

## **Part 1 - General**

### **1.1 Related Requirements**

- .1 Section 31 05 16 - Aggregate Materials
- .2 Section 31 23 33 – Excavating, Trenching and Backfilling Works
- .3 Section 33 46 16 – Subdrainage Piping

### **1.2 References**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, sieves, testing, woven wire, inch series.
  - .2 CAN/CGSB-8.2, sieves, testing, woven wire, metric.
- .2 Canadian Standards Association (CSA International)
  - .1 .CAN/CSA-A23.1-04/a23.2-04, concrete materials and methods of concrete construction/methods of test and standard practices for concrete.
  - .2 .CAN/CSA-A3000-03(R2005), cementitious materials compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001, cementitious materials for use in concrete.
    - .2 CSA-A3002, masonry and mortar cement.
  - .3 CAN/CSA-A165 series, CSA standards on concrete masonry units (Consists of A165.1, A165.2 and A165.3).
  - .4 CAN/CSA-G30.18, billet steel bars for concrete reinforcement.
  - .5 CAN/CSA-G164, hot dip galvanizing of irregularly shaped articles.
- .3 .Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 Ontario Provincial Standard Specifications (OPSS)
  - .1 OPSS 407-november 2004, construction specification for maintenance hole, catch basin, ditch inlet and valve chamber installation.

### **1.3 Action and Informational Submittals**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets.
- .2 Quality Assurance Submittals:
  - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Manufacturer's instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

#### **1.4 Quality Assurance**

- .1 Pre-installation meetings: convene pre-installation meeting one week prior to beginning work of this section, with Contractor's Representative and Departmental Representative - Critical Path Method (CPM) to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

#### **1.5 Delivery, Storage and Handling**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

### **Part 2 - Products**

#### **2.1 Materials**

- .1 Cast-in-place concrete:
  - .1 Cement: to CAN/CSA-A3001, Type Gu.
  - .2 Concrete mix design to produce 21 mpa minimum compressive strength at 28 days and containing 25 mm maximum size coarse aggregate, with water/cement ratio to CAN/CSA-A23.1
    - .1 Air entrainment to CAN/CSA-A23.1, class exposure.
  - .3 Supplementary cementing materials: with minimum 20%, by mass of total cementitious materials to CAN/CSA A3001.
- .2 Precast manhole units: to ASTM C 478m, circular.
  - .1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
  - .2 Monolithic bases to be approved by Departmental Representative.
- .3 Precast catch basin sections: to ASTM C 139.
- .4 Joints: made watertight using rubber rings, bituminous compound, and epoxy resin cement.
- .5 Mortar:
  - .1 Aggregate
  - .2 Masonry cement: to CAN/CSA-A3002.
- .6 Ladder rungs: to CAN/CSA-G30.18, no.25m billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164.
  - .1 Rungs to be safety pattern (drop step type).
- .7 Adjusting rings: to ASTM c 478m.
- .8 Concrete brick: to can3-a165 series.
- .9 Drop manhole pipe: same as sewer pipe.
- .10 Galvanized iron sheet: approximately 2 mm thick.
- .11 Steel gratings, I-beam and fasteners: as indicated.
- .12 Frames, gratings, covers to dimensions as indicated and following requirements:

- .1 Metal gratings and covers to bear evenly on frames.
    - .1 Frame with grating or cover to constitute one unit.
    - .2 Assemble and mark unit components before shipment.
  - .2 Gray iron castings: to ASTM A 48/A 48m, strength class30b.
  - .3 Castings: coated with two applications of asphalt varnish.
  - .4 Manhole frames and covers: cover cast to OPSS 407.
  - .5 Catch basin frames and covers: to OPSS 407.
  - .6 Manhole frames and covers:
    - .1 Cover cast without perforations and complete with two 25 mm square lifting holes.
  - .7 Size: 762 mm clear diameter.
- .13 Granular bedding and backfill: in accordance with Section 31 05 16 - Aggregate Materials And Following Requirements:
- .1 Crushed stone, gravel.
  - .2 Gradations to be within limits specified when tested to ASTM C 13. Sieve sizes to CAN/CGSB-8.1.
  - .3 Table:

Sieve Designation	% passing	
	Stone/gravel	Gravel/sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30-90
0.425 mm	10-25	10-50
0.180 mm	-	-
0.075 mm	0-8	0-10
  - .4 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-In-Place Concrete.
- .14 Unshrinkable fill: in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

### Part 3 - Execution

#### 3.1 Manufacturer's Instructions

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### 3.2 Excavation And Backfill

- .1 Excavate and backfill in accordance with Section 31 23 33 - Excavating Trenching And Backfilling As Indicated.
- .2 Obtain approval of Departmental Representative before installing, manholes or catch basins.

### 3.3 Concrete Work

- .1 Position metal inserts in accordance with dimensions and details as indicated.

### 3.4 Installation

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses.
  - .1 Maximum of three units behind point of pipe laying will be allowed.
- .3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
- .4 Cast bottom slabs directly on undisturbed ground.
- .5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% corrected maximum dry density.
- .6 Precast units:
  - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.
  - .2 Make each successive joint watertight with departmental approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.
  - .3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
  - .4 Plug lifting holes with pre-cast concrete plugs set in cement mortar or mastic compound.
- .7 For sewers:
  - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
  - .2 Bench to provide smooth u-shaped channel.
  - .3 Side height of channel to be 0.75 times full diameter of sewer.
  - .4 Slope adjacent floor at 1 in 20.
  - .5 Curve channels smoothly.
  - .6 Slope invert to establish sewer grade.
- .8 Compact granular backfill to 95% corrected maximum dry density.
- .9 Place unshrinkable backfill in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- .10 Installing units in existing systems:
  - .1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation and install new unit as specified.
  - .2 Make joints watertight between new unit and existing pipe.
  - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

- .11 Set frame and cover to required elevation on no more than four courses of brick.
  - .1 Make brick joints and join brick to frame with cement mortar.
  - .2 Parge and make smooth and watertight.
- .12 Place frame and cover on top section to elevation as indicated.
  - .1 If adjustment required use concrete ring.
- .13 Clean units of debris and foreign materials.
  - .1 Remove fins and sharp projections.
  - .2 Prevent debris from entering system.
- .14 Install safety platforms in manholes having depth of 5 m or greater, as indicated.

### 3.5 Adjusting Tops of Existing Units

- .1 Remove existing gratings, frames and store for re-use at locations designated by Departmental Representative.
- .2 Sectional units:
  - .1 Raise or lower straight walled sectional units by adding or removing precast sections as required.
  - .2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.
    - .1 When amount of raise is less than 600 mm use standard manhole brick, modoloc or grade rings.
- .3 Monolithic units:
  - .1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with cast-in-place concrete.
  - .2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.
  - .3 When monolithic units with tapered upper section are lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.
  - .4 Install additional manhole ladder rungs in adjusted portion of units as required.
  - .5 Re-use existing gratings, frames.
  - .6 Re-set gratings and frames to required elevation on not more than 4 courses of brick.
    - .1 Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.
    - .2 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

### 3.6 Field Quality Control

- .1 Leakage test:
- .2 Install watertight plugs or seals on inlets and outlets of each new manhole and fill manhole with water.
- .3 Leakage not to exceed 0.3% per hour of volume of manhole.
- .4 If permissible leakage is exceeded, correct defects.
- .5 Repeat until approved by Departmental Representative.

- .6 Departmental Representative will issue test certificate for each manhole passing test.

### **3.7 Cleaning**

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

## **Part 1 - General**

### **1.1 Related Requirements**

- .1 Section 31 05 16 - Aggregate Materials And Following Requirements
- .2 Section 31 23 33 – Excavating, Trenching and Backfilling Works

### **1.2 References**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, sieves, testing, woven wire, inch series.
  - .2 CAN/CGSB-8.2, sieves, testing, woven wire, metric.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA B1800, plastic non-pressure pipe compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 And B182.11).
    - .1 CSA B182.1, plastic drain and sewer pipe and pipe fittings.
  - .2 CSA-G401, Corrugated Steel Pipe Products

### **1.3 Action and Informational Submittals**

- .1 Inform Departmental Representative of proposed source of bedding and filter materials and provide access for sampling at least 4 weeks prior to commencing work.
- .2 Submit to Departmental Representative for testing, following samples of materials proposed for use at least 4 weeks prior to commencing work:
- .3 Submit manufacturer's test data and certification that drain pipe materials meet requirements of this section at least 4 weeks prior to beginning work.
- .4 Certification to be marked on pipe.

### **1.4 Waste Management And Disposal**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal packaging material for recycling in accordance with waste management plan.
- .3 Separate for reuse and recycling and place in designated containers waste in accordance with waste management plan.
- .4 Divert unused materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Divert unused concrete materials from landfill to local facility approved by Departmental Representative.
- .6 Divert unused aggregate materials from landfill to facility for reuse as approved by Departmental Representative.
- .7 Divert unused clay pipe materials from landfill to local facility approved by Departmental Representative.
- .8 Fold up metal banding, flatten and place in designated area for recycling.

## Part 2 - Products

### 2.1 Materials

- .1 Plastic pipe and fittings: to BNQ 3624-115, nominal inside diameter 100 mm.
- .2 Perforated plastic pipe and fittings: to CAN/CSA-b182.1. Nominal pipe sizes 150 mm.
- .3 Bedding gravel or crushed stone; hard, durable particles, graded evenly in size from 16 to 8 mm.
- .4 Granular filter material in accordance with Section 31 05 16- Aggregate Materials And Following Requirements:
  - .1 Screened stone or gravel.
  - .2 Gradations to be within limits specified when tested to ASTM C 136. Sieve sizes to CAN/CGSB-8.1.
- .5 Table
- .6 

Sieve designation	% passing
200 mm	-
75 mm	-
50 mm	-
38.1 mm	-
25 mm	-
19 mm	-
12.5 mm	100
9.5 mm	-
4.75 mm	70-100
2.00 mm	60- 95
0.425 mm	15- 40
0.180 mm	0- 10
0.075 mm	-

## Part 3 - Execution

### 3.1 Trenching

- .1 Do trenching and backfilling in accordance with Section 31 23 33 - Excavating Trenching and Backfilling.
- .2 Place bedding material after approval of trench by Departmental Representative.

### 3.2 Bedding

- .1 Place 100 mm layer of bedding material to full trench width and compact to minimum 95% of maximum density to ASTM d 698

### 3.3 Installations 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 Ensure barrel of each pipe is in contact with bed throughout full length.
- .3 Begin laying at outlet and proceed in upstream direction.
- .4 Lay perforated pipes with perforations downwards.



- .5 Lay bell and spigot pipe with bell ends facing upstream.
  - .1 Do not mortar joints.
- .6 Cover joints of bell and spigot pipe with two-ply tar paper strips not less than 150 mm wide.
  - .1 Use strips of sufficient length to permit ends to be laid flat on bedding and turned outward on either side of pipe for a minimum distance of 75 mm.
- .7 Make joints tight in accordance with manufacturer's instructions.
- .8 Make watertight connections to existing drains, new or existing manholes and catch basins where indicated or as directed by Departmental Representative.
- .9 Plug open upstream ends of pipes with watertight concrete, steel or wood bulkheads.
- .10 Surround pipe with bedding gravel and compact as directed by Departmental Representative.
- .11 Surround and cover drain with filter material in uniform 150 mm layers to an elevation of at least 150 mm above top of drain and compact to at least 95% maximum density to ASTM D 698.
- .12 Wrap or sleeve perforated pipe with geotextile filter as indicated.
- .13 Backfill remainder of trench as directed by Departmental Representative.
- .14 Do not place bedding surround and backfill materials in frozen condition.
- .15 Protect sub-drains against flotation during installation.
- .16 Install "y" connections to surface as indicated, for flushing.

**END OF SECTION**