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5-1 DESIGN

5-1.01 GENERAL

All sanitary sewer mains, manholes, side sewers, and other sanitary sewer facilities shall be designed and constructed in accordance with the latest edition of the *"Criteria for Sewage Work Design"* published by the *Washington State Department of Ecology*, the WSDOT/APWA Standards Specifications, and these Standards.

5-1.02 SANITARY SEWER MAIN EXTENSION

A sanitary sewer main extension shall be required when the property does not front a sewer main. The sewer main shall be extended 5 feet beyond the farthest edge(s) of the property, or as directed by the City Engineer. The sanitary sewer shall be sized for the ultimate development of the tributary area and match the City's Sanitary Sewer Comprehensive Plan. The City may require the installation of a larger size main if the City determines that it is needed to meet the requirement for future service. 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, type, and conditions of existing sewer mains. If the proposed development requires pump station and/or force main upgrade, it shall be done at the Developer's expense. The extent of the improvements shall be extended from the project to a point where the system is deemed reliable. The improvements shall be consistent with the City's Design Standards for new construction and must be approved by the City Engineer.

If the Developer's project directly benefits other property owners, the Developer may enter into a reimbursement agreement with the City per AMC Chapter 12.32.

5-1.03 SANITARY MANHOLE

Manhole Location

Sanitary sewer manholes shall be located so that the center of the frames and covers shall be in the middle of the traveled lanes on the west or south side of the street center lines, or as directed by the City to make sure frames and covers are not located in the tire track of a traveled lane. If sanitary sewers are in easements, they shall be in the middle of the easements and parallel to the easement lines unless otherwise directed by the City Engineer.

Sanitary manholes shall be installed at the end of each line; all changes in grade, size, or alignment; all intersections; and at distances not greater than 400 feet.

Drop Manhole

Drop manholes may be allowed if a sanitary sewer extension has no possibility of future extension to avoid unnecessary construction costs. See Standard Detail SS-060.

Manhole Diameter

The sanitary manhole diameter depends on sizes, location and number of holes for pipes. The minimum diameter of manholes shall be 48 inches. Larger diameters are required for larger diameter sewers. The maximum pipe size is 12 inches for 48 inch manholes, 24 inches for 54 inch manholes, 36 inches for 72 inch manholes, and 48 inches for 96 inch manholes.

The minimum distance between cutout holes is 8 inch (48 inch or 54 inch manholes) and 12 inches (72 inch or 96 inch manholes) measured on the inside of the manhole. The cutout hole size is equal to the outer pipe diameter plus manhole wall thickness. A minimum access diameter of 24 inches shall be provided. See City Standard Details SS-010 and SS-015.

Manhole Depth

The minimum sanitary manhole depth shall be 7 feet. The minimum depth of flat-top manholes may be used with the approval of the City. Where depths are more than 25 feet, the manhole base slabs shall be designed by a Professional Structural Engineer licensed in the State of Washington.

Manhole Inverts

Drop in invert elevation across the manhole shall typically be from 0.1 to 0.2 feet. Maximum allowable drop in invert elevation across the manhole shall be 2.0 feet.

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

Clean-Out

Cleanouts are not an acceptable substitute for manholes. This rule does not apply to 6 inch building sewers. Clean-out location and spacing for building sewers are governed by Section 5-1.13 in these Standards.

5-1.04 SANITARY SEWER PIPE

Sewer Pipe Sizing

No public gravity sewer 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 ultimate development, peak flow including inflow/infiltration (I/I) shall not exceed 50% capacity of the main. Existing sewer mains shall have peak flow of 75% capacity of the main.

No storm drainage connections shall be made to the City's sanitary sewer system.

Pipe Material

Sanitary sewer pipe shall be SDR 35 PVC conforming to ASTM 3034 where invert depths are from 5 feet to 14 feet. When invert depths are shallower than 5 feet or deeper than 14 feet, Class 52 ductile iron pipe (DIP) epoxy coated or 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 must be DIP or C900 including side sewers.

Sewer Depth

In general, gravity sewers should be sufficiently deep to receive wastewater from basements. Gravity sewers should also be sufficiently deep to benefit future developments. The minimum depth of gravity sewer is 5 feet.

Slope

Sanitary sewers shall be laid with uniform slope between manholes. All sanitary 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 using an "N" value of 0.013. The following are the minimum slopes, however, slopes greater than these are desirable.

Sewer Pipe Diameter	**Minimum Slope**
(inches)	**(% 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 pipe slope exceeds 20%. Each pipe length shall have one anchor block and they shall be spaced at 20 foot on center.

Timber baffle or hill holders shall be required on unpaved slopes that exceed 20%, with minimum spacing of 20 feet on center.

Alignment

In general, sanitary sewers 24 inches or smaller shall be laid with straight alignment between manholes. Curvilinear alignment of sewer larger than 24 inches may be considered on a case-by-case basis, providing compression joints are specified and the specific pipe manufacturer's maximum allowable pipe joint deflection limits are not exceeded. Curvilinear sewers shall be limited to simple curves which start and end at manholes. When curvilinear sewers are proposed, minimum slopes required in these Standards must be increased accordingly to provide a recommended minimum velocity of 2.0 feet per second when flowing full.

Changes in Pipe Size

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

5-1.05 SEWER IN RELATION TO STREAMS

Sanitary sewers crossing streams 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 shall be designed to minimize the number of stream crossings.

Sanitary sewers 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. Sanitary 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 is located in rock;

2) A minimum of 5 feet of cover above the top of the casing pipe in other material.

5-1.06 AERIAL CROSSING

Supports shall be provided for all joints in sanitary sewer for aerial stream crossing. The supports shall be designed to prevent frost heave, overturning, and settlement.

Precautions against freezing, such as insulation and increased slope, shall be provided. Expansion joints shall be provided between above ground and below ground sewers.

For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe shall be placed no lower than the elevation of the 100 year flood. Ductile iron pipe with mechanical joints is required.

5-1.07 HORIZONTAL SEPARATION FROM OTHER UTILITIES

Sanitary sewer mains shall be laid 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 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.

Horizontal clearances from sanitary sewers:

Cable	5’
Gas	5’
Power	10’
Storm drain	5’
Telephone, Fiber optic	10’
Water	10’

5-1.08 VERTICAL SEPARATION FROM OTHER UTILITIES

Sewers crossing water mains shall be laid 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 the water main to be above the sewer main. Where a sewer crosses a water main, one full length of water pipe (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 has the right to 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 as directed by the City Engineer. DOE criteria will also apply.

Vertical clearances from sanitary sewer:

Cable	1’
Gas	1’
Power	1’
Storm drain	1’
Telephone, Fiber optic	1’
Water	1.5’

5-1.09 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 City Standard Detail W-230. 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 if not owned by the City. 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. The Design Engineer shall refer to the City Standard Detail W-230.

5-1.10 SEWER CONNECTION

A side sewer shall be connected to the sewer main with a 6 inch tee connection or at a manhole. Where an existing side sewer stub is not available, a ROMAC tapping tee or core drilled INSERT-A-TEE is required for an existing sewer main. See City Standard Detail SS-100.

All new sanitary sewer mains (8 inches and larger) shall connect to existing sewer mains at manholes. If an existing manhole is not available, a new saddle manhole on existing sewer is required per the City Standard Detail SS-020.

The Design Engineer shall check that the existing manhole diameter is adequate to accommodate the new sewer mains. If not, the existing manhole shall be upgraded at the Developer's expenses. 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 approves the removal of the plugs.

5-1.11 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 sanitary sewer system. An oil/water separation device shall be installed on the private property by the property owner. Water discharged from any oil/water separator to the sanitary 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, are to be provided 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 Interceptor

The size and design of grease interceptors and hydromechanical grease interceptors (HGI's) shall conform to the Uniform Plumbing Code and shall be approved by the City Building Official after review by the Utilities Division. The interceptor 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, 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 City Utilities crews any time with a 24 hour verbal notification to the occupant or property owner, or as allowed by the discharge agreement.

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.

5-1.12 EASEMENTS

All public sanitary sewer mains, manholes, air valves, lift stations, and other appurtenances not in public right-of-way shall have 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. The width of the easement depends on the maximum depth of the sewer in the easement (see table below).

Depth (ft)	Easement Width (Ft)
< 5	10
5 - 10	15
10 - 15	20
15 - 20	25
>20	30

Before the project is accepted by the City, easements shall be recorded. Easement drawings and legal description shall be included as exhibits.

If off-site easements are required on properties not owned by the Developer or the City, the Developer shall acquire the easements at their own expense before construction plans are approved by the City.

5-1.13 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 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 Detail SS-090.

4 inch side sewers on private property from the end of a 6 inch stub to the building may be a minimum of 4 inches for residential side sewers with a single connection within the lot.

Each unit in a duplex or triplex shall have its own separate side sewer stub and connection. 6 inch minimum pipe shall be used for commercial side sewers.

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 connected to a manhole.

Maximum distances between side sewer clean-outs shall be 100 feet. All side sewer clean-outs on commercial and multi-family developments shall include at grade access with covers per the City Standard Detail SS-080.

5-1.14 SEPTIC TANKS

Septic systems are generally not allowed within the City limits. If the City Engineer determines that public sanitary sewer service is not available or it is not "practical" to provide public sewer service, the septic tank systems may be installed upon approval by the City Engineer and issuance of a septic permit by the Snohomish Health District.

5-1.15 PRIVATE GRINDER PUMP

Use of grinder pumps 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 grinder pumps. The applicant shall demonstrate that there is no other feasible means of sewer service available.

The Design Engineer shall specify pumps with proper flow rate and dynamic head and provide pump curves from the manufacture to the City 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 UPC. Exterior grinder pumps systems shall be approved by the City Engineer.

5-1.16 LIFT (PUMP) STATION

All sanitary 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.

Lift stations shall be wet well and dry well type as manufactured by Smith & Loveless with auxiliary power generators, automatic transfer switches, telemetry, and alarms. Design reports, plans and specifications for lift stations shall be prepared by the Design Engineer and

reviewed/approved by the City. The following are general guidelines for lift station design.

Pump

All lift stations shall have a designed minimum pumping capacity of 250 GPM.

(Items supplied by Smith & Loveless) *Blank spaces will need to be completed when lift station is sized*.

One (1) only Smith & Loveless Duo-Duct, factory assembled, Automatic Pumping Station complete with 8 feet in diameter welded steel chamber, 8.5 feet internal height, xx integral base beam suctions. xx common side outlet discharge pipe, 36 inches diameter xx inches long entrance tube, access ladder, and electrical conduits to control panel in station.

Principal items of equipment will include two (2) Smith & Loveless Vertical, Non- Clog, xx pumps directly connected to xx HP, 1760 RPM, 460/3/60 Motors; ¼ inch plugged taps on suction and discharge; automatic static/dynamic pumping level controls using multiple float switch system connected with intrinsically safe GEM relays; NEMA, UL listed Central Control Panel with circuit breakers, motor starters, control circuitry; sump pump with integral discharge to wet well; ventilation blower with PVC inlet duct; dehumidifier; four magnesium anode packs with 15 foot copper leads; all internal wiring in the main chamber only.

The entrance tube with electrical conduits and ladder, the magnesium anode packs, level transducer and the two float switches for the wet well are furnished, but not installed. One or two circumferential welds are required to attach the entrance tube to the main chamber (by others). Touch up epoxy paint is provided to cover the weld areas.

Control Panel

The lift station control panel shall be equivalent to Clearwater Controls and Automations P/N LS-1000.

The panel shall be placed in the main building within reach of the dry well hatch.

Additional accessories included in the panel are:

1) Run time meters for pumps.

2) Signal and alarm contacts listed under the signal, alarm and data collected by telemetry section.

3) Terminal strips for external alarm and for telemetry system.

4) Emergency generator connection for the power interlocks to allow only one pump to run under generator power.

5) The 460/3/60 electrical power shall be installed and connected to the control panel terminals by a licensed Electrical Contractor.

6) Control panel shall be mounted in the lift station building in close proximity of the dry well entrance.

7) The control system shall consist of a wet well mounted, hydrostatic level transmitter, control panel mounted level indicator, pump controller and back-up emergency pump control from high and low wet well level floats. The back up float control shall be completely independent from the level transducer and pump control.

The control panel front cover shall have:

1) Wet well level indicator in inches.

2) Hand off auto switches for each pump.

3) Pump alternator switch from either pump 1, 2 or alternate each cycle.

4) Pump hour meters that read to the hundredth of the hour.

5) Data entry screen for setting levels.

6) Local alarm horn silencing switch.

7) Independent alarm reset push buttons for each pump.

8) Overload reset push buttons.

The pump controller shall receive a signal from the wet well level sensor and display the wet well level in inches on the control panel:

1) Low wet well level alarm.

2) Lead pump off.

3) Lag pump off.

4) Lead pump on.

5) Lag pump on.

6) High wet well level alarm.

In the event that the wet well transducer or pump controller failure, the high and low wet well float shall provide independent back up pump control. When the high wet well level float is tripped one pump shall start and run for the time set on the emergency run timer. The other pump shall start after a set amount of time and shut off with the first pump. If

the timer is still active when the low level float is reached, the pumps shall shut down. At no time while the station is in automatic control shall the pumps, pump below the low level float.

The hand/off/auto switch shall control the pumps by the controller while in the auto position. When the "hand" position is selected, the pump shall continue to run until the switched is moved to "off" or "auto" position. The hand position shall be the only way to pump below the low level float switch.

The pump alternator shall allow the pumps to alternate at the end of each pump cycle while in "alternate" position. When set on pump "1" or "2" the pump that is selected shall continue to be the lead pump and the other pump shall be used as the lag pump.
The data entry screen shall allow the operator to review and/or change the set points and review current and/or past alarms.

Telemetry

Telemetry shall be supplied and installed in the lift station. Telemetry components are to be included as part of the control panel. Telemetry shall be installed and operation verified by the supplier and the City.

Signals, Alarms, and Data to be Collected by Telemetry

1) High-high and low-low floats – Alarm

2) Pump fail by motor overload and check valve limit switch – Alarms

3) Water in dry well – Alarm

4) Power failure phase monitor – Alarm

5) Common generator failure – Alarm

6) Flow rate and total – Data

7) Wet well level – Data

8) Pump run – Data

9) Diesel fuel tank low fuel alarm – Alarm

10) Emergency button alarm – Alarm

11) Transfer switch position – Data

12) Generator running – Data

13) Pump run time – Data

14) Pump starts – Data

15) All data shall match existing Microsoft Office reports at the time of construction

Generator

The diesel generator shall be either Kohler or Onan. The minimum generator size shall be 25 KW. The generator shall be installed to automatically start during the event of a power outage and shall be sized to run all ancillary uses and one pump at a constant duty rating. The minimum fuel tank capacity shall be 100 gallons and shall be full at time of startup. The generator shall be capable of running for 36 hours without refueling. Connection points shall be provided by the manufacturer for alarms that are specified under the section "Signals and Alarms" that apply to the generator. Generator panel will have a minimum of the following operational items:

12 light alarm panel to include:

1) Run

2) Pre-low oil pressure

3) Pre-high engine temp

4) Low oil pressure

5) High engine temperature

6) Over speed

7) Over crank

8) Low engine temperature

9) Low fuel

10) Switch off

11) Low coolant level

- AC volts meter
- AC amperes meter
- RPM and Hz meter
- Field breaker

- Upper scale/lower scale indicator
- Voltage adjuster
- Emergency stop button
- Hour meter
- Temperature gauge
- Oil gauge
- DC volts gauge
- Phase selector to control view of volts and amperes meter

Equipment and Parts to be Furnished

1) One SnapOn® four drawer tool chest or approved equal.

2) Lock out/tag out station with appropriate equipment to lock out/tag out all equipment in the lift station. The equipment shall be the same type specified in the City's lockout/tag out program.

3) One cordless wall mounted telephone 900 mega Hz.

4) Safety climb for dry well entrance tube drop and one OSHA approved safety harness.

5) Manufacturer's recommended spare parts shall be provided for all equipment as specified in the Operation and Maintenance manuals (O&M).

6) Three complete sets of the O&M manuals.

7) One wall mounted fire extinguisher in enclosure. The minimum size shall be 6 pounds.

Wet Well

1) Minimum wet well size is 12 feet diameter.

2) The wet well shall have two explosion proof 110 VAC lights.

3) A wet well blower must be attached to either the wet well top or its own slab. It may not be attached to the generator building. The blower shall be enclosed to prevent exposure to the outside elements. The enclosure shall be built to allow access and match the lift station building.

4) The wet well shall have an operator walkway.

5) Transducer and float support shall be accessible from the operator walkway.

Yard Hydrant

One freeze proof 1 inch yard hydrant shall be installed outside of the building (placement to be determined during plan review). Hydrant shall have a minimum 3 foot bury and be an IOWA Woodford or approved equal. Yard hydrant shall have a separate shut off valve with valve box. ⅝ inch water service per City Standard Detail W-040 shall be provided as part of the lift station construction. Cross Connection control required per City Standard Detail W-090.

Telephone Line

1) One type 3002 voice grade leased multi-point telephone line shall be installed at the proposed lift station.

2) RJ-11 jack shall be provided with the two wires clearly identified and circuit I.D. number for that leg.

3) The telephone line shall be connected to a specific telephone circuit, specified at the time of design of the lift station.

4) The above telephone line will be for the telemetry system.

5) One additional telephone line shall be provided for a telephone.

Flow Meter

A magnetic flow meter with 4 to 20 milli amp output will be installed on the discharge line in accordance with the manufacturer's set up and operations manual. The meter will be from a company with local representation and service technicians for calibration and operational trouble shooting. Flow will be totalized in hundreds of gallons. If the meter is installed outside of the main building the flow tube will be NEMA 6 rated.

Pump Station Building

The following criteria and minimum requirements shall apply to the lift station building. Additional items to match the building to development structures may be allowed but must be approved by the City Engineer.

1) Building permit required and will need to include electrical, plumbing, and mechanical.

2) Land use permit, design review, and other applicable permits may be required.

3) Building shall meet all applicable zoning and building code requirements.

4) Building size shall be a minimum 14 feet x 20 feet.

5) Building shall have 2 inch x 6 inch stud construction.

6) Craft face R-19 insulation.

7) ⅝ inch fire rated drywall finished and painted with enamel white paint.

8) All conduits shall be run exposed on the exterior of building drywall.

9) 6 inch beveled cedar siding with 1 inch x 4 inch corner boards or as otherwise approved.

10) 6 foot x 6 foot, 8 inch x 1 ¾ inch double swing insulated metal doors; key operated dead bolt, minimum of 6 keys keyed to City Standard.

11) Roof standards:

- 2 inch x 6 inch rafters 24 inch on center.
- 2 inch x 6 inch rafter ties.
- 2 inch x 8 inch ridge board.
- ½ inch plywood (CD) decking.
- 4 feet x 4 feet clear opening access hatch with internal lock (must be placed directly over dry well access tube).

12) Roofing materials:

- Profile TBC 305 Series Standing Seam Roofing (18 inches wide).
- Gauge = 22-gauge.
- Finish = Kynar 500, Evergreen Code #815G112.
- Flashing, closures, trim, gutters, downspouts, etc., shall be fabricated of same material, gauge, and finish as the roofing.
- Fasteners shall be as per manufacturer's recommendation.

13) Rain gutter with down spout must be provided on access door side of building. Downspouts must be connected to the drainage system.

14) All exterior wood surfaces shall be treated with a brown or equal latex stain. (Other

colors must be approved by the City Engineer).

15) Minimum clearances of 3 feet will be required between any components to include distance from the wall. Exceptions to this will be:

- The generator to wall where louver is and;
- One (1) foot from the back of the dry well hatch to the finished wall. Clearances must meet electrical codes or provide safe access to all components.

16) One solid wood wall mounted cabinet with minimum size of 3 feet x 3 feet x 16 inches.

17) Emergency eye wash station with overhead shower required.

18) Provide an emergency contact sign for the outside of the building per City of Arlington Standards.

19) Provide adequate yard lighting with automatic timer.

20) Additional Electrical Requirements:

- Air intake and exhaust louvers in generator room shall be motor operated. They shall open upon generator start-up and close with generator shut down.
- Wet well controls shall be intrinsically protected.
- Low wet well water alarm float shall also provide pump lockout upon activation and be self clearing.
- Pump station building lighting shall consist of 2 incandescent fixtures with 150 watt bulbs.
- Audio/Visual alarm shall be installed on the exterior of the building (location to be determined by the City Engineer). Horn and light must be one unit. Unit must have silence and reset buttons. Horn shall be 85 db.
- Wet well lights and blower shall be switched on the exterior of the building in a weatherproof box (location to be determined by the City Engineer).
- A minimum of two internal 20 amp double outlets with GFI.

Fencing

The pump station site shall be enclosed by a 6 feet tall, black vinyl coated chain link fence. A 12 foot black vinyl double swing gate shall also be installed (location to be

determined by the City Engineer). Two gates may be required in some situations.

Site Access

Appropriate area shall be provided to allow City vehicle, turn around and access wet well with vactor truck. This is defined as a vehicle 30 feet in length. This may be accomplished in conjunction with a street or a turn around area. The entire area within the fence shall be paved, including the driveway approach to the street.

Force Main

The force main shall be installed per these Standards. Force main valving shall be installed on the lift station site. Valves shall be placed in a concrete vault of a size to allow City personnel access to the valves for safe maintenance. The minimum force main size shall be 4 inches. The force main shall be constructed with CL 52 epoxy coated ductile iron pipe.

Landscaping

All Developer installed landscaping will remain the maintenance responsibility of the Developer/Homeowners Association. This includes landscaping within the dedicated property of the lift station site. Any landscaping within the fenced area will be maintained by the City.

5-1.17 MONITORING MANHOLE

Monitoring manholes are required for all industrial/commercial applications and other applications as determined by the City Utilities Manager. The monitoring manhole shall be located to be accessed 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 Inspector. See City of Arlington Standard Detail SS-130.

5-2 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 WSDOT/APWA Standard Specifications and these Standards, and approved by the City.

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, 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.

The Developer and/or Contractor is required to provide construction material submittals to the City. See Section 5-3.02 for material submittal procedures and requirements.

5-2.01 MANHOLE

Manholes shall be constructed of pre-cast sections with a 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 Details SS-010. Any request to deviate from these details must be reviewed by 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.

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 or concrete (masonry) rings may be used for adjustment of the casting to final street grade. Pre-cast bases shall be furnished with cutouts or knockouts. Knockouts shall have a wall thickness of 2 inch minimum.

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.

5-2.02 MANHOLE RING AND COVER

Ductile iron rings and cast iron rings and covers shall conform to the City Standard Detail SS-030 and Section 9-05.15 of the WSDOT/APWA Standard Specifications.

Manhole rings shall be gray iron conforming to the requirements of AASHTO M 105 Grade 30B. Manhole cover shall be ductile iron conforming to ASTM A536, GR 80-55-06, and Olympic Foundry Part No. MH 30 or approved equal. Rings and covers shall be tested for accuracy of fit and shall be locked down with a 5 ⅝ inch stainless steel socket head cap screws. All castings shall have a bituminous coating.

5-2.03 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 pipe 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.

3) AWWA C900 PVC pipe shall be pressure class 150 (SDR 18) unless otherwise called for in the plans. 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.

5-2.04 SIDE SEWER

Side sewer services 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.

5-2.05 TRACER TAPE

Utility pipe tracer tape shall be detectable below ground surface, color coded, with utility name printed on tape. 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 approved equal.

5-2.06 PLUGS

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

5-2.07 BACKWATER CHECK VALVE

Backwater check valves installed on 4 inch through 8 inch diameter side sewers 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 45 degree angle to direction of flow. Flow area through valve shall equal full pipe area. Valve body shall be cast iron 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”.

5-2.08 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.

5-2.09 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 approved equal. See Standard Detail W-230.

5-2.10 CONTOLLED DENSITY FILL

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

5-2.11 CONCRETE

Concrete used for pads, thrust blocking, encasement, or slope anchor shall be mixed from materials acceptable to the City and shall have a 30 day compressive strength of not less than 2,500 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.

5-2.12 BEDDING MATERIAL

Bedding material shall be ⅜ inch minus manufactured pea gravel. Pipe bedding shall be ⅜ inch minus pea gravel meeting the requirements of Section 9-03.17 of the WSDOT/APWA Standard. Bedding will be to the pipe zone shown on Standard Details SS-120.

5-3 CONSTRUCTION

5-3.01 GENERAL REQUIREMENTS

All work shall be constructed as shown in the Plans and in accordance with 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 regulations of the State, County and local jurisdictions. The Contractor shall arrange for such inspection by these agencies and shall submit evidence of their approval, if requested by the City.

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

5-3.02 MATERIAL SUBMITTALS

The Developer/Contractor shall provide material submittals to the City for approval after the plans are approved for construction. The Developer shall assume the risk for material or equipment, which is fabricated or delivered prior to the City's approval of material submittals.

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

for approval.

The City's review of material submittals covers only general conformity to the plans and these Standards. The Developer is responsible for quantity determination. No quantities are to be verified by the City. The Developer is responsible for any errors, omissions or deviations from the contract requirements. Review and approval of submittals by the City does not relieve the Developer from his obligation to furnish required items in accordance with the plans and these Standards.

Each "Material Submittal" section shall follow a Material Submittal Form provided by the City. Each submittal must have the specific part number(s) checked or highlighted along with its specific purpose.

5-3.03 PRE-CONSTRUCTION CONFERENCE

The Developer/Contractor shall contact the Public Works Department (360-403-3500) to schedule a pre-construction conference after plans are approved before staking and construction start. The conference shall include the Developer, Developer's Engineer, and Contractor, representatives from the permit agencies, other utility companies, and City staff. An on-site tailgate meeting between the Contractor and the City Inspector shall be arranged by the Contractor at least 48 hours prior to commencing construction.

5-3.04 CONSTRUCTION SCHEDULE

The Developer/Contractor shall provide the City with the construction schedule a minimum of five (5) business days prior to start of sewer system extension 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.

5-3.05 EASEMENT

Prior to the start of the sewer system extension construction, the Developer must acquire easements for construction of any sewer mains or facilities not located in existing City right-of-way, City easements, or on the Developer's property.

5-3.06 PERMITS

All public right-of-way permits for the sewer system extension shall be obtained by the Developer at the Developer's expense. The Developer shall provide the traffic control plan prepared by the Developer, Developer's Engineer, or Contractor. The Developer shall apply for and obtain permits from other agencies listed in Section 1-3.04 of these Standards prior to commencing construction.

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 and fittings shall be loaded and unloaded using forks or cable choker in a manner that avoids shock or damage, and under no circumstances shall they be dropped,

skidded, or rolled against other pipe. Damaged pipe will be rejected, and the Contractor shall immediately place all damaged pipe apart from the undamaged and shall remove the damaged pipe 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.

5-3.08 STAKING

Staking shall be performed by or under the direct supervision of the Developer's Land Surveyor licensed in the State of Washington. Provide the City with two (2) business days notice to inspect construction staking before construction begins.

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

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.

5-3.09 DEVIATION FROM PLANS

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

If the City is aware of any deviation from the approved plans and determines that it is not acceptable, the City shall give a written notice to the Developer. The project will not be accepted unless the deviation is corrected.

5-3.10 INSPECTION AND TESTING

The City Inspector shall have access to the project site for the purpose of inspections and testing at all times. The Contractor shall provide proper facilities for such access, inspection, and testing.

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

Before a pressure test is to be observed by the City Inspector, the Contractor shall make whatever preliminary tests 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 Contractor. The Contractor shall correct such deficiencies before final inspection by the City Inspector.

5-3.11 WATER QUALITY

The Contractor is required to implement water pollution controls and maintain these until the project is accepted by the City. The Contractor shall familiarize themselves with the requirements of the DOE and other regulatory agencies having jurisdiction over such matters. The oil and chemical storage site shall be approved by the City and the area shall be diked. There shall be no disposal of waste oil or oil products on the project site. The Contractor shall provide a waste oil disposal tank if needed.

5-3.12 CONSTRUCTION ON EXISTING EASEMENTS

All work on the public utility easements shall be performed in accordance with easement provisions. Easements shall be restored equal to or better than the original conditions. The Contractor shall not work on easement areas until specifically authorized by the City Engineer. The City and the Contractor shall coordinate with the property owner(s).

5-3.13 PRE-CONSTRUCTION PHOTOS

Before commencing any construction work as described in the plans, the Contractor shall provide photographs of pre-existing conditions of the area that will be disturbed during construction operations. 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 Inspector.

The photographs shall be 5 inch x 7 inch, color prints, contained in albums, catalogued, and cross-referenced. A digital copy shall also be provided by the Contractor.

5-3.14 UNDERGROUND UTILITIES

The plans 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. This information is not guaranteed to be accurate, and the Contractor is responsible to check for interferences and obstructions by inquiry from the different utilities and by underground exploration before commencing excavation.

The Contractor 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). If the utility is not included in the one-call number system service, notice shall be provided individually to those owners of underground utilities known to or suspected of having underground utilities within the area of proposed excavation.

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 by the Contractor. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the applicable agency.

The Contractor shall excavate around and under active utilities with special care and shall support and maintain them in service. Where it is necessary to cut, move or reconnect any service lines, arrangements shall be made with the respective utility owners.

The Contractor shall coordinate with utility owners and notify the City in advance of any conflicts affecting the work schedule, and/or possible cost increase to the City if the project is a City capital improvement projects.

The Contractor shall be responsible for any damage of utilities or services resulting from his operations and shall hold the City harmless from any claims resulting from disruption of or damage to same.

5-3.15 TRENCH EXCAVATION

Trench excavation and backfill operations within State right-of-way: All excavation and backfill within state right-of-way shall adhere to the 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 standards set forth by the WSDOT.

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 and the Contractor shall confine his operations within those limits. Debris resulting from the clearing and grubbing shall be disposed of by the Contractor.

Trenches shall be excavated to the line and grade shown in the plans or designated by the City. Where higher strength pipe or special bedding is required because of excess trench width, it shall be furnished.

Unsuitable material below the depth of the bedding shall be removed to the extent approved

by the City Inspector and replaced with satisfactory materials as determined 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 written approval of the City Engineer.

When trenching operations take place in the 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, 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 Detail SS-120.

5-3.16 SHEETING AND SHORING

The Contractor shall provide and install sheeting and shoring 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.

5-3.17 TRENCH DEWATERING

The Contractor shall maintain sufficient pumping equipment 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 Contractor shall plug the pipe and cease working until the trench water is completely pumped out or otherwise controlled, to the satisfaction of the City Inspector. Dewatering and its methods shall be the responsibility of the Developer/Contractor. Any method used must be in accordance with the specifications and requirements of the City and DOE.

5-3.18 MANHOLE

Manhole Foundation

Unless otherwise directed by the City, manhole bases (pre-cast base sections or cast-in-place) 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 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 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 a water proof coating that overlaps the manufacturer's water proofing by a minimum of 1 inch when required by the City Inspector. Shop drawings of the joint design shall be submitted to the City Inspector 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. See Standard Detail SS-010.

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. 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 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.

Pipe Connections at Manholes

All pipes except PVC pipe entering or leaving the manhole shall be provided with flexible joints within ½ 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.

Drop Manholes

Drop manholes shall be constructed with an outside drop connection per City Standard Detail SS-060 for new manholes. Inside drop structures may be allowed on connections to existing manholes if approved by the City Engineer.

Ladders

Manhole ladders shall be installed in accordance with the approved manufacturer's recommended procedures and City Standard Detail SS-040 on sides of manholes opposite the pipe and channels if possible.

Connection to Existing Manholes

When connecting to an existing manhole, check that the existing manhole diameter is adequate to accommodate the new sewer mains. The existing manhole may need upgrade or repair at the Developer's expenses. 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. If connection to an existing manhole places a channel directly under access opening, move the ladder and rotate the cone section to place the access the over concrete shelf.

The Contractor shall verify invert elevations 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.

The Contractor shall excavate 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.

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 must provide a minimum of 1 inch and a maximum of 2 inch clearance around the outside circumference of the pipe. 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 ½ 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 Contractor shall provide protective clothing and equipment (coveralls, gloves, boots, head covering, goggles, and respirators) to crews working with asbestos cement pipe in order to 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 396-62-07705. Asbestos cement pipe shall be left and buried in the trench.

Pipe Plugging at Connections

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

Saddle Manhole

A saddle manhole shall be constructed per City Standard Detail SS-020 and these Standards. The existing pipe shall not be cut until approval is received from the City.

Manhole Ring and Cover

Manhole rings and covers shall be installed per City Standard Details SS-01 and SS-03. 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

Manholes located in the public right-of-way, not less than 8 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 4 inches to 6 inches above the finished grade or as directed by the City Inspector. See Standard Detail SS-070.

Locking cover 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 approved equal.

5-3.19 SEWER MAIN

General

No broken or defective sewer pipe and related materials will be allowed to 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 City Standard 120. If the maximum trench width is exceeded without authorization from the City Inspector, the Developer 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. The Developer shall control surface run-off 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 ⅜ inch minus manufactured pea gravel. Bedding will be to the pipe zone shown on the City Standard Detail SS-120. The pipe zone is identified as 6 inches below the bottom of the pipe to 12 inches above the top of pipe.

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. The Developer may use Controlled Density Fill (CDF) for pipe backfill above the pipe's invert level.

Laying Sewer Pipe

All sewer main installations shall have line and grade set by survey, prior to construction. Staking shall show each manhole, cuts 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.

The Contractor may use any method such as "line and batter board" and "laser beam" etc., which would allow the Contractor to accurately transfer the control points provided by the Surveyor in laying the pipe to the designated alignment and grade.

When using the "line and batter board" method, the Developer shall transfer line and grade 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, the work shall be immediately stopped and the cause remedied before proceeding with the work.

When using a "laser beam" to set pipe alignment and grade, the Developer shall constantly check the position of laser beam from surface hubs provided by the Surveyor to ensure the laser beam is still on alignment and grade. In the event the laser beam is found out of position, the Contractor shall stop working and make the necessary corrections to the laser beam equipment and pipe installed.

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.

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 Inspector. 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 specifically approved by the City Inspector. The Developer shall ensure that the project site is 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.

The Contractor shall provide experienced personal on-site to oversee the construction process during all shoring operations. Where conditions exist which require shoring, the Contractor shall adequately shore trenches to protect existing property, utilities, pavement etc. and to provide safe working conditions inside and above the trench. The method of shoring shall be according to the Contractor’s design. The Contractor may elect to use a combination of shoring and over break, tunneling, boring, sliding trench shields, or other

methods to accomplish the work, provided the method(s) meet all applicable local, State and Federal safety codes. Damages resulting from improper cribbing or from failure to crib shall be the sole responsibility of the Developer.

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 Inspector for every 200 lineal feet of sewer main installed. The City Inspector has the discretion to require additional tests, in locations specified by the City Inspector. All testing shall be at the expense of the Developer.

The Contractor shall remove all excavated trench material deemed by the City Inspector to be unsuitable for trench backfill at the Contractors expense.

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

Under no circumstances shall pipe materials be dropped or dumped into 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 Inspector. 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 Inspector, 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 at the Developer's expense.

Connection to Existing Pipe

When connecting to the end of a existing pipe known to have a bell at the end of the pipe, a new pipe in the same material as the existing pipe, 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 a existing pipe known to have a plain end, or must be cut, plans shall specify 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 approved equal. 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, the Developer shall use flexible gasket coupling, adapter or coupling-adapter to make a watertight joint. Couplings shall be those manufactured by "Romac", "Smith Blair", or approved equal for reinforced pipes and "Fernco" or approved equal as approved by the City Inspector for non-reinforced pipes.

Jacking, Auguring and Tunneling

See Section 2-10 – Underground Utilities.

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 existing sewer main is to be abandoned, the manhole shall be rechanneled with 3,000 psi cement concrete.

Cleaning and Testing of Sanitary Sewer

All sanitary sewer pipe shall be cleaned and tested after backfilling. Testing shall be by either exfiltration or low pressure air method. The Contractor has the option to select the method of testing, unless the ground water table is such that the City Inspector may require the infiltration test.

The Contractor 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 Inspector. The Developer shall notify the City Inspector 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 Inspector. The Developer 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 Developer to the satisfaction of the City Inspector.

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 Contractor. 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 VHS video tape and written report shall be submitted to the City. Acceptance of the sewer will be made after the tape has been reviewed and approved by the City Inspector. Any tap to an existing system needs to be televised as well. No ponding within the sanitary sewer line will be accepted.

If the Contractor elects to test larger diameter pipe 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 Inspector.

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

If any sewer installation fails to meet the requirements of the test method used, the Developer shall determine the source or sources of the leakage and shall replace all defective pipes. The complete pipe installation shall meet the requirements of the test method used before being considered acceptable. Replacement of defective pipe shall not commence until the Developer has received approval of their plan from the City Inspector.

Exfiltration Test

Prior to exfiltration leakage testing, the Developer may fill the pipe with clear water to permit normal absorption into the pipe walls provided, however, after filling the pipe the Developer shall complete the leakage test within 24 hours. When under test, the allowable leakage shall be limited according to the provisions which to follow. 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 equation:

Maximum leakage (in gallons per hour) = $0.28 \times \frac{\sqrt{H}}{\sqrt{6}} \times D \times \frac{L}{100}$

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 new sanitary sewer mains within the public right-of-way and those in the easements to be maintained by the City will be subject to a visual inspection with a TV camera. Any deficiencies noted by the TV camera inspection shall be corrected to the satisfaction of the City Inspector.

5-3.20 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 tee or core drilled INSERT-A-TEE. See City Standard Detail SS-100.

All side sewers shall have a 6 inch clean-out at the property line per City Standard Detail SS-080. The riser portion of the clean-out shall be PVC unless otherwise approved by the City Inspector. 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 12 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 2 inches in height "SEWER LOT 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

All side sewers shall be tested after backfill. Side sewers 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 sewers consisting of a single length of pipe will not be required. Testing shall be performed in the presence of the City Inspector in accordance with these Standards or as directed by the City Inspector.

When a new side sewer is installed, the entire length of new pipe installed shall be tested.

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 shall show the following:

1) Location of the side sewer, its connection with the building(s) and all dimensions.

2) Show station as distance of side sewer tee from the center of the next downstream manhole.

3) The depth and point of connection of the side sewer to the sanitary sewer main.

4) Any additional information which might be deemed pertinent.

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. The contractor shall cap the end of the side sewer to remain in place. Side sewer demolition shall be performed in the presence of the City Inspector.

5-3.21 CLEANOUT

All clean-outs in the City right-of-way or easements shall be extended to grade and a 3 feet x 3 feet x 4 inch concrete pad shall be installed around all clean-outs in unpaved areas. See City of Arlington Standard Detail SS-080.

5-3.22 GREASE TRAP AND INTERCEPTOR

Grease traps and interceptors shall be installed and sized according to the criteria in the Uniform Plumbing Code. Grease trap and interceptors shall be located on private property, and they shall remain privately owned and maintained at the owner's or occupant's expense. These facilities shall be available for the inspection by the City's Public Works crews with a 24 hour verbal notification to the occupant or property owners.

5-3.23 PRIVATE GRINDER PUMP

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

5-3.24 LIFT (PUMP) STATIONS

Lift stations shall be constructed, per approved plans and specifications prepared by a Design Engineer licensed in the State of Washington.

5-3.25 SPECIFICATIONS NOT COVERED BY THESES STANDARDS

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