ENGINEERING STANDARDS

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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 ⅝ 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 ⅜ inch minus manufactured washed pea gravel. Pipe bedding shall be ⅜ 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 n 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 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 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 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 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 ⅜ 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:

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

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.

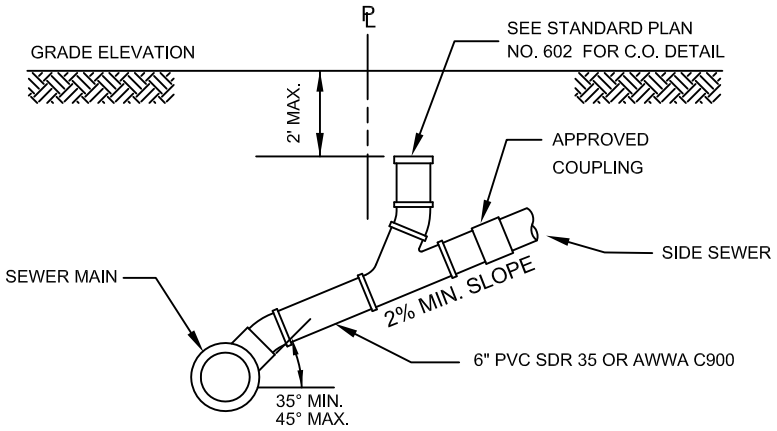
END OF SECTION

CITY OF SNOHOMISH

ENGINEERING DESIGN AND CONSTRUCTION STANDARDS

SANITARY SEWER

DRAWING INDEX

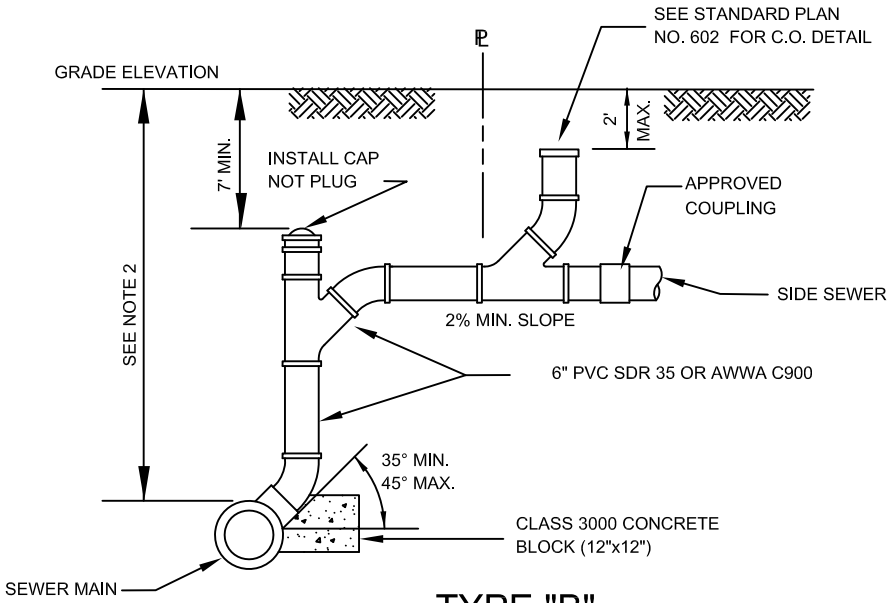


TYPE "A"

NTS

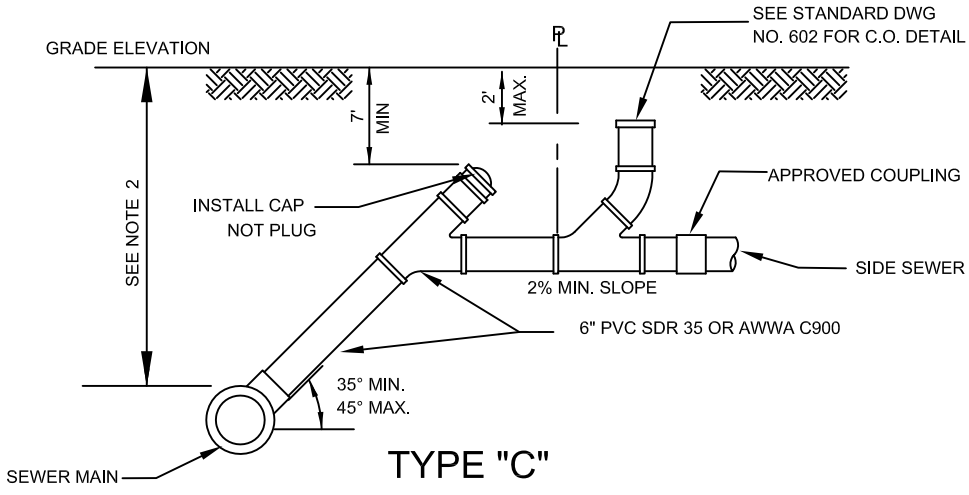
NOTES

1. SIDE SEWER CONNECTIONS TO NEW MAINS SHALL BE FACTORY TEES.
2. TYPE B&C SHALL BE USED ONLY WHEN MAIN DEPTH EXCEEDS 15 FEET OR AS APPROVED BY THE CITY ENGINEER.
3. APPROVED COUPLING SHALL BE FERNCO OR APPROVED EQUAL.
4. SIDE SEWER SHALL BE EXTENDED 10' BEYOND THE PROPERTY LINE TO PREVENT DAMAGE TO THE CLEAN OUT AND TO MINIMIZE CONFLICTS WITH OTHER UTILITIES WHEN SERVICE IS CONNECTED
5. SIDE SEWERS SHALL BE MARKED PER SECTION 6.3.20 OF THESE STANDARDS.



TYPE "B"

NTS



TYPE "C"

NTS

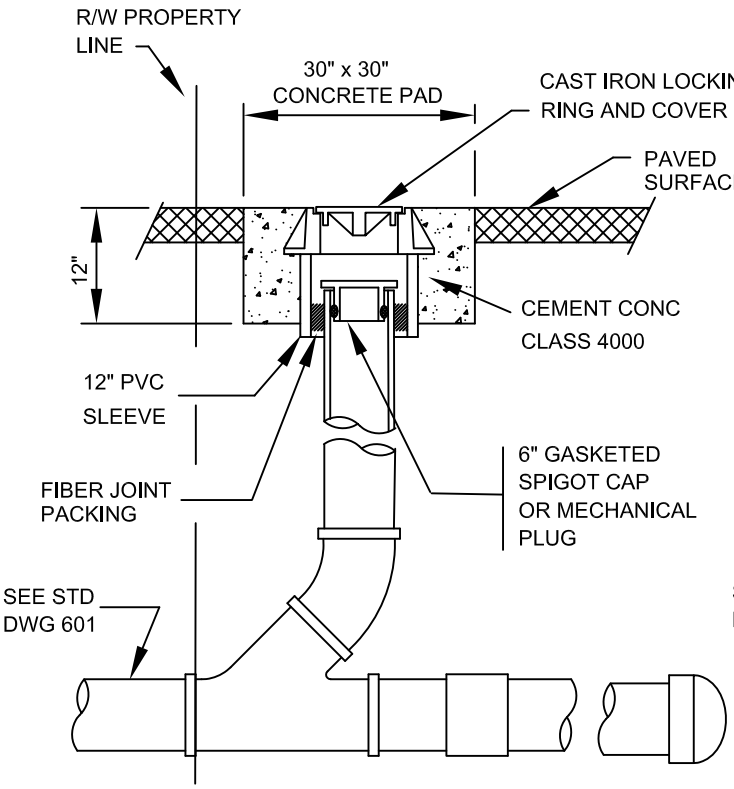
SNOHOMISH
WASHINGTON

TYPICAL SIDE SEWER CONNECTIONS

Approved By:
S L S
City Engineer
Date: April 2010

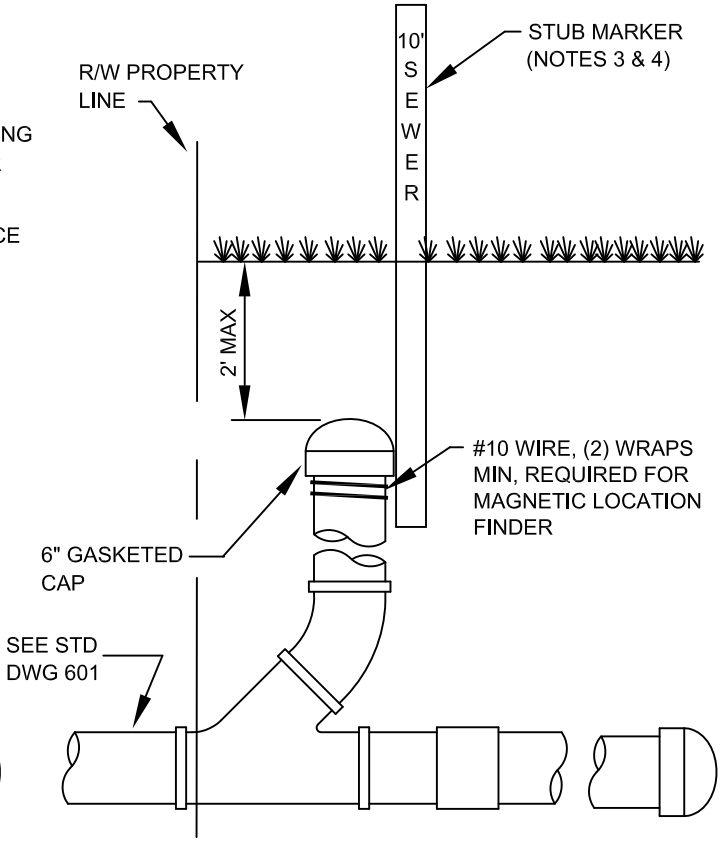
601
Number

City of Snohomish Public Works Department



PAVED AREAS, CITY RIGHT OF WAYS AND EASEMENTS

NTS

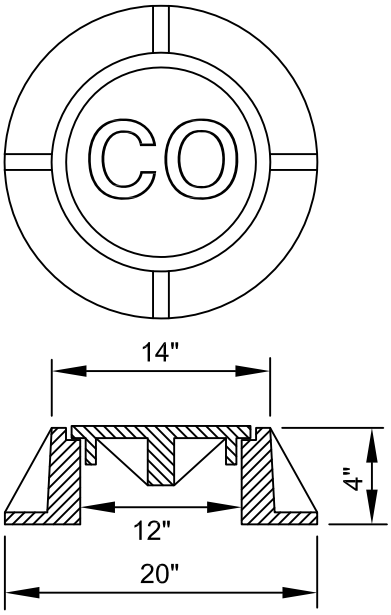


UNPAVED PRIVATE AREAS

NTS

NOTES

1. CLEAN-OUT PIPE AND FITTINGS SHALL BE PVC.
2. FOR NEW PLATS THE VERTICAL RISER PORTION OF THE CLEAN-OUT WILL BE CONSTRUCTED AT TIME OF CONNECTION TO BUILDING TO MINIMIZE DAMAGE. THE 6" WYE AND 6" PVC PIPE W/GASKETED CAPS WILL BE INSTALLED PRIOR TO BUILDING CONNECTION.
3. A 2"x4" STUB MARKER SHALL EXTEND DOWN TO A MINUMUM OF 24" BELOW GROUND. A MIN OF 36" SHALL EXTEND ABOVE GROUND.
4. THE STUB MARKER SHALL BE PAINTED WITH WHITE TRAFFIC PAINT AND THE WORD "SEWER" AND THE DEPTH IN FEET FROM GROUND TO SEWER STUB INVERT SHALL BE PAINTED ON THE MARKER WITH 3" HIGH BLACK PAINTED LETTERS.



12" CAST IRON LOCKING RING AND COVER

NTS

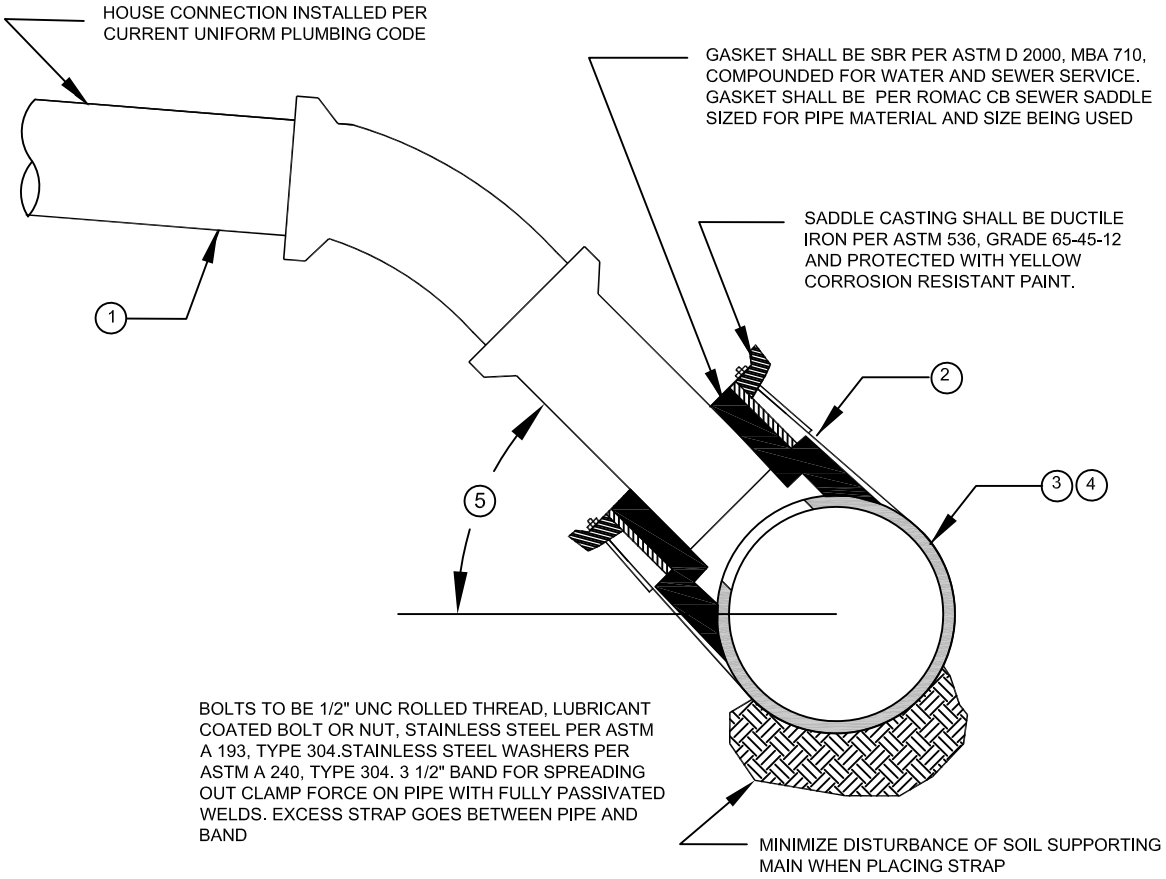
SNOHOMISH WASHINGTON

SEWER CLEAN OUT

Approved By: S L S, City Engineer
Date: April 2010

602 Number

City of Snohomish Public Works Department



NOTES

1. PVC SIDE SEWER. FOR REMAINDER OF PVC SERVICE SEE STD PLAN 601.
2. ROMAC "CB" SEWER SADDLE OR APPROVED EQUAL.
3. EXISTING SANITARY SEWER MAIN.
4. CORE DRILL EXISTING MAINLINE PIPE PER MANUFACTURER'S SPECIFICATIONS.
5. 35° MIN, 45° MAX

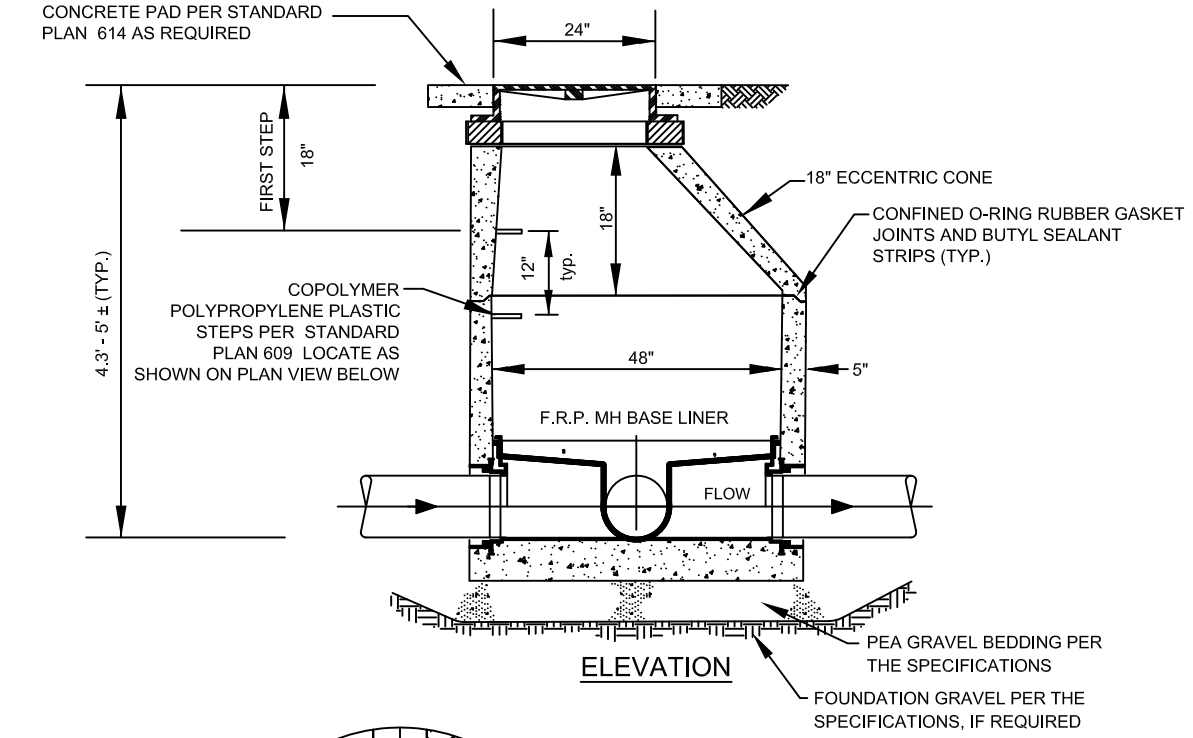
SNOHOMISH
WASHINGTON

TYPICAL SIDE SEWER TAP TO EXISTING SEWER MAINS

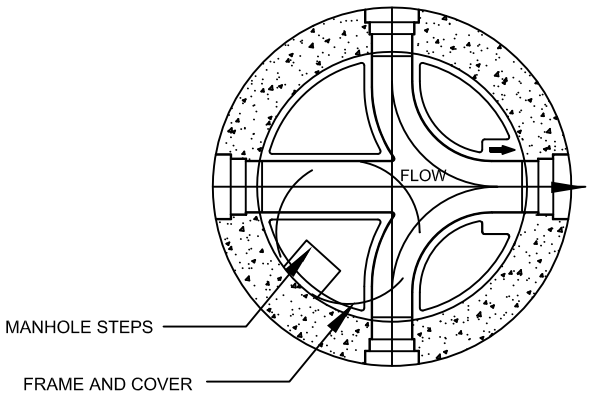
Approved By:
S L S
City Engineer
Date: April 2010

603
Number

City of Snohomish Public Works Department



ELEVATION



PLAN

PRECAST SHALLOW MANHOLE W/ BASE LINER

NOT TO SCALE

Notes:

1. USE 18" ECCENTRIC CONE AND 2' BASE FOR SHALLOW MANHOLE APPLICATION.
2. MINIMUM DROP IN THE INVERT ELEVATION THROUGH THE MANHOLE SHALL BE 0.1'. MAXIMUM DROP IN THE INVERT ELEVATION THROUGH THE MANHOLE SHALL BE 0.5'.
3. MARKER POSTS MAY BE REQUIRED IN EASEMENTS.
4. THE MANHOLE BASE LINER SHALL BE A FIBERGLASS REINFORCED PLASTIC (F.R.P.) BASE LINER SYSTEM.
5. GROUT ADJUSTING RINGS INSIDE, OUTSIDE AND BETWEEN. GROUT UNDER CASTING.

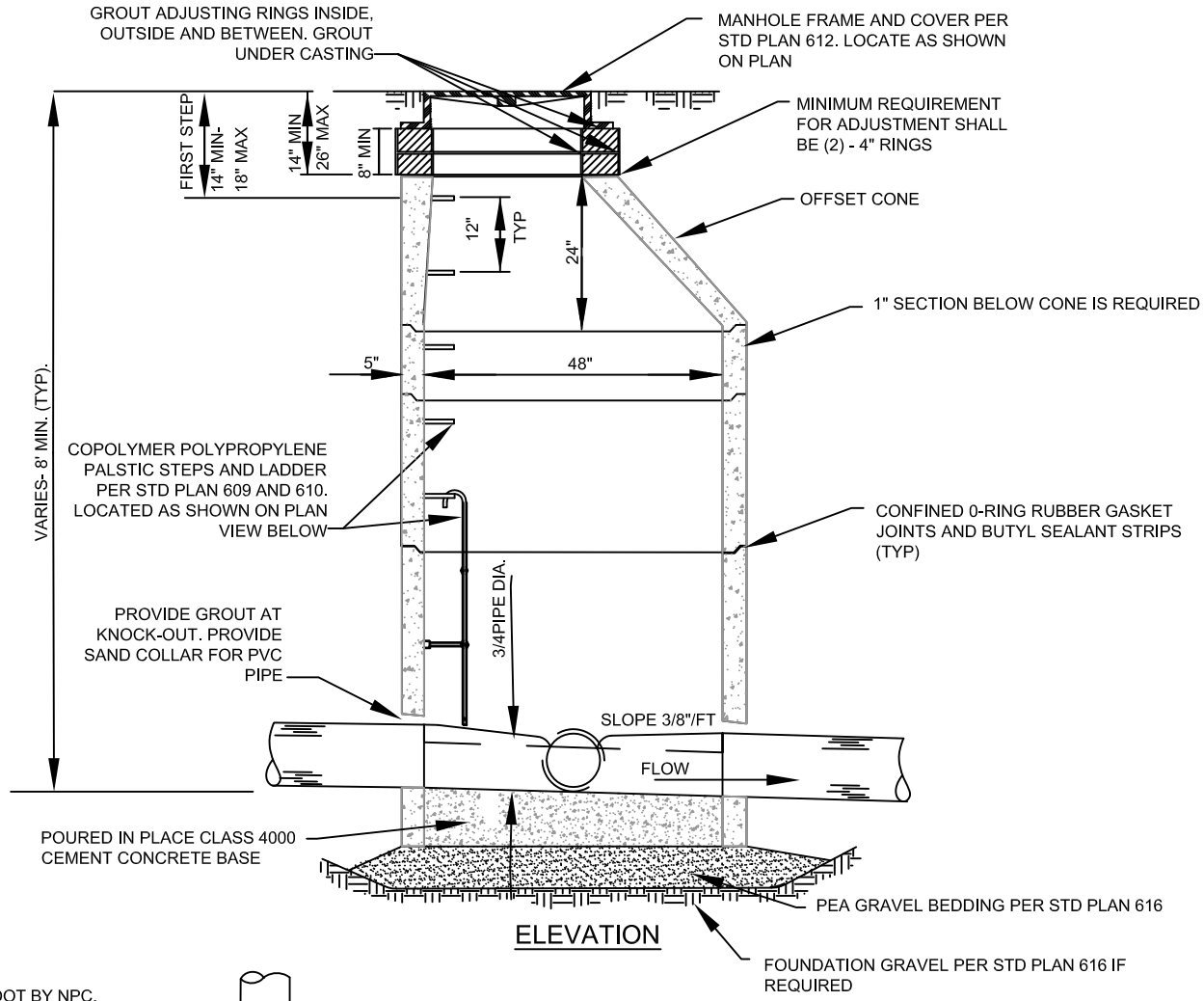
SNOHOMISH WASHINGTON

PRECAST SHALLOW MANHOLE WITH BASE LINER

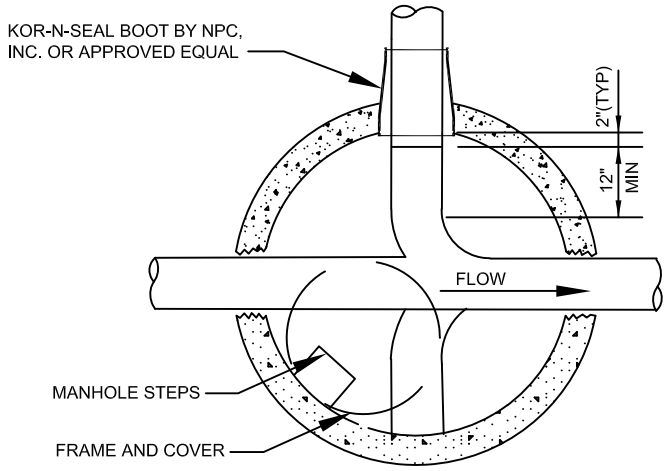
Approved By: S L S
City Engineer
Date: April 2010

604
Number

City of Snohomish Public Works Department



ELEVATION



PLAN

NOTES:

1. MINIMUM DROP IN THE INVERT ELEVATION THROUGH THE MANHOLE SHALL BE 0.1". MAXIMIM DROP IN THE INVERT ELEVATION THROUGH THE MANHOLE SHALL BE 0.5"
2. MARKER POSTS MAY BE REQUIRED IN EASEMENTS.

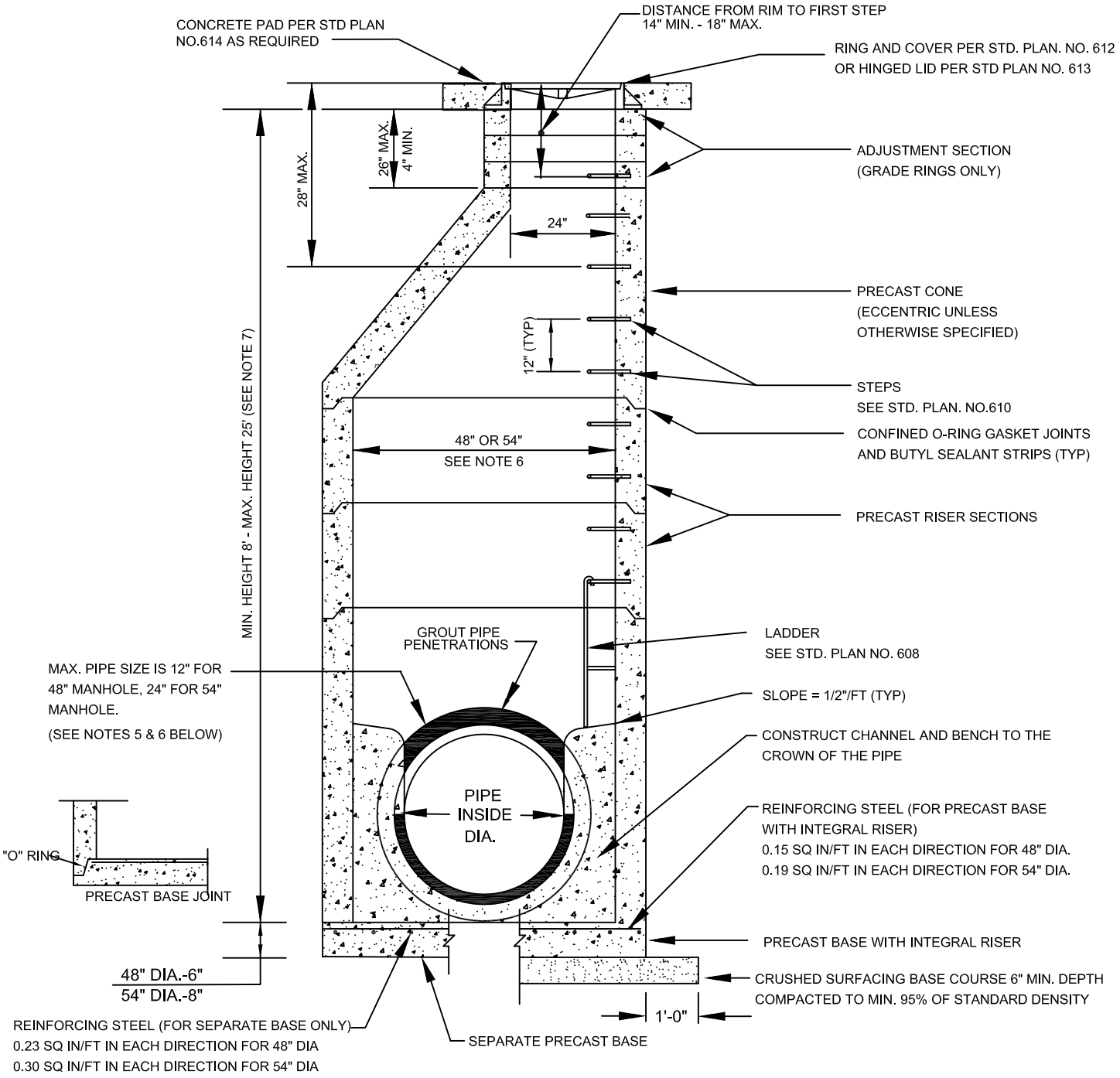
SNOHOMISH WASHINGTON

SADDLE MANHOLE - 48" to 54"

Approved By: S L S
City Engineer
Date: April 2010

605
Number

City of Snohomish Public Works Department



NOTES

1. MANHOLES TO BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199 (ASTM C 478) UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN STANDARD SPECIFICATIONS.
2. NON-REINFORCED CONCRETE IN CHANNEL AND SHELF SHALL BE CLASS 3000. ALL PRECAST CONCRETE SHALL BE CLASS 4000.
3. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM AND BE CORE DRILLED ONLY. NO HAMMERING IS ALLOWED; KOR-N-SEAL FACTORY INSTALLED BOOTS ARE ALLOWED.
4. 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 1" MINIMUM CLEARANCE.
5. KNOCKOUT OR CUTOUT HOLE SIZE IS EQUAL TO PIPE OUTER DIAMETER PLUS MANHOLE WALL THICKNESS. MAXIMUM PIPE SIZE IS 12" FOR 48" MANHOLE, 24" FOR 54" MANHOLE. MINIMUM DISTANCE BETWEEN HOLES IS 8" (MEASURED ON THE INSIDE OF THE MANHOLE).
6. MANHOLE SIZE DEPENDS ON SIZE, LOCATION AND NUMBER OF HOLES FOR PIPES. MANHOLE DESIGN AND SIZE SHALL BE APPROVED AND WARRANTED BY THE MANHOLE SUPPLIER.
7. FOR HEIGHTS OVER 25' MANHOLE BASE SLAB DESIGN SHALL BE DESIGNED BY A LICENSED STRUCTURAL ENGINEER.
8. GROUT ADJUSTING RINGS INSIDE, OUTSIDE AND BETWEEN. GROUT UNDER CASTING.

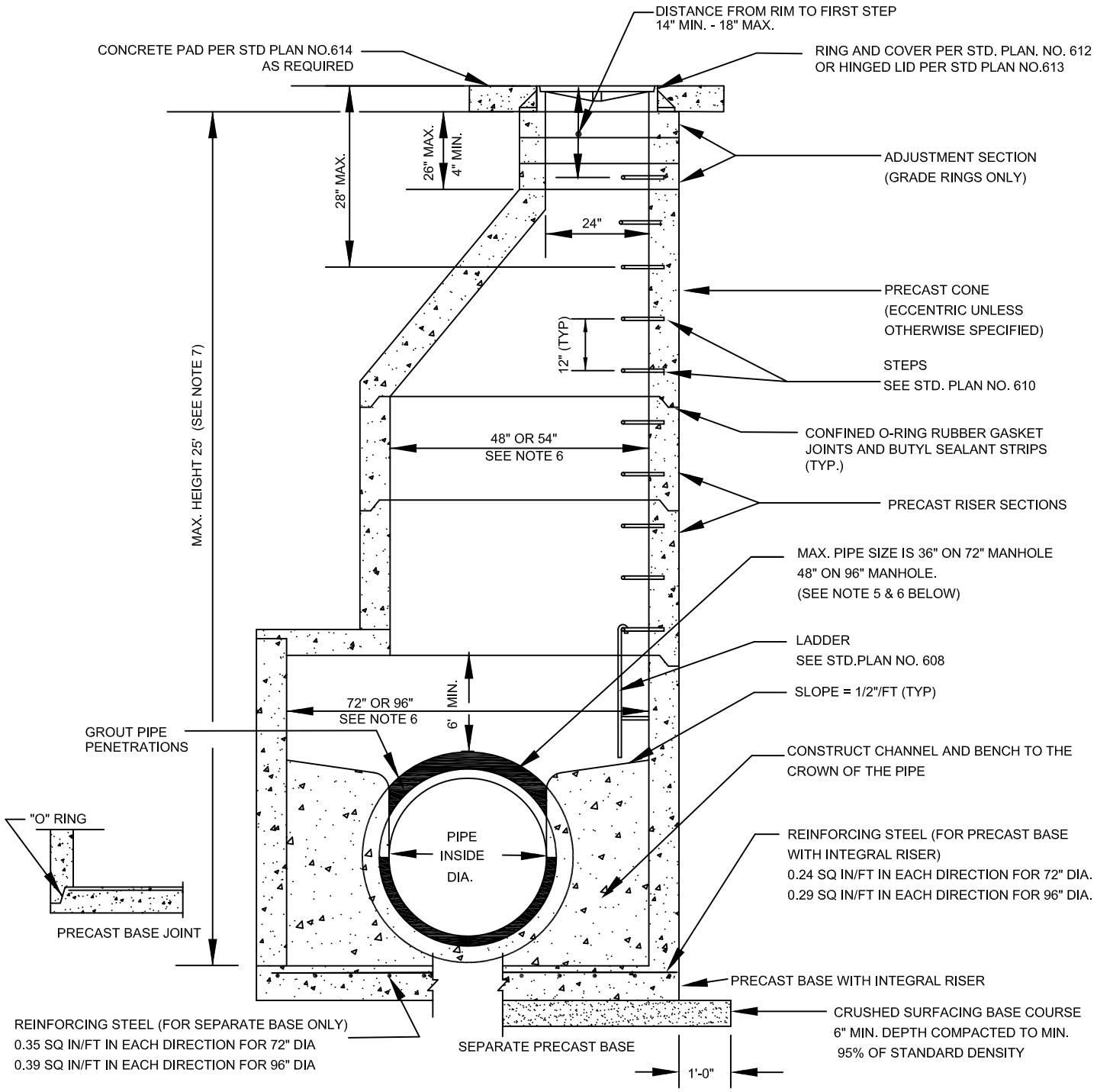
SNOHOMISH WASHINGTON

TYPE 1 MANHOLE (48" AND 54")

Approved By: S L S
City Engineer
Date: April 2010

606
Number

City of Snohomish Public Works Department



NOTES

1. MANHOLES TO BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199 (ASTM C 478) UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN STANDARD SPECIFICATIONS.
2. NON-REINFORCED CONCRETE IN CHANNEL AND SHELF SHALL BE CLASS 3000. ALL PRECAST CONCRETE SHALL BE CLASS 4000.
3. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM AND BE CORE DRILLED ONLY. NO HAMMERING IS ALLOWED; KOR-N-SEAL FACTORY INSTALLED BOOTS ARE ALLOWED.
4. 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 1" MINIMUM CLEARANCE.
5. KNOCKOUT OR CUTOUT HOLE SIZE IS EQUAL TO PIPE OUTER DIAMETER PLUS MANHOLE WALL THICKNESS. MAXIMUM HOLE SIZE IS 36" FOR 72" MANHOLE, 48" FOR 96" MANHOLE. MINIMUM DISTANCE BETWEEN HOLES IS 12"(MEASURED ON THE INSIDE OF THE MANHOLE).
6. MANHOLE SIZE DEPENDS ON SIZE, LOCATION AND NUMBER OF HOLES FOR PIPES. MANHOLE DESIGN AND SIZE SHALL BE APPROVED AND WARRANTED BY THE MANHOLE SUPPLIER.
7. FOR HEIGHTS OVER 25' MANHOLE BASE SLAB DESIGN SHALL BE DESIGNED BY A LICENSED STRUCTURAL ENGINEER.
8. GROUT ADJUSTING RINGS INSIDE, OUTSIDE AND BETWEEN. GROUT UNDER CASTING.

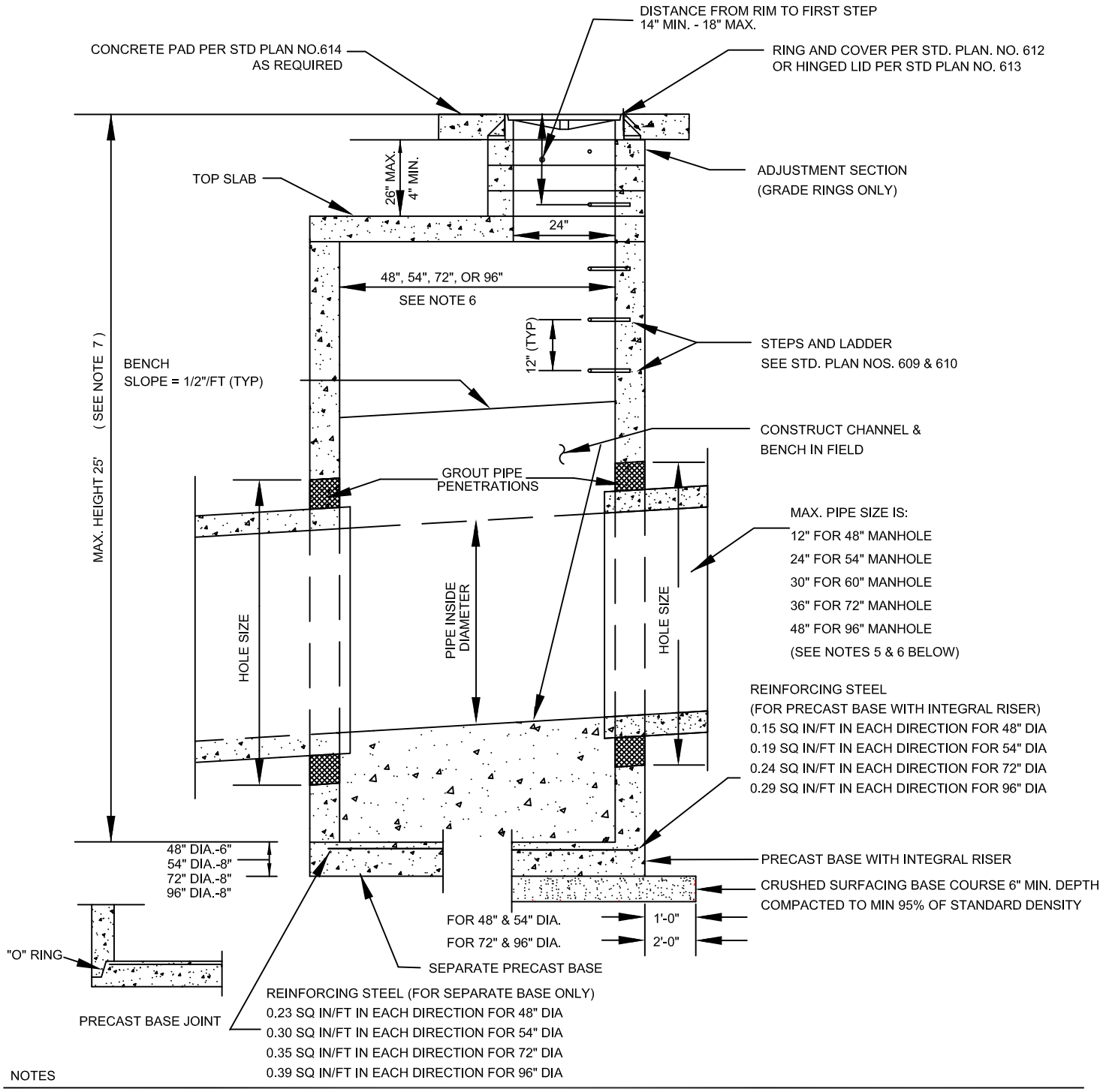
SNOHOMISH
WASHINGTON

TYPE 2 MANHOLE (72" AND 96")

Approved By:
S L S
City Engineer
Date: April 2010

607
Number

City of Snohomish Public Works Department



NOTES

1. MANHOLES TO BE CONSTRUCTED IN ACCORDANCE WITH AASHTO M-199 (ASTM C 478) UNLESS OTHERWISE SHOWN ON PLANS OR NOTED IN STANDARD SPECIFICATIONS.
2. NON-REINFORCED CONCRETE IN CHANNEL AND SHELF SHALL BE CLASS 3000. ALL PRECAST CONCRETE SHALL BE CLASS 4000.
3. PRECAST BASES SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MINIMUM AND BE CORE DRILLED ONLY. NO HAMMERING IS ALLOWED; KOR-N-SEAL FACTORY INSTALLED BOOTS ARE ALLOWED.
4. 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 1" MINIMUM CLEARANCE.
5. KNOCKOUT OR CUTOUT HOLE SIZE IS EQUAL TO PIPE OUTER DIAMETER PLUS MANHOLE WALL THICKNESS. MAXIMUM PIPE SIZE IS 12" FOR 48" MANHOLE, 24" FOR 54" MANHOLE, 36" FOR 72" MANHOLE AND 48" FOR 96" MANHOLE. MINIMUM DISTANCE BETWEEN HOLES IS 8" (MEASURED ON THE INSIDE OF THE MANHOLE).
6. MANHOLE SIZE DEPENDS ON SIZE, LOCATION AND NUMBER OF HOLES FOR PIPES. MANHOLE DESIGN AND SIZE SHALL BE APPROVED AND WARRANTED BY THE MANHOLE SUPPLIER.
7. FOR HEIGHTS OVER 25' MANHOLE BASE SLAB DESIGN SHALL BE DESIGNED BY A LICENSED STRUCTURAL ENGINEER.
8. GROUT ADJUSTING RINGS INSIDE, OUTSIDE AND BETWEEN. GROUT UNDER CASTING.

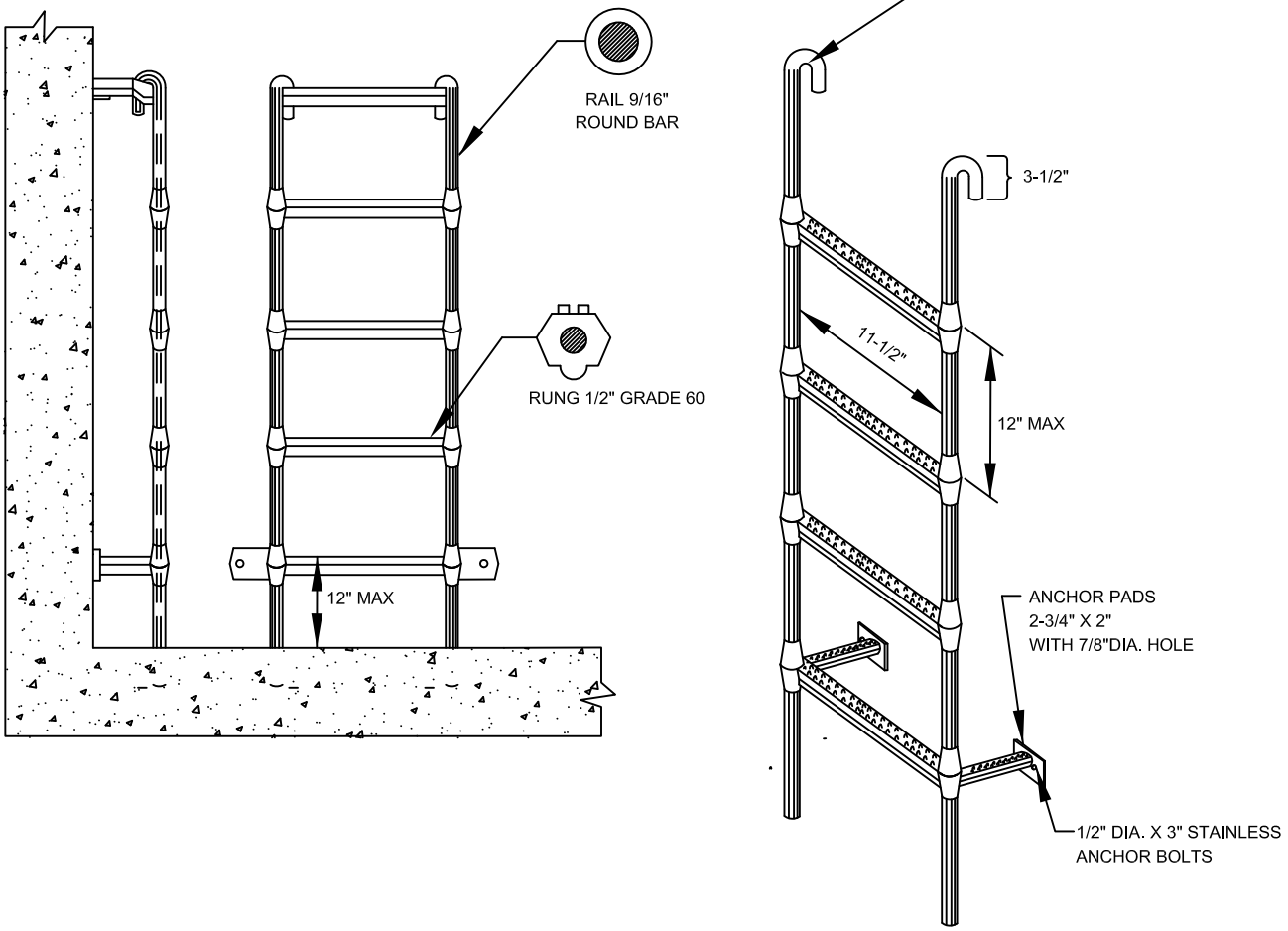
SNOHOMISH
WASHINGTON

TYPE 3 MANHOLE
(48" THROUGH 96")

Approved By:
S L S
City Engineer
Date: April 2010

608
Number

City of Snohomish Public Works Department



NOTES:

1. STEPS SHALL BE REINFORCED COPOLYMER PROPOLENE PLASTIC CONFORMING TO:

   (A) ASTM C 478 AND AASHTO M-199, HORIZONTAL LOAD SHALL BE 1500 LBS.

   (B) ASTM A615 GRADE 60 (DEFORMED REINFORCING STEEL BAR).

   (C) POLYPROPYLENE CONFORMS TO D-4101.

2. MANHOLE STEPS SHALL HAVE MOLDED SAFETY HAND GRIP. RED REFLECTORS ARE REQUIRED.

3. ALL FABRICATION DIMENSIONS INDICATED ARE MINIMUM.

4. THE ENTIRE POLYPROPYLENE PLASTIC MATERIAL SURROUNDING THE REINFORCING STEEL BAR SHALL BE CAST MONOLITHICALLY. MINIMUM COVER SHALL BE $\frac{3}{16}$ INCH.

5. STEPS SHALL BE AT A MINIMUM OF 12 INCHES.

6. STEPS SHALL BE INSTALLED IN ACCORDANCE WITH THE APPROVED MANUFATURER'S RECOMMENDED PROCEDURE.

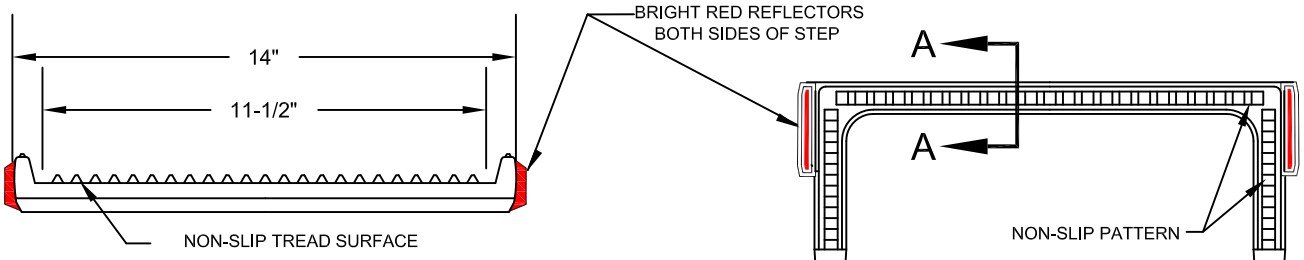
SNOHOMISH
WASHINGTON

POLYPROPYLENE LADDER

Approved By:
S L S
City Engineer
Date: April 2010

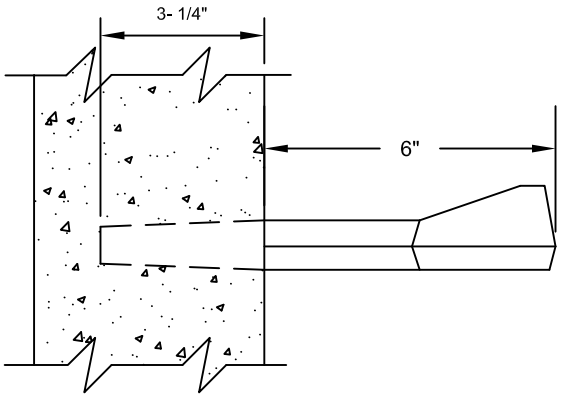
609
Number

City of Snohomish Public Works Department

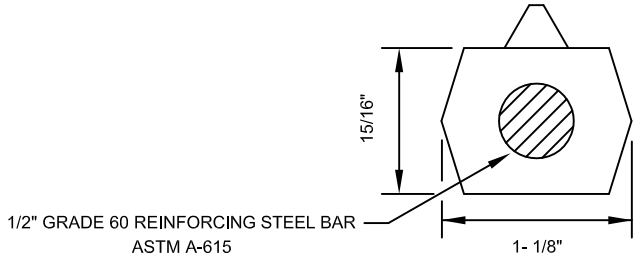


ELEVATION

PLAN



SIDE ELEVATION



SECTION A-A

NOTES:

1. STEPS SHALL BE REINFORCED COPOLYMER PROPOLENE PLASTIC CONFORMING TO:

   (A) ASTM C 478 AND AASHTO M-199, HORIZONTAL LOAD SHALL BE 1500 LBS.

   (B) ASTM A-615 GRADE 60 (DEFORMED REINFORCING STEEL BAR).

   (C) POLYPROPYLENE CONFORMS TO D-4101.

2. MANHOLE STEPS SHALL HAVE MOLDED SAFET YHAND GRIP. RED REFLECTORS ARE REQUIRED.
3. ALL FABRICATION DIMENSIONS INDICATED ARE MINIMUM.
4. THE ENTIRE POLYPROPYLENE PLASTIC MATERIAL SURROUNDING THE REINFORCING STEEL BAR SHALL BE CAST MONOLITHICALLY. MINIMUM COVER SHALL BE $\frac{3}{16}$ INCH.
5. STEPS SHALL BE SPACED AT A MAXIMUM OF 12 INCHES.
6. STEPS SHALL BE INSTALLED IN ACCORDANCE WITH THE APPROVED MANUFATURER'S RECOMMENDED PROCEDURE.

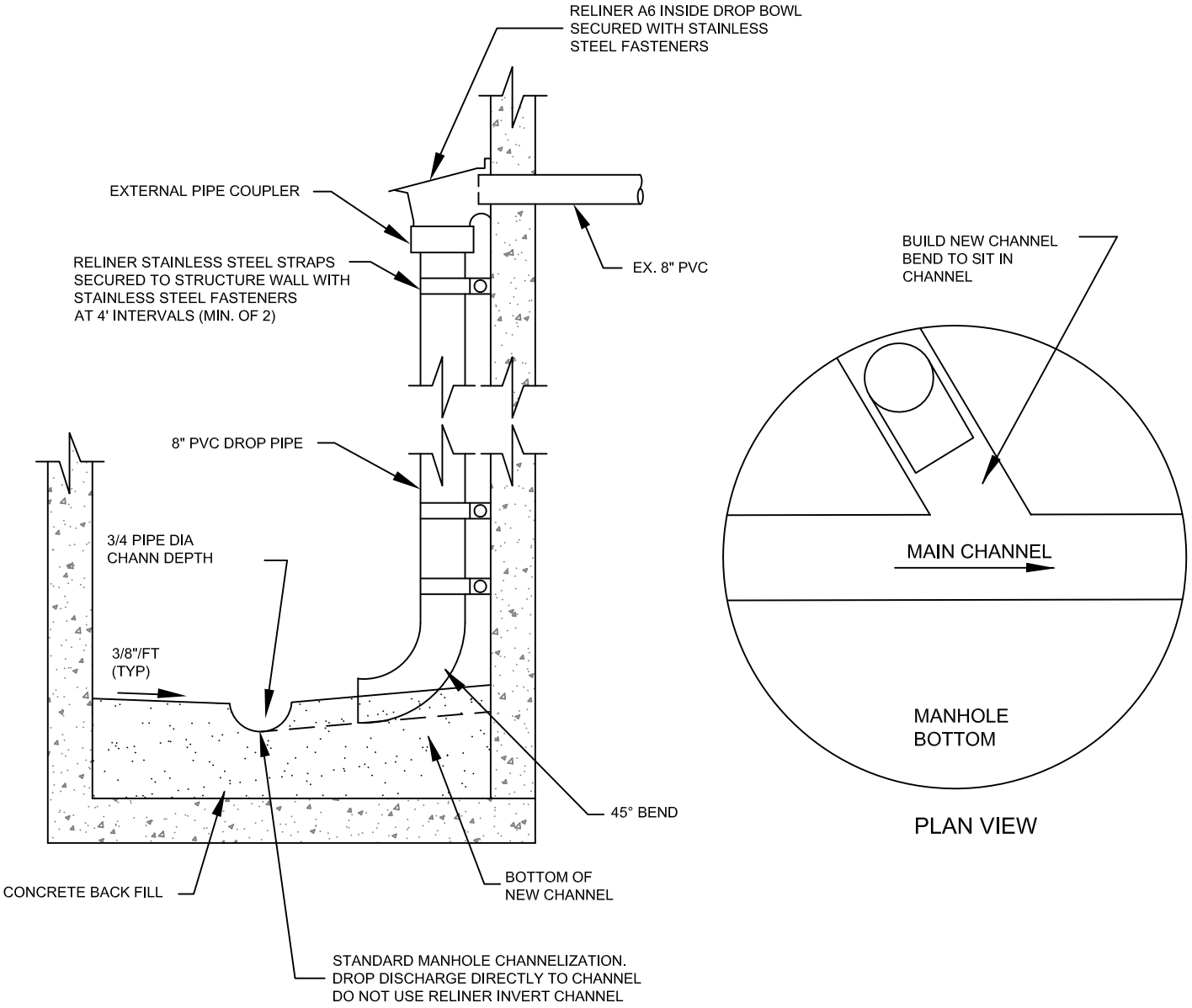
SNOHOMISH
WASHINGTON

POLYPROPYLENE PLASTIC STEP

Approved By:
S L S
City Engineer
Date: April 2010

610
Number

City of Snohomish Public Works Department



NTS

NOTE:
DROP INLET SHALL BE RELINER-DURAN W/A6 BOWL OR EQUAL AS APPROVED BY CITY.
INSTALL PER MANUFACTURER'S SPECIFICATIONS.

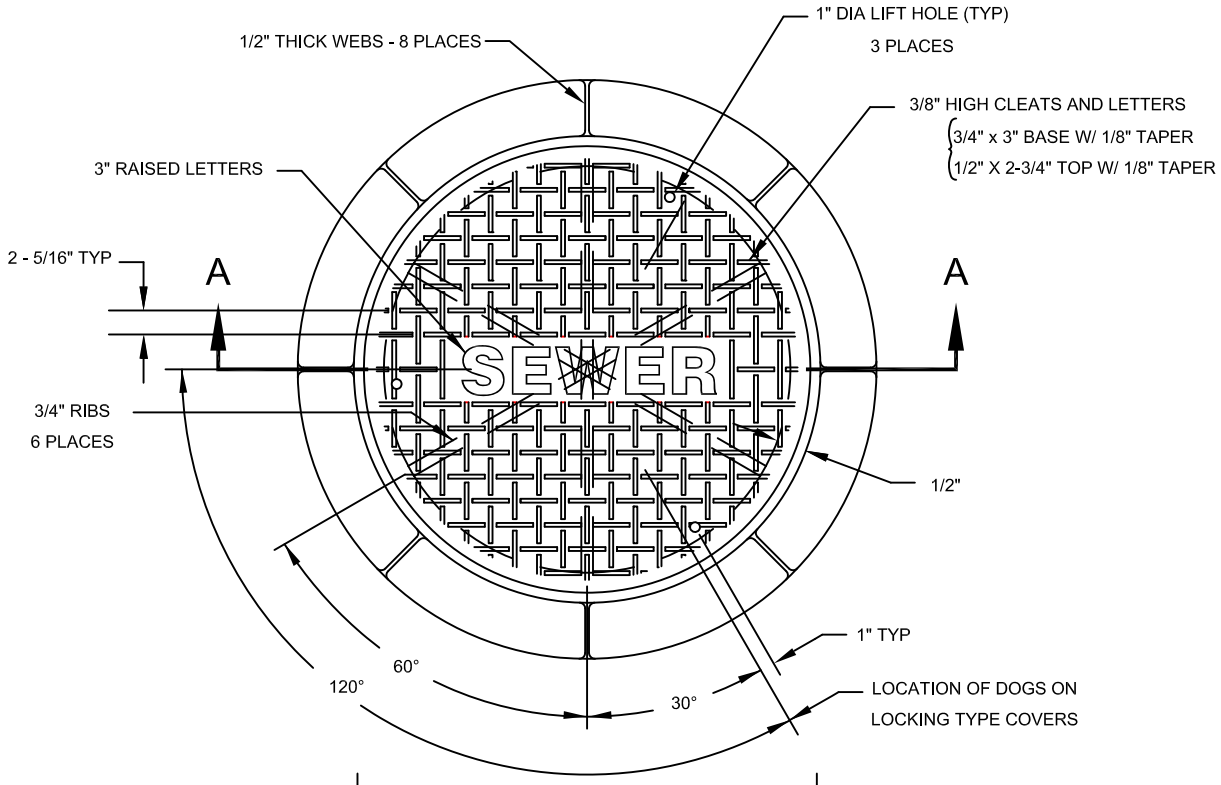
SNOHOMISH
WASHINGTON

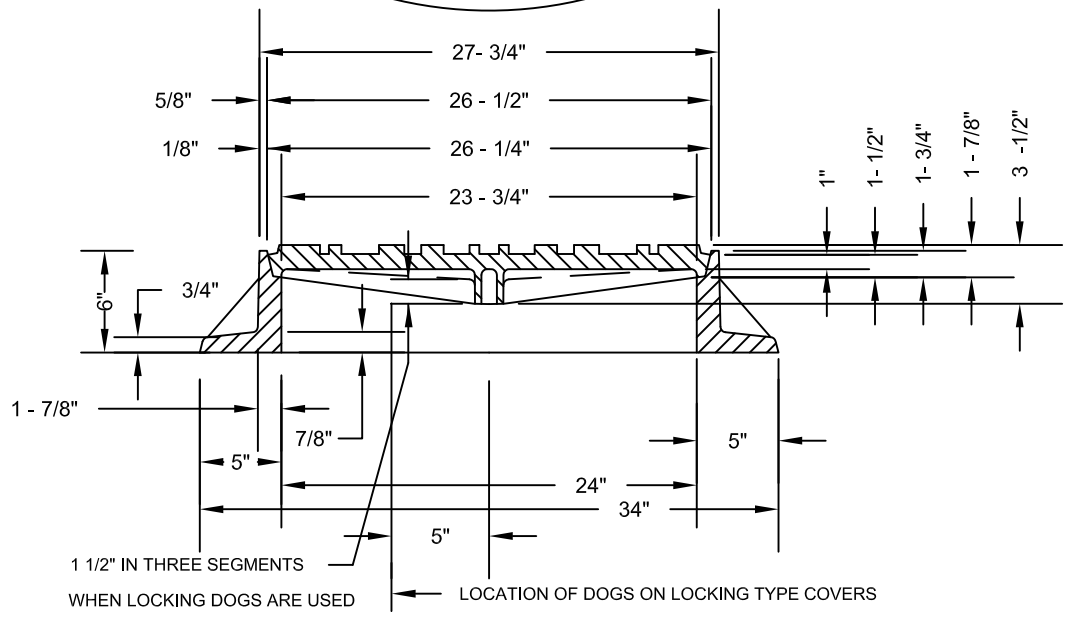
INSIDE DROP MANHOLE CONNECTION

Approved By:
S L S
City Engineer
Date: April 2010

611
Number

City of Snohomish Public Works Department





SECTION A-A

NOTES:

1. MANHOLE RINGS SHALL BE GRAY IRON CONFORMING TO THE REQUIREMENTS OF AASHTO M 105, GRADE 30B.
2. MANHOLE COVER TO BE DUCTILE IRON CONFORMING TO ASTM A536, GR 80-55-06 - EAST JORDAN IRON WORKS
3. LOCKING COVER SHALL BE USED IN ALL LOCATIONS. THE LID SHALL BE LOCKED DOWN WITH 3-5/8" S.S. SOCKET HEAD CAP SCREWS.
4. RING AND COVER SHALL BE TESTED FOR ACCURACY OF FIT AND SHALL BE MARKED IN SETS FOR DELIVERY.
5. ALL CASTINGS TO HAVE A BITUMINOUS COATING.

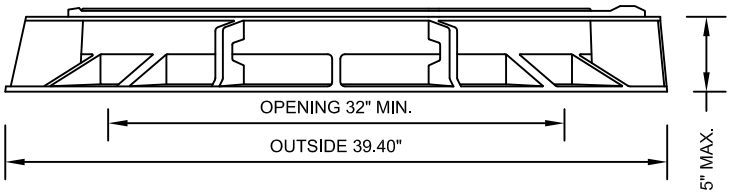
SNOHOMISH
WASHINGTON

MANHOLE RING AND COVER

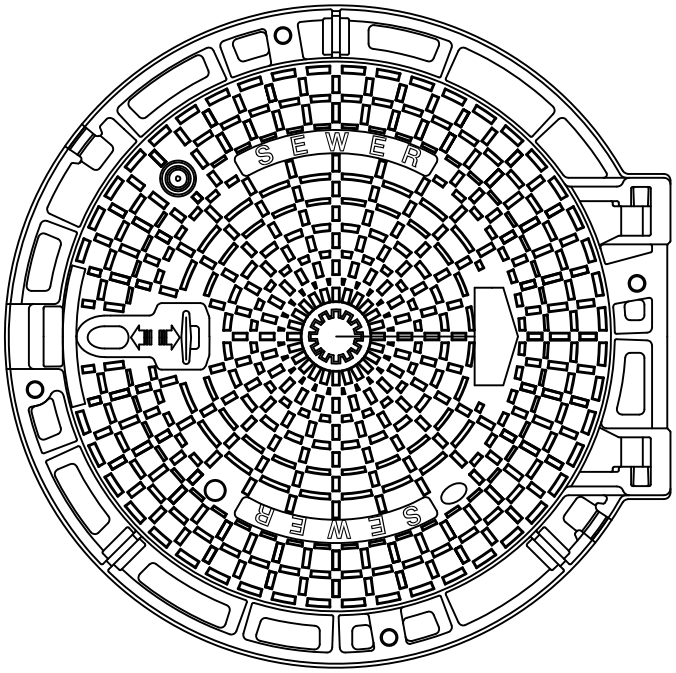
Approved By:
S L S
City Engineer
Date: April 2010

612
Number

City of Snohomish Public Works Department



ELEVATION



PLAN

NOTES:

1. MANHOLE COVER AND FRAME SHALL BE PARMEX OR APPROVED EQUAL. COVER AND FRAME SHALL BE MANUFACTURED FROM DUCTILE IRON.
2. COVER SHALL BE STAMPED SEWER.
3. COVERS SHALL BE DULY HINGED AND INCORPORATE A 90° BLOCKING SYSTEM TO PREVENT ACCIDENTAL CLOSURE. COVER SHALL BE ONE MAN OPERABLE USING STANDARD TOOLS AND SHALL BE CAPABLE OF WITHSTANDING A TEST LOAD OF 80,000 LBS.
4. FRAMES SHALL BE CIRCULAR, INCORPORATE A SEATING RING AND A FITTED PLUG IN EACH HINGE HOUSING AND BE AVAILABLE IN A 32" CLEAR OPENING. THE FRAME DEPTH SHALL NOT EXCEED 5 ", AND THE FLANGE SHALL INCORPORATE BEDDING SLOTS, BOLT HOLES AND LIFTING EYES.
5. ALL COMPONENTS SHALL BE BLACK COATED.
6. FRAME WEIGHT: 107 LBS
   COVER WIEGHT: 162 LBS.
   TOTAL WEIGHT: 269 LBS.

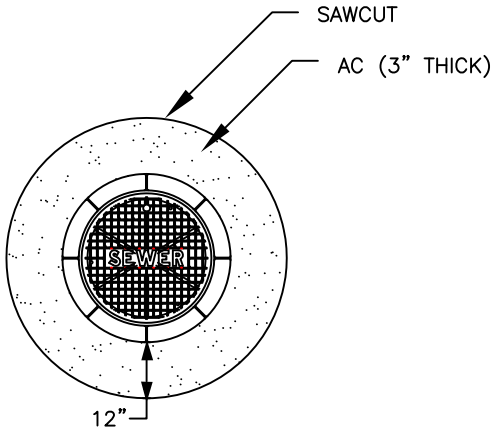
SNOHOMISH
WASHINGTON

HINGED MANHOLE COVER

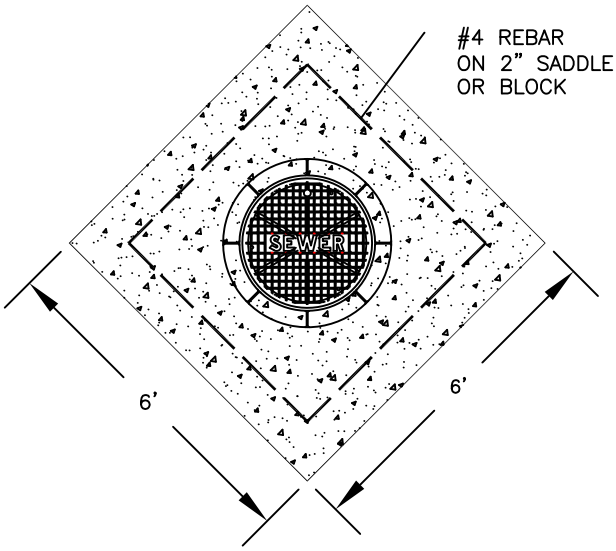
Approved By:
S L S
City Engineer
Date: April 2010

613
Number

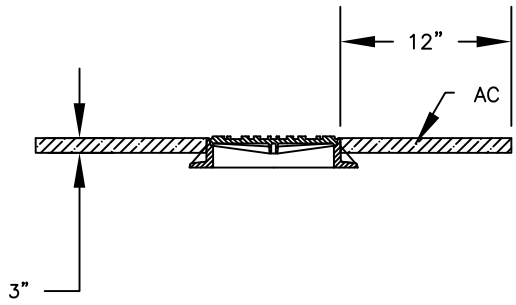
City of Snohomish Public Works Department

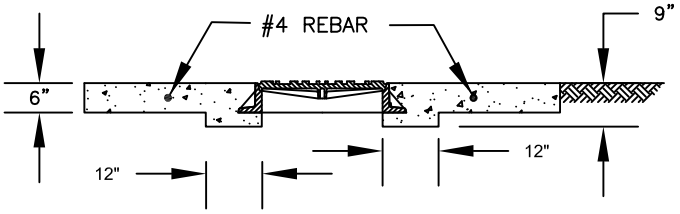


PAVED TRAFFIC AREAS



OUTSIDE PAVED TRAFFIC AREAS





NTS

NOTES:

1. CONCRETE SHALL CONFORM TO CURRENT STANDARDS AND SHALL BE 5.5 SACK MIX. (MINIMUM 3000-PSI 28-DAY STRENGTH)
2. WHERE DEPTH OF NECK EXCEEDS 26 INCHES, ADJUST MANHOLE TO GRADE BY INSERTING A NEW MANHOLE BARREL SECTION BETWEEN THE CONE AND EXISTING BARREL.
3. ADJUSTMENT RINGS/BLOCK, TOP OF CONE SECTION, AND BOTTOM OF IRON RING, SHALL BE WET STACKED IN 3/4" GROUT, PLASTER SMOOTH INSIDE AND OUT.
4. STEPS OR RUNGS SHALL BE ADDED AS NEEDED PER STND PLAN 608 AND 609.
5. PRECAST ADJUSTMENT RINGS SHALL BE CAST WITH GROOVE TO ALLOW FIELD INSTALLATION OF SAFETY STEP.
6. CONCRETE PERIMETER SEAL SHALL EXTEND TO 12 INCH MINIMUM OR 2 INCHES BELOW THE BOTTOM OF THE ADJUSTMENT RINGS OR BLOCKS.
7. SAWCUT ONLY. NO OVERCUTTING LIMITS OF PATCH.
8. IN NON-TRAFFIC AREAS (LANDSCAPED) THE CONCRETE PAD IS 4" THICK WITHOUT REINFORCEMENT.

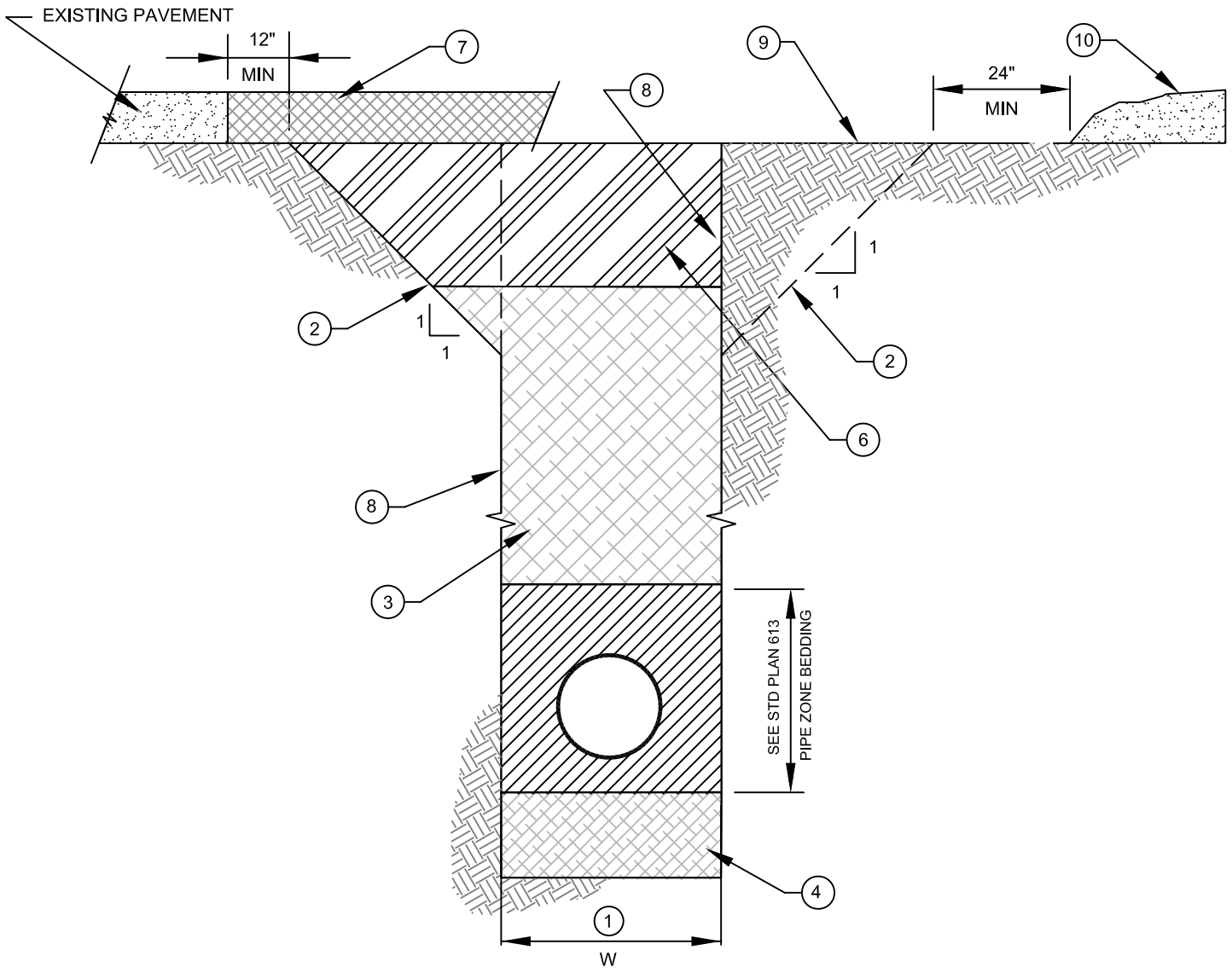
SNOHOMISH WASHINGTON

MANHOLE PAD AND ADJUSTMENT

Approved By:
S L S
City Engineer
Date: April 2010

614
Number

City of Snohomish Public Works Department



NOTES

1. W = MAXIMUM WIDTH OF TRENCH. FOR PIPES 15" OR LESS IN DIA, W = 40", FOR PIPES 18" OR GREATER, W = 1-1/2 X I.D. + 18".
2. ALTERNATE LAID-BACK TRENCH TO MEET O.S.H.A. REQUIREMENTS (NO SLOPES STEEPER THAN 1:1 EXCEPT FOR ROCK).
3. NATIVE MATERIAL IF ALLOWED IN ADVANCE BY THE CITY ENGINEER, OR IMPORTED GRAVEL BORROW AS DIRECTED SHALL COMPACT TO 90 % MAXIMUM DENSITY EXCEPT FROM SUBGRADE DOWN 4' WHICH SHALL BE CSTC.
4. CLASS A FOUNDATION GRAVEL, IF REQUIRED BY THE CITY ENGINEER TO REPLACE UNSUITABLE MATERIAL.
5. FOR ADDITIONAL COMPACTION INFORMATION SEE STANDARD PLAN 617.
6. THE TOP 4' OF BACKFILL SHALL BE CSTC. THE CONTRACTOR HAS THE OPTION TO FILL THE ENTIRE EXCAVATION TO SUBGRADE WITH CSTC. MINIMUM COMPATION 95% MAXIMUM DENSITY.
7. SEE CITY OF SNOHOMISH STANDARD PLAN 316 FOR PAVEMENT PATCH DETAILS.
8. VERTICAL TRENCH WALLS WITH SHORING SHALL CONFORM TO O.S.H.A. REGULATIONS.
9. SUBGRADE OR GROUND SURFACE IN NON-PAVED AREAS.
10. EXCAVATED NATIVE MATERIAL OR APPROVED STOCKPILED BACKFILL MATERIAL.

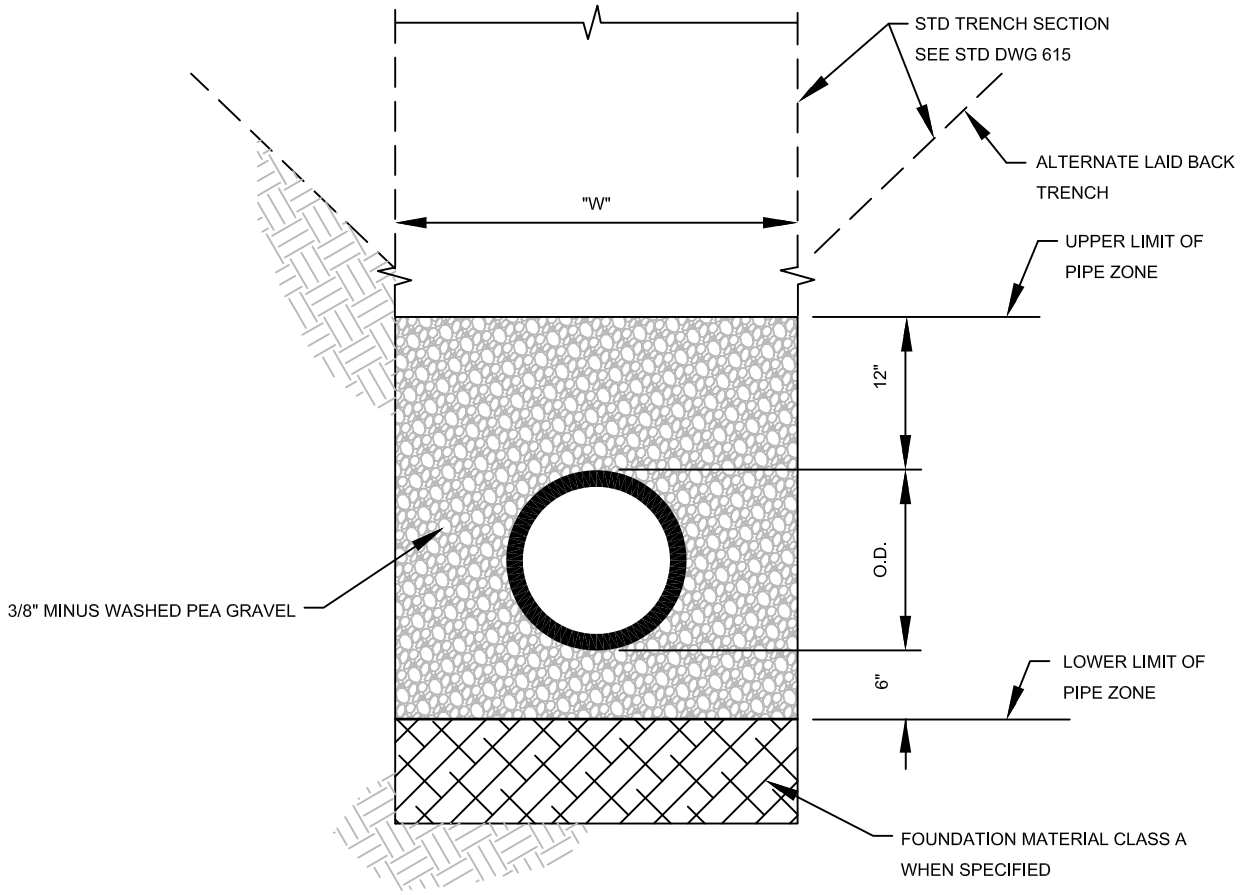
SNOHOMISH
WASHINGTON

TYPICAL SEWER TRENCH SECTION

Approved By:
S L S
City Engineer
Date: April 2010

615
Number

City of Snohomish Public Works Department



LIMITS OF TRENCH:

1. W = MAXIMUM WIDTH OF TRENCH. FOR PIPES 15" OR LESS IN DIA W = 40". FOR PIPES 18" OR GREATER, W = 1-1/2 X I.D. + 18"

BEDDING AND FOUNDATION MATERIALS:

1. BEDDING MATERIAL SHALL BE PEA GRAVEL CONCFORMING TO SECTION 9-03.12 (3) OF THE STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION WSDOT/APWA.
2. FOUNDATION MATERIAL, IF REQUIRED, SHALL BE FOUNDATION MATERIAL CLASS A CONFORMING TO SECTION 9-03.12 OF THE STANDARD SPECIFICATIONS FOR ROAD, BRIDGE AND MUNICIPAL CONSTRUCTION WSDOT/APWA.

PROCEDURE FOR COMPACTION:

1. PROVIDE UNIFORM SUPPORT UNDER PIPE BARREL.
2. COMPACT BEDDING MATERIAL TO 90% MAXIMUM DENSITY EXCEPT DIRECTLY OVER PIPE. HAND TAMP ONLY.
3. HAND TAMP UNDER HAUNCHES.
4. FOR ADDITIONAL COMPACTION INFORMATION SEE STANDARD PLAN 617.

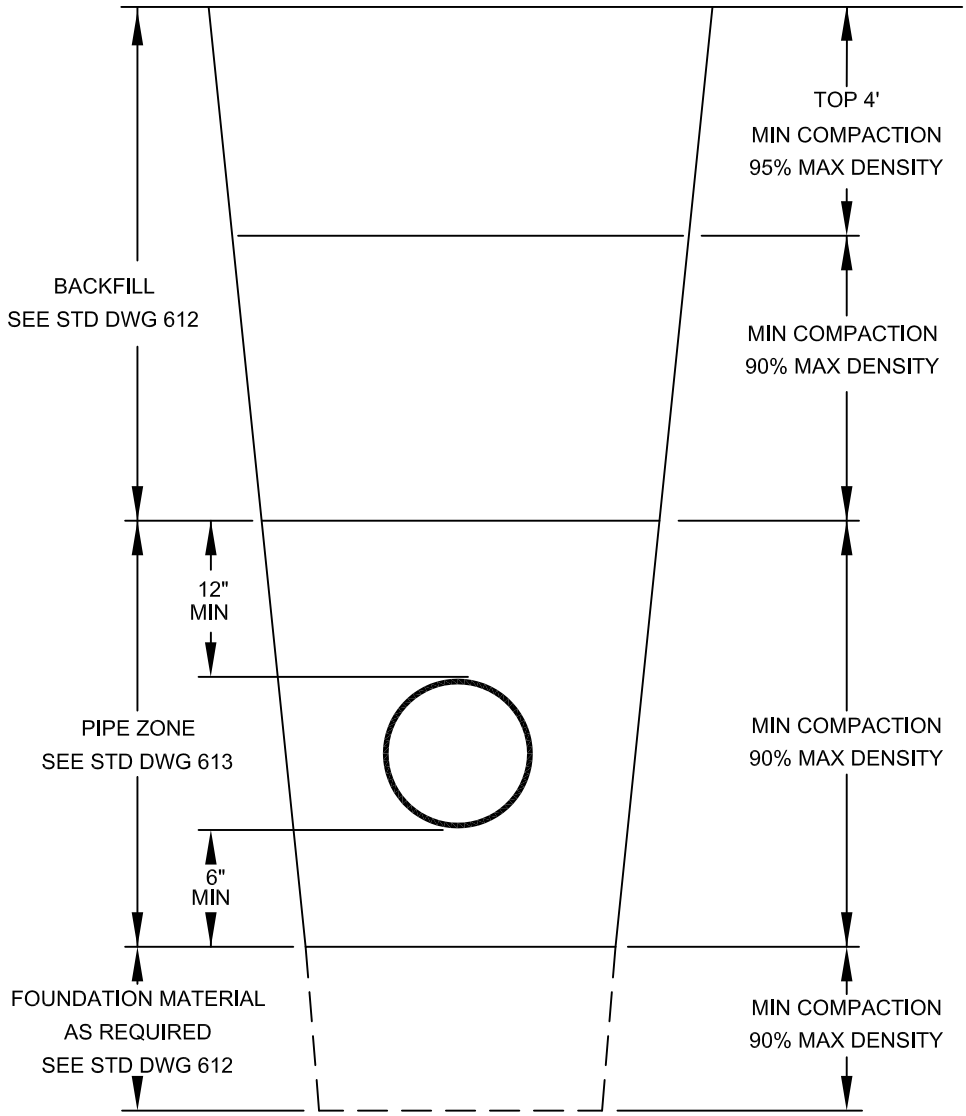
SNOHOMISH
WASHINGTON

BEDDING FOR SEWER PIPE IN TRENCHES

Approved By:
S L S
City Engineer
Date: April 2010

616
Number

City of Snohomish Public Works Department



SECTION

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NOTES:

1. ALL BACKFLL MATERIAL SHALL BE PLACED IN LIFTS NOT TO EXCEED 12 INCHES BEFORE COMPACTION UNLESS AUTHORIZED BY THE CITY ENGINEER DUE TO THE CHARACTER OF THE MATERIAL AND COMPACTING EQUIPMENT.
2. MECHANICAL COMPACTION OF BACKFILL MATERIAL SHALL NOT BEGIN UNTIL THE DEPTH OF COMPACTED MATERIAL IS 2 FEET ABOVE THE TOP OF PIPE.
3. EACH LIFT SHALL BE MECHANICALLY COMPACTED TO THE REQUIRED DENSITY PRIOR TO PLACING SUCCEEDING LIFTS OF BACKFILL MATERIAL
4. COMPACTON TESTS SHALL BE AS REQUIRED BY THE CITY ENGINEER, BUT IN NO CASE LESS THAN 2 TESTS EVERY 200 FEET OF TRENCH LENGTH (ONE AT SUBGRADE AND ONE AT 50% OF TRENCH DEPTH).
5. IN PLACE DENSITY WILL BE DETERMINED BY ONE OR MORE OF THE FOLLOWING METHODS
   ASTM D1556 – TEST FOR DENSITY OF SOIL IN PLACE BY THE SAND CONE METHOD.
   ASTM D2167 – (RUBBER. BALLON METHOD)
   ASTM D2922 – (NUCLEAR METHOD)
6. LABORATORY DENSITY WILL BE DETERMINED BY ASTM D698, MOISTURE DENSITY RELATIONS OF SOILS AND SOIL AGGREGATE MIXTURES.

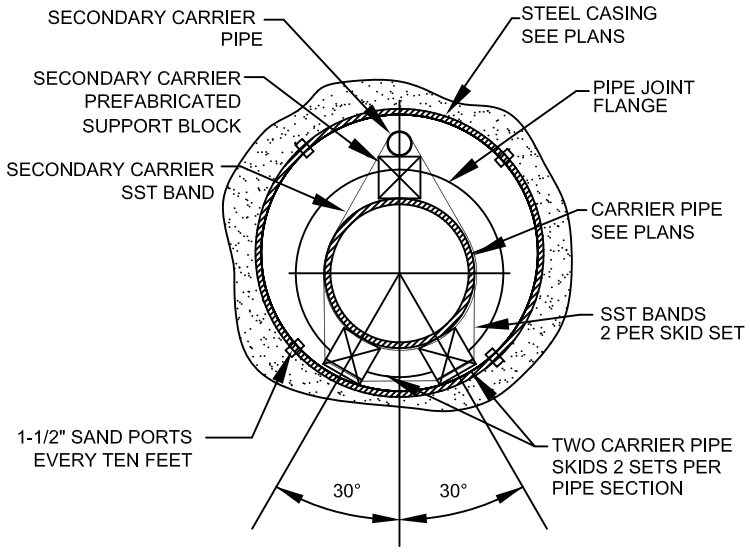
SNOHOMISH
WASHINGTON

TYPICAL SEWER TRENCH COMPACTION

Approved By:
S L S
City Engineer
Date: April 2010

617
Number

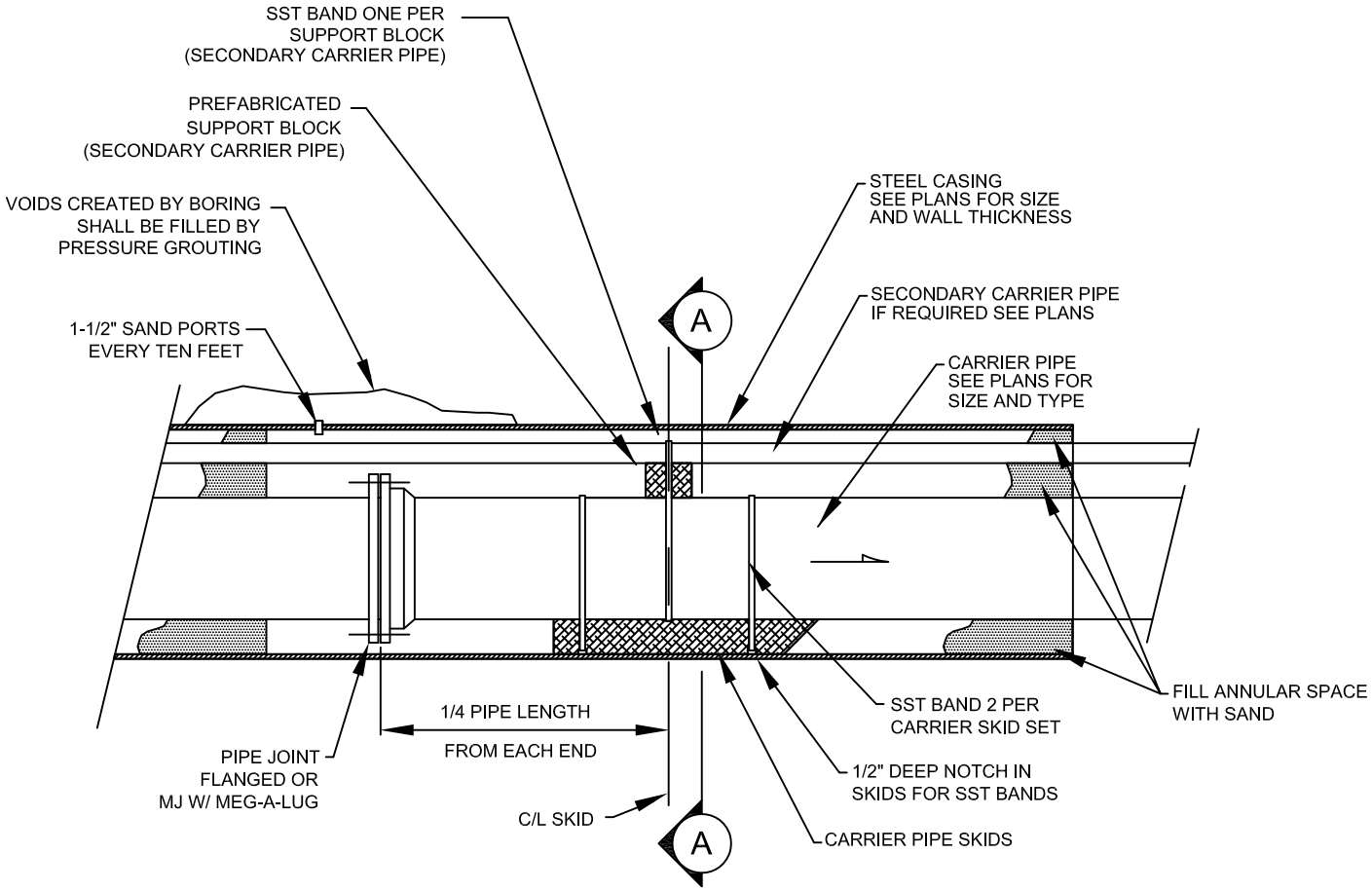
City of Snohomish Public Works Department



A TYPICAL SECTION
NTS

CONSTRUCTION NOTES:

1. ALL JOINTS OF CARRIER PIPE WITHIN CASING SHALL BE FLANGED (FL) OR MECHANICAL JOINT (MJ) FITTINGS WITH MEG-A-LUG
2. RESTRAINTS.
   CARRIER PIPE WILL BE PRESSURE TESTED BY CONTRACTOR AND TV'D BY CITY CREWS BEFORE FILLING ANULAR SPACE OF CASING PIPE WITH SAND.
3. CARRIER SKIDS SHALL BE SECURELY ATTACHED TO CARRIER PIPE W/STAINLESS STEEL BANDS (MIN 2 BANDS PER SKID SET).
4. CARRIER SKIDS SHALL BE ROUNDED OR BEVELED ON LEADING EDGE, AND SHALL BE NOTCHED TO RECEIVE SST BANDS.
5. CARRIER SKIDS SHALL BE APPROVED PREFABRICATED SKIDS. A 1" MIN CLEARANCE SHALL BE MAINTAINED BETWEEN JOINT FLANGE AND CASING.
6. SECONDARY CARRIER PIPES SHALL BE SECURED TO THE TOP OF THE MAIN CARRIER PIPE AS SHOWN.
7. SECONDARY CARRIER PIPE WILL BE TESTED BEFORE CASING ANNULAR SPACE IS FILLED.



SNOHOMISH WASHINGTON

CASING DETAIL

Approved By: S L S
City Engineer
Date: April 2010

618
Number

City of Snohomish Public Works Department