

**DIVISION 2 – SITE WORK****SECTION 02722 – SEWER SYSTEM - MINIMUM DESIGN STANDARDS****1. PLAN APPROVAL**

In addition to the requirements for plan approval in the General Requirements, the plans shall clearly show the lots and blocks to be served and the location of the sanitary sewer mains with reference to property lines. All service wyes shall be stationed for proper control and for future location. Profiles shall give dimensions, grade, rim elevations, and invert elevations into and out of the manholes of the sewer to be constructed. The plan view shall include topographic information with at least 2 foot contours for all lots in the service area.

**2. DESIGN FLOW**

**2.01.** The design shall include consideration for providing service to the entire area tributary to the outfall point. Estimates of residential sewage contribution shall be based on 100 gallons per capita per day with a peak hour factor of 3. Minimum residential population density shall be figured on a basis of 3.5 persons per house, structure density based on the zone, and 70 percent of total land area developed as residential unless otherwise zoned, subdivided, or restricted.

**2.02.** Institutional, commercial, and industrial sewage contribution estimates shall be based on the design criteria set by the Colorado Department of Public Health and Environment (CDPHE) with review by the Town. Allowance shall be made for infiltration flow of 50 gallons per day per inch diameter per mile of pipe. Design flow shall be the sum of the peak flow as computed above and the flow due to infiltration as determined above or by actual field experience if worse.

**2.03.** Sewers 15 inches in diameter and smaller shall carry the peak design flow at a maximum flow depth of half the pipe diameter. Sewers larger than 15” in diameter may be designed to flow up to three quarters full at peak design flow rate. The minimum velocity at the design flow rate shall be 2.0 feet per second (fps). Where actual flow will be much below normal for several years the minimum velocity shall be achieved by suitable grades at the partial design flow.

**3. PIPING DETAILS**

**3.01.** Materials: Piping materials shall meet the requirements specified in the Standard Specifications for Sewer Collection System Construction. In most cases pipe shall be SDR 35 PVC. Use of materials other than PVC pipe shall be permitted only with prior approval of the Town.

**3.02.** Size: Normally sanitary sewer mains shall be 8 inch diameter or larger to facilitate maintenance. Service connections shall be 4 inch diameter or larger. Six (6) inch sewer mains may be installed under special conditions where only 3 or fewer residential connections will be made to the line, and where approved by the Town. Smaller force mains may be used under certain conditions with approval of the Town.

**3.03.** Grades: The following minimum grades shall apply unless hydraulic (flow) requirements above supersede the grade criteria:

<u>Sewer Diameter</u>	<u>Minimum Grade (percent)</u>
4 inch	2.0 or 1/2 inch per foot
6 inch	1.00
8 inch and larger	0.50

**3.04. Minimum Velocity:** Pipes must be designed to flow at a minimum of 2 fps at design flows unless the Town approves a deviation which will only be considered under extreme circumstances.

**3.05. Maximum Slope:** Sewer shall be designed with slopes of less than 10%. If the ground profile is steeper than that, control the slope of the sewer with the use of adequately spaced drop manholes. Where velocities greater than 5 feet per second are attained, special provisions shall be made to keep the liquids from separating from the solids and to protect against displacement by erosion and shock.

**3.06. Manhole Spacing and Design:** Manholes shall be provided at every change in direction or grade, or connection with other sewer main; maximum spacing shall be 400 feet for lines 15 inches or smaller, and 450 feet for lines larger than 15 inches. A minimum of 0.10' foot drop shall be provided in manholes with a maximum change in direction of 45 degrees and 0.20 feet for changes in direction greater than 45 degrees. Sewer lines shall be straight and not curved between manholes in both line and grade. Manholes shall be stubbed out with suitable size pipe wherever future extension of the sewer is anticipated. Where pipes of different size come into or exit a manhole, the tops of the pipes shall be at the same elevation so that the smaller pipe is not subject to submergence from the larger pipe.

**3.07. Flexible Joints near Manhole:** Provide a flexible joint in the pipe 12 to 18 inches from all manhole walls and other solid structures.

**3.08. Terminal Manhole:** There shall be a terminal manhole at the end of all sewer lines, past the last sewer service.

**3.09. Underdrains:** Where underdrains are to be constructed with the sewer mains (or other locations), cleanouts or manholes shall be provided for the underdrain at each manhole or at 400 foot maximum intervals for the underdrain. Typically underdrains installed with sewer mains shall be placed to the side and below the sewer main

**3.10. Drop Manhole:** Drop manholes should be provided when the change in elevation through the manhole is in excess of 24 inches. Designs that require drop manholes, require Town authorization.

**3.11. Depth of Bury:** Minimum cover on sewer mains shall normally be seven feet to ground surface. Bury of 7 to 9 feet is considered normal. Depths outside this range will require specific approval of the Town.

**4. LIFT STATIONS**

The need for pumping facilities and the design of these facilities shall be discussed with the Town prior to beginning design. The use of lift stations is discouraged unless truly necessary. The Town reserves the right to dictate the location and type of pumping facilities to be constructed and to require extra maintenance services from the developer and/or to impose additional charges to the users.

**5. INVERTED SIPHONS**

The use of inverted siphons is discouraged especially in low flow and intermittent flow situations. If the Town does approve the use of a siphon system, the system shall have not less than 2 barrels, with a

minimum pipe size of 6 inches and shall be provided with necessary appurtenances for convenient flushing and maintenance. The manholes shall have adequate clearances for jetting. In general, sufficient head shall be provided with pipe sizes selected to secure velocities of at least 3.0 feet per second for average flows. The inlet and outlet details shall be arranged so that the normal flow is diverted to one barrel and so that either barrel may be out of service for cleaning.

## **6. SERVICE CONNECTIONS**

**6.01.** Typically, the service line should not be any closer than five feet to the side property line, and no service line may be constructed through or in front of any adjoining property. Whenever possible, service lines shall be installed perpendicular to the main and shall be located 10 feet inside the downhill property line. Minimum fall on 6 inch sewer service lines shall be 1/8 inch (1%) per foot (2% preferred) and for 4 inch pipe 1/4 inch per foot (2%). Minimum cover of the sewer service shall be three (3) feet at the property line where there will be no basements.

**6.02.** Full body wyes shall be provided in the sewer main for service connections at each building site. Service lines shall be shown on the drawings in plan and profile. Tapping saddles will only be allowed with approval of the Town for circumstances which necessitate their use and not allowed for new construction. Fittings shall be angled upwards so that the upper invert of one-eighth bend connected to the fitting will have an elevation equal to or higher than the inside top of the sewer main. Service lines installed during main line construction shall extend through the front utility easement, have a cleanout out at the termination and be plugged with a water and air tight seal and marked with a 2 x 4 brought to grade and backed by a steel T post marked with the depth of the line. Riser connections shall be installed where the elevation of the top of the fitting is more than 12 feet below finished ground surface. See Standard Specifications and typical drawing for more detail on service stub-ins and connections.

**6.03.** Before a Contractor or property owner begins building a basement or any habitable structure below ground, the Owner or Contractor shall ensure that the level of the most adjacent sewer is 6 inches in elevation lower than the flood level of the lowest fixture or drain in said basement. This requirement will be waived if the Contractor or Owner installs a sewer lift station or an approved backflow prevention device.

**6.04.** Sewer mains shall be extended to a point at least 20 feet up from the lowest lot corner adjacent to the sewer main of the uppermost lot to be served and terminate in a manhole. Service connections will not be allowed to enter directly into a manholes except when the diameter of the service line is 50% or more of the main in which case a special manhole shall be added for that purpose. Only with the approval of the Town may service connections be allowed immediately above or below a manhole.

## **7. CONSTRUCTION**

**7.01.** In general construction shall conform with the Standard Specifications for Sewer System Construction as well as with the Excavation, Backfill, and Compaction, Specifications (Section 02200). Select bedding shall extend from 6 inches below the pipe barrel to springline (half way up the pipe). Compaction in this region is critical to support the pipe and must be 95% Standard Proctor. The first one foot of backfill over the pipe shall be hand placed, hand compacted, select material as defined in the Excavation and Backfill Specifications. For gravity sewer line construction, a single size screen rock between ¾" and 1-1/2" shall be used as select bedding. Place a non-woven geotextile on top of the screened rock or wrap the entire pipe zone in a geotextile wrap.

**7.02.** In places where the sewer has less than four feet of cover, provisions shall be made to protect pipe from impact loading. If very shallow insulation may be required.

**7.03.** An approved cut-off wall shall be constructed on the lower side of crossings such as under open ditches, canals, or creeks, to prevent water from following the sewer trench.

**7.04.** Underdrains, where required, shall be formed by creating a non-woven geotextile wrap around screened bedding around the sewer pipe and underdrain. See Sewer / Seep trench typical drawing.

## **8. PROTECTION OF WATER SUPPLIES**

**8.01.** There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any sewage, non-potable, or polluted water into the potable supply directly or through contamination of the surrounding soils.

**8.02.** Whenever possible, sewer mains and service lines should be laid at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a horizontal separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if it is laid in a separate trench, or it is laid in the same trench with the water mains located at one side on a bench of undisturbed earth with at least five feet of horizontal separation.

**8.03.** Unless there is at least 10 feet horizontal separation, the elevation of the crown of the sewer must be at least 18 inches below the invert of the water main or the sewer line encased.

**8.04.** Whenever sewer must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of a sewer cannot be buried to meet the above requirement, the water main may be relocated to provide this separation or the sewer pipe shall be encased by either a single joint of PVC or HDPE pipe for a distance of 10 feet on each side of the water. When possible, one full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible. When it is impractical to encase the sewer, the water line shall be encased with the same criteria above.

**8.05.** When sewer lines or services cross above water mains or services, the water mains must be protected at a minimum by the criteria above. In such cases, there shall be no joints within ten feet on each side of the water line. In all cases where the sewer line is above the water, a casing shall be required and the ends of the casing shall be sealed in a watertight manner with a reducing no-hub gasket or other approved method. Both lines should be pressure tested to assure water tightness.

**8.06.** There shall be a minimum clear distance vertically of 8" between the uppermost part of the lower utility and the lowermost part of the upper utility including casings to allow for proper bedding. In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of any of the pipes.

**8.07.** The Town shall have final review authority of all proposed designs which do not provide adequate separation. These requirements for protection of the water system against contamination from non-potable water conveyances shall apply equally to water mains and service connections.

**9. MISCELLANEOUS REQUIREMENTS**

**9.01.** Rain water leaders, roof drains, surface drains, or ground water drains shall not be connected to the sanitary sewer. Each sanitary sewer service system shall be separate from the drainage system.

**9.02.** Grease and sand traps shall be installed where required by the provisions of the Ridgway Municipal Code and/or the International Plumbing Code.

**10. TESTING**

Testing of sewer lines and services, manholes and appurtenances shall conform with the requirements of the applicable portions of the Sewer System Construction (Section 02723) regarding lapping, vacuum, in- & exfiltration, and pressure testing.