

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1      Section 31 23 10 - Excavation, Trenching and Backfilling.
- .2      Section 32 11 23 - Aggregate Base Course.
- .3      Section 33 41 00 – Storm Utility Drains

**1.2            REFERENCES**

- .1      American Society for Testing and Materials (ASTM International)
  - .1      ASTM A48/A48M-03, Standard Specification for Gray Iron Castings.
  - .2      ASTM C478-08, Specification for Precast Reinforced Concrete Manhole Sections.
  - .3      ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>(600 kN-m/m<sup>3</sup>)).
- .2      Ontario Provincial Standard Drawings (OPSD)
  - .1      OPSD 400.020 (November 2007) – Cast Iron, Square Frame With Square Flat Grate for Catch Basins, Herring Bone Openings.
  - .2      OPSD 401.01 (November 2007) – Cast Iron, Square Frame with Circular Closed or Open Cover for Maintenance Holes.
  - .3      OPSD 405.020 (November 2003) – Maintenance Hole Steps Solid
  - .4      OPSD 701.010 (November 2009) – Precast Concrete Maintenance Hole 1200mm Diameter.
  - .5      OPSD 701.011 (November 2009) – Precast Concrete Maintenance Hole 1500mm Diameter.
  - .6      OPSD 701.021 (November 2004) – Maintenance Hole Benching and Pipe Opening Details.
  - .7      OPSD 701.030 (November 2009) – Precast Concrete Maintenance Hole Components 1200mm Diameter Tapered Top and Flat Cap.
  - .8      OPSD 701.031 (November 2009) – Precast Concrete Maintenance Hole Components 1200mm Diameter Riser and Monolithic Base.
  - .9      OPSD 701.040 (November 2009) – Precast Concrete Maintenance Hole Components 1500mm Diameter Transition Cone and Slab.
  - .10     OPSD 701.041 (November 2009) – Precast Concrete Maintenance Hole Components 1500mm Diameter Riser and Monolithic Base.
  - .11     OPSD 704.010 (November 2004) – Precast Concrete Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
  - .12     OPSD 704.011 (November 2004) – High Density Polyethylene Adjustment Units for Maintenance Holes, Catch Basins, and Valve Chambers.
  - .13     OPSD 705.010 (November 2004) – Precast Concrete Catch Basin 600 x 600mm.
  - .14     OPSD 708.020 (November 2006) – Support for Pipe at Catch Basin or Maintenance Hole.

- .3 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 404 –November 2007, Construction Specification for Maintenance Hole, Catch Basin, Ditch Inlet, and Valve Chamber Installation.
  - .2 OPSS 1351-November 2004, Material Specification For Precast Reinforced Concrete Components for Maintenance Holes, Catch Basin, Ditch Inlet And Valve Chambers.
  - .3 OPSS 1853-November 2001, Material Specification For Rubber Adjustment Units for Maintenance Holes, Catch Basin, Ditch Inlet And Valve Chambers.
  - .4 OPSS 1854-November 2004, Material Specification For High Density Polyethylene Adjustment Units for Maintenance Holes, Catch Basin, Ditch Inlet And Valve Chambers.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Precast catch basin units: to ASTM C478 and OPSD 705.010, complete with 600mm deep sump.
  - .1 Adjusting rings: to ASTM C478 and OPSD 704.010 or OPSD 704.011.
  - .2 Frames, gratings, covers to dimensions as indicated and following requirements:
    - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
    - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
    - .3 Castings: coated with two applications of asphalt varnish.
    - .4 Catch basin frames and covers:
      - .1 Elsewhere: to OPSD 400.020.
  - .3 Components: to ASTM C478M and OPSS 1351.
- .2 Precast manhole units:
  - .1 1200mm diameter maintenance holes:
    - .1 Circular to ASTM C478 and OPSD 701.010,
      - .1 Storm Manholes: complete with 300mm sump as per OPSD 701.010.
      - .2 Sanitary Manholes: Benching as per OPSD 701.021.
    - .2 Top section: flat slab top type with opening offset for vertical ladder installation to OPSD 701.030.
    - .3 Components: to OPSD 701.031, ASTM C478 and OPSS 1351.
  - .2 1500mm diameter maintenance holes:
    - .1 Circular to ASTM C478 and OPSD 701.011.
      - .1 Storm Manholes: complete with 300mm sump refer to OPSD 701.010.
    - .2 Transition slab: flat slab type with opening offset for vertical ladder installation to OPSD 701.040.

- .3 Components:
  - .1 Riser and Base Slab: to OPSD 701.041, ASTM C478 and OPSS 1351.
  - .2 Chimney:
    - .1 Riser: to OPSD 701.031, ASTM C478 and OPSS 1351.
    - .2 Top section: flat slab top type with opening offset for vertical ladder installation to OPSD 701.030.
- .3 Joints: to be made watertight using rubber rings.
- .4 Ladder rungs: to OPSD 405.020.
- .5 Adjusting rings: to ASTM C478, OPSD 704.010 or OPSD 704.011, OPSS 1853 and OPSS 1854.
- .6 Frames, gratings, covers to dimensions as indicated and following requirements:
  - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
  - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
  - .3 Castings: coated with two applications of asphalt varnish.
  - .4 Manhole frames and covers:
    - .1 Storm Sewer:
      - .1 In lawn and paved areas: Type B open cover cast with perforations and complete with two 25 mm square lifting holes to OPSD 401.010.
    - .2 Sanitary Sewer: Type A closed cover with two 25 mm square lifting holes to OPSD 401.010
- .3 Granular bedding : Granular base material in accordance with Section 32 11 23 - Aggregate Base Course

### **Part 3 Execution**

#### **3.1 EXCAVATION AND BACKFILL**

- .1 Excavate and backfill in accordance with Section 31 23 10 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing, manholes.

#### **3.2 INSTALLATION**

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade, in accordance with OPSS 407. Maximum relative difference between specified invert elevations not to exceed 10mm.
- .2 Complete units as pipe laying progresses.
- .3 Set precast concrete base on 150 mm minimum of granular base material compacted to 100% maximum density to ASTM D698.

- .4     Precast units:
- .1     Make each successive joint watertight with Departmental Representative approved rubber ring gaskets.
  - .2     Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
  - .3     Compact granular backfill to 95% maximum density to ASTM D698.
  - .5     Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.
  - .6     Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.
  - .7     Refer to OPSD 708.020.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 31 23 10 - Excavating, Trenching and Backfilling.
- .2 Section 32 11 23 - Aggregate Base Course.
- .3 Section 33 05 14 – Manholes and Catch Basin Structures.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft<sup>4</sup>-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .2 ASTM F714-08, Standard Specification for Joints for Polyethylene Pipe (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
  - .3 ASTM D 2657-07, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA B1800-02, Thermoplastic Non-pressure Pipe Compendium (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8, B182.11 and B182.13).
    - .1 CSA B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.
    - .2 CSA B182.2-11, PSM Type polyvinylchloride (PVC) Sewer Pipe and Fittings.
    - .3 CSA B182.6-11, Profile polyethylene (PE) sewer pipe and fittings for leak-proof sewer applications.
    - .4 CSA B182.11-02, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .3 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 409-November 2009 – Construction Specification For Closed-Circuit Television Inspection of Pipelines
  - .2 OPSS 1840 (November 2006) – Material Specification For Non-Pressure Polyethylene Plastic Products.

**1.3 SUBMITTALS**

- .1 Submit product literature for storm sewer pipe and culverts in accordance with Section 01 00 10 – General Instructions.
- .2 Certification to be marked on pipe.

**Part 2 Products**

**2.1 OPEN CUT PIPE**

- .1 For pipe diameters up to and including 450mm diameter:
  - .1 Plastic Pipe:
    - .1 Type PSM Polyvinyl Chloride (PVC): to CSA-B182.2.
    - .2 Standard Dimensional Ratio (SDR): 35.
    - .3 Locked-in gasket and integral bell system.
    - .4 Nominal lengths: 4 m.
  - .2 For pipe diameters over 450mm diameter:
    - .1 Profile polyethylene pipe:
      - .1 Open profile polyethylene pipe and fittings to: to CSA-182.6, stiffness 320kPa.
        - .1 Joints gasketed, water tight to CSA-B182.6

**2.2 TRENCHLESS PIPE**

- .1 Encasement Bore
  - .1 Carrier Pipe:
    - .1 High Density Polyethylene (HDPE): DR 21, Resin PE 3408 as per ASTM F417.
      - .1 Pipe Size: 457.2mm diameter (inside diameter 411.0mm).
      - .2 Pipe to be free of concentrated ridges, discolouration, excessive spot roughness, pitting, varying wall thickness, free of cracks, over exposure to ultra violet light, foreign inclusions, and gashes, nicks, or abrasion in excess of 10% of the wall thickness.
      - .3 Pipe joints: thermal butt fusion as per ASTM D2657.
      - .4 HDPE pipe and fittings for storm sewers shall be extruded in white colour throughout its thickness.
  - .2 Casing Pipe:
    - .1 Smooth walled steel pipe to ASTM A252, Grade 2, minimum yield strength of 240kPa.
    - .2 Cathodic Protection
      - .1 Anode Type M-32-22. The size and type of anode to be in accordance with City of Ottawa Standards M. S. No. MW-19.9.

**2.3 PIPE BEDDING AND SURROUND MATERIAL OPEN CUT**

- .1 Granular base material: refer to Section 32 11 23 – Aggregate Base Course.

**2.4 BACKFILL MATERIAL OPEN CUT**

- .1 Type 1 Fill: in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

**3.2 OPEN CUT TRENCH INSTALLATION**

- .1 Trenching
  - .1 Do trenching Work in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling.
  - .2 Do not allow contents of sewer or sewer connection to flow into trench.
  - .3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.
- .2 Granular Bedding
  - .1 Place bedding in unfrozen condition.
  - .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated up to spring line of pipe.
  - .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
    - .1 Do not use blocks when bedding pipes.
  - .4 Shape transverse depressions as required suiting joints.
  - .5 Compact each layer full width of bed to at least 95 % maximum density to ASTM D698.
  - .6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.
  - .7 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
- .3 Pipe Installation
  - .1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
  - .2 Handle pipe-using methods approved by pipe manufacture.
    - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
  - .3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.
    - .1 Maximum allowable variation from indicated pipe invert elevations as measured at the manholes not to exceed 25m.
    - .2 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
  - .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
  - .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

- .6 Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.
  - .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
  - .8 Install plastic pipe and fittings in accordance with CSA B182.11.
  - .9 Joints:
    - .1 Plastic pipe:
      - .1 Gaskets integral with pipe.
      - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
      - .3 Align pipes before joining.
      - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material. Lubricate gaskets before jointing is attempted.
      - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Do not install pipes with damaged or disturbed gaskets.
      - .6 Complete each joint before laying next length of pipe.
      - .7 Minimize joint deflection after joint has been made to avoid joint damage.
      - .8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
  - .10 When any stoppage of Work occurs, restrain pipes, to prevent "creep" during down time.
  - .11 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
  - .12 Make watertight connections to manholes and catch basins.
  - .13 Use prefabricated saddles for connecting pipes to sewer pipes.
    - .1 Joints to be structurally sound and watertight.
      - .1 Catch basin connection to concrete pipe: to OPSD 708.10.
      - .2 Catch basin connection to plastic pipe: to OPSD 708.030.
  - .14 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.
- .4 Pipe Surround
- .1 Place surround material in unfrozen condition.
  - .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
  - .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thicknesses as indicated.
    - .1 Do not dump material within 1 m of pipe.
  - .4 Place layers uniformly and simultaneously on each side of pipe.
  - .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.



- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95 % maximum density to ASTM D698.
- .5 Backfill
  - .1 Place backfill material in unfrozen condition.
  - .2 Place backfill material, above pipe surround, in accordance with Section 31 23 10 Excavating, Trenching and Backfilling, up to grades as indicated.

### 3.3 TRENCHLESS INSTALLATION

- .1 Casing Bore Pipe Installation:
  - .1 Casing
    - .1 Install pipe by casing bore where indicated and in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
    - .2 Cathodic protection :
      - .1 Install two anodes at upstream end of casing pipe and install two anodes at downstream end of casing pipe.
  - .2 Carrier Pipe
    - .1 Handle pipe using methods approved by Departmental Representative and in accordance with manufacturer's installation instructions. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
    - .2 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
      - .1 Pipe jointing to be butt fused in accordance with manufacturer's instructions and ASTM D2657.
        - .1 Pipe joints to be true to alignment and have uniform roll-back bead.
        - .2 Allow joint to cool sufficiently, as recommended by pipe manufacturer, prior to removal of jointing pressure.
        - .3 Joints to be inspected and approved by Departmental Representative prior to insertion.
        - .4 Do not exceed maximum pipe deflection recommend by pipe manufacturer.
    - .3 Maximum allowable variation from indicated pipe invert elevations as measured at the manholes not to exceed 25m.

### 3.4 TESTING

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Television and photographic inspections:

- .1 Carry out closed circuit television (CCTV) of installed sewers in accordance with OPSS 409.
- .2 Submit one copy of CCTV inspection report to Departmental Representative for review. CCTV inspection report will be used by Departmental Representative in assessing acceptance of installed works.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 31 23 10 - Excavating Trenching and Backfilling.

**1.2 REFERENCES**

- .1 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 1004 (November 2012) – Material Specification for Aggregates – Miscellaneous.
  - .2 OPSS 1840 (April 2011) – Material Specification For Non-Pressure Polyethylene Plastic Products.

**1.3 SUBMITTALS**

- .1 Submit samples in accordance with Section 01 00 10 – General Instructions.
- .2 Submit to Departmental Representative for testing, following samples of materials proposed for use at least 4 weeks prior to commencing work:
  - .1 Clear Stone.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Subdrains:
  - .1 150mm diameter high density polyethylene tubing perforated with filter sock to OPSS 1840.
  - .2 210 kPa stiffness.
- .2 Pipe bedding and surround material:
  - .1 Clear Stone: 19mm, Type II to OPSS 1004.

**Part 3 Execution**

**3.1 TRENCHING**

- .1 Do trenching and backfilling in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
- .2 Place bedding after approval of trench by Departmental Representative.

**3.2 BEDDING**

- .1 Place 150 mm layer of bedding material and surround material to 300mm above top of tubing.

**3.3            INSTALLATION OF PIPE SUB-DRAINS**

- .1      Lay pipe drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points.
- .2      Begin laying at outlet and proceed in upstream direction.
- .3      Make joints tight in accordance with manufacturer's instructions.
- .4      Make watertight connections to new manholes and catch basins where indicated.
- .5      Plug open upstream ends of pipes with caps.
- .6      Surround pipe with pipe bedding and surround material.
- .7      Backfill remainder of trench to Section 31 23 10 - Excavating Trenching and Backfilling as indicated.
- .8      Do not place bedding surround and backfill materials in frozen condition.
- .9      Protect sub-drains against flotation during installation.

**END OF SECTION**