

# 6. Wastewater Collection System

## PART I – DESIGN

### 6.1 General

The wastewater collection system shall be designed with sufficient capacity to convey peak flows, including an allowance for inflow and infiltration (I/I). The following *minimum* criteria shall apply to the Design, as applicable to the proposed development:

#### 6.1.1 Average and Peak Flows in Residential Areas:

- a.) Population Density: minimum 40 persons/ha
- b.) Average Sewage Generation Rate: 320 L/capita/day
- c.) Peaking Factor shall be the larger of 2.5 or

$$= 1 + \frac{14}{4\sqrt{P}} \text{ where } P = \text{contribution population in 1,000s}$$

#### 6.1.2 Average and Peak Flows in Commercial, Industrial, and Institutional Areas:

- a.) The lower limit for average Sewage Generation Rate shall be 20m<sup>3</sup>/day/Ha
- b.) Peaking factor will vary with the nature of the development. The Consultant shall conduct an analysis of the proposed commercial, industrial, and institutional developments to estimate the peaking factor. Regardless of the results of the analysis, a minimum peaking factor of 3.0 shall apply.

#### 6.1.3 Inflow/Infiltration (I/I) Allowance:

- a.) Inflow: 0.4 L/s for every manhole located within a sag area on a roadway with some form of water inflow control in place
- b.) Infiltration: 0.28 L/s/ha

### 6.2 Gravity Sewer Mains

#### 6.2.1 Pipe Diameter:

- a.) Minimum 200 mm

#### 6.2.2 Flow Velocity:

- a.) Minimum 0.6 m/s
- b.) Maximum 3.0 m/s

#### 6.2.3 Manning's "n":

- a.) n = 0.013

#### 6.2.4 Required Sewer Capacity:

- a.) Estimated Design Flow / 0.86

### 6.2.5 Pipe Slope

a.) Minimum slope shall conform to the following table:

Pipe Diameter (mm)	Minimum Slope (%)
200	0.40
250	0.30
300	0.22
375	0.15
450	0.12
≥ 525	0.10

b.) The first 100 m section of sewer main shall have a minimum slope of 1.0%.

c.) Minimum slopes shall be increased by 50% for curved sewers.

### 6.2.6 Pipe Design

a.) Strength design shall be integral to the pipe selection process.

### 6.2.7 Horizontal Alignment

- a.) Sewer mains shall be located within the road right-of-way, in accordance with the Engineering Standard Drawings.
- b.) For commercial, industrial, institutional, and multi-family residential developments, the Consultant shall design typical cross-sections depicting the locations of the various necessary infrastructure to suit the particular development. Such cross-sections shall be subject to the review and acceptance of the Town.
- c.) Sanitary sewer mains must be located at least 3.0 m horizontally from any water main and 1.8 m horizontally from any storm sewer main or gas line, as measured between the nearest pipe walls of the two mains.
- d.) Public Utility Lot (PUL) widths shall be a minimum of 6.0 m for a single utility and 9.0 m for two utilities. A 1.0 m easement is required on the lots to either side of a PUL.
- e.) Curved sewers shall run parallel to the centreline of the road. Long radius-type bends or a combination of 22½° bends and straight pipe shall be used to achieve the curve.

### 6.2.8 Vertical Alignment

- a.) Mains shall be installed to provide a minimum depth of cover of 3.0 m, as measured from the top of the pipe to the final finished grade at the surface.
- b.) Mains shall be installed to provide adequate sewer service connection depth at the property line.
- c.) At crossings with water mains, refer to Section 5.2.9 c.
- d.) At crossings with storm water mains, the following requirements shall apply:
  - i. Typically, storm water mains shall cross above sanitary sewer mains with sufficient vertical separation to allow for proper bedding and support of both mains.
  - ii. Where it is necessary for a storm water main to cross under a sanitary sewer main, the storm water main shall be protected by providing the following:
    - A minimum vertical separation of 0.5 m, as measured between the nearest pipe walls of the two sewer mains;
    - The sanitary sewer main shall be structurally supported to prevent joint deflection and settling; and
    - A full length of pipe shall be used for the sanitary sewer main at the crossing location. The pipe section shall be centered above the storm sewer main so that the nearest joints in the storm sewer main are equidistant from the crossing location.

### **6.3 Manholes**

- 6.3.1 The maximum distance between manholes shall not exceed 120 m.
- 6.3.2 Manholes are required at all changes in pipe diameter, grade, and direction, at junctions, at the ends of mains, and at either end of a curved sewer.
- 6.3.3 Manholes must be located to accommodate access by maintenance equipment and vehicles.
- 6.3.4 Wherever possible, manholes shall be located on the projection of property lines to avoid conflict with driveways.
- 6.3.5 At manholes where changes in pipe diameter occur, the crowns, or obverts, of the mains shall be placed at the same elevation. Regardless of the design flow and pipe slope, pipe diameter shall not be permitted to be decreased through the downstream direction.
- 6.3.6 For straight-run manholes, a minimum drop of 12 mm shall be provided between the manhole inlet and outlet. For corner-run manholes, a minimum drop of 50 mm shall be provided between the manhole inlet and outlet.
- 6.3.7 For corner-run manholes, designed to achieve a necessary change in direction of the sewer main, the angle of direction change shall not exceed  $\pm 90^\circ$ . This may be further restricted in cases where the estimated sewer flows through the main are not high enough to achieve sufficient cleansing velocity. For sewer mains greater than 600 mm in diameter, changes in flow direction at manholes should not exceed  $45^\circ$ , unless a suitable transition manhole is provided.
- 6.3.8 Drop structures are required at manholes with a vertical separation of 300 mm or greater between the inlet and outlet mains. Internal drop structures may be used for sewer mains of 250 mm diameter or less. External drop structures must be provided for sewer mains greater than 250 mm diameter. Refer to the Engineering Standard Drawings for further information on drop structures.
- 6.3.9 Do not locate manholes within sag areas or depressions where surface ponding might occur. Where such is unavoidable, provision must be made to suitably seal the manhole from surface runoff inflow.

### **6.4 Wastewater Gravity Service Connections**

- 6.4.1 Each lot and multi-family unit shall have its own wastewater service connection designed in accordance with the following sections and the Engineering Standard Drawings.
- 6.4.2 Service connections for commercial, industrial, and institutional lots, and apartment developments, shall be sized according to the anticipated user requirements.
- 6.4.3 Service connection pipe diameter shall be a minimum of 100 mm.
- 6.4.4 The minimum slope of service connections shall be 2.0%.
- 6.4.5 Sewer service connections shall have a minimum depth of cover of 2.60 m and a maximum depth of cover of 3.0 m, as measured from the top of the pipe to the final finished grade.
- 6.4.6 Where a sewer service must connect to a sewer main exceeding 4.5 m in depth below the finished surface, a riser shall be installed to 2.9 m depth at the property line in accordance with the Engineering Standard Drawings.
- 6.4.7 Where bends are required, long radius-type bends shall be used. Alternatively, a combination of  $22.5^\circ$  bends and straight lengths of pipe may be used.

- 6.4.8 The sewer service shall be installed on the downstream side of the water service pipe relative to the direction of flow of the sewer main.
- 6.4.9 Where the water service is 50 mm or smaller in size, the water and wastewater services shall be located in a common trench. Where services are located in a common trench, provide minimum 300 mm horizontal and vertical separation between water and sewer services.
- 6.4.10 Where the water service is larger than 50 mm diameter, water service pipes shall be located in a separate trench, at least 3 m from any sewer services and 1.8 m from any other buried utility lines.
- 6.4.11 Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 1.0 m from the back of the easement line, or 4.0 m past the property line.
- 6.4.12 At the end of cul-de-sacs, the three lots nearest to the manhole may have their sewer services connected to the manhole just above the benching. Sufficient spacing between the connections shall be provided to maintain the structural integrity of the manhole. Benching of this manhole must be epoxy coated or resin lined to provide smooth surface.
- 6.4.13 Where the service length, measured from the main to the building, will exceed 30 m, provide a cleanout manhole at the property line. Cleanout manholes shall be in accordance with the Engineering Standard Drawings.
- 6.4.14 Service connections for commercial, industrial, institutional, and multi-family residential lots, shall be designed with consideration of the depth requirements for servicing of these lots and the potential impact on the depth requirement for the downstream sewer main.
- 6.4.15 For industrial, commercial, institutional, and multi-family residential lots, a sampling manhole shall be provided on the wastewater service connection, just inside of the road right-of-way. The manhole shall be installed at the time that the lot is developed and the service is installed.

## **6.5 Unapproved Connections**

- 6.5.1 Weeping tiles, roof leaders, and other stormwater or groundwater handling appurtenances shall not be permitted to tie-in to the wastewater collection system. Refer to Section 7.0 for the requirements pertaining to these systems.

## **6.6 Lift Stations and Sewage Force Mains**

- 6.6.1 Wherever possible, every reasonable effort should be made in the design to provide a drainage system for the Development that relies solely on gravity for conveyance in order to minimize the overall operation and maintenance requirements and life cycle costs of the system.
- 6.6.2 Where absolutely necessary, the Town may accept design proposals which include lift stations and force mains to convey wastewater out of the Development. Economic analysis, long term costs, maintenance provisions, orderly development and temporary servicing schemes will all be deciding factors.
- 6.6.3 The Consultant shall consult with the Town while conducting the Design to obtain the Town's preliminary comments and input regarding any proposed lift station and force main. The Town may have additional requirements of the Design in this respect.
- 6.6.4 General Lift Station Requirements
  - a.) Pumps should be non-clog type, capable of passing a 75 mm solid, easily removed from servicing, equipped with pressure gauges/tapes, stand by pump, backup power connection & proper discharge and suction velocities.
  - b.) Pumping capacity shall be designed for peak flows with 100% redundancy.

- c.) Backup power generation capability is required at all new lift stations.
- d.) The backup generator and station controls shall be located in a suitable building located adjacent to the lift station.
- e.) Shall be "SCADA" ready and designed to accommodate emergency pumping.
- f.) The lift station shall be situated in a such a manner as to minimize the impact to adjacent development in terms of visibility, odour, and noise.
- g.) All structures shall be architecturally compatible with the Development and located such that it is readily accessible by Town staff. Adequate heating, ventilation, lighting, access and safety provisions must be provided. Grounds surrounding the lift station shall be aesthetically pleasing and compatible with surrounding development.
- h.) Lift station grounds shall be fenced, gated, and landscaped to the approval of the Town.
- i.) Lift stations shall not be located in areas subject to flooding during a major rainfall event.
- j.) Lift stations shall be properly commissioned with test results and calibration of all major equipment; a checklist and verification of operability of valves, gates, air releases, lifting equipment, ventilation, lighting, heating, plumbing, electrical, and other systems as required.
- k.) Three hardcopies and one digital copy of all maintenance and service manuals shall be provided to the Town prior to the issuance of a Construction Completion Certificate.

6.6.5 Force mains shall be designed and constructed in accordance with the same requirements for water mains, as specified in the applicable sections of Section 5.0.

6.6.6 The Design shall be in accordance with Alberta Environment Standards and Guidelines and shall fully describe the details regarding any proposed lift station and force main system. The Town may request additional details regarding the design in order to ascertain its acceptability.

6.6.7 The force main and lift station shall be properly designed to service the ultimate capacity of the contributing development area.

## **PART II – MATERIALS**

### **6.7 Gravity Sewer Mains**

Gravity sewer mains shall be polyvinyl chloride (PVC) or concrete pipe.

#### **6.7.1 PVC Pipe and Fittings**

- a.) PVC pipe shall be acceptable for up to 900 mm diameter sewer mains.
- b.) PVC pipe and fittings shall meet CAN/CSA-B182.2 with locked-in elastomeric ring gasket and integral bell system joint type.
- c.) Minimum pipe dimension ratio shall be DR35. Required pipe dimension ratio may be increased depending on strength design, considering trench depth and road loading, and soil types.
- d.) Pipe shall be installed within two years from the production date indicated on the certification.
- e.) Joint lubricants shall be compatible with gasket material.

#### **6.7.2 Concrete Pipe and Fittings**

- a.) Non-Reinforced Circular Concrete Pipe and Fittings
  - i. Non-reinforced concrete pipe shall be acceptable for less than 350 mm diameter sewer mains where strength design, considering trench and road loading, for the pipe is suitable.
  - ii. Pipe and fittings shall meet CAN/CSA-A257.1, Class 3, and designed for flexible rubber gasket joints to CAN/CSA-257.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.
- b.) Reinforced Circular Concrete Pipe and Fittings
  - i. Reinforced concrete pipe shall be acceptable for sewer mains with a diameter of 300 mm and up.
  - ii. Pipe and fittings shall meet CAN/CSA-257.2, concentric reinforcing, designed for flexible rubber gasket joints to CAN/CSA-257.3, and constructed with Type HS sulphate resistant Portland cement to CAN/CSA-A3000.
  - iii. Strength design, considering trench and road loading, shall be integral to pipe design process. D-load shall be as determined by load analysis.

c.) Lined Pipe and Fittings

- i. Reinforced concrete gravity sewer mains greater than 750 mm in diameter must be lined with a suitable liner, non-susceptible to surface damage from H<sub>2</sub>S induced corrosion.
- ii. Liner shall be PVC or HDPE and shall be cast into the interior pipe wall.
- iii. Liner shall be free of cracks, cleavages, or other defects adversely affecting the protective characteristics of the material.
- iv. The lining shall be repairable at any time during the life of the pipe or the structure.
- v. In accordance with ASTM-D412, the minimum tensile strength across welded joints shall be 14 MPa.
- vi. Liner shall be T-Lock, as manufactured by Ameron Protective Lining Products, or accepted alternate.
- vii. Alternate pipe materials, non-susceptible to surface damage from H<sub>2</sub>S, may be proposed and will be reviewed by the Town.

## 6.8 Manholes

- 6.8.1 Manholes shall be minimum 1,200 mm in diameter and in accordance with the Engineering Standard Drawings.
- 6.8.2 Manhole materials shall be reinforced concrete, constructed of Type HS sulphate resistant cement.
- 6.8.3 Precast manhole sections, adjusting neck rings, and manhole steps shall conform to CAN/CSA- A257.4 and ASTM-C478.
- 6.8.4 Wherever possible, pre-benched standard manhole bases shall be used and shall include pre-cored connections with watertight joints. Duraseal, or accepted alternate.
- 6.8.5 Manhole joints shall meet the requirements of CAN/CSA-257.3 and ASTM-C443. Furthermore, all joints shall be sealed with a non-shrink grout both inside and outside for the full circumference of the manhole. Where manholes are located in areas with high water table and/ or high susceptibility to infiltration, must be wrapped and sealed to the satisfaction of the Town.
- 6.8.6 Manhole steps shall be standard safety type, constructed of hot-dipped iron in accordance with ASTM-A615 and ASTM-A123 or aluminum, forged of 6061-76 aluminum alloy, with a minimum tensile strength of 200 MPa.
- 6.8.7 Frames and Covers
- a.) Manhole frames and covers shall be made of iron and shall conform to ASTM-A48 and in accordance with the Engineering Standard Drawings.
  - b.) Frames for manholes on paved surfaces shall be Norwood NF-90 floating type (in sag locations) with rubber gasket seal and solid cover, as manufactured by Norwood Foundry Ltd., or accepted alternate. Norwood NF-80 floating type to be installed at all other paved locations.
  - c.) Frames for manholes not on paved surfaces shall be Norwood NF-39 with solid cover, as manufactured by Norwood Foundry Ltd., or accepted alternate.
  - d.) Covers shall be imprinted with "Sanitary Sewer".
- 6.8.8 Perched manholes, or accepted alternate, are required for sewer mains from 600 mm to 1,050 mm in diameter unless soil conditions do not allow or directed by the Town otherwise, and shall be in accordance with the Engineering Standard Drawings.
- 6.8.9 Tee-riser manholes, or accepted alternate, are shall be used for sewer mains greater than 1,050 mm in diameter and shall be in accordance with the Engineering Standard Drawings.
- 6.8.10 For manholes exceeding 7 m in depth, the Town may stipulate additional requirements for manholes.
- 6.8.11 The Town may require lockable covers be provided where safety or security risks may be a concern.

## **6.9 Wastewater Gravity Service Connections**

- 6.9.1 Single-family residential sewer services shall be PVC pipe conforming to Section 6.7.1.
- 6.9.2 Sewer services for all other developments, in accordance with Section 6.4, shall comply with Section 6.7.
- 6.9.3 Wye-type, or Tee-type fittings shall be used to connect service connections to sewer mains for all new construction. Tee-type fittings must be positioned such that the service connection discharges into the upper half of the sewer main. Strap-on type service saddles shall only be permitted for service connections to existing mains.

## **6.10 Force Mains**

Force mains shall be PVC or high density polyethylene (HDPE) pipe.

### **6.10.1 PVC Pipe and Fittings**

- a.) PVC pipe and fittings shall conform to Section 5.7 of these Standards.

### **6.10.2 HDPE Pipe and Fittings**

- a.) HDPE pipe shall be classified as PE3408, conforming to CSA B137.1 for 150 mm diameter and smaller, and CGSB-41-GP-25M for 200 mm diameter and larger.
- b.) Minimum acceptable pipe diameter for shall be 100 mm.
- c.) Pipe material shall conform to ASTM-D1248 Type III, Class C, Category 5.
- d.) Pipe Design:
  - i. The pipe shall be designed in accordance with ASTM-F714.
  - ii. Minimum acceptable pipe class shall be DR-26.
  - iii. Strength design, considering trench and road loading, shall be integral to pipe design process.
- e.) All fittings to be fusible and designed to operate at not less than the design working pressure of the pipe system for which it is to be installed.

### **6.10.3 Valves**

- a.) Valves for force mains shall be gate valves conforming to Section 5.9 of these Standards, or plug valves (Milliken, Val-Matic or approved alternate) and must be suitable for wastewater applications.

## **6.11 Bedding and Backfill**

- 6.11.1 Refer to Section 5.13 of these Standards.

## **PART III – CONSTRUCTION**

### **6.12 General**

- 6.12.1 The following section represent the minimum requirements for some typical, key construction procedures for wastewater collection system construction. These minimum requirements must be met or exceeded by the detailed construction specifications and drawings developed by the Consultant.
- 6.12.2 Construction activities must adhere to the provisions of the Erosion and Sediment Control Plan prepared for the Development in accordance with Section 1.10.1.7.

### **6.13 Quality Assurance**

- 6.13.1 Refer to Section 5.15 of these Standards.
- 6.13.2 All PVC pipe shall be tested by the manufacturer and marked in accordance with CAN/CSA- B182.2.

## **6.14 Quality Control Testing**

6.14.1 Refer to Section 5.16 of these Standards.

## **6.15 Site Preparation**

6.15.1 Prepare the site in accordance with Section 3.26 of these Standards.

## **6.16 Clearing**

6.16.1 Conduct clearing in accordance with Section 3.27 of these Standards.

## **6.17 Grubbing**

6.17.1 Complete grubbing in accordance with Section 3.28 of these Standards.

## **6.18 Topsoil Stripping and Stockpiling**

6.18.1 Strip and stockpile topsoil in accordance with Section 3.29 of these Standards.

## **6.19 Trench Excavation**

6.19.1 Refer to Section 5.22 of these Standards.

## **6.20 Alignment and Grade**

6.20.1 Lay pipe to the required alignment and grade, with manholes and all other appurtenances at the locations identified on the construction drawings or otherwise directed by the Town.

6.20.2 Provide minimum 3.0 m depth of cover on sewer mains, unless otherwise authorized by the Town in writing. Where depth of cover is less than 3.0 m, provide insulation, to the approval of the Town.

6.20.3 Acceptable tolerances are as follows:

- a.) Alignment – the centreline of the pipe shall not be more than 100 mm off the specified alignment.
- b.) Elevation – the pipe invert shall not be more than 6 mm plus 0.01 mm per mm diameter of the pipe off the specified elevation.
- c.) Joints – for concrete pipe, deflections at joints shall not exceed that specified by CAN/CSA-A257. For PVC pipe, deflections at joints shall not exceed those recommended by the manufacturer.

6.20.4 All pipe shall be laid sloping in the desired direction with no reversed grades on any pipe lengths.

6.20.5 Maintain, and provide to the Town upon request, grade sheets for the installation of the pipe.

6.20.6 No deviation shall be made from the required alignment or grade without the written consent of the Town.

## **6.21 Pipe Bedding and Pipe Zone Backfill**

6.21.1 Refer to Section 5.24 of these Standards.

## **6.22 Pipe Installation**

6.22.1 General

- a.) Provide 48-hour notice to the Town's Infrastructure for inspection of materials. All materials must be inspected and approved by the Town prior to install.
- b.) Follow manufacturer's instructions for pipe installation. Installation of PVC pipe and fittings shall be in accordance with CAN/CSA-182.11.
- c.) Do not allow contents of existing sewers or sewer connections to flow into the trench.



- d.) Do not use heavy vibratory equipment for compaction of backfill until at least 1 m of backfill has been placed over the pipe.
- e.) When pipe laying is complete, the sewer must be thoroughly cleaned of all dirt, stones, rubbish, and debris. Deleterious material shall be prevented from entering the installed lines and traveling into the existing system.
- f.) Do not install PVC pipe and fittings in areas that are, or may be, contaminated with organic solvents, petroleum products, or other materials which may negatively effect the structural integrity of the PVC product.

#### 6.22.2 Laying Pipe

- a.) Lay pipe with the bells up grade, and proceed up grade.
- b.) Any bowed pipe shall be laid on its side such that the bow is horizontal.
- c.) Produce a smooth, uniform invert.
- d.) Plug lifting holes with non-shrink grout.
- e.) For connections to existing sewer pipes, submit a field-jointing plan to the Town for review and acceptance prior to commencing the field joint.

#### 6.22.3 Joining Pipe

- a.) Join pipe in accordance with the manufacturer's recommendations.
- b.) Clean and check the sealing surfaces to ensure that they are smooth, concentric, and free from imperfections that might affect the sealing performance of the gasket.
- c.) Lubricate sliding surfaces and couple the pipes immediately.

#### 6.22.4 Connecting to Existing Mains

- a.) Notify the Town in writing at least one (1) week prior to connecting to an existing sewer main. Apply in writing to the Town's Infrastructure Department including a work plan identifying necessary flow control and a contingency plan detailing the procedures to be observed in the event of problems during the connection process or other emergency. Written acceptance must be received from the Town at least 24 hours before connecting to existing mains.

#### 6.22.5 Connecting to Existing Manhole

- a.) Manhole connection shall not exceed a reasonable size to permit the smooth movement of the new pipe into the manhole.
- b.) All due care shall be taken to avoid damage to surrounding areas of the manhole. Any areas of the manhole that have been damaged during the manhole connection shall be repaired by the Contractor to the satisfaction of the Town.
- c.) Following installation of the new pipe, the manhole connection area shall be suitably repaired, link sealed and grouted, providing a watertight seal around the pipe.
- d.) The flow channel in the manhole shall be modified to provide a smooth continuation of flow from the manhole connection pipe through the manhole.

#### 6.22.6 Plugging of Dead Ends

- a.) Insert standard plugs into the bell ends of fittings or pipe bells at dead ends.

### 6.23 Setting Manholes

#### 6.23.1 General

- a.) Bases shall be placed on solid, unfrozen ground.
- b.) Construct manhole unit plumb and true to alignment and grade.
- c.) Cover all interior and exterior joints with suitable non-shrink grout. Wrap and seal manhole, if required.
- d.) External drop structure assemblies shall be encased in concrete.
- e.) Plug all lifting holes with non-shrink grout.

### 6.23.2 Manhole Benching

- a.) Build pipes and stubs into manholes and form smooth flow channels, or use pre-benched manhole base sections.
- b.) Benching shall provide smooth inverts on regular curves through the manhole.

### 6.23.3 Manhole Completion

- a.) Backfill around the manhole with sand, as specified in Section 5.13.2, or fillcrete. Sand, or approved alternative backfill shall be placed and compacted to minimum 98% Standard Proctor Density in uniform lifts not exceeding 150 mm in depth.
- b.) Wherever possible, set the conical tops such that the vertical side is on the right hand side of the manhole, when looking upstream.
- c.) Ensure manhole rungs are aligned.
- d.) In grassed areas, provide 300 mm depth clay cap around the manhole.
- e.) Place frame and cover on top section to elevation indicated, and adjust tops flush finished grades. If adjustment is required, use concrete grade rings (maximum 200 mm), placed with non-shrink cement mortar. Pare, make smooth and watertight, inside and out.
- f.) Manholes in high water table to be wrapped and sealed.

## 6.24 Wastewater Gravity Service Connections

Gravity wastewater services, in accordance with Section 6.4, shall conform to the following:

- 6.24.1 New services on existing development crossing under roads shall be augered as shown on the Engineering Standard Drawings, as applicable. At the end of cul-de-sacs and for lots located adjacent to the mains, open trenching installation of the services may be permitted with the written authorization of the Town.
- 6.24.2 Services installed by open trench or through auger pits shall be bedded in accordance with Section 5.24.
- 6.24.3 Pipe zone backfill shall be placed to 300 mm above the crown of the highest service in the trench or auger pit.
- 6.24.4 Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 1.0 m from the back of the easement line, or 4.0 m past the property line.
- 6.24.5 Plug the service connection following installation, as per manufacturers specifications.
- 6.24.6 Install red-painted stakes, 38 mm by 89 mm in size, extending from the termination point of the service point to a minimum of 1.0 m above the finished surface elevation.
- 6.24.7 Backfill trenches and auger pits in accordance with Section 5.31.
- 6.24.8 Augering and Boring
  - a.) Refer to Section 5.29.7.
- 6.24.9 Connection to the Sewer Main
  - a.) Install in-line tee-type fittings in accordance with the manufacturer's recommendations on new subdivisions.
  - b.) Where the use of strap-on type service saddles has been authorized by the Town, install in accordance with the manufacturer's recommendations for existing developments.
  - c.) Apply construction adhesive or similar non-destructive sealant, to ensure a watertight seal.

#### 6.24.10 Pipe Installation

- a.) Refer to Section 6.22.

#### 6.24.11 Record of Services

- a.) Refer to Section 5.29.12.

### 6.25 Trench Backfill

- 6.25.1 Refer to Section 5.29.12 of these Standards.

### 6.26 Low Pressure Sewage Systems

#### 6.26.1 System Design Overview

- a) The sanitary sewer system shall be of sufficient capacity to service the ultimate population projection of the development area. The flows and factors outlined in the following sections shall be used in the design of low pressure sanitary sewer systems.

The Developer and the Developer's Consultant are responsible to ensure that the infrastructure is designed and constructed to achieve manufacturers' design life expectations consistent with good design and construction practice. System proposals must identify disposal means in accordance with Alberta Environment regulations and guidelines. Plan-profile drawings, specifications and a letter report shall be prepared by a qualified Professional Engineer and be submitted to the Town and Alberta Environmental Protection for review and approval prior to construction.

#### 6.26.2 Estimating Average Sewage Flows

- a.) Refer to Section 6.1 of these Standards for average sewage flow calculation parameters.
- b.) Recommended pump rate and head will need to be provided. This information shall be included in any design submissions and the developer shall ensure that all future purchasers are aware of this requirement.

#### 6.26.3 Pipe Sizing

- a) A report from the Developer's Consultant must be prepared to ensure that pipe sizing is calculated in consideration with the topography of the serviced lands and the population projections. Minimum pipe size 75mm.

#### 6.26.4 System Materials

- a) The Developer shall supply and install only new materials.
- b) All such materials which are defective in manufacture, damaged in transit, or have been damaged after delivery shall be replaced by the Developer at their expense.
- c) All Standards referred to mean the latest editions of that Standard.
- d) Where products are specified, it is intended that approved equals are also accepted, to the approval of the Town.

#### 6.26.5 High Density Polyethylene (HDPE) Pipe

- a.) High Density Polyethylene (HDPE) pipe shall be DR11 or DR13.5, PE 3408 Iron pipe sized (IPS) and shall conform to CSA B137.1, ASTM F714 and ASTM D3350 Standards. Pipe sized from 13mm through 76mm shall conform to ANSI/AWWA C901-02 Standard. Pipe sized from 100 mm through 1575 mm shall conform to ANSI/AWWA C906-00 Standard.
- b.) Approved manufactured pipe fittings shall be used. If unavailable other alternative must meet Town of Whitecourt approval first.
- c.) All joints are to be thermal heat fused. Mechanical service connections are not approved.
- d.) All components shall be made of corrosion resistant material.

- e.) Pipe age not to exceed two years at time of installation.

#### 6.26.6 Low Pressure Sewer Mains

- a.) Sewer main alignments shall be as depicted on the Standard Engineering Drawings.
- b.) Mains shall be at a depth adequate to provide a minimum of 3 m depth of cover from finished grade to top of pipe.
- c.) Auguring or directional drilling is required under all existing roads, unless otherwise approved.
- d.) Compaction of any trenches and auger pts and repair of any settlements that occur within warranty period is required.
- e.) A separate service line with a curb stop, marked "SEWER" at the property line is required for each lot.
- f.) Flushing access manholes are required at that start of each collection main to facilitate removal of main line blockages.
- g.) Manual air/vacuum relief valves are required at all high points for removal of hydrogen sulphide gases from anaerobic decomposition of organics.
- h.) A minimum distance of 3 m horizontal separation must be maintained between a sewer main and any water main.
- i.) A minimum distance of 1.8 m horizontal separation must be maintained between a sewer main and any gas line as measured between the nearest pipe walls of the two mains.
- j.) Marker posts shall be installed perpendicular to all valves, air release and flushing standpipe locations, adjacent to the property line.
- k.) Any downstream receiving manhole shall be lined with epoxy coating or other approved material to prevent corrosion.

#### 6.26.7 Fittings

- a.) High Density Polyethylene (HDPE), DR 11 conforming to ASTM F714 and CAN B137.1, shop molded fittings shall be used.
- b.) All HDPE molded fittings shall meet the requirements of ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings, or ASTM F1055 electrofusion-type fittings.

#### 6.26.8 Valves

- a.) Gate valves for 75 mm and larger shall be iron body, bronze mounted gate valves with a non-rising spindle, which open by turning in a counter clockwise direction. All valves shall conform with AWWA C500 for bronze mounted solid wedge gate valves or AWWA C509 for resilient seated gate valves. Interior to be factory coated with epoxy coating conforming to AWWA C50. Exterior to be factory epoxy coated. Corrosion reduction to be provided by installation of a zinc sacrificial anode. Valves to be flanged for polyethylene pipe.
- b.) Brass ball valve curb stops shall be used for valves 50 mm and smaller conforming with ASTM B62 compression type. Curb service boxes to be epoxy coated with stainless steel stem to suit 3.0 m depth of bury. Curb box cap to be marked "SEWER". All curb stops shall incorporate stainless steel sleeves for connections to polyethylene pipe.
- c.) Cast iron main valve boxes conforming to ASTM A48, Class 25 type A of the sliding type shall be required on all main valves. Coating inside and outside shall be an asphaltic coating. Set screws to be galvanized. Top cap of box to be marked "SEWER".
- d.) Extension stem to be 25 mm square mild steel with 50 mm operating nut and flange suitable for 3.0 m bury. A rock disk nut is required on all valves.
- e.) Schedule 40 PVC valve boxes for the bottom boot of Norwood Foundry Type A Sliding type valve boxes or approved equal are permitted in areas not exposed to vehicle load.

## 6.26.9 Service Connections

### 6.26.9.1 General

- a.) Each lot must have a separate service.
- b.) Proper sewer service curb stops or valves are required for each service connection on a low pressure sewage force main. These shall be installed to the centerline of all lots at 0.3m off property line, in accordance with the engineering standard drawings and shall have the word "sewer" stamped on the cap or lid to differentiate them from water curb stops.
- c.) Service connections shall be extended beyond the gas line into the lot to terminate a minimum of 4.0 m from the property line or 1.0 m past the utility easement.

### 6.26.9.2 Details

- a.) Sanitary sewer service pipe shall be 40 mm, DR 11 high density polyethylene pipe.
- b.) Main connections shall be made by means of fused in-line tees or saddles. All fittings and joints must be assembled by electro fusion or butt fusion for HDPE piping. Services to be in one piece, no mechanical connections are permitted between main connection and curb stop.
- c.) Curb stop shall be non-draining type.
- d.) Minimum depth of cover shall be 3 m from finished grade over top of pipe.

## 6.26.10 Septic Tank/Pump

- a.) Use two-compartment tank or a single-compartment tank with a pump vault, sized and constructed in accordance with Alberta Plumbing Codes.
- b.) Any non-residential building with a sump may be required to have a sediment tank for sump drainage located prior to their pump out.
- c.) Extend tank access risers at least 150 mm above finished ground surface, provide watertight manhole covers and divert surface runoff away from the manhole cover.
- d.) Tank must be large enough to provide the following:
  - i) 450 mm for pump submergence, minimum.
  - ii) Full day of emergency storage capacity above the high water alarm level, utilizing the septic tank freeboard capacity below ground and/or below building drain outlet invert.
  - iii) Minimum 12-hour retention time below high water alarm level for proper treatment of the sewage flow.
  - iv) Storage of sludge and scum accumulation.
  - v) Typically, 3800 L (100 gal) minimum total tank storage for an average three-bedroom dwelling.
  - vi) Reference "Alberta Private Sewage System Standard Practice" current version), for Septic Tanks, Sewage Holding Tanks and Sewage Effluent Tanks.
- e.) Tank must be sealed watertight tank (fibreglass, or one-piece precast pump tank or special provisions for assuring watertight tank.)
- f.) Tanks shall be vented such that the airspace above the wastewater level is always at atmospheric pressure.
- g.) Anti-buoyancy provisions must be adequate. Where high ground water exists, tank assemblies shall be securely anchored to avoid floating.
- h.) All pipe and wire conduits into tank must be through hubs or fittings made during the construction of the tank and installed in a watertight and gastight fashion.
- i.) No drainage or any water other than sanitary waste water shall be allowed to enter the tank.
- j.) The effluent shall enter the pump compartment or pump vault from the clear zone of the tank between the scum and sludge layers.

## 6.26.11 Pump Requirements

- a.) Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer.

- b.) Pump units shall be submersible types, either semi-positive displacement or centrifugal, with integrally built grinder assembly and isolation valves. Pump units shall pump directly into low-pressure mains. Pumping equipment shall meet all applicable safety, fire and health requirements for the intended application and location.
- c.) The unit shall operate at 120 or 240 volts' single phase, and be able to provide the required flows at the design total dynamic head. All complete grinder pump installation manuals including but not limited to electrical wiring, piping installations and detailed installations, shall be provided to the installer and Town personal prior to construction.
- d.) Property owners are responsible for all cleaning, maintenance and replacement of low pressure pump units within their private property. All operation and pump maintenance manuals must be provided to the property owner and to any future purchasers.
- e.) The pump unit shall be constructed such that open shafts are not exposed inside the raw sewage passageways where they can become clogged.
- f.) Grinder pump rated maximum pumping pressures shall not exceed 85% of low pressure collection pump systems, designed maximum working pressure.
- g.) Pump discharge pipe must be of DR 11 HDPE or stronger and include check valve, disconnect union and gate valve within the pump tank.
- h.) Pump assembly shall include all level controls to turn unit on/off at set levels. In addition, high level pump operation alarms shall be provided.
- i.) When any pump is located at a high elevation than the elevation of the terminal end then a siphon-break valve must be provided for that pump.

#### 6.26.12 System installation

The system shall be installed as per the manufacturer's specifications and the detailed construction specifications prepared by the Developer's Engineer.

#### 6.26.13 Trenching, Bedding and Backfilling

See Section 5.22

#### 6.26.14 Inspection and Testing

- a.) The low-pressure collection system shall be pressure tested prior to commissioning, after backfilling operations are complete and at least 36 hours after the casting of concrete thrust blocks.
- b.) Zero infiltration/exfiltration is permitted.
- c.) Components to be tested shall included the entire collection system including any service pumps. Test duration shall be a minimum of two hours, or if the pipe network is buried eight hours.
- d.) Before acceptance of the work, the entire system shall be subject to a hydrostatic pressure test in the presence of the developer's consultant and the Town of Whitecourt representative. The Developer shall provide all necessary labour, materials and equipment for the test including a suitable pump, measuring tank, pressure hoses, connections, plugs, caps, gauges, and all other apparatus necessary for filling the main, pumping to the require test pressure and recording the pressure and expansion-leakage losses. The Developer shall provide evidence that the gauges used are accurate.
- e.) Expel air from collection system, by slowly filling main with water. High points must have automatic air/vacuum relief valves to vent air when filling and be closed when pressure is applied.
- f.) A hydrostatic test pressure of 1.5 times the maximum operating pressure of the pipe at the lowest point in the system main shall be applied (but not less that 350kpa (50psi).
- g.) Pressurized pipe to require test pressure over a two-hour period and hold required test pressure for an additional hour to allow for pipe expansion and stretching prior to the leakage test if the pipe is exposed. If the pipe network is buried, test duration shall be a minimum of eight hours prior to leakage test.
- h.) Test period shall be for two hour durations. Amount of make-up water (leakage) required to return the pipe to required test pressure shall not exceed the allowance given in the following table.

## Field Testing of Low Pressure Sewer Systems

Nominal Pipe Size (mm)	Allowance for Expansion (leakage) (litres/100m of pipe) 2 Hour Test
50	1.6
75	1.9
100	3.1
150	7.5
200	12.5

Total time under test pressure must not exceed eight hours. If tests are not accepted due to leakage or equipment failure, test section must be permitted to “relax” for eight hours’ period prior to the next testing sequence.

### 6.27 Gravity Sewer Main Inspection and Testing

6.27.1 Any sewer mains that fail to pass inspection and testing, or having obstructions, breaks, or any other defects, shall be repaired, re-inspected, and re-tested to the satisfaction of the Town, at the Developer’s sole expense.

6.27.2 Prior to applying to the Town for a Construction Completion Certificate and placing sewer mains into operation, the sewer mains shall be thoroughly cleaned of all debris and inspected by CCTV.

#### 6.27.3 Closed-Circuit Television (CCTV) Inspection

- a.) CCTV inspection of all installed sewer mains must be completed.
- b.) One copy of the written CCTV inspection report, including still photographs (showing typical pipe details, joints, and service connections, and any defects) and video footage of inspection must be provided to the Town with the application for the Construction Completion Certificate and Final Acceptance Certificate.
- c.) Video footage must be in full colour video format, unless otherwise accepted by the Town.
- d.) Where the CCTV inspection shows infiltration present within any un-commissioned sewer main, the Town may require an infiltration or exfiltration test be completed.

#### 6.27.4 Testing

- a.) Where testing is required, the Town will determine if the test shall be an infiltration or exfiltration test.
- b.) The Town will direct which sections of the main shall be tested.
- c.) The Developer shall provide all water, materials, equipment, and labour required for the testing. Equipment shall include plugs, meters, and other measuring equipment that is acceptable to the Town, to measure exfiltration or infiltration.
- d.) Infiltration testing shall be performed by plugging the upstream end of the test section and measuring flow at the downstream end.
- e.) Exfiltration testing shall be performed by plugging both ends of the test section and filling the test section to provide a hydrostatic head of 600 mm above the top of the highest point in the test section.
- f.) The test duration shall be 4 hours.
- g.) The allowable leakage shall be as follows:

Type of Pipe	Allowable Leakage
Concrete Pipe	60 L/mm dia./km/day
PVC Pipe	5 L/mm dia./km/day

- h.) No additional leakage allowance will be made for manholes.

## **6.28 Sewer Service Inspection and Testing**

- 6.28.1 All sewer services shall be visually inspected using a lamp test and/or ball tested at the time of installation to ensure consistent alignment and grade. The Consultant must witness all such tests.
- 6.28.2 For service connections longer than 30 m, three (3) months prior to the expiry of the Warranty Period, the Developer shall be responsible for conducting CCTV inspection of the service connections, in accordance with the applicable requirements of Section 6.27.3
- 6.28.3 Any sewer services that fail to pass inspection and testing, or having obstructions, breaks, or any other defects, shall be repaired, re-inspected, and re-tested to the satisfaction of the Town, at the Developer's sole expense.
- 6.28.4 The Consultant must provide a written report confirming satisfactory inspection and testing of each sewer service. The report shall be provided with the application for the Construction Completion Certificate.

## **6.29 Final Inspection**

- 6.29.1 Three (3) months prior to the expiry of the Warranty Period, the Developer shall be responsible for arranging for an additional CCTV inspection of the installed sewer mains, in accordance with the applicable requirements of Section 6.27.3.
- 6.29.2 Any sewer mains having obstructions, breaks, sags, or any other defects, shall be repaired, re-inspected, and re-tested to the satisfaction of the Town, at the Developer's sole expense, prior to application for the Final Acceptance Certificate.
- 6.29.3 One copy of the written CCTV inspection report, including still photographs and video footage of inspection must be provided to the Town with the application for the Final Acceptance Certificate.
- 6.29.4 The Final Acceptance Certificate shall not be issued by the Town until the CCTV reports and footage has been reviewed and accepted by the Town.