

CITY OF VERNONIA PUBLIC WORKS DESIGN STANDARDS

SECTION: 4.0000 - SANITARY SEWERS

4.0010 - GENERAL DESIGN REQUIREMENTS

Performance Standards - Sanitary sewer system design shall meet the policies and guidelines of the current Oregon Administrative Rules (OAR), and the Oregon Department of Environmental Quality (DEQ) guidelines.

Sanitary sewer systems shall be designed to provide gravity service to all areas of development where public. Pump stations are acceptable only if it is not possible to provide gravity service.

Sanitary sewer system capacity shall be designed for ultimate development density of the tributary area. The system shall allow for future system extension and for future development.

Sanitary sewers shall be designed to remove the domestic sewage and industrial wastes from basements of houses, where practical, commercial or industrial buildings, and all public and private establishments where possible.

Storm water, including street, roof or footing drainage, shall not be discharged into the sanitary sewer system, but shall be removed by a system of storm drains or by some other method separate from the sanitary sewer system.

Unpolluted or non contact cooling waters shall not be discharged into sanitary sewers. The overflow drains and filter backwash lines of swimming pools and "hot tubs" shall drain into a sanitary sewer.

As a condition of sewer service, all developments will be required to provide public sewers to adjacent upstream parcels in order to provide for an orderly development of the drainage area. This shall include the extension of sewer mains in easements across the property to adjoining properties and across the street frontage of the property to adjoining properties when the main is located in the street right-of-way. This shall include trunk sewers that are oversized to provide capacity for upstream development.

All sewer service lines shall be extended a minimum of ten ft. (10') beyond the last property served within the subdivision.

All sewer lines shall be located within the public right-of-way as directed by the City Engineer. These lines are placed in the public right-of-way for ease of maintenance, access, control of the facility operation of the facility, and to provide required replacement and/or repair.

Where sewers are constructed on slopes greater than 20%, in areas designated as hazardous or where there are site conditions that may cause damage to improvements, slippage or slides as determined by the City Engineer, a soils and/or geologic report may be required.

Where the finished graded surface is greater than twenty (20) percent, or as required by the City Engineer, soil stabilization fabric shall be placed over the entire disturbed area.

Standard specifications and drawings relevant to this section may be found in the most current edition of the APWA Standard Specifications for Public Works Construction, Oregon Chapter.

4.0011 - PIPE MATERIALS AND SIZE

All public sanitary sewers shall be constructed with concrete, PVC, or HDPE pipe as specified in the appropriate section of the Vernonia Standard Specifications. Where required for added

strength, Ductile Iron pipe may be used. Concrete pipe strength shall meet the applicable sections of ASTM C-14 and ASTM C-76. PVC pipe and fittings shall conform to ASH D-3034, SDR 35.

Private sanitary sewers shall meet the appropriate sections of the Uniform Plumbing Code (UPC.)

All sanitary sewer main lines shall be a minimum diameter of eight inches (8"). Six inch (6") diameter sewer for non extendible sewers of up to 250 feet in length serving eight (eight) lots or less may be permitted with approval.

4.0012 - MINIMUM DESIGN CRITERIA

Velocity - All sanitary sewers shall be designed on a grade which produces a mean velocity, when flowing half-full or full, of no less than two feet (2") per second.

Manning Equation - When calculating minimum pipe slopes and velocities, the engineer shall use the manning pipe friction formula.

Pipe Coefficient - The minimum pipe roughness coefficient for sanitary sewers shall be 0.013.

4.0020 - ALIGNMENT AND COVER

4.0021 - RIGHT OF WAY LOCATION

Sanitary sewer lines shall be located five feet (5') north and west from the right-of-way centerline. All changes in direction of pipe shall be made at a manhole.

Sewers shall be located in the street right-of-way. If streets have curved alignments, the center of the manhole shall not be less than six feet (6') from the curb face on the outside of the curve nor the sewer centerline less than six feet (6') from the curb face on the inside of the curve.

Curved alignments in sanitary sewers are not permitted.

4.0022 - MINIMUM COVER

All sanitary sewers shall be laid at a depth sufficient to drain building sewers, to protect against damage by frost or traffic, and to drain basement sewers, where practical. Sufficient depth shall mean the minimum cover from the top of the pipe to finish grade at the sewer alignment. In new residential hillside subdivisions, mainline and lateral sewers shall be placed in the street at a depth sufficient to drain building sewers on the low side of the street.

Sanitary sewers in residential areas shall be placed in the street with the following minimum cover:

Building Service Lateral- Six feet (6')
Trunk and Collector Sewer in the roadway - Eight feet (8')
In easements - Eight feet (8')

Where pipes cross under ditches or streams and the cover is less than three feet (3'), extra protection will be required as discussed in Section 4.0025.

Where the topography is relatively flat and existing sewers are shallow (five feet (5') or less), the minimum cover shall be three feet (3').

Deviation from the above standards will be considered on a case-by-case basis when one of the following circumstances exist:

- a. Underlying rock strata - required: A request in writing to the City Engineer together with submittal of a soils report with a plan and profile certifying that bed rock exists three feet (3') below the undisturbed ground surface at all investigated alignments.
- b. A ditch or stream must be crossed - required: A plan and profile; horizontal scale 1" = 20', vertical scale 1" = 2'.

- c. Where three ft. (3') of cover is not possible, the sewer line shall be ductile iron or
- d. A pumping station may be substituted with approval of the City Engineer.

4.0023 - SEPARATION WITH WATER LINES

Mains shall be installed a minimum clear distance of ten feet (10') horizontally from water lines and shall be installed to go under water lines with a minimum of 18 inches of clearance at intersections of these pipes. Exceptions shall first be approved by the City Engineer. In all instances the distances shall be measured edge to edge. The minimum spacing between water mains and storm drains, gas lines, and other underground utilities, excepting sanitary sewers, shall be three feet (3') horizontally when the standard utility location cannot be maintained.

4.0024 - EASEMENTS

Sewers placed in easements along a property line shall have the easement centered on the property line and the sewer shall be offset 18 inches from the property lines. For sewers placed in easements located other than along a property line, the sewer shall be placed in the center of the easement. The conditions of the easement shall be such that the easement shall not be used for any purpose which would interfere with the unrestricted use for sewer main purposes. Under no circumstances shall a building or structure be placed over a sanitary sewer main or sewer easement. This shall include overhanging structures with footings located outside the easement. Further, no trees or large bushes shall be planted in the easement.

Easements for sewers less than 12 inches in diameter shall have a minimum width of fifteen feet (15'). Sewers greater than 12 inches in diameter shall have a minimum easement width of twenty feet (20').

Sewers with more than eight feet (8') of cover and/or inside diameters 24 inches or greater will require wider easements. A slope of one horizontal to one vertical from the sewer invert to ground surface will be used to determine easement width. Easement widths shall vary from the fifteen foot (15') minimum by five foot (5') increments; for instance, 15, 20, 25 feet.

Easement locations for public sewer mains serving a PUD, apartment complex, or commercial/industrial development shall be in parking lots, private drives, or similar open areas which will permit unobstructed vehicle access for maintenance by City personnel.

All easements must be furnished to the City for review and approval prior to recording.

4.0025 - RELATION TO WATERCOURSES

Generally, the top of all sanitary sewers entering, crossing or adjacent to streams, irrigation ditches or drainage ways shall be at a sufficient depth below the natural bottom of the waterway to protect the sewer line. One foot (1') of cover is required where the sewer is in rock, three feet (3') of cover is required in other materials. In paved channels, the top of the sewer line shall be placed at least six inches (6") below finish grade of the batten of the channel, except as provided above.

Sewers located along streams shall be located outside of the stream bed and sufficiently removed therefrom to provide for future possible stream channel widening. All manhole covers shall be watertight, at or below the 100 year flood elevation.

Sewers crossing streams or drainage channels shall be designed to cross the stream as nearly perpendicular to the stream channel as possible and shall be free from change of grade. The minimum cover shall be 36 inches from the bottom of the stream bed or drainage channel.

Pipe material shall be ductile iron with an 18-foot length of pipe centered on the stream or drainage channel centerline. The ductile iron pipe shall extend to a point where a one-to-one slope, which begins at the top of the bank and slopes down from the bank away from the channel centerline, intersects the top of the pipe.

A scour pad centered on the sewer line will be required when the top of the pipe to the bottom of the stream or drainage channel is thirty inches (30") or less. The scour pad shall be concrete, six inches (6") thick and six feet (6') wide, reinforced with number four (4) rebar twelve inches (12") on center both ways and shall extend to a point where a one-to-one slope, that begins at the top of the bank and slopes down from the bank away from channel centerline intersects the top of the pipe. Each deviation from the above requirements will be reviewed on a case-by-case basis.

4.0030 - STRUCTURES

4.0031 - MANHOLES

Manholes shall conform to ASTM C-478.

Manholes shall be located at changes in slope, alignment, pipe size, and at all pipe junctions with present or future sanitary sewers.

Manhole spacing shall not be greater than 400 feet.

The angle between incoming and out going sewer lines shall be greater than 80-degrees.

Designs for manholes are shown in the Standard Drawings. They are suitable for most conditions. New designs or revisions should not be shown on the construction drawings unless the standard designs are not suitable. New or revised designs may be necessary if:

- a. One or more of the sewers to be connected to the manhole is over 36 inches in diameter. Smaller diameters may require a special design if the manhole is at an alignment change.
- b. Several sewers will be connected to the manhole.
- c. There is less than 80 degrees between the incoming and outgoing sewer.
- d. The manhole will be subject to unusual structural loads.
- e. Diversion or other flow control measures are required.

Where one or more of conditions a), b), or c) are encountered, a drawing of the manhole base should be made to determine if it is feasible to use designs shown in the Standard Drawings. It may be necessary to restrict the options to a specific Standard Drawing specified by a note on the construction drawings. If a special design is required for any reason, it will be necessary to show the details on the construction drawings and to provide structural calculations as needed.

Some alternate manhole features are shown in the Standard Drawings. Where these features are required, they must be specified by a note on the construction drawings. Some examples are:

- a. Flat tops must be used in lieu of cones where there will be less than four feet (4') between the manhole shelf and the top of the manhole
- b. Watertight manhole frames and covers are to be used if flood waters are expected to cover the manhole top or if the manhole must be located in the street gutter. Such conditions should be avoided wherever feasible.
- c. Tamper-proof manhole frames and covers are required in areas subject to vandalism, such as areas which are not readily visible to the general public or the property occupants.

Standard for elevation differences at manholes have been established to compensate for normal energy losses and to prevent surcharging of a sewer by a larger sewer. For purposes of slope calculation and for establishing elevation differences, the elevations are given at the intersection of the sewer centerline (usually the center of the manhole). The rules for elevation differences at manholes are:

- a. The crowns of incoming sewers shall be at least as high as the crown of the outgoing sewer.
- b. If the incoming and outgoing sewers are of equal size and are passing straight through the manhole, no added elevation change is required.
- c. If sewers intersect or the alignment changes at the manhole, the invert elevation difference shall be at least 0.10 feet for 0°-45° of horizontal deflection angle, and 0.20 feet for over 45° of horizontal deflection angle.
- d. The slope of a sewer within a manhole shall be no less than the slope of the same sewer outside of the manhole.
- e. Where the difference between the slope of the incoming and out going pipe is greater than six percent (6%), the slope across the manhole shall be the average of the incoming and outgoing pipes.
- f. Drop connections are required when the vertical distance between flow lines exceeds two feet (2'). The diameter of the drop connection must be specified on the construction drawings. The diameter of the drop connection shall not be more than one pipe size smaller than the diameter of the incoming sewer. Smooth flow lines with vertical distances of less than one foot (1') must be provided wherever feasible. Drop connections shall be outside drops.
- g. All connections must enter the manhole through a channel in the base. This includes drop connections and connections to existing manholes.

Where conditions make compliance with these rules impractical, exceptions will be permitted. It will be necessary, however, for the designer to provide a complete analysis of the need for such designs.

4.0032 - CLEAN OUTS

Cleanouts will not be approved as substitutes for manholes on public sewer lines. Clean outs are permitted at the upper end of a sewer that will be extended during a future construction phase. When the sewer is extended, the clean out will be removed and a manhole shall be installed in the appropriate location. If future extension requires a change in sewer alignment or grade, a manhole will be required at the cleanout location.

Cleanouts are permitted at the end of a non-extendable sewer line that does not exceed 250 feet in length nor serve more than eight lots (8).

4.0033 - ANCHOR BLOCKS

For sewer pipes greater than four inches (4") in diameter, concrete anchor blocks shall be required if the slopes are greater than twenty percent (20%). Anchor blocks shall key into trench sides. Spacing for anchor blocks is as follows:

SPACING FOR ANCHOR BLOCK FOR ALL SIZE PIPE

SLOPE %	MINIMUM SPACING (FT)
0 - 19.99	NO ANCHOR REQUIRED
20 - 34.99	35
35 - 50.99	25
51 - OR MORE	15 OR SPECIAL DESIGN

4.0034 - WATER BARS

Where the finished graded surface has a slope greater than or equal to 3 units horizontal to 1 unit vertical or as required, water bars shall be installed. The water bars shall be sloped slightly to drain runoff water away from the pipe line alignment. Water bars shall have a maximum spacing of forty feet (40').

4.0040 - SERVICE LATERAL

Service laterals are those public sewer lines to which a private building sewer connects.

Each individual building site shall be connected by a separate private building sewer service line connected to the public sewer. Combined sewer service lines will be permitted only when the property cannot legally be further divided. Examples of this is a residential lot with a house and an unattached garage or shop with plumbing facilities.

The minimum inside diameter of a sewer service lateral shall be four inches (4") and shall be equal to or greater than the building sewer diameter. Service laterals are to be built to the same construction standards and of the same materials as the sewer mainline. Service laterals in general shall be placed at 90° to the main sewer line to avoid excessive exposure to other utilities during excavation for construction or maintenance of the service lines. Angles other than 90° may be approved for special conditions such as cul-de-sac lots. In no case shall the angle between the main and the service be less than 90°. Service line connections shall not be made at manholes except at cul-de-sacs.

The minimum slope of sewer service lines shall be 2 percent (1/4 inch per foot) except that for unusual conditions, a slope of 1 percent (1/8 inch per foot) may be approved. It will be necessary, however, for the designer to provide a complete analysis of the need for any sewer service lateral slope less than 2.00 percent. The maximum slope shall be 100 percent (45° or one foot per foot). Deep connection risers (see the Standard Detail for service lateral to deep sewers) or drop connections to manholes must be used where service line slopes would exceed 100 percent.

Tees for service laterals shall be installed at 100% slope, and 1/16 or 1/8 bends shall be installed to provide proper grade for service lateral. Service laterals shall be extended to the end at street right-of-way line or easement line, when a sewer is installed in easement. A water tight plug shall be installed in end of lateral and a 2" x 4" wood marker shall be placed at lateral end from pipe invert to two feet (2') above the ground. 2" x 4" top to be painted white and marked with the depth of the lateral measured from ground to invert of pipe. Curb line to have an S stenciled in white paint on face of the curb at lateral crossing.

4.0050 - CONNECTION TO EXISTING SEWERS

Connections to, and extensions of, existing sewers will occur to facilitate new development.

Connections to existing manholes shall be made with the following guidelines:

- a. Where the invert of the connecting pipe is two feet or less above the manhole shelf, a beaver slide will be constructed utilizing Portland Cement concrete. The sewage entering the manhole will follow a smooth concrete channel transitioning evenly from the invert of the inlet pipe into the main channel. Sewage will not be allowed to fall freely to the manhole base.
- b. Where the invert of the connecting pipe is more than two feet above the manhole shelf, the contractor will be required to construct an outside drop with the inlet pipe invert being located at the manhole shelf. The sewage entering the manhole will follow a smooth concrete channel transition from the inlet pipe into the main channel.
- c. Where the invert is required to enter below the shelf of the manhole, the inlet pipe will not enter below a point where the crown of the new inlet pipe is below the crown of the outlet pipe. The base of the manhole will be rebuilt if damaged in this process. The sewage will enter the main flow in a smooth channel transitioning from the inlet pipe to the main channel.

- d. No pipe will enter an existing manhole where the angle between the incoming flow and the outgoing flow is greater than 90°.

When sewers are extended from cleanouts, the entire cleanout assembly, including the wye, shall be removed.

New building service laterals will be made at existing tees where possible.

When tees do not exist on the Public Sanitary Sewer System, the new lateral sewer will enter the collection system through a "cored" opening with an approved connector.

4.0060 - PRIVATE SEWER LINES

Private sewer systems shall be constructed in accordance with the UPC.

4.0070 - SYSTEM TESTING

All pipe shall be pressure tested and manholes leak tested per the latest edition of the APWA Standard Specifications for Public Works Construction, Oregon Chapter.

4.0080 - SEWAGE PUMP STATION DESIGN STANDARDS

4.0081 - GENERAL

The pump station shall be a ground level self priming pump type facility or other type approved by the Superintendent of Public Works.

The station shall be designed by an engineer registered in the State of Oregon and experienced in the design of such facilities. Service area peak flows, pump station cycle and hydrogen sulfide calculations shall be submitted to the City for review and approval.

4.0082 - CONSTRUCTION

Station construction will include: wet well, pump enclosure, associated piping and valves, electrical controls, automatic dialer, visual alarm, emergency power transfer switch and connection receptacle, lighting, heater, ventilating fan, instrumentation, access road, fencing, landscaping, potable water supply, and shall conform to the Department of Environmental Quality (DEQ) standards and Oregon Administrative Rules (OAR) Chapter 340, Division 52.

4.0083 - CAPACITIES

Pump station shall be designed to pump the peak waste water flow from the service area. When the service area is not built out, staging of pump station capacity will be allowed. The wet well shall be sized to allow for a minimum number of starts per hour. Inlet piping will not be used as a portion of the wet well.

4.0084 - HYDROGEN SULFIDE

Calculations for hydrogen sulfide production shall be performed. Hydrogen sulfide control equipment shall be installed as required. The method used (flow back, air injection, chemical injection) shall be reviewed and approved by the City Engineer.

4.0085 - ELECTRICAL

a) ELECTRICAL

Pump station and related facilities will be constructed to Electrical and Building Codes.

Electrical controls shall be located above ground mounted in a waterproof enclosure. Electrical panels shall be listed. The pump station wet well shall be considered a hazardous location. Level controls in the wet well shall be intrinsically safe.

b) CONTROLS

Controls may be mechanical relays or programmable logic-controllers. Pumps shall automatically alternate lead-lag position with each pumping cycle.

Pump level control shall be by multi-trode.

c) POWER

An auxiliary power connector shall be mounted on the exterior of the station with a manual transfer switch mounted in the interior.

Where the flow is substantial or where environmental damage may occur due to power failure, the City Engineer may require permanent standby power.

Alarms include:

Pump failure
Power failure
Telemetry failure
High water level

4.0086 - MATERIALS

a) Pumps

A minimum of two pumps shall be supplied. Each pump shall be capable of pumping the peak waste water flow. Where more than two pumps are used, the station shall be able to pump peak waste water flow when the largest pump is out of service.

Pumps shall be self priming pumps, with V-belt drives, manufactured by Hydromatic, Gorman Rupp or equal, explosion-proof suitable for hazardous location when required, and shall be UL or FM listed.

b) PIPING & VALVES

Piping and fittings shall be ductile iron to a point at least two feet (2') outside the station. Valves shall be metal, suitable for wastewater use. Valves shall be designed for wastewater service. Provide pressure gages with isolation and purge valves on pump suction and discharge piping.

Steel fabrications shall be hot dipped galvanized. Painting is required on valves, piping, and pipe fittings.

Force main shall be designed for nominal flow velocity in the range of 3 to 5 ft/sec.

Force mains shall not be less than four inches (4") in diameter for raw sewage.

c) SPARE PARTS

Supply two sets each of all gaskets, bearings, V-belts, and mechanical seals for rotation equipment.

4.0087 - ADDITIONAL FEATURES

Provide 1-inch anti-freeze hose bibb. Potable water shall be provided by an above ground reduced pressure back flow Preventer.

Provide positive ventilation in the enclosure.

Provide odor control as required.

Landscaping will only be required when the station is visible from the public roadway and then only to blend with the local aesthetics.

A 6-foot chain link fence shall surround the pump station when required by the City Engineer.

4.0088 - OPERATING AND MAINTENANCE DATA

Compile product data and related information appropriate for City's maintenance and operation of products furnished under the contract.

Prepare operations and maintenance manual.

Instruct City's personnel in the maintenance of products and in the operation of equipment and systems.

4.0090 - EROSION CONTROL

Erosion control will be required for all areas disturbed during construction and following construction until permanent protection is established.

Temporary facilities may include silt fences, drain barriers, gravel entries, ditches, surface stabilization or other devices as necessary.

Temporary/permanent hydro-seeding or acceptable seeding and mulching must be provided whenever perennial cover cannot be established on sites which will be exposed after September 1 or prior to June 1.