipe sizes 30 inches or larger. Material removed shall be replaced with appropriate backfill material, which shall be compacted to 95% standard proctor. See Standard Plan 617.

6-3.17 SHEETING AND SHORING

Sheeting and shoring shall be provided and installed as necessary to protect workers, the work and existing utilities and other properties in compliance with OSHA and WISHA requirements.

Removal of the sheeting and shoring shall be accomplished in such a manner that there will be no damage to the work or to other properties.

6-3.18 TRENCH DEWATERING

Sufficient pumping equipment shall be provided and maintained on the project site to keep the trench free from standing water. Surface runoff shall not be allowed to flow to the trench. The trench water or other deleterious materials shall not be allowed to enter the pipe at any time. If, at anytime, water is found to be entering the new sewer pipe, the pipe shall be plugged and all work shall cease until the trench water is completely pumped out or otherwise controlled, to the satisfaction of the City Engineer. Any method used must be in accordance with the specifications and requirements of the City and current DOE stormwater manual for western Washington and any other applicable State regulations.

6-3.19 MANHOLE

Manhole Foundation

Unless otherwise directed by the City, manhole bases (pre-cast base sections) shall be placed on a minimum thickness of 6 inches of crushed surfacing base course meeting the requirements of Section 9-03.9(3) of the current WSDOT/APWA Standard Specifications. The crushed surfacing base course must be compacted to 95% of standard density.

Manhole Sections

Manhole sections shall be placed and aligned so as to provide vertical sides and vertical alignment of the ladder steps. The completed manholes shall be rigid, true to dimension and watertight. Rough or uneven surfaces shall not be permitted inside or outside. All manhole sections shall be newly manufactured and free of breaks or cracks.

Joints between pre-cast manhole elements shall be rubber gasketed in a manner similar to pipe joints conforming to ASTM C-443 and they shall be grouted inside and outside. The grout used between joints in the pre-cast sections and for laying manhole adjusting bricks shall be composed of two-part cement to one-part of plaster sand. All joints shall be thoroughly wetted and completely filled with non-shrink grout, smoothed both inside and outside. Grout shall be ½ inch minimum thick and 3 inch minimum on each side of joints. The exterior joints shall receive Riser Wrap® or an equivalent approved by the City Engineer that overlaps the manufacturer's water proofing by a minimum of 1 inch when required by the City Engineer. Shop drawings of the joint design shall be submitted to the City Engineer for approval prior to manufacture.

Completed joints shall show no visible leakage and shall conform to the dimensional requirements of ASTM 478. They must be inspected before backfill.

Grout such as "JetSet®" or similar products shall not be used in the City of Snohomish.

Lift Holes and Steel Loops

All manhole lift holes shall be completely filled with expanding grout and smoothed both inside and outside to ensure water tightness. All steel loops must be removed, flush with the manhole structure. The stubs shall be covered with grout and smoothed. Rough or uneven surfaces shall not be permitted.

Manhole Channels

All manholes shall be channeled unless otherwise approved by the City Engineer. Channels shall match existing sewer grades. Channels shall converge with smooth transitions rounded into well finished junctions. Channel sides shall be carried up vertically to the crown elevation of the various pipes. Concrete shelves between channels shall be smoothly finished, warped evenly and sloped to drain.

All standard manholes shall have a minimum drop of 0.10 feet to a maximum drop of 2.0 feet between the invert in and the invert out. Shallow manholes shall have a minimum drop of 0.10 feet to a maximum drop of 0.50 feet between the invert in and the invert out.

Pipe Connections at Manholes

All pipes except PVC pipe entering or leaving the manhole shall be provided with flexible joints within $\frac{1}{2}$ of a pipe diameter or 12 inches, whichever is greater, from the outside face of the manhole structure. The flexible joint shall be placed on firmly compacted bedding, particularly within the area of the manhole excavation which normally is deeper than that of the sewer trench. Special care shall be taken to see that the openings through which pipes enter the manhole are completely and firmly rammed full of non-shrink grout to ensure water tightness.

PVC pipe connected to manholes shall be provided with a manhole adapter complete with gasket and approved by the City Engineer. No PVC pipe joint shall be placed within 10 feet of the outside face of the manhole.

All stubbed out pipes placed through manhole walls for future connections shall be suitably plugged and blocked, with bell end left intact in a manner acceptable to the City Engineer.

Kor-N-Seal[®] factory installed boots are allowed.

Drop Manholes

Drop manholes shall be constructed with an inside drop connection per City Standard Plan 611 for all manholes.

Ladders

Manhole ladders shall be installed in accordance with the approved manufacturer's recommended procedures and City Standard Plans 608 and 609 on sides of manholes opposite the pipe and channels if possible.

Connection to Existing Manholes

When connecting to an existing manhole, the existing manhole diameter must be adequate to accommodate the new sewer mains. If not, the existing manhole shall be upgraded or repaired as directed by the City Engineer at the expense of the party responsible for the project. If the existing manhole access is less than 24 inches in diameter, and/or concentric cone (manhole over 7 feet deep), the manhole shall be upgraded to include a new 24 inch ring and cover and/or eccentric cone. If connection to an existing manhole places a channel directly under access opening, the ladder shall be moved and the cone section rotated to place the access over concrete shelf.

Invert elevations shall be verified by the party responsible for the work prior to construction. The crown elevation of laterals shall be the same as the crown elevation of the incoming pipe unless specified. The existing base shall be reshaped to provide a channel equivalent to that specified for a new manhole.

Excavation shall be done completely around the manhole to prevent unbalanced loading. The manhole shall be kept in operation at all times and the necessary precautions shall be taken to prevent debris or other material from entering the sewer, including a tight pipeline bypass through the existing channel if required by the City Engineer.

Connection of new sewer pipe to an existing manhole shall be accomplished by using core drilled holes to match the size of pipe. All openings shall be pipe O.D. plus structure wall thickness. The transition of connecting channels shall be constructed so as not to interrupt existing flow patterns.

Upstream pipes, except PVC pipe, penetrating the walls of manholes shall be placed with the bell facing out such that the bell is placed snug against the outside wall of the structure as the angle of penetration allows. Pipe, except PVC pipe, leaving or entering the manhole shall be provided with a flexible joint within $\frac{1}{2}$ of a pipe diameter, or 12 inches, whichever is greater. After pipes have been placed to their final position, they shall be grouted tight with non-shrink grout. PVC pipe shall be connected to an existing manhole per these Standards.

The party responsible for the work shall assure the workers' exposure to asbestos material be at or below the limit prescribed in WAC 296-62-07705.

Asbestos cement pipe shall be cut with a reed wheel cutter with controlled flowing water. Contaminated clothing shall be transported in sealed, impermeable bags and labeled in accordance with WAC 296-62-07705. Asbestos cement pipe shall be left and buried in the trench.

Pipe Plugging at Connections

At the connection to the existing sewer system, the party responsible for the work shall physically plug all new sewer connections until all tests have been completed and the City Engineer approves the removal of the plugs.

Saddle Manhole

A saddle manhole shall be constructed per City Standard Plan 605 and these Standards. The existing pipe shall not be cut until approval is received from the City Engineer.

Manhole Ring and Cover

Manhole rings and covers shall be installed per Standard Plan 612. All castings shall be coated with bituminous coating prior to delivery at the job site. Manholes in paved areas shall match the finished grade of the pavement.

Grade Adjustment

For manholes located in the City right-of-way, not less than 4 inches and not more than 26 inches shall be provided between the top of the cone (or slab for flat top manholes) and the bottom of the manhole frame. Grade adjustments shall be done within 24 hours after paving. Paving, repaving, and patching shall be completed within 72 hours. Manhole rim elevations in unpaved areas (planters and grassed areas) shall be at grade or as directed by the City Engineer. See Standard Plan 614. Locking covers shall be used for all manholes. Manholes shall not be located in areas subject to inflow. If a manhole must be located in an area subject to inflow in the opinion of the City Engineer, the manhole shall be equipped with a PRECO[®] sewer guard watertight manhole insert or an equivalent approved by the City Engineer.

6-3.20 SEWER MAIN

General

No broken or defective sewer pipe and related materials shall be used. The maximum permissible trench width between the foundation level and to 12 inches above the pipe shall be 40 inches for pipe 15 inches or smaller or 1½ times the inside diameter plus 18 inches for pipes 18 inches or larger. See Standard Plan 615. If the maximum trench width is exceeded without authorization from the City Engineer, the Contractor will be required to provide pipe of higher pressure class or to provide a higher class of bedding, at the discretion of the City Engineer.

During excavation and installation of the sewer lines and placement of trench backfill, excavations shall be kept free of water. Surface run-off shall be controlled so as to prevent entry and collection of water in excavations. The static water level shall be drawn down a minimum of 1 foot below the bottom of the excavation so as to maintain the undisturbed state of the foundation soils and along the placement of any fill or backfill to the required density. The dewatering system shall be installed and operated so that the groundwater level outside the excavation area is not reduced to the extent which would damage or endanger adjacent structures or property.

Pipe Bedding

Pipe bedding shall be ¾ inch minus manufactured washed pea gravel. Bedding will be to the pipe zone shown on Standard Plan 616. The pipe zone is identified as 6 inches below the bottom of the bell to 12 inches above the top of pipe for pipe sizes 24 inches or smaller and 9 inches below the bottom of the pipe to 12 inches above the top of pipe for 30 inches or larger.

Bedding shall be installed and spread smoothly so that the pipe is uniformly supported. Subsequent lifts are not to exceed 6 inches in thickness and shall be installed to the crown of the pipe. All lifts shall be individually compacted to 90% of the maximum density as determined by ASTM D-698. A 12 inch lift of material shall be placed and compacted over the crown of the pipe prior to backfilling the trench.

Laying Sewer Pipe

All sewer main installations shall have line and grade set by survey, prior to construction. Staking shall show each manhole cut to all inverts. All sewer mains shall be straight between manholes at a minimum depth of 7 feet measured from the invert, unless otherwise approved in writing by the City Engineer or shown on the approved plans.

Any method may be used that accurately transfers the control points provided by the Surveyor in laying the pipe to the designated alignment and grade (such as "line and batter board" and "laser beam" etc.).

When using the "line and batter board" method, the line and grade shall be transferred into the ditch where they shall be carried by means of a taut grade line supported on firmly set batter boards at intervals of not more than 30 feet. Not less than three batter boards shall be in use at one time. In the event that the batter boards do not line up, work shall immediately stop and the situation remedied before work proceeds.

When using a "laser beam" to set pipe alignment and grade, the position of laser beam from surface hubs provided by the surveyor shall be constantly checked to ensure the laser beam is still on alignment and grade. In the event the laser beam is found out of position, work shall immediately stop and the necessary corrections shall be made to the laser beam equipment and pipe installed before work proceeds.

There shall be a minimum horizontal clearance between sewer and water main of 10 feet, unless a design alternative has been specifically approved by the City Engineer. Sanitary sewers shall be installed lower than water mains whenever possible. Where sanitary sewers and water mains cross, there shall be a minimum vertical separation of 18 inches between water mains and sanitary sewer mains unless an alternative design has been specifically approved by the City Engineer. Water mains shall be above sewer mains. Where clearances cannot be met, party responsible for the work shall use a pipe casing or other approved methods shall be used to protect the domestic water supply from potential cross contamination.

Sanitary sewers laid 14 feet and deeper must be epoxy coated ductile iron pipe of Class 52 or C-900 PVC.

Trenches shall be excavated to a depth and grade required. Pipe bedding shall be placed to provide a uniform and continuous bearing and support for the pipe on solid undisturbed or compacted ground.

Sewer lines shall be laid upgrade from the starting point of connection on the existing sewer or from a designated starting point, as approved by the City Engineer. Sewer pipe shall be installed with the bell end forward or upgrade. After placing a length of pipe in the trench, the spigot shall be centered in the bell and the pipe forced home and brought to correct line and grade. During joining, the pipe shall be partially supported to minimize unequal lateral pressure and to maintain concentricity. Pipe handling after the gasket has been affixed shall be carefully controlled to avoid disturbing and dislocating the gasket. Any disturbed or dislocated gaskets shall be removed, cleaned, replaced and lubricated before joining the sections.

The maximum amount of open trench on streets and roadway shoulders shall not exceed 150 feet at any one time unless otherwise approved by the City Engineer. The project site shall be a safe environment at all times. At the end of each day all open trenches must either be backfilled or covered with steel plates and barricaded with attached flashing yellow lights to prevent vehicles, people and animals from falling into the trench.

Experienced and qualified personnel shall be on-site to oversee the construction process during all shoring operations. Where conditions exist which require shoring, trenches shall be adequately shored to protect existing property, utilities, pavement etc. and to provide safe working conditions inside and above the trench. Shoring shall be designed and installed in accordance with applicable local, State and Federal laws and regulations. A combination of shoring and over break, tunneling, boring, sliding trench shields, or other methods may be used to accomplish the work, provided the method(s) meet all applicable local, State and Federal laws and regulations.

Compaction tests shall be required for all backfilled trenches in paved public roadways and in roadway shoulders. A minimum of one test location shall be chosen by the City Engineer for every 200 lineal feet of sewer main installed. The City Engineer has the discretion to require additional tests in locations specified by the City Engineer. All testing shall be at the expense of the party responsible for the project.

All excavated trench material deemed by the City Engineer to be unsuitable for trench backfill shall be removed from the project site.

No construction materials, soil, debris etc. shall be stockpiled in the City right-of-way unless specific permission is granted in writing by the City Engineer.

Under no circumstances shall pipe materials be dropped or dumped into the trench. Broken or otherwise defective pipe shall be removed from the job site and replaced.

Every precaution shall be taken to ensure foreign material does not enter the pipe. When pipe laying is not in progress, the open ends of the pipe shall be closed by a water tight plug or other means approved by the City Engineer. If water is in the trench when work resumes, the seal on the pipe shall remain in place until the trench is completely pumped dry. No pipe shall be laid in water, or when in the opinion of the City Engineer, trench conditions are unsuitable.

No willows, poplars, cottonwoods, birches, soft maple, gum or any other tree or shrub whose roots are likely to obstruct public sewers are allowed within 30 feet of any public sewer. Any of these trees found to be located within 30 feet of a proposed sewer main shall be removed by the party responsible for the work.

Connection to Existing Pipe

When connecting to the end of an existing pipe known to have a bell at the end of the pipe, a new pipe of the same material as the existing pipe shall be used. The plans can specify connection by inserting a spigot of the new pipe into the existing bell end, with a “donut” gasket.

When connecting to the end of an existing pipe known to have a plain end, or needing to be cut, plans shall specify the use of a coupling to connect new and existing lines.

Couplings and O-ring adapters utilized for joining pipes of dissimilar materials or different nominal sizes shall be flexible elastomeric PVC as manufactured by Fernco®, Inc. or an equivalent approved by the City Engineer. Couplings shall be supplied with 316 stainless steel band clamps, fasteners and shear rings as applicable to the sizes and types that are being connected together.

Plugs and Connections

All fittings shall be capped or plugged with a plug of an approved material and gasketed with the same gasket material as the pipe unit, or the pipe shall be fitted with an approved mechanical stopper, or the pipe shall have an integrally cast knock-out plug. The plug shall be able to withstand all test pressures without leaking.

Jointing

Where it is necessary to break out or connect to an existing sewer during construction, only new pipe having the same inside diameter will be used in reconnecting the sewer. Where joints must be made between pipes with a mismatched wall thickness, a flexible gasket coupling, adapter or coupling-adapter shall be used to make a watertight joint. Couplings shall be those manufactured by "Romac", "Smith Blair", or an equivalent approved by the City Engineer for reinforced pipes and "Fernco®" or an equivalent approved by the City Engineer for non-reinforced pipes.

Jacking, Auguring and Tunneling

Jacking, auguring and tunneling shall be done in accordance with current WSDOT/APWA Standard Specifications.

Slope

All sanitary sewers shall be designed and constructed to give mean velocities of not less than 2.0 feet per second when flowing full. The slopes shall meet the minimum required in these Standards.

Sewer Abandonment

Existing sewer lines to be abandoned shall be removed or filled completely with sand, concrete or controlled density fill. At the manhole connection where the existing sewer main is to be abandoned, the manhole shall be rechanneled with 3,000 psi cement concrete.

Cleaning, Testing and Television Inspection of Sanitary Sewer Pipe

All sanitary sewer pipes shall be cleaned and tested after backfilling. Testing shall be by either exfiltration or low pressure air method unless the ground water table is such that the City Engineer requires an infiltration test.

The party responsible for the project shall clean and flush all sewer lines with clean water using approved jet vactoring equipment prior to testing.

All testing shall be under the direction and in the presence of the City Engineer. The party responsible for the work shall notify the City Engineer at least 2 business days prior to the start of any testing. Cleaning and testing of sewer lines shall be completed within 15 business days after backfilling of sewer lines and structures. Any additional delay will require the written consent of the City Engineer. The party responsible for the work shall furnish all labor, materials, tools, and equipment necessary to make clean and test the sewer lines. Any damage resulting from testing shall be repaired by the party responsible for the work to the satisfaction of the City Engineer.

All tees and stubs shall be plugged with flexible jointed caps, or acceptable alternate, securely fastened to withstand the internal test pressure. These plugs or caps shall be readily removable and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

Testing of sewer mains shall include a television inspection by the party responsible for the project. Television inspection shall be done after the air test has passed and before the roadway is paved. Immediately prior to a television inspection, enough water shall run down the line so it comes out the lower manhole. A copy of the DVD and written report shall be submitted to the City Engineer. Acceptance of the sewer will be made after the DVD has been reviewed and approved by the City Engineer. Any tap to an existing system needs to be televised as well. No ponding within the sanitary sewer line will be accepted. Contact the Public Works Inspector for television testing procedure form.

If larger diameter pipe is tested one joint at a time, leakage allowances shall be converted from GPH per 100 feet to GPH per joint by dividing the number of joints occurring in 100 feet. If leakage exceeds the allowable amount, corrective measures shall be taken and the line shall be re-tested to the satisfaction of the City Engineer.

A mandrel test in accordance with Section 7-17.3(2)G of the current WSDOT/APWA Standards and Specifications may be required by the City Engineer for sewers mains (not side sewer lines).

If any sewer installation fails to meet the requirements of the test method used, the source or sources of the leakage shall be determined and all defective pipes replaced. The complete pipe installation shall meet the requirements of the test method used before being considered acceptable. Replacement of defective pipe shall be in accordance with a replacement plan approved by the City Engineer.

Exfiltration Test

Prior to exfiltration leakage testing, the pipe may be filled with clear water to permit normal absorption into the pipe walls. The leakage test shall be completed within 24 hours after filling the pipe. When under test, the allowable leakage shall be in accordance with the following. Specified allowances assume pre-wetted pipe.

Leakage shall be no more than 0.28 GPH per inch diameter per 100 feet of sewer, with a hydrostatic head of 6 feet above the crown at the upper end of the test section, or above the natural

groundwater table at the time of test, whichever is higher. The length of pipe tested shall be limited so that the pressure at the lower end of the section tested does not exceed 16 feet of head above the invert, and in no case shall the length of pipe being tested be greater than 700 lineal feet or the distance between manholes, whichever is shorter.

Where the test head is other than 6 feet, the maximum leakage shall not exceed 0.28 GPH per inch of diameter, per 100 feet of pipe length times the square root of the test head. The leakage can be determined from the following equation:

$$\text{Maximum leakage (in gallons per hour):} \quad 0.28 * \frac{\sqrt{H}}{\sqrt{6}} * D * \frac{L}{100}$$

Where: D = diameter (in.)
 L = length of pipe (ft.)
 H = test head (ft.).

When the test is to be made one joint at a time, the leakage per joint shall not exceed the computed allowable leakage per length of pipe.

Television Inspection

All sanitary sewers shall be inspected by the use of a Closed Circuit Television (CCTV) camera and footage provided to the City on DVD. All deficiencies noted by the CCTV camera inspection shall be corrected to the satisfaction of the City Engineer prior to final acceptance of the project. No VHS tapes will be accepted.

The following information shall be electronically generated and displayed on the CCTV footage at the beginning of each sewer main inspection:

- 1) All video and inspection reporting shall be done in DVD format.
- 2) All joints shall have a 360 degree view to inspect for faulty joints.
- 3) An inspection of each lateral connection, documentation of the location of each lateral connection and the total length shall be shown on the inspection report.
- 4) Inspection reports shall include the project name, city, address, date, pipe size, type of pipe, direction, surveyed footage, and current weather conditions.
- 5) CCTV data shall be Granite XP version 2 or approved equal.
- 6) A 1-inch diameter target ball clearly visible shall be used.
- 7) Before the camera is set in the pipe, a 5 gallon bucket of water contrasting color dye shall be poured into a manhole.
- 8) All DVDs shall be labeled with the Contractor's name, location of the video, the test date and manhole numbers on a professional video inspection label.
- 9) Re-inspection of pipes is required within 10-12 months of acceptance date.

6-3.21 SANITARY SIDE SEWERS

Fittings and Clean-outs for Side Sewers

All fittings shall be factory produced and shall be designed for installation on the pipe to be used. Fittings shall be of the same quality and material as the pipe used, except when installing a PVC insert on existing pipe.

Side sewers shall be connected to the tee provided in the public sewer where such is available, utilizing approved fittings or adapters. Where no tee is provided or available, connection shall be made by the use of a Romac tapping saddle. See Standard Plan 603.

All side sewers shall have a 6 inch clean-out at the property line per Standard Plan 602. The riser portion of the clean-out shall be PVC unless otherwise approved by the City Engineer. For longer side sewer installations, extra clean-outs will be required at spacing not to exceed 100 feet.

Marking of Side Sewers

Tracer tape shall be installed over side sewer pipes and side sewer stubs. The tracer tape shall be placed 24 inches to 48 inches below the finished grade and it shall extend its full length. The location of all side sewers shall be marked with a 10 gauge wire and 2 inch x 4 inch wood marker at the termination of the stub. The marker shall be connected to the pipe at the invert and wrapped around marker post. Above the ground surface, it shall be painted white with black letters of 3 inches in height "SEWER xx INVERT DEPTH xx". Offset markers may be used when the side sewer location is within an existing driveway or other obstacle.

Testing of Side Sewers

When a new side sewer line is installed, the entire length of new pipe installed shall be tested. All side sewers shall be tested after backfill. Side sewer lines that are reconstructed or repaired to a length of 10 feet or more shall be tested for water-tightness. Testing of newly reconstructed sections of side sewer lines consisting of a single length of pipe is not required. Testing shall be performed in the presence of the City Engineer in accordance with these Standards and Section 7-17 Sanitary Sewers of the 2010 WSDOT/APWA Standard Specifications.

In cases where a new tap is made on the main, the first joint of pipe off the main shall be installed with a test tee, so that an inflatable rubber ball can be inserted for sealing off the side sewer installation for testing. In cases where the side sewer stub is existing to the property line, the test ball may be inserted through the clean-out wye to test the new portion of the side sewer installation.

Side Sewer As-Built Plans

The as-built drawings for side sewer lines shall show the following:

- 1) Location of the side sewer line, its connection with the building(s) and all dimensions.
- 2) Show station as distance of side sewer line tee from the center of the next downstream manhole.
- 3) The depth and point of connection of the side sewer line to the sanitary sewer main.
- 4) Any additional information which might be deemed necessary by the City Engineer.

Side Sewer Demolition

Side sewer demolition shall be performed prior to removal of building foundation. The side sewer for each building shall be excavated and removed from the house connection to the property line or the main as required by the City Engineer. The end of the side sewer shall be capped to remain in place. Side sewer demolition shall be performed in the presence of the City Engineer.

6-3.22 CLEANOUT

All clean-outs in paved areas, City right-of-way and easements shall be extended to grade and a 30" x 30" x 12" concrete pad shall be installed per Standard Plan 602. All clean-outs in private unpaved areas shall be installed per Standard Plan 602.

6-3.23 GREASE TRAP AND INTERCEPTOR

Grease traps and interceptors shall be installed and sized according to the criteria in the current Uniform Plumbing Code. Grease trap and interceptors shall be located on private property, and they shall remain privately owned and maintained by property owner or occupant. These facilities shall be available for the inspection by the City's Building Official at all times.

6-3.24 PRIVATE GRINDER PUMP

Private grinder pumps shall be installed in accordance with the manufacture's procedures and per approved plans by the City Engineer. The force main shall be pressure tested at 150% of the total dynamic head. All inspections must be completed prior to backfilling.

6-3.25 LIFT (PUMP) STATIONS

Lift stations shall be constructed in accordance with approved plans and specifications prepared by a engineer licensed in the State of Washington. Please reference Appendix A6 for lift (pump) station standards.

6-3.26 SPECIFICATIONS NOT COVERED BY THESE STANDARDS

In the event a construction or installation specification relating to sanitary sewers is not covered by these Standards, the City Engineer may require compliance with other applicable manuals or standards.

END OF SECTION

ENGINEERING STANDARDS

SECTION 5

WATER DISTRIBUTION

5-1 DESIGN

5-1.01 GENERAL

Extension or modification to the City's water system shall be made strictly in accordance with the construction plans prepared in accordance with these Standards, the Snohomish Municipal Code, and the City's Water Comprehensive Plan, and approved by the City Engineer. Additionally, all construction of water system extensions shall conform to these Standards, applicable American Water Works Association (AWWA) Specifications and the current WSDOT/APWA Standard Specifications.

These Standards do not include design of the City's general facilities such as wells, pump stations, in-ground reservoirs, storage tanks, or treatment plant. The City's general facilities require special design and will be reviewed and approved by the City Engineer on a case-by-case basis.

5-1.02 HYDRAULIC REQUIREMENTS

Distribution System Pressure

All water mains shall be sized following a hydraulic analysis based on flow demands and pressure requirements. Per the DOH design manual current edition, during fire suppression events, the water system must be able to provide 20-psi minimum pressure at ground level at all points throughout the distribution system. The water system must be able to provide this minimum pressure under fire-flow conditions plus the MDD rate when all equalizing and fire flow storage is depleted (WAC 246-290-230(6)). The required working pressure in the City of Snohomish distribution system should be approximately 40 to 80 psi, not less than 30 psi when all equalizing storage is depleted, and not greater than 90 psi due to the age and condition of the current infrastructure. Higher pressures in unusual circumstances shall be submitted to the City Engineer for review. Individual pressure reducing valves (PRV) are required when the static pressure at the service level exceeds 60 psi.

Distribution System Velocities

Per the DOH design manual current edition, "DOH recommends a maximum velocity of no more than 8-feet per second (fps) under PHD conditions, unless the pipe manufacturer specifies otherwise. Maximum velocities greater than 8 fps may occur under fire flow conditions, for short main sections, or piping in pump and valve station facilities. Engineers should conduct a hydraulic transient (water hammer) analysis for distribution piping designed to exceed 10 fps during PHD or fire flow conditions (Walski et al. 2003; AWWA 2004)."

Distribution System Fire Flow

Fire flow requirements shall be determined by the City Fire Marshall. The available fire flow will be determined by the City Engineer using the water system hydraulic model.

5-1.03 WATER MAIN EXTENSION

Residential

Water main extensions shall be required when a parcel does not front an existing water main. All residential water main extensions shall be extended to a point 10 feet beyond the farthest property corner where practical as determined by the City Engineer. In addition, water mains shall be installed through all internal streets and looped to all adjacent mains that will, in the City Engineer's opinion, extend past or through the property in the future; and stub to the property line where it is likely that they will be needed to connect to future mains. Depending on the property size, shape and the Water Comprehensive Plan, the City may require mains to be constructed on more than one, and up to all, sides of the property. The City Engineer may also require that extra service lines be installed to be used for sampling stations.

If a proposed water main extension is located in 2 or more pressure zones, the City Engineer may require installation of pressure reducing stations, isolation valves, check valves, and/or booster pump stations.

Dead-end mains shall be kept to a minimum by making appropriate looping and tie-ins whenever practical in order to provide increased reliability of service, assist with water quality and reduce head loss.

If a water main extension directly benefits multiple property owners, a latecomer reimbursement agreement in accordance with SMC Chapter 15.17 may be appropriate.

Non-Residential Properties

Water main extensions shall be required when a parcel does not front an existing water main. All non-residential water main extensions shall be extended to a point 10 feet beyond the farthest property corner where practical as determined by the City Engineer, and/or stub or connect to present and future mains or as directed by the City Engineer. The City Engineer may also require that extra service lines be installed to be used for sampling stations.

If the proposed water main extension is located in 2 or more pressure zones, the City Engineer may require installation of pressure reducing stations, isolation valves, check valves, and/or booster pump stations.

Dead-end mains shall be kept to a minimum by making appropriate looping and tie-ins whenever practical in order to provide increased reliability of service, assist with water quality and reduce head loss.

If a water main extension directly benefits multiple property owners, a latecomer reimbursement agreement in accordance with SMC Chapter 15.17 may be appropriate.

5-1.04 WATER MAIN LOCATION

Water mains and appurtenances should be installed within the right-of-way of public streets and roads. Water mains may be installed within City easements across private properties. Water mains within public right-of-way shall be located on the north and east sides of the centerlines. Water mains shall be in the shoulder of the roadway for rural roads, and approximately 6 feet from the street centerline for urban streets. See Standard Plan 322.

The City Engineer may approve exceptions to this requirement in order to minimize the cutting and replacing of pavement, to avoid conflicts with other underground utilities, to permit sanitary sewers to be installed on the “low side” of streets, or for other appropriate reasons. As nearly as practical, mains shall be installed on a particular street with the distance from the property line and/or centerline varied as little as possible. Water mains shall not be located under or behind parking lanes, curbs, gutters, or sidewalks. Valve boxes shall be located outside the normal wheel track whenever possible.

If there is an easement across a paved area on private property, the water main shall be installed in the driving lanes (not under parking stalls).

Water mains may be laid along road/street curves by using bends. Pipe joint deflection may be allowed upon approval by the City Engineer but the deflection shall not exceed one half of the manufacturer’s recommended deflection.

5-1.05 HORIZONTAL SEPARATION

Water mains shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer, storm drain, and septic tank and/or absorption field. The distance shall be measured edge to edge. If the City Engineer determines it is not practical to maintain a 10 foot separation, the City Engineer may approve deviation on a case-by-case basis using criteria from the Washington State Department of Ecology (DOE). Such deviation may include installation of the water main closer to a sanitary sewer provided that the water main is laid in a separate trench or on undisturbed earth shelf located on one side of the sanitary sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. Water service connections and side sewers shall have minimum horizontal clearance of 10 feet unless otherwise approved by the City Engineer.

Minimum horizontal clearances from water mains:

Utility	Minimum Horizontal Clearance in feet
Cable	5
Gas	5
Power	5
Telephone, Fiber Optic	5
Storm Drain	10
Sanitary Sewer	10
Septic Tanks/Drainfields	10

5-1.06 VERTICAL SEPARATION

Wherever practical, water mains shall cross other utilities at right angles. If this is not practical as determined by the City Engineer, the crossing angle shall be maintained between 45 and 90 degrees. Water mains crossing sanitary and storm sewers shall be laid to provide a minimum vertical clearance of 18 inches between the outside of the water main and the outside of the sewer. Where a water main crosses sanitary and storm sewers, one full length of water pipe shall be used with the pipe centered over the sewer for maximum joint separation. When the above conditions cannot be met and in accordance with applicable DOE criteria, the City Engineer may approve a variance, but shall require that the sewer be constructed of ductile iron pipe and be pressure tested before being activated, and/or be encased.

Minimum vertical clearances from water mains:

Utility	Minimum Vertical Clearance in feet
Cable	1
Gas	1
Power	1
Telephone, Fiber Optic	1
Storm Drain	1.5
Sanitary Sewer	1.5

When it is not practical to maintain this minimum separation between the water main and sanitary and storm sewers, the vertical clearance may be less than 6 inches and Ethafoam pads are required. The water main may also be encased per Section 5.1.11 Steel Casing.

5-1.07 SETBACK DISTANCE FROM BUILDINGS

Water mains shall be located a minimum of 5 feet from covered parking, 10 feet minimum from building and retaining walls. A 20 foot wide minimum easement shall be provided for a water main between buildings.

5-1.08 WATER MAIN SIZING

Transmission mains and specific areas outlined in the City's Water Comprehensive Plan require 12 inch or larger water mains.

When serving fire hydrants and for local distribution mains in residential areas, 8 inch or larger pipe is required.

6 inch pipe shall not be used as part of the distribution system except as fire hydrant runs not longer than 50 feet.

5-1.09 PIPE MATERIAL

Water mains shall be cement mortar lined ductile iron pipe (DIP) Class 52 unless otherwise approved by the City Engineer.

5-1.10 PIPE FITTINGS

Pipe shall be furnished with mechanical joints or rubber gasket push-on joints (Tyton joint only) unless flanged joints or restrained joints are required. Horizontal or vertical bends shall be used when joint deflection would exceed one-half of the pipe manufacturer's recommended maximum deflection. Restrained joints are required on all hydrant runs, steep slopes, non-bearing soils and in other conditions as determined necessary by the City Engineer.

5-1.11 STEEL CASING

Ductile iron pipe shall be encased in a steel casing when crossing: (1) under rockeries over 5 feet high; (2) under retaining wall footings over 5 feet wide; and (3) under reinforced earth retaining walls (both wall and reinforcing material). Casings shall extend a minimum of 5 feet past each edge of the structure, or a distance equal to the depth of pipe, whichever is greater. Minimum vertical clearance between the bottom of the wall or footing and top of the pipe or casing shall be 2 feet. The pipe trench at the casing shall be backfilled with gravel backfill material when the vertical clearance is less than 3 feet.

Ductile iron pipe shall be encased in a steel casing when crossing under a railroad or State/County highway. Casings and carrier pipe shall be installed in accordance with applicable other local, State, and/or Federal laws and/or regulations. In the case of railroad crossings, the project shall also comply with regulations established by the railroad company.

The carrier pipe shall be supported by casing spacers. Casing spacers shall be placed under the carrier pipe to ensure approximate centering within the casing pipe and to prevent damage during installation. See Standard Plan 522.

Steel casings may also be required when water mains cross creeks or wetlands.

5-1.12 COVER DEPTH

A cover depth of 3 feet above the top of water mains shall be maintained if possible. The cover depth shall not be less than 3 feet or more than 5 feet without the approval of the City Engineer.

If the water main is within the State or County right-of-way, the cover depths shall be in accordance with the State or County requirements.

5-1.13 SLOPES

Where the longitudinal slopes are 20% or greater, all pipe joints shall be restrained. Anchor blocks shall be used in conjunction with joint restraint where slopes are 20% or greater. Timber baffle/hill

holders shall be required on unpaved slopes that exceed 20%. Maximum spacing between the holders shall be 18-foot on center with a minimum of 1 holder for each pipe length.

5-1.14 POLYETHYLENE ENCASEMENT

The City Engineer may require that ductile iron pipe and fittings be protected by 8-mil polyethylene encasement in areas of severely corrosive soils or in accordance with AWWA/ANSI C105/A21.5.

5-1.15 CONCRETE BLOCKING

When using horizontal and vertical concrete blocking, show locations and type of blocking on the plans as shown on Standard Plans 505 and 506. Concrete blocking is required on all fittings including restrained joint fittings.

An 8 inch pipe at a vertical bend shall be restrained a minimum of 36 feet (2 joints) from each side of a bend. A 12 inch or larger pipe at a vertical bend shall be restrained a minimum of 54 feet (3 joints) from each side of a bend. No change in horizontal direction or diameter shall occur within 36 feet of the vertical bend. Special blocking or joint restraint designs may be required for poor soil, conflicting utility, etc.

5-1.16 ASBESTOS CONCRETE PIPE CROSSING

When a proposed water main crosses existing asbestos concrete (A.C.) pipe, the City shall require removal and replacement of the A.C. pipe with ductile iron pipe at the expense of the person or entity responsible for the water main project. The A.C. pipe removal and disposal shall be performed in accordance with all applicable Puget Sound Clean Air Agency (PSCAA) requirements, including but not limited to obtaining a permit from PSCAA for the removal work, and other applicable State and/or Federal laws and regulations. A permit from PSCAA to perform the A.C. pipe removal is required prior to construction drawing approval. Ductile iron pipe crossings shall be connected to the existing A.C. main with Romac extended range transition couplings.

5-1.17 VALVES

Sufficient valves shall be provided on water mains so that interrupted service and sanitary hazards will be minimized during repairs. Valves shall be located at no more than 300 foot intervals in commercial, industrial and multi-family areas and at no more than one block or 600 foot intervals in other areas. At water main intersections, valves shall be placed on 4 legs at each cross and 3 legs at each tee (unless tapping an existing water main). The valves shall be spaced so that no more than one fire hydrant is removed from service with any separate main shut down.

An auxiliary valve shall be installed on each hydrant run at the tee. A valve shall be installed on a water main at each end of an easement for the main. Additional valves may be required for area isolation and unidirectional flushing. Valves on water mains shall, where practical, be located within paved area of the street. A valve box or chamber shall be provided for every valve.

Generally valve sizes shall be the same as the water main. All valves 12 inch and smaller shall be resilient seated gate valves unless minimum cover cannot be achieved. If minimum cover cannot be achieved a butterfly valve shall be installed. All valves larger than 12 inch shall be butterfly type if approved by the City Engineer. When butterfly valves are installed, the operation nuts shall be on the north or east sides of the water mains. If a valve is installed in gravel or unpaved area, a concrete pad shall be set around each valve box at finished grade per Standard Plan 512.

5-1.18 FIRE HYDRANTS

Fire hydrants shall be installed for buildings where water is served by the City. The final number of hydrants and their locations shall be approved by the City Fire Marshal.

The maximum spacing of fire hydrants serving single-family dwellings or duplex dwellings on individual lots shall be 600 feet and not more than 300 feet from the front property line of the main body of a lot. Required distances shall be measured along the normal fire department hose laying route.

Fire hydrants serving multi-family and commercial lots shall be located not more than 300 feet on center and shall be located so that at least one hydrant is located within 150 feet of all structures or uses. Fire hydrants shall not be closer than 50 feet from multi-family or commercial buildings. On arterial streets without residential access, maximum hydrant spacing shall be 600 feet.

Any hydrant run exceeding 50 feet in length shall be 8 inches in diameter unless otherwise approved by the City Engineer. The joints of hydrant runs shall be restrained. No domestic or fire sprinkler service shall be tapped on any hydrant run. Fire hydrants shall be installed at the ends of each dead end line more than 300 feet in length. Said fire hydrants may be removed to conform to standard spacing requirements when the main is again extended with the City's approval. Hydrant valves shall be no more than one pipe length and no closer than three feet from the hydrant it serves. Fire hydrant installation is shown in Standard Plan 507.

5-1.19 COMBINATION AIR VACUUM RELIEF VALVES

Combination air vacuum relief valves as shown in Standard Plan 511 shall be installed on high points of new water mains where the elevation difference between the high point and the next low point exceeds one (1) pipe diameter, or as otherwise required by the City Engineer. The air valves shall be located outside the traveled portion of the roadway, preferably behind the curb or sidewalk and within the public right-of-way and the public utility easement. If possible, the water main profile shall be adjusted to eliminate the use of the air valves.

5-1.20 BLOW-OFFS

Each dead-end main shall be provided with a fire hydrant if flow and pressure are sufficient or with an approved flushing hydrant or a blow-off assembly shown in Standard Plan 510 for flushing purposes. Flushing devices shall be sized to provide flows that will give a velocity of at least 2.5 feet per second in the water main being flushed. No flushing device shall be directly connected to any sewer. Blow-off assemblies shall be located outside the traveled portion of the roadway, behind the curb or sidewalk, and within the public right-of-way or public utility easement.

A 2 inch blow-off assembly shall be required for testing and disinfection of new water mains, where hydrants are not available.

5-1.21 CONNECTION TO EXISTING SYSTEM

Connections to existing water mains 8 inches and larger shall be via a wet tap shown in Standard Plan 513 unless cut-in is required by the City Engineer in order to install additional valves.

Connections to existing water mains smaller than 8 inch diameter shall be made by cutting in a tee, unless otherwise approved by the City Engineer.

5-1.22 EASEMENTS

All water mains, valves, fire hydrants, meters, sampling stations, air vacuum relief valves, blow-offs, and other appurtenances not in public right-of-way shall be within public utility easements designated on submitted plans to provide the City with permanent access to these mains and appurtenances, as well as easements for future line connections, as required. Unless otherwise approved by the City Engineer, the easement for the water mains shall be 20 feet in width and 10 feet on all sides of the pipe lines, a minimum of 5 feet on each side of fire hydrants and other appurtenances (such as meters, sampling stations, air/vacuum valves, blow-offs, etc). Easements shall be fully executed and recorded with the Snohomish County Auditor prior to project acceptance by the City. The form of easement documents shall be subject to the approval of the City Attorney. Easement drawings and legal description shall be included as exhibits to each easement.

If off-site easements are required on properties not owned by the party responsible for the project, the responsible party shall acquire the easements at his/her expense before construction plans will approved by the City Engineer.

5-1.23 SERVICE CONNECTIONS

Service connections, including saddle, service line, meter box and appurtenances, shall be installed as part of the construction of all new water system extensions. A fire sprinkler meter per City Standards shall be provided if required by the City Fire Marshal. All service connections must be protected by a Washington State Department of Health (DOH) approved backflow prevention assembly in accordance with WAC 246-290-490. See Standard Plans 501 through 504a.

For residential developments, meter boxes shall be located in front of the lot to be served unless otherwise approved by the City Engineer. Meter boxes shall be close to the property line, behind the sidewalk, in a landscape area within public right-of-way or public utility easement, but not in paved areas such as sidewalk or driveway. An easement shall be established and recorded for placement of the water service if the required location is outside of the right-of-way or established public utility easement. Meters for two neighboring lots shall be installed near the common lot line to ease meter reading. Meters located close to driveways shall use boxes with traffic rating. The distance from the water main to the meter box shall not exceed 50 feet unless otherwise approved by the City Engineer. Meters shall be located in or as close to the public right-of-way as possible. Service lines shall be perpendicular to the water main if possible. See Standard Plan 502 for single family services and 503 and 504 for multi-family or commercial.

For commercial and multi-family developments, meters shall be located behind the back of a curb or sidewalk and not behind parking space or other obstructions. Meters shall be located for ease of reading.

Minimum allowable service lines from mains to meters shall be 1 inch for a single family residential buildings and 2 inch for multi-family or commercial buildings. All duplexes, triplexes and fourplexes must have separate services and meters for each unit. Multifamily buildings with five or more units must have separate services and meters for each building. Irrigation and fire sprinkler systems shall also be served by separate services and meters unless otherwise approved by the City Engineer. Each irrigation and fire sprinkler system shall be equipped with an approved backflow preventer. A minimum pressure of 30 psi at the meter shall be maintained when service is flowing at anticipated maximum flow rates. If friction losses will cause the pressure at the building to drop below the minimum, the service line size shall be increased to an appropriate size to maintain the required minimum pressure level.

The standard meter size is $\frac{5}{8}$ inch x $\frac{3}{4}$ inch for a single family residential house. Non-residential services and meter sizes (minimum $\frac{5}{8}$ inch x $\frac{3}{4}$ inch) shall be determined by the engineer or architect per the current Uniform Plumbing Code and subject to the approval of the City Building Official, and the plans shall show the locations and sizes of the services and meters.

Static service pressures at ground floor elevation shall be determined at all lots/buildings to ensure compliance with system pressure standards. Plans shall identify lots/buildings where the builder/owner will be required to install individual pressure reducing valve (PRV) when service pressures exceed 60 psi. A PRV shall be located on the customer side of the meter, outside of the public right of way, and a minimum of 3 feet from the water meter box.

5-1.24 EXISTING WATER MAIN ABANDONMENT

Existing water mains that are out of service shall be removed or abandoned as required by the City Engineer. If water mains are to be abandoned, the ends of the abandoned water mains shall be plugged by filling with Class 2500 concrete for a minimum length of 12 inches.

5-1.25 PRESSURE REDUCING STATIONS

If the proposed water project shall be located in two or more pressure zones, pressure reducing stations may be required by the City Engineer.

5-1.26 CROSS-CONNECTION CONTROL

The City strictly prohibits interconnection of other water supplies with the City's water system.

A backflow prevention device is required for all irrigation systems, fire sprinkler systems, commercial service connections and other water uses which may cause contamination of the City water system. Approved backflow prevention assemblies shall meet the requirements of the WAC 246-290-490 ("Cross Connection Control Regulation in Washington State"), and the recommendations of the PNWS-AWWA Cross Connection Control Manual and the City of Snohomish Cross Connection Control Program. The types of backflow prevention devices to be used for a specific project shall be determined by the City's Cross Connection Specialist.

Fire sprinkler system connections to the City's water system shall be owned and maintained by the property owner, beginning immediately at the valve where the fire sprinkler system connects to the City's water main.

The backflow prevention assembly on fire sprinkler system connections shall be located as close to the serving water main as possible, either on the owner's property or in an easement.

5-1.27 PRIVATE WELLS

To receive water services from the City, the property owner shall either:

(1) decommission the existing well(s) in accordance with WAC 173-160-381. The owner shall provide a copy of the decommission report to the City Water Division.

OR

(2) physically separate all domestic water supply piping from well(s) piping and permanently cap all terminations so that the two systems cannot be intertied. A double check valve (DCV) assembly shall be installed at the water meter and annual DCV testing requirements shall be met and reports submitted to the City's Water Division.

However, if the property is undergoing development such as, but not limited to, platting or subdivision, all well(s) shall be decommissioned in accordance with WAC 173-160-381 and a copy of the decommission report shall be delivered to the City Water Division.

5-2 MATERIAL

5-2.01 GENERAL

All materials shall be new and undamaged. The same manufacturer of each item shall be used throughout the work. All materials not specifically referenced shall comply with applicable sections of ANSI, ASTM, AWWA or the current WSDOT/APWA Standard Specifications and approved by the City Engineer.

When specific manufacturers or models are specified in these Standards, no substitutions will be allowed without prior approval by the City Engineer. If required by the City Engineer, the Contractor shall furnish certification from the manufacturer of the materials being supplied that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the reference Standards.

5-2.02 DUCTILE IRON PIPE

Ductile iron pipe shall be Class 52 (Tyton joint only) and cement mortar lined unless otherwise specified and shall conform to AWWA/ANSI C151/A21.51. Standard thickness of cement mortar lining shall be in accordance with AWWA/ANSI C104/A21.4.

5-2.03 HIGH DENSITY POLYETHYLENE PIPE

High density polyethylene (HDPE) pipe shall conform to AWWA C900.

5-2.04 WATER SERVICE PIPE

Water service pipe shall be Driscopipe CTS Class 200 Hi-Mol Poly pipe. Driscopipe shall conform to ASTM D-27370SDR9 (PE3408). CTS 110 SS liners for polypipe shall be used.

5-2.05 FITTINGS AND JOINTS

All fittings for ductile iron pipe shall be ductile iron compact (short body) fittings conforming to AWWA/ANSI C153/A21.53 and shall be cement mortar lined conforming to AWWA/ANSI C104/A21.4.

Joints shall be mechanical joints or rubber gasket push-on joints (Tyton joints only) unless flanged joints or restrained joints are required and shown in the plans. Pipe with push-on joints shall be suitable for use with mechanical joint fittings. Ductile iron pipe fittings shall have a pressure rating of 350 psi for push-on or mechanical joint fittings and 250 psi for flange joint fittings drilled in accordance with AWWA/ANSI C111/A21.11, unless otherwise noted.

Rubber gaskets for push-on joints (Tyton joint only) or mechanical joints shall be in accordance with AWWA/ANSI C111/A21.11. Gasket material for flanges shall be neoprene, Buna N, chlorinated butyl, or cloth inserted rubber.

5-2.06 RESTRAINED JOINTS

Where restrained joints are required, they shall be either bolted or boltless design, flexible after assembly, and can be disassembled without special tools. Any device utilizing round point set screws shall not be permitted. All couplings installed underground to connect ductile iron pipe shall be manufactured of ductile iron.

Restrained joints shall be Meg-A-Lug Series 1100, TR Flex, Grinnell 595 shackle clamp, or approved equal.

5-2.07 COUPLINGS

Flexible coupling and transition coupling cast components shall be ductile iron. Bolts and nuts shall be in accordance with ASTM A536-80, Grade 65-45-12. Bolts shall be high strength, low alloy steel track head bolts with national course rolled thread and heavy hex nuts. Gaskets shall meet AWWA/ANSI C111/A21.11 composition specifications.

5-2.08 BOLTS AND NUTS

Bolts, nuts and washers used for securing fittings shall be of similar materials. Steel bolts shall meet the requirements of ASTM A307 or ASTM F568 for carbon steel or ASTM F593 or ASTM F738 for stainless steel. Nuts shall meet the requirements of ASTM A563 for carbon steel or ASTM F594 or ASTM F836 for stainless steel. Iron bolts and nuts shall meet the requirements of ASTM A536, grade 65-45-12.

5-2.09 GATE VALVES

All gate valves shall be resilient seated gated valves conforming to the latest revision of AWWA C509 or C515. All gate valves shall be epoxy coated and turn counter clockwise to open. All gate valves shall have ANSI flanges or mechanical joints ends.

Buried gate valves shall be non-rising stem suitable for installation with the type and class of pipe being installed. Operating stems shall be equipped with standard 2 inch operation nut, and O-ring stem seals.

5-2.10 BUTTERFLY VALVES

Butterfly valves shall be used only when adequate cover cannot be achieved with gate valves.

5-2.11 VALVE MARKER POSTS

Valve marker posts shall be Carsonite blue plastic markers and labeled "WATER" or approved equal. See Standard Plan 509.

5-2.12 VALVE BOXES

Valve boxes shall be installed on all buried valves. Ears (lugs) on all valve boxes shall be placed in alignment with the pipe. The box and lid shall be cast iron, two piece slip type. The cover shall have the word "WATER" cast in the upper surface. Valve boxes, lids and extensions shall be East Jordan Ironworks deep style lid. All castings shall be coated with asphaltic varnish.

A valve operating nut extension shall be furnished and installed on all valves where the finished grade is more than 36 inches above the valve operating nut. Extensions are to be a minimum of 12 inches long with only one extension per valve. The operating nut extension shall extend into the top section of the valve box. See Standard Plan 512.

5-2.13 VALVE VAULTS

Valve vaults shall be dimensioned and sized for valve removal and replacement. Vaults shall be furnished in pre-cast concrete sections with sufficient strength to withstand H-20 traffic loading together with access frames and covers.

5-2.14 COMBINATION AIR VALVES

Combination air valves shall be designed to operate with potable water under pressure to permit discharging a surge of air from an empty line when filling and relieve the vacuum when draining the system. The air valves shall also release an accumulation of air when the system is under pressure. This shall be accomplished in a single valve body designed to withstand a pressure of 300 psi.

The body and cover shall be cast iron conforming to ASTM A48, Class 30. Floats shall be stainless steel conforming to ASTM A 240 and designed to withstand 1,000 psi. Seats shall be Buna N rubber. Internal parts shall be stainless steel or bronze. Combination air valves shall conform to AWWA C512. Air valves shall have double concrete meter boxes Fogtite 2T with solid steel lid. See City of Snohomish Standard Plan 511.

5-2.15 BLOW-OFF ASSEMBLIES

Blow-off assemblies shall be as shown in Standard Plan 510.

5-2.16 FIRE HYDRANTS

Fire hydrants shall be 5 ¼ inch MVO “Traffic Model” type with approved breakaway features, and meet or exceed the requirements of AWWA C502 as well as have the following:

- 1) A standard 5 inch Storz pumper port and two 2½ inch NST side ports, all opening by turning counter clockwise with 1½ inch operating nut;
- 2) Be painted with two coats of hi-gloss equipment yellow enamel paint, with the distance from the foot valve stenciled on the hydrant; and
- 3) A 5 inch Storz adaptor.

Fire hydrants shall be M&H 929 Reliant, Mueller Super Centurion 250 only or AVK Series 2780 Nostalgic.

5-2.17 TAPPING SLEEVES

Tapping sleeves shall be used in lieu of cut-in tees except as otherwise approved by the City Engineer. Tapping sleeve valves shall be epoxy coated and resilient seat. Acceptable sleeves include:

Pipe Material	Type of Tapping Sleeve
Ductile Iron or Cast Iron Pipe	Epoxy Coated Fabricated Steel
Asbestos Cement	Fabricated Stainless Steel Full

5-2.18 SADDLES AND CORPORATION STOPS

Service saddles shall be ROMAC, Ford or equal and shall have stainless steel double straps. See Standard Plans 501 and 502.

Corporation stops shall be the ball valve type and shall be Ford or Mueller. Corporation stops for use with the saddle shall be of bronze in accordance with AWWA Standard C800 with AWWA IP inlet by compression outlet.

5-2.19 METER BOXES

Meter boxes used for meters, sampling stations, and blow-offs shall be high density polyethylene meter boxes with solid ductile iron hatches with 2 inch touch read hole manufactured by Mid States Plastics, Inc., or an equivalent as approved by the City Engineer. Refer to Standard Plans 501 and 502 for sizes and part numbers.

5-2.20 PRESSURE REDUCING STATION

Any pressure reducing station for a specific project shall be designed by a qualified, licensed engineer. The design shall be submitted to the City Engineer for approval. A typical pressure reducing station is shown in Standard Plan 520.

5-2.21 REDUCED PRESSURE BACKFLOW ASSEMBLY

All reduced pressure backflow assemblies (RPBA) shall be as listed on the most current edition of the "Approved Backflow Prevention Assemblies" published by DOH. The assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks. The RPBA shall be installed in an above ground enclosure. The enclosure shall be Hot Box, or an equivalent as approved by the City Engineer. See Standard Plans 517 through 519.

5-2.22 DOUBLE CHECK VALVE ASSEMBLY

All double check valve assemblies (DCVA) shall be as listed on the most current edition of the "Washington State Approved Backflow Prevention Assemblies" published by DOH. The assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks. See Standard Plans 514 through 516.

5-2.23 STEEL CASING

Steel casing shall be black steel pipe conforming to ASTM A53. Casing shall be as specified in Standard Plan 522.

5-2.24 CASING SPACERS AND END SEALS

Casing spacers and end seals shall be sized for pipe being installed and shall be manufactured by Advance Products & Systems, Cascade Waterworks, Pipeline Seal and Insulators Co., or an equivalent as approved by the City Engineer. See Standard Plan 522.

5-2.25 CONCRETE

Thrust blocking, encasement, or slope anchor concrete shall be mixed from materials acceptable to the City Engineer and shall have a 30-day compressive strength of not less than 2,500 psi. See Standard Plans 505 and 506.

The mix shall contain five (5) sacks of cement per cubic yard and shall be of such consistency that the slump is between 1 inch and 5 inches. All concrete shall be mechanically mixed.

5-2.26 BEDDING MATERIAL

Bedding material shall be as specified in Section 9-03.12(3) "Gravel backfill for Pipe Zone Bedding" of the WSDOT/APWA Standard Specifications. See Standard Plan 524.

5-2.27 CONTROLLED DENSITY FILL

Controlled Density Fill (CDF) shall be a mixture of Portland Cement, admixture (optional), FlyAsh, aggregates and water. It shall be proportioned to provide a grout, non-segregating, free flowing, self-consolidating and excavatable material that will result in a non-settling fill which has measurable unconfined compressive strength.

Controlled Density Fill (CDF) shall conform to the requirements of Section 2-09.3(1)E of the current WSDOT/APWA Standard Specifications.

5-3 CONSTRUCTION STANDARDS

5-3.01 GENERAL REQUIREMENTS

All work shall be constructed as shown in the plans and in accordance with these Standards.

Materials shall be installed in compliance with the manufacturer's instructions and specifications, except where a higher quality of workmanship is required by the plans and these Standards.

All work shall also be done in accordance with all applicable Federal, State, County and other local laws and regulations. The Contractor shall arrange for inspection by these agencies and shall submit evidence of their approval if requested by the City.

5-3.02 MATERIAL SUBMITTALS

Material submittals shall be submitted to the City Engineer for approval after the plans are approved for construction.

Five (5) sets of material submittals are required. The City Engineer shall either approve or otherwise indicate the reasons for disapproval. Disapproved submittals shall be resubmitted to the City Engineer for approval.

The City Engineer's review of material submittals covers only general conformance to the plans and these Standards and not for quantity determination. No material quantities shall be verified by the City.

Each "Material Submittal" section shall follow a cover page and state the category of the materials that are submitted for review. Each submittal must have the specific part number(s) checked or highlighted along with its specific purpose. The following shows the preferred order to list the material categories:

- 1) Pipe, Fittings, Pipe Restraints and Casing.
- 2) Valves (Gate Valves, Air Valves, Blow-off, and Valve Boxes).
- 3) Hydrants and Attachments.
- 4) Service Fittings, Service Pipe, Saddles, Ball Valves, Corps, Sleeves, etc.
- 5) Boxes for Meters, Sampling Stations, Blow-offs, and Air Valve Assemblies.
- 6) Cross Connection Control Assemblies (DCDA, RPBA, RPDA, DCVA).
- 7) Bedding Material with Sieve Analysis.
- 8) Other items if required.

5-3.03 PRE-CONSTRUCTION CONFERENCE

The party responsible for the project shall contact the City Public Works Inspector (360-282-3193) to schedule a pre-construction conference after the plans, material submittals, grading, and right-of-way permits are approved. The conference shall include the party responsible for the project, design engineer, and contractor, representatives from the permit agencies, other utility companies, and City staff. An on-site tailgate meeting between the contractor and the Public Works Inspector shall be arranged by the contractor at least 48 hours prior to commencing construction.

5-3.04 CONSTRUCTION SCHEDULE

The party responsible for the work shall provide the City Engineer with the water system extension construction schedule a minimum of five (5) business days prior to start of water system extension construction to arrange staking inspection and to give permitting agencies and customers two (2) business days notice.

5-3.05 EASEMENT

Prior to start of water system extension construction, the party responsible for the project must acquire and record all necessary public utility easements for construction, installation and maintenance of any water mains or facilities not located in the public right-of-way, in City easements, or on the party's property.

5-3.06 PERMITS

The party responsible for a water system extension project shall obtain at their expense all necessary permits from the City and other appropriate State and Local agencies and entities. The party responsible for the work shall provide the traffic control plan prepared by themselves, the design engineer or the Contractor.

5-3.07 HANDLING OF PIPE

All types of pipe shall be handled in a manner that prevents damage to the pipe, pipe lining or coating. Pipe shall be bagged or plugged from the manufacturer or supplier before unloading at the site. Pipe and fittings shall be loaded and unloaded using forks or cable choker in a manner to avoid shock or damage, and under no circumstances shall they be dropped, skidded, or rolled against other pipe. Damaged pipe will be rejected, and all damaged pipe shall be placed apart from the undamaged pipe and shall be removed from the project site within 24 hours.

Pipe shall be stacked in such a manner as to prevent damage to the pipe, to prevent dirt and debris from entering the pipe, and to prevent any movement of the pipe. The bottom tiers of the stack shall be kept off the ground on timbers, rails or other similar supports. Pipe on succeeding tiers shall be alternated by bell and plain end. Timbers of 4"×4" dimensions shall be placed between tiers and chocks shall be placed at each end to prevent movement. Each size of pipe shall be stacked separately.

Threaded pipe ends shall be protected by couplings or other means until the pipe is installed. Dirt or other foreign material shall be prevented from entering the pipe or pipe joints during handling and installation. When pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the City Engineer to ensure cleanliness inside the pipe.

5-3.08 STAKING

Staking shall be performed by or under the direct supervision of a land surveyor licensed in the State of Washington. Two (2) business days notice shall be provided to the City to inspect construction staking before construction begins.

Staking shall be placed in 50 foot intervals and at all fittings on base line or edge of easement with stationing, hub elevations, and cuts to top of pipe.

5-3.09 DEVIATION FROM PLANS

No deviations from the approved plans and these Standards shall be allowed without the City Engineer's approval. Minor changes may be approved by the Public Works Inspector. If major

changes are required, the design engineer shall revise, sign and submit the plans for the City Engineer's approval prior to restart of construction.

5-3.10 INSPECTION AND TESTING

The City Public Works Inspector shall have access to the project site for the purpose of inspections and testing at all times. Proper facilities shall be provided for such access, inspection, and testing.

If any work is covered without approval or consent of the City Public Works Inspector, it must be uncovered for inspection if required by the City Public Works Inspector.

Before a pressure test is to be observed by the City Public Works Inspector, the party responsible for the work shall make whatever preliminary tests are necessary to ensure that the material and/or equipment are in accordance with the plans and these Standards. Written and/or verbal notices of deficiency shall be given to the party responsible for the work. The party responsible for the work shall correct such deficiencies before final project inspection by the City Public Works Inspector.

5-3.11 WATER QUALITY

Water pollution controls shall be implemented and maintained until the project is accepted by the City Engineer. The party responsible for the project shall familiarize themselves with the requirements of DOE and other regulatory agencies having jurisdiction over such matters.

Water with chlorine residual must be dechlorinated using City-approved means and discharged into the environment when the water has zero chlorine residual. Dechlorinated water discharged into the environment shall be done so without causing erosion or impact to the environment. With the approval of the City Engineer, water with chlorine residual may be discharged into the City's sanitary sewer system. Water containing chlorine residual shall not be discharged into the storm drainage system or any waterway.

The oil and chemical storage site for the project shall be approved by the City Engineer and the area shall be diked. There shall be no disposal of waste oil or oil products on the project site. A waste oil disposal tank shall be provided if deemed necessary by the City Engineer.

5-3.12 CONSTRUCTION ON EXISTING EASEMENTS

All work within public utility easements shall be performed in accordance with terms and conditions of the respective easement. Each easement area shall be restored to equal to or better than the condition of the easement area that existed prior to the work. Work shall not be performed within any public utility easement area unless such work is specifically authorized by the City Engineer. The party responsible for the project shall provide advance written notification to and shall coordinate the authorized work with the persons and/or entities owning property that is adjacent to the easement area.

5-3.13 PRE-CONSTRUCTION PHOTOS

Prior to commencement of work, photographs shall be provided to the City that clearly show the conditions of the project site immediately before the anticipated start of the work. Photographs will be obtained as follows:

- 1) 50 foot interval in easements up station and down station.
- 2) Any other locations as directed by the Public Works Inspector.

The photographs shall be 4 inch x 6 inch, color prints, contained in albums, catalogued, and cross-referenced. A digital copy of each photograph shall also be provided to the City Engineer.

5-3.14 UNDERGROUND UTILITIES

The plans shall show the approximate locations of various existing utilities known to the design engineer such as gas lines, water mains, storm drainage, power lines, telephone lines, TV cables, fiber optics, and other obstructions based on information obtained from various sources. The party responsible for the project is responsible to check for interferences and obstructions by inquiry from the different utilities and by underground exploration before commencing excavation.

The party responsible for the project shall request field locating and notify the owners of underground utilities about the scheduled commencement of excavation through the one-call system (1-800-424-5555).

Notice shall be made to owners of underground utilities not less than two (2) business days or more than ten (10) business days prior to scheduled date of commencement of excavation. Test pits, for the purpose of locating underground utilities or structures in advance of the construction, shall be excavated and backfilled. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the City or applicable agency.

Excavation around and under active utilities shall be performed with special care to ensure that utility service is not interrupted. Where it is necessary to cut, move or reconnect any service lines, arrangements shall be made with the respective utility owners.

The party responsible for the work shall coordinate with all utility owners and arrange for the movement or adjustment, either temporary or permanent, of utility conflicts and shall also notify the City, in advance, of any conflicts affecting the work.

The party responsible for the project shall indemnify, defend and hold harmless the City from any claim for damage of utilities and/or disruption to services resulting from project activities/operations. The form of the indemnification agreement shall be subject to the approval of the City Attorney.

5-3.15 TRENCH EXCAVATION

Trench excavation and backfill operations within State right-of-way: All excavation and backfill within the State right-of-way shall adhere to the current *WSDOT/APWA Standard Specifications*.

Trench excavation and backfill operations within County right-of-way: Excavation within Snohomish County right-of-way shall conform first to Snohomish County Road Standards, and secondly to current *WSDOT/APWA Standard Specifications*.

Trench excavation and backfill operations within City right-of-way: Excavation within the City right-of-way shall conform to these Standards.

Clearing and grubbing limits may be established by the City or governing agency for certain areas. Debris resulting from the clearing and grubbing shall be appropriately disposed of in accordance with applicable local and State laws and regulations.

Trenches shall be excavated to the line and grade shown in the plans or as designated by the City Engineer. Higher pressure class pipe or special bedding may be required because of excess trench width.

Unsuitable material below the depth of the bedding shall be removed to the extent approved by the Public Works Inspector and replaced with materials approved by the City Engineer.

The length of trench excavation in advance of pipe laying shall be kept to a minimum and shall not exceed more than 100 feet without prior written approval of the City Engineer.

When trenching operations take place in public right-of-way, the pavement and all other improvements shall be restored as required by the right-of-way permit.

When excavation of rock is encountered, all rock shall be removed to provide a clearance below and on each side of all pipe, valves, and fittings of at least 6 inches for pipe sizes 24 inches or smaller and 9 inches for pipe sizes 30 inches and larger. Material removed shall be replaced with appropriate backfill material, which shall be compacted to 95% standard proctor. See Standard Plan 525.

5-3.16 SHEETING AND SHORING

Sheeting and shoring shall be provided and installed as necessary to protect workers, the work and existing utilities and other properties in compliance with OSHA and WISHA requirements. All sheeting and shoring above the pipe shall be removed prior to backfilling. Sheeting below the top of the pipe may be cut off and left in place. Removal of the sheeting and shoring shall be accomplished in such a manner that there will be no damage to the work or to other properties.

5-3.17 TRENCH DEWATERING

Sufficient pumping equipment shall be provided and maintained on the project site to keep the trench free from standing water. Surface runoff shall not be allowed to flow into the trench. The trench water or other deleterious materials shall not be allowed to enter the pipe at any time. If water is found to be entering the new water main at any time, the water main shall be plugged and all work shall stop until the trench water is completely pumped out or otherwise controlled to the satisfaction of the Public Works Inspector. Any dewatering method used shall be in accordance with the specifications and requirements of the City and DOE.

5-3.18 PIPE BEDDING

Bedding material, when required by the City, shall be as specified in these Standards and the current WSDOT/APWA Standard Specifications. For the type of pipe (rigid or flexible) to be installed, pipe zone bedding is defined as 6 inches below the pipe and around the pipe, and 12 inches above the pipe. Native material may be used for bedding of ductile iron pipe if judged to be suitable by the City Engineer. Gravel backfill for pipe zone bedding shall be select granular material free from wood waste, organic material, and other extraneous or objectionable materials and shall have a maximum dimension of 1½ inches. Pipe zone bedding up to 12 inches over the top of the pipe shall be evenly and carefully placed. Gravel backfill for pipe zone bedding shall be compacted to 95% maximum dry density per ASTM D1557 by approved methods (hand-held tools), so as to provide firm and uniform support for the full length of the pipe, valves, and fittings. See Standard Plan 524.

5-3.19 CONCRETE THRUST BLOCKING

Bends, tees, plugs, reducers, and caps, unless otherwise specified, shall be blocked in accordance with Standard Plans 505 and 506. All poured in place blocking shall have a minimum measurement of twelve inches 12 inches between the pipe and the undisturbed soil. Concrete blocking shall have a minimum of ¼ square foot bearing against the fitting. Blocking shall be adequate to withstand full test pressure as well as to continuously withstand operating pressure under all conditions of service. All concrete shall be 2,500 psi minimum and mechanically mixed.

Blocking shall, unless otherwise shown or directed, be placed so that pipe and fittings will be accessible for repair. Eight-mil polyethylene sheets shall be installed around all fittings and all bolts, nuts, and glands for future dismantling.

In the event of a shut down where time does not permit the proper setting of the concrete blocking, ecology blocks shall be installed with concrete poured around the connection point of the fitting and the blocks with the approval of the Public Works Inspector.

5-3.20 TRENCH BACKFILL AND COMPACTION

Trench backfill shall be done above the pipe zone bedding. All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, frozen soil, or other unsuitable material. Trench backfill material shall be as specified in these Standards and the current WSDOT/APWA Standard Specifications.

Compaction of the backfill shall, at the minimum, be accomplished by mechanical tamper, by vibrating, by rolling, or by a combination of these methods, as approved by the City Engineer. Water settling is not permitted. A testing laboratory acceptable to the City Engineer shall be used to perform on-site density tests to show that the specified density has been obtained. The approval of the compaction method and the achievement of the specified density shall in no way relieve the Contractor of responsibility for all repairs caused by settlement of the backfill prior to acceptance and during the two year period after acceptance of the project.

Prior to backfilling, form lumber and debris shall be removed from the trench. Sheeting used by the Contractor shall be removed just ahead of the backfilling. Backfill shall not be deposited in the trench in any manner which will damage or disturb the pipe or the initial backfill. Care shall be taken to prevent any damage to the pipe or its protective coating. After the initial backfill is placed,

the remaining backfill material shall be placed in successive layers not exceeding 1 foot, (12 inches) in loose thickness, and each layer shall be compacted to the density specified below. Asphalt pavement restoration shall either be by a patch or overlay method as required and noted on the right-of-way permit. When a patch method is used, the trench limits shall be saw cut prior to the final patch.

All pavement cuts shall be made by saw cuts. The saw cuts shall be 1 foot outside the trench width. If the permit requires an overlay, then the Contractor may use a jackhammer for cutting the existing pavement. Grinding may be required.

All trenching shall be backfilled in accordance with Standard Plan 525. All trench backfill materials shall be compacted to 95% maximum dry density, as determined by ASTM D1557.

Native material may be used for backfill upon approval of the City Engineer or the permitting agency.

When the trench is perpendicular to the traveled lane or any driveways, the full depth shall be backfilled with crushed surfacing top course material. When the trench is parallel, the top 4 feet must be backfilled with crushed surfacing top course material. Controlled Density Fill (CDF) may be required by the City Engineer or the permitting agency.

Backfill compaction shall be performed in 8 to 12 inch lifts. Compaction tests shall be performed in 4 foot vertical increments maximum. The test results shall be given to the City Engineer for review and approval prior to paving. Tests shall be performed at maximum intervals of 50 feet along the length of the trench.

If the area is unpaved and not subject to vehicle traffic, the backfill shall be compacted to a minimum of 90% of maximum dry density as determined by ASTM D-1557.

5-3.21 LAYING DUCTILE IRON PIPE

Work shall be accomplished in accordance with AWWA C600 and the manufacturer's recommendations.

Depths of pipe shall conform to approved plans. The typical cover depth of pipe is 36 inches measured from finished grade to top of pipe.

The bottom of the trench shall be finished to grade in such a manner that the pipe will have bearing along the entire length of the barrel. Bolts on mechanical pipe and fittings shall be tightened uniformly with a "Torque" wrench which measures the torque for mechanical joints as follows:

2 inch to 3 inch pipe sizes $\frac{5}{8}$ inch bolts 40 to 60 foot pounds

4 inch to 24 inch pipe size $\frac{3}{4}$ inch bolts 60 to 90 foot pounds

Except where restrained joint systems are required, mechanical or push-on Tyton joints shall be used. Installation of push-on joint pipe shall be in accordance with the manufacturer's instructions.

When it is necessary to deflect pipe from a straight line in either the horizontal or the vertical plane, the amount of joint deflection shall not exceed one half (1/2) of the maximum deflection recommended by the pipe manufacturer. The pipe manufacturer's joint deflection recommendations shall be provided to the City Engineer prior to pipe installation as a part of the Material Submittals.

Where field conditions require deflection or curves not anticipated on the plans, an appropriate plan revision shall be prepared by the design engineer and submitted to the City Engineer for approval.

Whenever it becomes necessary to cut a length of pipe, the cut shall be done in conformance with all safety recommendations of the cutting equipment manufacturer. Cutting shall be done in a safe manner without creating damage to the pipe or cement mortar lining. The cut shall be made by an abrasive pipe saw or an approved pipe cutter.

The outside of slip joint pipes shall be beveled and smoothed so that good connections can be made without gasket damage.

All parts of the pipe ends, couplings, fittings and appurtenances shall be cleaned to remove oil, grit, or other foreign matters from the joints. Care shall be taken to keep the joints from contacting the soil.

5-3.22 POLYETHYLENE ENCASUREMENT

Installation of polyethylene encasement shall be in accordance with the latest AWWA Standard C105. All ductile iron pipe and fittings installed in highly corrosive soils shall be wrapped in a manner approved by the City Engineer except as specifically excluded in the approved plans or in these Standards.

5-3.23 FIRE HYDRANT INSTALLATION

Fire hydrants shall be set as shown in Standard Plans 507 through 509 and AWWA Standard C600. The portion of the hydrants above the ground shall be painted with 2 coats of high gloss equipment yellow paint. The entire hydrant run shall be restrained joint.

All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb or at the City Fire Marshall's discretion, with pumper nozzle facing the curb. Hydrants shall be set to the established grade. Hydrants shall be installed so that the breakaway flange is 2" to 6" inches above finished grade per Standard Plan 507.

When a dry barrel hydrant is set, drainage shall be provided at the base of the hydrant by placing 1½ inches of washed drain rock from the bottom of the trench to at least 12 inches above the drain port opening in the hydrant and to a distance of 2 foot around the elbow. Fire hydrants shall not be located within 10 feet horizontally of a sanitary sewer main or side sewer.

When a hydrant is installed in an unpaved area, a concrete fire hydrant pad shall be installer per Standard Plan 508.

Additional information regarding placement of hydrants can be found in AWWA Manual M17.

When fire hydrants are located in parking lots, or other areas where vehicles may have access, hydrant guard posts shall be installed. Guard posts shall be installed according to the minimum dimensions shown in Standard Plan 509.

Reflective pavement markers for fire hydrants are required.

5-3.24 VALVE INSTALLATION

Prior to installation, valves shall be inspected for approved part/maker's numbers; cleanliness of valve ports, especially seating surfaces, handling damage, and cracks.

When butterfly valves are installed, the operation nuts must be on the north or east sides of the water mains or as directed by the Public Works Inspector.

The valve and valve box shall be set plumb and centered on the valve. Valves 12 inches or larger shall be supported by a concrete block (16 inches x 16 inches x 4 inch solid concrete) on a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

Valves shall be installed in the closed position. Where the valve operating nut is more than 3 feet below finished grade, a valve stem extension conforming to the Standard Plans must be installed. See Standard Plan 512. Tapping valves shall be water tested prior to tapping water main.

A valve box or vault shall be provided for every valve. Valve box top sections shall be adjusted flush with the finished pavement, and in those areas to be excavated for future roadway grades, enough adjustment shall be provided in the valve box to allow the top of the box to be adjusted to the required grade.

Backfill around valves shall be carefully tamped in 6 inch lifts for the full depth of the trench with the valve box in place. A minimum of 2 feet x 2 feet x 4 inch concrete pad shall be provided for a single valve box and a minimum of 4 feet x 4 feet x 4 inch concrete pad shall be provided for multiple valve boxes installed in gravel or unpaved areas as shown in Standard Plan 512.

5-3.25 COMBINATION AIR AND VACUUM RELEASE VALVE

Location of the air/vac shown in the plans is approximate. Air valves shall be set at the high points of the water main. The water main profile may need adjustment so that the high point and air/vacuum valve is installed in a convenient location with the Public Works Inspector's approval. Installation shall be as shown in Standard Plan 511.

5-3.26 BLOW-OFF ASSEMBLIES

Blow-off assemblies shall be installed as shown in Standard Plan 510. A valve marker post shall be installed when the gate valve is installed in unpaved area or as directed by the Public Works Inspector.

5-3.27 VALVE MARKER INSTALLATION

Marker posts shall be set for all valves located in unpaved areas and as directed by the City Engineer except auxiliary hydrant valves. Installation shall be as shown in Standard Plan 509.

5-3.28 SERVICE LINES

New Service Installations

Generally, corporation stops are located at ten o'clock or two o'clock positions on the circumference of the pipe. Taps shall be accomplished by saddle tap only. No direct taps shall be allowed. Taps shall be installed with double strap stainless steel saddles. When more than one tap in an existing cast iron pipe is necessary to deliver the required flow, the taps should be staggered around the circumference at least 12 inches apart (not in line). The service line shall be pressure tested before placing in service. Service installation shall be as shown in Standard Plans 501 through 504a.

Reconnecting Existing Services

Service connections shall be installed as shown in the approved plans and Standard Plans. Service lines shall be installed in paved areas by boring, and under sidewalks and curbs by boring and tunneling. Damages shall be repaired by the Contractor. A 30 inch minimum cover shall be provided on service lines. Service lines shall be installed 90 degrees horizontally to the main to intercept the existing meters. Installed service lines shall be flushed prior to connection to the meter.

Angle ball meter valves, check valves and setters (if required) and boxes shall be installed as shown in the Standard Plans or as directed by the City Engineer.

Existing service connections shall not be transferred to the new mainline until the new mainline has been successfully flushed, disinfected, tested and approved by the Public Works Inspector. When transferring services from the existing mainline to the new mainline, sanitary precautions shall be taken as necessary to protect the potable water supply in both the existing and new mains.

5-3.29 PRESSURE REDUCING STATION

Pressure reducing stations shall be installed as shown in Standard Plan 520, in approved plans, and in accordance with the manufacturer's recommendations. The pressure reducing valves, strainers, pressure relief, pipe and fittings shall be constructed in accordance with the applicable AWWA and Uniform Plumbing Code requirements. Pressure reducing valves 6 inches or larger shall be supported by pipe supports. Supports shall be bolted to the vault floor.

Pressure relief discharge pipe shall be placed in a location that will not be subject to damage or erosion during discharge of water. The pressure reducing valve manufacturer's representative(s) shall be present during the start up of the pressure reducing station.

5-3.30 CONNECTION TO EXISTING WATER MAIN

Points of connection to existing water mains shall be exposed prior to trenching of the new mains, and not less than 48 hours prior to the anticipated connection time. Unless specifically provided for

elsewhere in these Standards, at least five (5) business days notice shall be given to the City Engineer prior to the anticipated connection time. The City Engineer shall be responsible for notifying the City Fire Chief and customers affected by the shut-off. Water main shut-off shall not be scheduled to take place on Fridays, or on the day before a holiday, unless otherwise approved by the City Engineer.

The party responsible for the project shall ensure that existing fittings are in accordance with the approved plans and that the connection will be made in accordance with the plans. If the connection cannot be made in accordance with the plans, the City Engineer shall be so notified. The design engineer shall submit revised plans that provide appropriate connection to the City Engineer for approval.

Connection to the existing water system shall be done only after the new mains are flushed and have passed pressure and purity tests. All connections to the existing water system must be approved by the City Engineer and shall be made in the presence of the City Public Works Inspector. Only authorized City representatives shall operate the valves in the existing water system.

Connections to existing water system may be made under pressure with a tapping machine by determining the size and type of pipe and installing a tapping tee with a tapping gate valve. Tapping tees shall be installed as shown in Standard Plan 513. Work shall not start until all materials, equipment, and labor are ready. The tapping tee and valve shall be installed in a horizontal position so that the valve stem is vertical. Where cut-ins are required in existing pipes, the work shall be conducted so as to minimize the interruption of service. Necessary pipe, fittings and gate valves shall be assembled at the site ready for installation prior to the shut-off of water in the existing main. Once the water main has been shut off, the work shall be promptly completed and shall not be halted until the water main is back in service.

The interiors of all pipe and fittings, particularly couplings and sleeves, to be used in final cut-in connection shall be swabbed or sprayed with a 200 mg/L hypochlorite solution prior to installation.

Flushing shall start as soon as repairs or connections are completed and shall be continued until discolored water is eliminated. Flushing shall be done in the presence of the City Water Quality Control Specialist.

5-3.31 SCHEDULE OF TESTS

The Public Works Inspector and the Water Quality Control Specialist shall be notified at least two (2) business days before a section of water main is ready for inspection and test. The Water Quality Control Specialist shall inspect and observe the hydrostatic test. The City Engineer shall be notified at least two (2) business days prior to purity test and flushing. The party responsible for the project shall be present at the project site when the Water Quality Control Specialist takes water samples. Sufficient manpower and resources shall be provided by the responsible party to accomplish the work in a timely manner. Flushing shall be done under direct supervision of the Water Quality Control Specialist.

5-3.32 HYDROSTATIC PRESSURE TESTS

Water main, appurtenances and service connections shall be tested in sections of convenient lengths under a hydrostatic pressure of 220 psi for 15 minutes.

Pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose, piping, and measuring equipment necessary for performing the test shall be furnished and operated by the party responsible for the project.

Sections to be tested shall normally be limited to a maximum of 1,000 feet. The pipe shall be backfilled sufficiently to prevent movement of the pipe under pressure. Thrust blocking shall be in place for an adequate time for concrete to cure before testing. Where permanent blocking is not required, temporary blocking shall be furnished and installed prior to and removed after testing.

An approved double check valve assembly (DCVA) shall be provided to fill the new water mains for testing and flushing. The new water mains shall be filled and remain under 200 psi to 210 psi pressure for 24 to 48 hours to allow air to escape and the lining of the pipe to absorb water.

The pressure test shall be accomplished by pumping the main up to 200 psi to 210 psi, stopping the pump for 15 minutes, and pumping the main up to the test pressure again. During the test, the section being tested shall be observed to detect any visible leakage.

A clean container shall be used for holding water for pumping up pressure on the main being tested.

The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter. The meter shall be approved by the City Water Quality Control Specialist. Acceptability of the test will be determined as follows: The quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula:

$$L = \frac{SD\sqrt{P}}{266,400} \quad \text{in which,}$$

L	=	allowable leakage (gallons/hour)
D	=	nominal diameter of the pipe (inches)
P	=	test pressure during the leakage test (psi)
S	=	gross length of pipe tested (feet)

There shall not be an appreciable or abrupt loss in pressure during the 15 minute test period. Any visible leakage shall be corrected regardless of the allowable leakage specified above. Should the tested section fail to meet the pressure test successfully as specified, the defects shall be located and repaired and the pipeline retested.

Tests shall be made with the hydrant auxiliary gate valves open and the hydrant valve in the closed position. Once the new line is successfully tested, each valve shall be tested by closing each in turn and relieving the pressure behind it. The mains shall be tested between valves. As possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. This test of the valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The pressure differential across the valve shall not exceed the rated working pressure of the valve.

All service lines shall be flushed prior to contacting the Water Quality Control Specialist for a pressure test. All necessary equipment shall be ready and available for set up but not connected until the Water Quality Control Specialist is present for operation.

Defective materials or workmanship discovered as a result of hydrostatic field test shall be replaced or repaired and the hydrostatic test shall be repeated to the satisfaction of the City Engineer.

5-3.33 DISINFECTION AND FLUSHING OF WATER MAINS

Before being placed into service, new water mains and repaired portions of existing mains shall be chlorinated and a satisfactory bacteriological report obtained. Disinfection of water mains shall be accomplished in accordance with the requirements of the Washington State Department of Health, AWWA Standard C651, and in a manner satisfactory to the City Engineer. Sections shall be disinfected between adjacent valves unless otherwise approved by the City Engineer. All filling and flushing shall be done through a meter with a DCVA provided by the party responsible for the project. Valves shall only be operated by authorized City employees.

Flushing

Where dry calcium hypochlorite is used for disinfection of the pipe, flushing shall be done after disinfection. If a hydrant is not installed at the end of the water main, the Contractor shall provide a tap large enough to develop a flow velocity of at least 2.5 feet per second in the water main.

The flushing period must be approved by the City Engineer. The source water used for disinfection and pressure testing shall be flushed prior to its use to ensure that contaminants or debris are not introduced into the new pipe.

Taps for temporary or permanent release of air, chlorination or flushing purposes shall be provided as a part of the construction of the water mains.

Chlorination

The section to be tested shall be chlorinated so that a chlorine residual of no less than 25 mg/l (parts per million or ppm) remains in the water after standing 24 hours in the pipe. The initial chlorine content of the water shall not be less than 50 mg/l. The forms of chlorine that may be used in the disinfection operations are liquid chlorine and calcium hypochlorite granules.

Liquid Chlorine: Chlorine shall be applied by solution fed at one end of the section with a valve or hydrant at the opposite end open sufficiently to permit a flow through during chlorine application. The chlorine solution shall be fed into the pipeline already mixed by an automatically proportioning applicator to provide a steady application rate no less than 50 mg/l (ppm) chlorine. Hydrants along the chlorinated section shall be open during application until the presence of chlorine has definitely been detected in each hydrant run. When a chlorine concentration of no less than 50 ppm has been established throughout the line, the valves shall be closed and the line left undisturbed for 24 hours.

Dry Calcium Hypochlorite: Calcium hypochlorite conforming to AWWA B300 is available in granular tablet form and must contain approximately 65% available chlorine by weight. This

procedure is allowed only when the extension has been kept clean and dry. If piping has been submerged, or is unclean, refer to AWWA Standard C651.

Granulated chlorine: Dry calcium hypochlorite at 65% - 70% chlorine shall be placed in the pipe to yield a dosage no less than 50 mg/l. The number of ounces of 65% test calcium hypochlorite required for a 20 foot length of pipe equals $0.00843ld$, in which "D" is the diameter in inches (see current WSDOT Standards and Specifications). The main shall be filled with water at a rate to ensure that the water within the main will flow at a velocity no greater than 1 foot per second. Precautions shall be taken to ensure that air pockets are eliminated. When a chlorine concentration of not less than 50 ppm has been established throughout the line, the valves shall be closed and the line left undisturbed for 24 hours. If the water temperature is less than 41 degrees F, the water shall remain in the pipe for at least 48 hours.

After chlorination in accordance with the above, the line shall be thoroughly flushed and water samples taken. Flushing shall be done in a manner that avoids damage to surrounding property and that conforms to these Standards.

5-3.34 FINAL FLUSHING AND TESTING

Following chlorination, chlorinated water shall be flushed from the new water main until the replacement water throughout its length shows an absence of chlorine. In the event chlorine is normally used in the source of supply, the tests shall show a residual not in excess of that normally carried in the water supply system (never to exceed 2 mg/l).

After final flushing and before the new water main is connected to the distribution system, a sample collection test shall be scheduled with the City Engineer a minimum of two (2) business days in advance of test. The number of samples from the source and the number of representative sample points required will be determined by the Water Quality Control Specialist. Appropriate sample taps shall be furnished by the party responsible for the project. No hose or fire hydrant shall be used in the collection of samples.

At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for total coliform bacteria and for heterotrophic bacteria by the heterotrophic plate count (HPC) analysis. The maximum allowable coliform content of the flushed sample shall be zero. The maximum allowable HPC population count in all source samples shall be 80/ml. Any source sample that exceeds a count of 80/ml shall be ruled as an indeterminate test and a new set of source and construction samples for analysis shall be required. The maximum allowable HPC population count from any construction sample shall be no greater than twenty (20) counts above the highest source HPC population count.

Before placing the lines into service, a satisfactory report shall be provided to the Water Quality Control Specialist from the certified laboratory evidencing successful tests on samples collected from representative points in the system extension.

Should the initial test result in an unsatisfactory bacteriological test, additional chlorination using the above procedure shall be repeated until satisfactory results are obtained. Treated water flushed from the mains shall be disposed of in accordance with applicable State and local laws and regulations.

Chlorinated water shall never be flushed into the storm drain or a body of water. This includes lakes, rivers, streams, stormwater drainage systems, and any waters where fish or other natural aquatic life can be expected to be present.

5-3.35 ADJUST EXISTING STRUCTURE TO GRADE

Existing Structure Adjustment

Existing structures, including valve box covers affected by a pavement overlay, or adjustment in surface grade, shall normally be adjusted to grade within three (3) business days after the pavement overlay. The City Engineer may require immediate adjustment if the structure is critical to operations.

Valve Box Adjustment in Paved Areas

Raising the existing valve box shall be accomplished by adjusting the existing top section of the valve box or replacing the valve box. If the valve box base section needs to be extended, a 4 inch diameter cast iron soil pipe shall be installed with the bell end of the soil pipe inserted over the top of the existing valve box base section. The spigot end of the soil pipe shall be located a minimum of 6 inches and a maximum of 9 inches below finished grade. The valve box top section shall be slipped over the soil pipe and adjusted to the final grade. A polyethylene sheet, 8-mil thick, shall be placed between the valve box and soil pipe to prevent metal to metal contact where the sections overlap. In asphalt concrete pavement and overlay areas, excavation of the valve box to be raised shall be accomplished by saw cutting or neat line jack hammering the pavement a minimum of 12 inches around the perimeter of the valve box. The final adjustment of valve boxes shall be done within 24 hours after paving. Paving, repaving, and patching shall be completed within 72 hours.

Valve Box Adjustment in Unimproved Areas

Adjustment of valve box covers located in unpaved areas shall be the same as in paved areas.

5-3.36 ABANDONING FACILITIES

Abandonment of Water Main

Water mains no longer in service shall be removed and disposed of by the party responsible for the project. The water main may be abandoned in place with the approval of the City Engineer. When water mains are abandoned, the ends of the pipe and fittings shall be plugged by filling with Class 2500 concrete a minimum length of 12 inches on each pipe end. The City Engineer may require that the abandoned water mains be filled with sand or cement grout depending on the size, material, and location of the water main.

Removal of Service Lines

Service lines that are no longer in service and associated corporate stops shall be removed and disposed of by the party responsible for the project. Saddles shall be plugged with MIPT brass plugs.

Abandonment of Structures

Abandonment of structures shall be completed only after water facilities have been properly removed and/or abandoned. All valves and valve boxes shall be removed on abandoned valves.

5-3.37 LANDSCAPING AND LAWN REMOVAL AND REPLACEMENT

During the construction and installation of a water distribution system, the party responsible for the project shall minimize the disturbance and damage to any landscaping and lawn within the project area and shall restore the landscaping and lawn area to conditions prior to construction and installation.

5-3.38 BORING UNDER ROOTS

Boring under the root systems of trees that cannot be removed shall be accomplished by excavating a trench or pit on each side of the tree, being careful to avoid root injury, and then hand digging or pushing the pipe through the soil under the tree. The pit walls shall be a minimum of 7 feet from the center of the tree and shall have sufficient depth to lay the pipe at the grade shown on the plan and profile. Trees shall be removed unless otherwise directed by the City Engineer.

5-3.39 BORING AND JACKING

The vertical and horizontal location of existing utilities shall be verified by the party responsible for the project. If required to avoid conflicts and maintain minimum clearances, adjustment shall be made to the grade of the casing.

The pipe shall be bored and jacked where shown on the plans. All obstructions encountered shall be removed or penetrated. If groundwater is found to be a problem during boring operations, all necessary measures shall be taken to control the flow sufficiently to protect the excavation, pipe and equipment so that the work is not impaired. Any pipe damaged during the boring and jacking operation shall be repaired in a manner approved by the City Engineer.

The installation of the bored and jacked pipe shall be done in manner to ensure that no settlement or caving is caused to the above surface. Any such caving caused by the placement of the pipe shall be repaired by the party responsible for the project as directed by the City Engineer.

During the jacking operations, particular care shall be exercised to prevent caving ahead of the pipe which will cause voids outside of the pipe. If voids exist, the party responsible for the project shall drill through the wall of the pipe and fill the voids by pumping cement grout. All voids shall be filled to the satisfaction of the Public Works Inspector.

The carrier pipe shall be installed in the casing as shown in the City Standard Plans. The carrier pipe shall be supported with casing spacers as shown in the Standard Plans. The casing spacers shall conform to these Standards. The material shall be resistant to abrasion and sliding wear. There shall be a minimum of two spacers per length of pipe, and the spacing between spacers shall be as shown in Standard Plan 522. Spacers shall be installed per manufacturer's instructions.

Boring and receiving pits shall be backfilled with select native material approved by the City Engineer and compacted to 95% maximum dry density as determined by ASTM D-1557. A sufficient amount of select backfill material shall be provided to make up for the rejected material.

All disturbed ground shall be restored to its original condition or better.

5-3.40 WORKING WITH ASBESTOS CEMENT PIPE

When working with asbestos cement pipe, the work shall be done in manner that minimizes workers' exposure to asbestos material at or below the exposure limit as prescribed in WAC 296-62-07705 State and Federal Guidelines and Certification and PSAPCA requirements.

5-3.41 ASBESTOS CEMENT WATER MAIN CROSSINGS

Where a new utility line crosses below an existing asbestos cement (A.C.) water main, the A.C. water main shall be replaced with ductile iron pipe to a minimum of 8 feet on either side of the pipe crossing. Where directed by the City Engineer, the trench shall be backfilled with CDF from the bottom of the trench to the bottom of the A.C. main. All DIP crossings shall be constructed using ROMAC extended range transition couplings.

5-3.42 CONTROLLED DENSITY FILL

Controlled Density Fill (CDF) shall be used only by approval of the City Engineer. CDF can be proportioned to be flowable, non-segregating, or excavatable by hand or machine. Desired flowability shall be achieved with the following guidelines:

Low Flowability	below 6 inch slump
Normal Flowability	6 – 8 inch slump
High Flowability	8 inch slump or greater

CDF shall be placed by any reasonable means into the area to be filled. CDF patching, mixing and placing may be started if weather conditions are favorable, when the temperature is at 34 degrees F and rising. At the time of placement, CDF must have a temperature of at least 40 degrees F. Mixing and placing shall stop when the temperature is 38 degrees F or less and falling. Each filling stage shall be as continuous as possible. CDF shall not be placed on frozen ground.

Trench section to be filled with CDF shall be contained at either end of the trench section by bulkhead or earth fill.

When used to support existing A.C. pipe, the flowable CDF shall be brought up uniformly to the bottom of the A.C. pipe, as shown on the plans, or as directed by the City Engineer. Steel plates shall be provided and installed to span the utility trenches and prevent traffic contact with CDF for at least 24 hours after placement or until CDF is compacted or hardened to prevent rutting by construction equipment or traffic.

If CDF is used for trench backfill on ductile iron pipe it shall be encased in 5/8 inch minus crushed rock and services shall be encased in sand.

5-3.43 VAULT INSTALLATION

Vaults for water facilities (pressure reducing stations, valves, water service, flow meters, backflow prevention assemblies, etc.) shall be installed at the locations shown on the plan and as staked. Vaults shall be constructed as shown on the plans, Standard Plans and as directed by the City Engineer.

The excavation shall have a minimum of one (1) foot clearance between the vault outer surface and the earth bank. Foundation gravel or bedding concrete shall be used on top of undisturbed soil to support the vault. The vault shall be plumb and watertight. The access cover shall be seated properly to prevent rocking and shall be adjusted to match the finished grade.

The vault floor shall drain to daylight, or to a location specified on the plans. Gravity drain pipe shall be a minimum of 3 inches in diameter.

Where knockout locations for the pipe do not coincide with the locations of pipe penetrations into the vault, the party responsible for the project shall core drill openings for pipe.

A sump pump shall be required if directed by the City Engineer.

5-3.44 UTILITY CROSSING

If the minimum vertical distance between utility pipes is less than 6 inches and such installations are approved by the permitting agency, a rigid foam pad shall be placed between the pipes. The pad shall be outside diameter O.D. × O.D. × 2.5 inches thick minimum or as required to protect the pipes and O.D. is equal to the outside diameter of the larger pipe. The pad shall be a polyethylene foam plank (Dow Plastics Ethafoam 220), or approved equal. Additional measures may be necessary to ensure system integrity and may be required as evaluated by the permitting agency on a case by case basis.

END OF SECTION