



*Growing stronger together*

**SECTION 5 - STORM**

**Applicable on all County Roads**

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DETAILS

- D1812-1-2007: Rigid Board Insulation – Slab Type
- D1832-1-1993: Mechanical Joint Offset Installation - Under
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## **PART 1 - LOCATION AND DESIGN**

The current Ontario Provincial Standards and Ministry of the Environment and Climate Change (MOECC) Guidelines for the Design of Sewage Works provide the minimum requirements that must be met. In addition, the following criteria must be included in the Design presented for approval to the County.

### **1.1 Permitted Flows**

Storm drainage shall be designed to collect storm water discharge from pervious and impervious areas, both on private lands via catchbasins and private drain connections. Indirect connections of foundation drains (footing tile) via sump pumps to storm Private Drain Connections (PDC's) are permitted.

### **1.2 Location and Alignment**

Generally, storm drainage is to be located in front of, or in locations accessible to each lot or blocks facing the County Road. Storm sewers are to be located as per Section-1 General, Figure 1.2. Any deviation from these standards must be submitted in writing to the County Engineer or local Municipality for approval.

When a maintenance hole is designed to be located within the vicinity of a roundabout, storm maintenance holes are permitted to be located within the grassed area of the roundabout.

Storm sewers on private property are regulated by the Ontario Building Code (OBC). Where there are no specific regulations in the OBC, details from this manual will apply.

### **1.3 Drainage/Sub-drainage Area Plans**

Drainage/sub-drainage area limits for which sewers are to be designed for are to contain and follow the lot/block lines to the proposed maintenance holes located on the R.O.W.

Note: All areas and coefficients shall be shown for each drainage/sub-drainage areas.

### **1.4 External Sewershed Limits and Drainage Areas**

When designs abut undeveloped or unserved areas, the external sewershed limit shall be identified and designed for.

Note: All areas and coefficients are to be shown for all drainage areas within external watershed limits.

## 1.5 Design Chart

Storm sewer design calculations for approved drainage area plans are to be completed on the standard design chart as per Figure 5.1 for details and additional design information.

## 1.6 Peaking Factor Calculation

Flows shall be calculated using the formula:  $Q = 2.78 \times A \times C \times I$

Where Q= peak flow (L/s)  
 A= area (hectares)  
 C= runoff coefficient  
 I= average rainfall intensity (mm/hr)

## 1.7 Design Criteria

For Storm Sewer Design Guidelines refer to Chapter 5, Section 5.4 of the Ministry of the Environment and Climate Change (MOECC) Design Guidelines for Sewage Works.

### 1.7.1 Storm Design Curve

Intensity duration frequency (IDF) curves from Canada Atmospheric Environment Service (AES) for weather stations within a 50 kilometres radius of Oxford County are acceptable.

### 1.7.2 Time of Concentration

- a) The time of concentration for residential areas at the upstream end of a system shall be 15.0 minutes.
- b) The time of concentration is to be adjusted when lateral flows account for 50% or more in the design flows.
  - i) Adjusted time of concentration shall be calculated using the formula:

$$T_{c-adj} = \frac{(T_{ct})(Q_t) + (T_{cl})(Q_l)}{(Q_t - Q_l)}$$

Where  $T_{c-adj}$  = adjusted time of concentration (min)  
 $T_{ct}$  = time of concentration in the trunk sewer (min)  
 $Q_t$  = design flow in the trunk sewer (L/s)  
 $T_{cl}$  = time of concentration in the lateral sewer (min)  
 $Q_l$  = design flow in the lateral sewer (L/s)

- ii) The adjusted time of concentration is used downstream of the junction manhole.

### 1.7.3 Intensity

Rainfall intensity shall be taken from IDF curves.

## 1.8 Mannings Roughness Coefficient

A coefficient of 0.013 is to be used for all concrete, HDPE (Boss 2000), and polyvinyl chloride (PVC) pipe for pipe sizes 300 mm to 1650 mm. A coefficient of 0.011 is to be used for all pipe sizes 1800 mm or greater.

## 1.9 Pipe Size

Pipe size is determined using the formula where the pipe design flow is equal to or greater than the calculated peak design flow:

$$Q = (1/n) \times A \times R^{2/3} \times S^{1/2}$$

Where:

- Q = Design flow (m<sup>3</sup>/sec)
- n = Manning's roughness coefficient
- A = cross sectional area of flow (m<sup>2</sup>)
- R = hydraulic radius (area/wetted perimeter)
- S = slope of pipe (m/m) - %

The minimum allowable size of a storm sewer shall be 300 mm.

The minimum allowable size of a single catchbasin lead shall be 250 mm.  
The minimum allowable size of a double catchbasin lead shall be 300 mm.

On private property, the minimum size for storm building sewer shall be 100 mm, in accordance with Part 7 of the OBC.

## 1.10 Flow Velocity

Velocities in storm sewers shall be calculated using the following formula:

$$V = \frac{Q}{A}$$

Where:

- V = flow velocity (m/s)
- Q = Design flow (L/s)
- A = cross sectional area of flow (m<sup>2</sup>)

### 1.10.1 Minimum and Maximum Velocities

The minimum velocity permitted in storm sewers is 1.0 m/s

The maximum velocity permitted in storm sewers are:

- a) 4.5 m/s for 300 mm to 825 mm diameter sewer, and
- b) 6.0 m/s for 900 mm diameter and larger storm sewers

To determine velocities based on actual flow, as per Figure 5.2 “Hydraulic Elements of Circular Pipe”.

### *1.10.2 Minimum Grades*

- a) The minimum grade on a 300 mm diameter storm sewer is 0.54%.
- b) The minimum grade on all other sewer sizes shall be established by determining the minimum grade required to achieve a velocity of at least 1.0 m/s.

## **1.11 Pipe Depth**

### *1.11.1 Minimums*

The minimum depth of a storm sewer shall be 1.5 m from the finished ground elevation to the obvert of the pipe.

### *1.11.2 Maximum Depth of Cover*

- a) Concrete Pipe

The maximum allowable cover permitted on concrete pipe shall be as per OPSD 807.01, 807.03, 807.04 and 807.05.

- b) Flexible Pipe

The maximum allowable cover permitted on flexible pipe shall be as per OPSD 806.021, 806.040 and 806.06.

### *1.11.3 Vertical Separation*

In all cases this is measured from outside wall diameter to outside wall diameter.

When crossing over or under a sanitary sewer, a 0.30 m clearance shall be maintained between the two pipes.

Watermain and services crossing sewers or utility obstructions require a minimum 500 mm of clearance under and a minimum of 150 mm over the obstruction. Insulation may be required. Refer to Detail D1812-1-2007, D1832-1-1993, and D1833-1-1993.



This practice must also be followed when storm laterals are in conflict with any watermain or water service.

#### 1.11.4 Horizontal Separation

The minimum distance allowed by the County for sewers and watermain separation is 3.0 m, and should be constructed in separate trenches as per OPSS specifications.

If it is not possible to maintain this separation, approval by the Ministry of Environment and Climate Change (MOECC) is required.

### 1.12 Maintenance Holes

Maintenance holes shall be constructed as per OPSS 407. Where required, frost straps shall be installed as per OPSD 701.100.

The void between the sewer pipe and the cored hole of the precast maintenance hole shall be filled with cement bricks and approved non-shrinkable grout. All joints between bricks are to be completely filled with concrete mortar. Bricks shall be parged on the outside and inside of the maintenance hole. Parging shall contain an approved bonding agent. All mortar and approved non-shrinkable grout shall be mixed and placed in accordance with manufacturers specifications.

A maximum spacing between storm maintenance holes of no more than 110 m measured horizontally from centre of chamber to centre of chamber is required when pipe diameter is 300 mm to 975 mm diameter. The maximum allowable horizontal spacing for the corresponding pipe sizes larger than 975 mm are as follows:

Length	Sewer Diameter
130 m	1050-1350 mm
160 m	1500-1650 mm
305 m	1800 mm and larger

When placing a maintenance hole in the vicinity of a roundabout, storm maintenance holes should be placed within the area of a roundabout. Storm maintenance holes are permitted to be located within the grassed area of the roundabout provided any proposed landscaping does not hinder the access to the maintenance hole.

#### 1.12.1 Precast Maintenance Hole Sizing Criteria

All sizing of storm precast maintenance holes are based on incoming and outgoing pipe sizes and should be sized and conform to Figure 5.3.

#### 1.12.2 Maintenance Hole Diameter

Precast maintenance hole diameter requirements shall be as per OPSD 701.

### *1.12.3 Maintenance Hole Frame and Cover*

Maintenance hole frames and covers are required for all maintenance holes. Maintenance hole frames and covers shall be as per OPSD 401.010. This should be outlined on the contract drawings, in the general notes.

If the County Engineer feels that a public safety issue is possible in a designed area, they may require that a lockable maintenance lid be placed. These conditions may arise in proposed park areas.

For all of the above mentioned covers, a maximum of 150 mm of adjustment rings will be allowed, as per OPSD 704.01 and be effected by either the use of precast concrete adjustment units or “Lifesaver” Adjusting Units as manufactured by IPEX.

### *1.12.4 Maintenance Hole Steps*

Maintenance hole steps are required for access as per OPSD 405.010 or 405.020. Only steps supplied by the maintenance hole supplier will be accepted. They must be made of galvanized steel or aluminum. The reuse of existing steps is not acceptable.

The County requires steps be installed as per OPSD 704.010

### *1.12.5 Maintenance Hole Drop Structures*

For external drop structures on 1200 mm manholes only OPSD 1003.010 or 1003.020 will be accepted.

Internal drop structures shall be used in maintenance holes 1500 mm diameter and larger where a minimum height of 600 mm from the inlet pipe invert to the bottom of the outlet pipe invert. Drop pipes shall be one size smaller than the incoming sewer with a minimum of 150 mm diameter and a maximum of 375 mm diameter. Anchor straps shall not be placed within 150 mm of any maintenance hole section joint. Internal drop structure system shall be as per OPSD 1003.031 and must be approved by the County Engineer.

### *1.12.6 Maintenance Hole Safety Landing*

Maintenance hole safety landings shall be as per OPSD 404.020. Maintenance hole safety landings are required in maintenance holes with a depth of between 5.0 m and 10.0 m and should be shown on all proposed drawings or outlined in the general notes. All incoming pipes should be below any safety platform. Additional safety landings are required at third-point depths, when the maintenance hole is equal to or greater than 10.0 m to 15.0 m deep.

### *1.12.7 Waterproofing of Chambers and Manholes*

In areas of high groundwater waterproofing of chambers and manholes is required.

Waterproofing membrane shall be supplied and installed on all exterior concrete surfaces of the chambers and manholes, including the edges of the base slab, up to within 300 mm of the cover elevation.

The membrane shall be applied over a prime or tack coat and hand rolled to assure positive adhesion. A compatible elastomeric mastic shall be applied to seal horizontal and vertical terminations, as a flashing and to form corner fillets. Openings in walls or roof slabs for piping, valve boxes or access chimneys shall be sealed with two layers of membrane material and mastic to provide a tight seal.

Waterproofing membrane shall be Sealtight Mel-Rol waterproofing system as manufactured by W.R. Meadows or approved equal.

### *1.12.8 Benching*

All maintenance holes require benching at the bottom of the maintenance hole. Benching shall be as per OPSD 701.021. Where benching is different from OPSD 701.021, a benching detail is required.

Should an existing maintenance hole require additional benching to improve the hydraulics then the existing benching should be removed and new benching placed to the obvert of the existing pipes.

### *1.12.9 Adjustment Units*

Maintenance hole adjustment units shall be as per OPSD 704.010. Maintenance hole adjustment units are required on all maintenance holes to ensure that proper grade is provided between the top of the maintenance hole and the top of the maintenance hole lid. The difference in grade between the top of the maintenance hole lid and the first ladder rung shall not exceed 450 mm.

A maximum of 150 mm of adjustment rings will be allowed. This will be affected by either the use of precast concrete adjustment units or "Lifesaver" Adjusting Units as manufactured by IPEX.

When using precast concrete adjustment units, only approved PVC shims will be allowed. Concrete, clay brick and wood spacers will not be allowed.

## **1.13 Easement**

Easements are required for all sewers to be assumed by the County located outside a road allowance on privately owned property.

An easement is required to ensure that the municipal services and utilities crossing the site can be properly installed and maintained by the appropriate authority (County and private). An easement provides the right to use private land for a specific purpose which is in the public's interest.

*1.13.1 Type of Easement*

a) Municipal (Servicing) Easement

Is required for storm sewers and access roads that cross a site and which are maintained by the County or the County of Oxford's service provider.

b) Utility Easement

Is required for telephone, hydro, gas and cable television services. Each utility company should be consulted for their specific requirements.

c) Private Servicing Easement

Is required for private storm sewers and access roads that cross a parcel of land to service other private lands. A joint access and maintenance agreement between the interested parties shall be entered into.

d) Temporary Easements and Working Easements

Are required for storm sewers and access roads that cross a site temporarily. The services in the easement are to be maintained by the owner of the services.

*1.13.2 Minimum Easement Widths*

Easement widths are determined by the depth of cover from the centerline of the road/ground to the invert of a sewer or a minimum width of 5.0 m (2.5 m each side of pipe), assuming no other services are located within the easement.

**1.14 Catchbasins**

Catchbasins shall be constructed as per OPSS 407 with standard 600 mm sump unless otherwise specified. Catchbasins are to be provided to collect drainage from both pervious and impervious areas. The following are the general guidelines to be used in the provision of catchbasins and catchbasin leads.

*1.14.1 Location*

Street – On street corners and intersections, the catchbasin is to be located 0.6 m from the beginning of curve (BC) or end of curve (EC) of the curvature.

Lot/Rear Yard – The catchbasin and lead are to be located 0.6 m from the property line, entirely on one lot or block.

Parks – Catchbasins are to be located to minimize flow across pathways and provide positive drainage from park facility.

#### *1.14.2 Minimum Lead Diameter and Grade*

Street – The minimum diameter and grade of a catchbasin lead on a street is 250 mm @ 0.69% (velocity of 1.0 m/s)

Lot/Rear Yard – The minimum diameter and grade of a catchbasin lead in a rear yard is 300 mm @ 0.54% (velocity of 1.0 m/s)

Parks – The minimum diameter and grade of a catchbasin lead in a rear yard is 250 mm @ 0.69% (velocity of 1.0 m/s)

#### *1.14.3 Spacing*

The desired maximum distance between catchbasins or from a crest in a road to a catchbasin is 90 m, measured along the curb line on each side of the road.

#### *1.14.4 Depth of Cover*

The minimum depth of cover over a catchbasin lead is to be 1.5 m within the road allowance and 1.2 m off the road allowance. Where minimum depths cannot be achieved and therefore frost protection is warranted, insulation shall be required as per Detail D-1812-1-2007.

#### *1.14.5 Allowable Ponding*

No surface ponding is allowed to develop under a 2 year design storm event. Ponding on major overland flow routes allows for 300 mm on street catchbasins and 450 mm on rear yard catchbasins.

#### *1.14.6 Requirement for Length of Leads*

Standard catchbasins (600 mm x 600 mm), maintenance hole catchbasins and maintenance holes are to be constructed/connected in accordance with the following:

- a) Catchbasins within 9.0 m of a maintenance hole are to have their leads connected into the maintenance hole.
- b) Catchbasin leads 9.0 to 15.0 m may have their leads connected into the main sewer.

- c) Catchbasin leads 15.0 to 30.0 m in length may be constructed by:
  - i) Having a catchbasin at one end and the other connected into a maintenance hole or a sewer 900 mm in diameter and larger, or by
  - ii) Having the lead connected into a sewer 825 mm in diameter or smaller at one end with a maintenance hole catchbasin at the other end.
- d) Catchbasin leads over 30.0 m in length, are to be connected into a maintenance hole or a sewer 900 mm in diameter or larger at one end and have a maintenance hole catchbasin at the other end.

#### *1.14.7 Catchbasin Frame and Grates*

- a) Catchbasin Cast Iron Frame and Flat Square Grate  
To be constructed in conjunction with a catchbasin 600 mm x 600 mm as per OPSD 400.02.
- b) Catchbasin Cast Iron Curb Inlet Overflow Plate  
To be constructed in conjunction with curb inlet catchbasin as per OPSD 400.09.
- c) Ditch Inlet, Galvanized Steel, Honey Comb – Grating  
To be constructed in conjunction with ditch inlet catchbasin as per OPSD 403.01.

#### *1.14.8 Catchbasin Steps*

- a) Maintenance Hole Steps – Hollow  
To be constructed as per OPSD 405.010.
- b) Maintenance Hole Steps – Solid  
To be constructed as per OPSD 405.020.

#### *1.14.9 Catchbasin Subdrains*

Pipe subdrains shall be provided on both sides of all catchbasins installed in hard surface areas. Subdrains are not required in rear lot catchbasins or in a catchbasin located in grassed areas.

All subdrains shall be 150 mm diameter, minimum 3.0 m long, of perforated PVC pipe with geotextile filter sock MIRAFI 150N or Terrafix 200R. Pipe ends to be capped.

## 1.15 Storm Sewer Inlet and Outlet Structures - Headwalls

Headwalls are required at the end of all storm sewer systems which provide for a transition from the storm sewer to an open channel, river, creek, SWM pond or other received body of storm water. In some cases, headwalls are required at the inlet of a storm sewer and/or large storm drain.

### 1.15.1 Type of Headwall

The following headwall designs are based on the velocity and in certain cases the diameter of the storm sewer, as per Municipal Works Design Manual (Municipal Engineers Association – MEA) and OPSD.

There are five types of headwall designs:

- a) Under 1.3 m/s with pipe diameters under 600 mm – as per OPSD 804.03
- b) Under 2.1 m/s – MEA Type 1, as per OPSD 804.04 where applicable or detail design modifying of OPSD 804.04.
- c) Between 2.1 – 2.7 m/s – MEA Type 2, as per OPSD 804.04 where applicable or detailed design modifying OPSD 804.04 and 1 baffle post.
- d) Between 2.7 – 4.6 m/s – MEA Type 3, as per OPSD 804.04 where applicable, or detailed design modifying OPSD 804.04 and 3 baffle post
- e) Between 4.6 – 10.0 m/s – MEA Type 4 (stilling basin) or detail design

### 1.15.2 Concrete Strength

The concrete for all headwalls is to have a minimum strength of 30 MPa with a 5% to 7% air entrainment and 70 to 90 mm slump.

### 1.15.3 Chamfers

All exposed corners of all headwalls should be chamfered 25 mm or more depending on the size of the headwall.

### 1.15.4 Weeping Tiles

Weeping tiles are to be provided on each side at the base of the sewer outlet and extended through the headwall. On larger headwalls they shall be placed on the side or wing walls.

### 1.15.5 Baffle Posts

Baffle posts are to be provided for sewer flows between 2.1 m/s and 4.6 m/s. The locations of posts are per the type of headwall. The height of the baffle posts should be equal to the full depth of flow. Sizing of the posts are 1/6 the size of the pipe diameter together with reinforcing bars.

### 1.15.6 Grill/Grates

Hot dipped galvanized grills/gates are to be placed over the storm outlets horizontally or vertically as required and should be fixed to the headwall with anchor bolts. Grills and gates as per OPSD 804.05.

### 1.15.7 Railing

A railing is required on all headwalls which exceed 1.0 m in height from the top of the headwall to the proposed top of slope, as per OPSD 980.101.

### 1.15.8 Rip Rap/Rock Protection

Rip rap is to be constructed as per OPSD 810.01 at the end of headwalls, on the bottom and sides up to design water level, downstream until the projected side wall meets the channel slope at half the design water depth of flow, and at creeks and rivers.

## PART 2 - MATERIAL

### 2.1 Pipe Material

Both rigid and flexible pipe are permitted in the construction of storm sewer systems including private drain connections. These materials include PVC, concrete and HDPE pipe. All materials shall be CSA certified. **Field cut tees will not be permitted.** On private property, materials for storm sewers and private sewers shall comply with Part 7 of the OBC.

**The Contractor will get approval for pipe selection from the County Engineer prior to supplying the material to the site.**

#### PVC

- a) Polyvinyl chloride (PVC) pipe – smooth wall (CSA B182.2) – 100 mm – 600mm inclusive. Storm PVC main shall be SDR 35 as per OPSS 1841.
- b) Polyvinyl chloride (PVC) pipe – ribbed (CSA B182.4) – 200 mm – 600 mm pipe inclusive.



Storm services must be PVC SDR-28 (white) and have a factory placed tee at the main. All PVC and fabricated moldings shall be CSA certified.

### **Concrete**

Trench conditions shall be determined by the Consulting Engineer. Trench conditions shall be as per OPSD 807.010, 807.030, and 807.040. Concrete pipe material must comply with the following CSA requirements.

- a) Non-Reinforced – CAN/CSA257.1 Class 3 concrete for pipes 450 mm or less in diameter.
- b) Reinforced – CAN/CSA257.2 65-D concrete for pipes more than 450 mm in diameter.

### **HDPE**

High-density polyethylene (HDPE) double wall smooth interior annular profile pipe (CSA B182.6) with integral bell and spigot (Boss Poly-Tite) for use on storm sewer only (200 mm to 600 mm inclusive).

## **2.2 Directional Drilling Material**

Pipe material used for directional drilling shall be HDPE DR11 DIPS (Brown Stripe) or PVC. PVC pipe used for the directional drilling process must meet or exceed the pressure rating of HDPE DR 11.

For directional drilling of PVC pipe only the “Terra Brute”, “Cobra Lock” or fusible PVC jointing process shall be permitted. Inside diameters shall meet or exceed typical sizing requirements associated with PVC pipe.

HDPE fittings shall be butt fusion or mechanical joint only as per AWWA Specifications C110, C153 and C906. Push-on fittings are not permitted.

Pipe fittings including tees, bends, service saddles, etc. shall be rated at the same pressure rating or higher than the pipe. Mechanical joint adaptors shall include stiffener or as specified by the pipe manufacturer.

## **2.3 Bedding Material**

As per OPSS 1010

## **PART 3 - INSTALLATION**

The installation of storm sewers shall be as per OPSS 401, 404, 410, 517, and 1010 with the following exceptions/amendments.

**SECTION A - OPEN CUT****3.1 Line and Grade**

- a) Contractors shall provide stakes to indicate the line and grade of the storm sewer as well as the location of fittings, bends, tees, reducers and plugged or capped dead-ends in accordance with the approved drawings before beginning any work. Line and grades shall be marked a minimum of 20 m to a maximum of 50 m. Mains shall be laid and maintained to the required grades and locations with all fittings, etc. to be plumb and in accordance with the drawing locations. No deviation in excess of 150 mm will be permitted.
- b) Contractors shall carry out explorations where necessary to establish or discover the location and elevation of existing pipes, conduits or other buried objects.

**3.2 Frozen Ground**

Do not place material on frozen ground. Should the bottom of the trench become frozen remove and replace the frozen material with bedding material compacted to 100 percent Standard Proctor Density.

**3.3 Excavation and Trench Preparation**

- a) All excavations and trenching operations shall comply with the associated provisions of the Construction Projects Regulation (O.Reg 213/91). Trenches shall be provided so that pipe can be laid with the proper alignment and depth so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at all points between the Bell holes.
- b) Where trench excavations are not kept within the design limits of the pipe, the County Engineer may order sheathing and shoring, and/or a heavier class of pipe, and/or use of a higher class of bedding.
- c) Where the sub grade in its natural state is inadequate to support the pipe, the County Engineer will give instructions as to the proper procedure.
- d) The sub grade shall be removed where it has been adversely changed by construction operations and is not adequate to support the pipe. Replace with crushed stone or other approved material as directed by the County Engineer.

**3.4 Dewatering**

- a) Always maintain the excavation free of water.
- b) Do not use storm sewers for the discharge of water from the trench.

**3.5 Lowering & Laying**

- a) Before lowering and while suspended, the pipe shall be inspected for defects. Proper implements, tools and facilities as required by the County Engineer shall be provided by the Contractor. All materials shall be lowered into the trenches by suitable means.
- b) The interior of the pipe shall be inspected and completely cleaned of all sand or foreign materials before placing in the line. No foreign materials are to be placed in the pipe during its laying.
- c) The inside of the bell and the outside of the spigot shall be brushed and free from all oil, grease or dirt before jointing. Precautions must be taken to prevent dirt from entering the joint space. At all times when pipe laying is not in progress the open ends of the pipe shall be closed by water-tight plugs or other means approved by the Inspector. This must be adhered to during the noon hour as well as overnight. The trench shall be kept dry and free from water, no pipe shall be laid in water except by permission of the County Engineer. No water shall be allowed to run through installations during construction.
- d) Cutting of the pipe shall be done in a neat manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe.
- e) Pipe shall be laid with the bell ends facing in the direction of laying. Deviation from this shall only be permitted by the County Engineer.
- f) At grades above 10 percent, laying shall start at the bottom with the bell ends facing upward. When deflection in the line laying is required, either in the vertical or horizontal plane, the deflection may be made at the joints with the maximum allowable deflections not being exceeded. Pipe deflection will be done as per manufacture's specifications. If in the opinion of the Inspector, the deflection is excessive they will order the job stopped. The County Engineer or their representative, if they deems it required, will order the installation of specials in order to provide the required deflection. Offset locations and details shall be shown on Construction and As-Constructed Plans.
- g) When a new sewer crosses existing utilities, or where an existing watermain is undermined during laying operations, the County Engineer may order the installation of support beams. Support beams shall be approved by the County Engineer prior to placement. The removal or replacement of an undermined section of the existing watermain or sewer may also be required. The County Engineer shall decide the method to be used. In all cases where pipe is laid on backfilled material, the backfill shall consist of granular material compacted in 150 mm layers to a minimum of 95 percent Standard Proctor density. Pipe must not be laid on blocks.
- h) No pipe shall be laid until the preceding pipe joint has been compacted and the pipe carefully embedded and secured in place.

- i) All pipe and fittings shall be installed strictly in accordance with the manufacturer's instructions. At least two copies of the manufacturer's manual of instructions shall be kept on the job site; one copy in the possession of the foreman, the other with the pipe layers.
- j) Installations shall be kept thoroughly clean throughout, during the progress of the work and until the completion and final acceptance thereof. They shall be left clean on the completion of the work.
- k) The Contractor shall supply all fittings to complete the installation to the lines and grades shown on the drawings. Where vertical or horizontal curves are shown, the pipe line shall not deviate more than 300 mm from line, no more than 75 mm from grade.

### **3.6 Bedding**

For the purpose of this specification all materials placed between the trench bottom and 300 mm over the top of the pipe shall be considered as bedding. Bedding around the sewer and services may be granular material or clean screened sand.

- a) Granular materials greater than 19 mm in size shall not be used for pipe bedding. Granular material shall be compacted to a minimum of 95 percent Standard Proctor Density.
- b) Bedding material shall be placed full width of trench. Compact material around the pipe with hand tampers properly shaped to ensure full compaction below the haunches. Do not use mechanical tampers over the top of pipe where cover is less than 300 mm.
- c) The depth of trench excavations shall be sufficient to allow for the bedding required below the pipe invert.

### **3.7 Backfilling**

- a) Backfill shall be considered as starting from 300 mm over top of the pipe. All materials below this point shall be considered as bedding.
- b) If the County Engineer decides that the site selected excavation material either wholly or partially, is not suitable for backfill, then suitable imported material shall be provided of a type approved by the County Engineer.
- c) Backfill trenches from the top of the pipe bedding to the underside of surface restoration with site selected excavated material. Provide backfill free of roots, organic material and stone larger than 250 mm.

Backfill material shall be placed in lifts not exceeding 300 mm and compacted to a minimum 95 Percent Standard Proctor Density.

- d) Backfilling on a public road allowance, or in an area that is to be designated as a public road allowance, shall be done in accordance with the requirements of the County Engineer or other road authority. Backfill on all County road allowances in the travelled portion of the roadway shall be granular material as set out in the Ontario Provincial Standards.

Installation of material will be as directed by the County Engineer or other road authority.

- e) The Inspector may order the trench to be bedded by hand from the bottom of the trench to the centre line of the pipe with sand, placed in layers of 75 mm and compacted by vibratory equipment. Bedding material shall be deposited on each side of the pipe simultaneously.
- f) From the centre line of the pipe, fittings and appurtenances to a depth of 300 mm above the top of the pipe shall be backfilled by machine or by methods approved by the Inspector. The type of backfill material used shall be sand, gravel or approved excavated material. The Contractor shall use special care in placing and compacting this portion of the backfill so as to avoid damaging or moving the pipe.
- g) No frozen material shall be used for backfilling nor shall backfilling be carried out where material in the trench is frozen.
- h) The surface shall be restored so that all pavement, sidewalks, curbs, gutters, shrubbery, fences, poles, sod and other property and surface structures removed or disturbed during the work shall be restored to a condition at least equal to that before the work began.

### **3.8 Compaction Test**

The County Engineer may order compaction tests by an independent testing company. Tests will be arranged for by the County or the County of Oxford's service provider.

- a) When tests show that the compaction does not meet the specified requirement, the Contractor will carry out further compaction in a manner directed by the County Engineer, and pay for further testing to establish proof of the specified compaction.
- b) For backfill compaction, tests will be performed in accordance with the testing company's recommendations.
- c) Co-operate with the County Engineer and testing company by scheduling the placing and compaction of backfill so that tests can be progressively taken.

**SECTION B - DIRECTIONAL DRILLING****3.9 Scope**

This specification covers the requirements for the installation of pipes by horizontal directional drilling.

**3.10 Definitions**

Directional drilling is defined as trenchless installation of pipes pulled through a drilled and reamed hole.

A pilot hole is drilled under and across the surface area that cannot be disturbed along a predetermined horizontal and vertical design profile. Direction and elevation is controlled by a steering mechanism in the drill string just behind the cutting head. Reaming is enlargement of pilot hole to a suitable size to allow for the installation of the pipe.

**3.11 Submission and Design Requirements***3.11.1 Submissions*

Submit shop drawings showing all equipment and plans required to complete the pipe installation by direction boring. This information shall include:

- a) Direction boring equipment and specifications;
- b) Sequence of operation;
- c) Location of entry and exit points;
- d) Location of positioning of individual plant items such as drilling equipment, slurry holding tanks, power generation units, slurry recovery units and pumps, etc;
- e) Disposal site for cuttings;
- f) Dewatering plan; and
- g) Slurry management plan.

*3.11.2 Design Requirements*

Procedures, materials, and water management plan are to be acceptable to the Ministry of Environment and Climate Change (MOECC), Ministry of Natural Resources (MNR), local Conservation Authority and the other public agencies having jurisdiction over the project.

All plant, personnel and construction activity must be contained within working areas or easement limits shown on the Contract Drawings.

### 3.11.3 Record Drawing Requirements

Record drawings shall be provided following pipe installation. Record drawings shall include the following details:

- a) Horizontal (plan) location of installed pipe tied to known reference points.
- b) Profile of the installed pipe with elevations.
- c) Location of all joints and flanged connections tied to known reference.
- d) Subsurface ground conditions encountered (soil, clay, rock, etc.)

## 3.12 Equipment

The drilling equipment shall be suitable for installation of the pipe size and length required. The boring equipment shall consist of: the drilling rig, cutting and steering head, drill stems, power and control equipment, mixing tanks for drilling fluids and a slurry recovery system.

The steering system shall include a probe situated behind the cutting head that can interface with an above ground portable computer control console. The probe shall be able to indicate the orientation of the steering and cutting tool.

The cutting tool shall be steerable from the above ground computer control console so that any deviation from the design alignment can be corrected as boring progresses.

The drilling equipment shall be capable of being retractable and reset to a different horizontal alignment should obstacles such as boulders, tree roots, etc. be encountered. The Contractor shall not change the vertical alignment without the approval of the County Engineer.

A surface probe shall be provided that can detect the location and depth of the cutting tool/steering system. The surface probe shall be used to confirm that the pipe alignment is within the easement and at the location identified.

## 3.13 Construction

### 3.13.1 General

The Contractor shall provide all necessary equipment, drilling fluids, and power to perform the work specified.

### 3.13.2 Dewatering

The proposed dewatering method for the entry and exit pits and all excavations shall not be modified without written consent from the County Engineer.

All water extracted during any dewatering process shall be diverted through a filter system or settling ponds/basins to ensure minimum sediment transport.

The filter system or ponds/basins shall be located so as not to interfere with normal construction activity and the public use of such areas.

### 3.13.3 *Line and Grade*

Line and grade control will be maintained to the locations and elevations on the Contract Drawings. Variations in grade will not be acceptable.

The control system must be capable of maintaining line and grade to  $\pm 100$  mm over the total distance between the ground entry and exit points.

### 3.13.4 *Soil Transportation System*

The directional boring system shall have a slurry system designed to enable excavated soil removal. The slurry system shall have a system of screens and desilting/sedimentation tanks to separate the soil from the slurry. The drilling fluids may be transported to the drill rig for reuse. Disposal of the slurry on-site or into drainage systems will not be permitted.

### 3.13.5 *Entry and Exit Points*

The Contractor shall review site conditions and make an assessment of entry and exit points. Assessment shall take the following items into consideration:

- a) Entry and exit angles to facilitate boring equipment and allow for pulling pipe into reamed hole.
- b) Setbacks or open cut excavation requirements at entry and exit points to provide the pipe profile and construction of appurtenances as indicated on the Contract Drawings
- c) Location of other surface features (eg. adjacent structures, walkways, fences, poles, trees, etc.)
- d) Location of other underground features (eg. utilities, foundations, etc.)
- e) Protection of water courses against the transport of excavated or other materials into receiving waters.

### 3.13.6 *Pipe Installation*

High Density Polyethylene (HDPE) pipe shall be butt fusion welded to the required length at ground surface. PVC pipe shall be joined using the jointing process. The pipe shall not be laid to a radius greater than that recommended by the pipe manufacturer.

The successfully tested pipe shall then be installed in the reamed hole. The Contractor shall ensure by the use of shear couplings or other means that the amount of tension applied does not exceed the tensile capacity of the pipe during the pipe installation process.



The Contractor shall allow sufficient time for the longitudinal stresses in the HDPE to dissipate before the pipe is cut for connection.

The installed pipe shall be cut to the length and at elevations detailed in the contract drawings. The ends of the pipe shall be prepared for butt fused flanged connections. All joints shall be restrained.

### *3.13.7 Disposal of Materials*

Surplus excavated material and slurry shall be disposed off-site. The Contractor shall make his own arrangements for off-site disposal and for carrying out soil tests to ensure that disposal is consistent with MOECC guidelines, policies and regulations.

## **SECTION C - CONNECTIONS**

### **3.14 Connections to Existing Sewers**

The Contractor shall notify the County or the County of Oxford's service provider in writing a minimum of 48 hours in advance of their intention to connect to the existing storm sewer. The method of connecting shall be determined by the County Engineer. The Contractor shall submit a program for this work which shall be approved by the County Engineer before the work commences.

### **3.15 Jointing of Push on Joint Pipes**

- a) The jointing of the Push On pipes will be in accordance with the pipe manufacturer's specifications. Joints shall be bell and spigot with rubber gaskets.
- b) The deflection of Push On joint pipes, in order to form long radius curves, shall not exceed the manufacturer's recommendations.
- c) On straight lengths, no lateral deviation in excess of 150 mm will be tolerated and on straight grades no grade deviation in excess of 75 mm will be tolerated.

## **PART 4 – SERVICE INSTALLATION**

Storm sewer private drain connections (PDC's) are not permitted on County Roads or in the City of Woodstock. If a storm PDC is required it will be as approved by the County Engineer or local municipality. Storm sewer PDC's when required shall be installed as described in this section.

### **4.1 Location**

Private Drain Connections (PDC's) to single family, semi-detached and row housing lots are to be located in accordance with Figure 1.1, Section-1 General. Location of storm and sanitary services on lots in the Town of Tillsonburg may vary from Figure 1.1. Location must be confirmed with the Town of Tillsonburg.

All PDC's shall be installed a minimum of 1.0 m past property line on all new construction.

No PDC's are to be connected directly into a maintenance hole unless design constraints arise (i.e. cul-de-sac). This design must be approved by the County Engineer.

PDC's on private property of town house complexes, row housing and apartments are to be connected to a maintenance hole located on the R.O.W.

PDC's for industry and commercial property are also to be connected to a maintenance hole located on the R.O.W.

All PDC's shall be installed perpendicular to the sewer main using factory supplied tees, where possible. Under no circumstances will flow from the PDC enter the main against the flow in the main. Connections shall be as per OPSD 1006.020.

Where there is a conflict with the proposed PDC location due to a maintenance holes etc., then sweeps must be used to establish a perpendicular connection at the main and perpendicular to properly locate at the R.O.W.

#### **4.2 Minimum Size and Grade**

All commercial, industrial, and institutional private drain connections shall be sized according to the design criteria and must be shown on all design sheets and drawings for approval by the County Engineer. The following are the minimum standards:

- a) For residential, single family and semi-detached homes, the minimum diameter of pipe is 100 mm with a minimum allowable grade of 2.0%.
- b) For multi-family block, the minimum diameter of pipe is 300 mm with a minimum grade of 1.0%
- c) For commercial, the minimum diameter of pipe is 300 mm with a minimum allowable grade of 1.0%.
- d) For institutional and industrial, the minimum diameter of pipe is 375 mm with a minimum allowable grade of 1.0%.

#### **4.3 Connections to Maintenance Holes/Sewers**

When connecting PDC's to existing sewers in a lot infill situation, connections must be made with an approved saddle or premanufactured tees, as per OPSS 410 and OPSD 1006.020. Drop structures for maintenance holes shall be as per OPSS 1003.010, 1003.020, 1003.030, and 1003.031.

## a) Residential

PDC's of 100 mm, 150 mm, 200 mm, and 250 mm in diameter must be connected to the main sewer. No storm PDC's of this size are to be connected into any maintenance hole.

## b) Multi-family, Commercial, Institutional and Industrial

PDC's of 300 mm in diameter or larger are to be connected to the main sewer at maintenance holes, except in the cases where the main sewer is 900 mm in diameter or larger, in which the PDC may be connected directly into the sewer.

## c) Connections to Existing Sewers

In situations of a lot severance or lot infill where a new storm service will be connected to an existing main, the advocate of the severance/infill, or their agent, must determine if the existing sewer is at risk for surcharging or has a history of surcharging. This information, if available, may be obtained from the County or the County of Oxford's service provider.

If it is determined that there is a surcharge risk, then the development advocate must provide surcharge protection to their development. Connection can only occur if a County Waste Water Collection Operator is present. When connecting to existing manholes only cored holes with proper rubber connectors are acceptable. Written notice is required 48 hours in advance to schedule an inspection.

#### 4.4 Vertical Clearance

As outlined in 1.12 of this Section, the County has established a minimum clearance, when storm sewers cross other services. In all cases this is measured from outside wall diameter to outside wall diameter.

When crossing over or under a sanitary sewer, a 0.30 m clearance is required between the two pipes.

Watermain or services crossing sewers or utility obstructions require a minimum 500 mm of clearance under and a minimum of 150 mm over the obstruction. Insulation may be required. Refer to Detail D1812-1-2007, D1832-1-1993, and D1833-1-1993.

Where there is conflict in crossing existing utilities, and the utility is unable to relocate, a separation of 0.15 m is required between the two.

#### 4.5 Risers

Risers may be required in situations where there is a conflict of sewers or a greater than expected grade change. These risers must be manufactured, approved, supplied and placed as per OPSD 704.010.

#### **4.6 Cleanouts**

Where PDC's cleanouts are required within the R.O.W., approval must be granted by the County Engineer.

Where private maintenance hole cleanouts are required, they shall be located off of the R.O.W. For private PDC cleanouts, Part 7 of the OBC takes precedence.

#### **4.7 Depth**

The minimum depth of a storm PDC shall be 1.2 m from the finished property line elevation to the obvert of the pipe. In existing areas where new sewers are being constructed, the depth of service at property line may vary based on main line sewer designs and existing topography. The County of Oxford does not guarantee basement drainage.

Where storm PDC's are installed at depths of 3.5m or greater, laterals shall require a controlled settlement joint fitting. When the lateral is installed between 45° and 67.5° the controlled settlement joint shall be installed at the sewer tee. The controlled settlement joint permits axial movement of the riser when laterals are placed in deep excavations.

#### **4.8 Marking and Recording of PDC Service Connections**

Brown painted surface stakes 50 mm x 100 mm shall be placed during trench restoration to mark the termination of the storm PDC. These stakes shall extend from PDC invert to minimum 500 mm about finished boulevard grade.

Once the PDC has been placed, a record of its location must be produced for the As-Constructed drawings and provided digitally to the County as per Figure 1.3, Section-1 General.

Pipes are to be located on these drawings by showing proper plan view locations which includes any bends and sweeps between the tee and the R.O.W. tie-in or stub. Also required on the drawing is the pipes invert elevation at property line.

#### **4.9 Thermal Insulation**

##### **Rigid Board Insulation – Slab Type**

No watermain or water service shall have a ground cover less than 1.0 m deep from ground surface to the top of pipe. Insulation is required on all new or existing water services if minimum cover cannot be achieved.

For watermains crossing underground structures or conduits where minimum cover cannot be achieved, a "Frost Box" is required.

Watermains and services located 500 mm or less horizontally from a manhole or catchbasin shall require a minimum of 50 mm thick insulation. Insulation shall be installed to a minimum of 1.0 m each side of the structure.

Water services crossing over or under storm sewer requires a minimum 500 mm of clearance. In instances where clearance is 500 mm or less from storm sewers the water service shall require insulation.

Insulation shall be installed to a minimum of 1.0 m from the outside wall on both sides of the storm sewer. Material used to thermally insulate mains and services shall have a minimum compressive strength of 690 kPa. All thermal insulation joints shall be tightly butted together and secured by tape or other means to prevent movement during backfill. Manufactures specification of material shall be provided prior to installation.

Refer to Detail D1812-1-2007 for Rigid Board Insulation – Slab Type.

## **PART 5 – FIELD TESTING**

### **5.1 General**

The Contractor shall undertake a video inspection after cleaning and flushing as per OPSS 409 for all sewers upon completion of installation. After completion of the 2 year maintenance period, the sewers shall be videoed again to ensure there are no defects in material or installation. One copy of the video inspection with a condition survey report from each survey shall be supplied to the County or the County of Oxford's service provider.

### **5.2 Cleaning and Flushing Sewers**

Contractors are not permitted to flush the new sewer lengths into existing sewers. Contractors shall provide and place temporary plugs where necessary to prevent silt and debris from entering existing sewers.

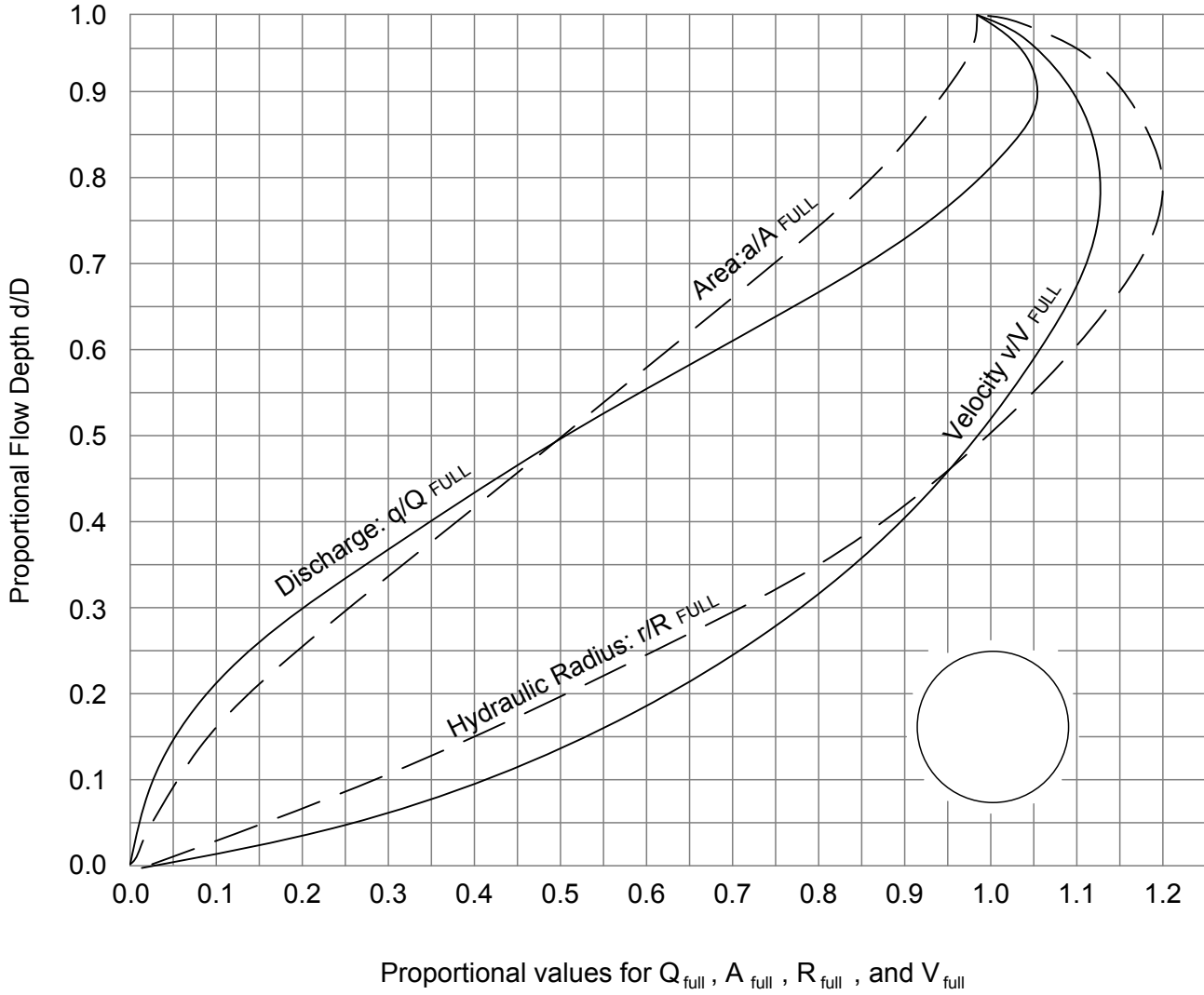
Where silt and debris has entered the existing sewers as a result of construction activities, the existing sewer lengths and manhole structures shall be inspected by the County Engineer. Once the affected areas have been identified, the Contractor shall clean, flush and video those sections as directed by the County Engineer at their own expense.



**SECTION 5 – STORM**

**FIGURES**





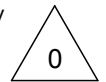
## OXFORD COUNTY

# HYDRAULIC ELEMENTS OF CIRCULAR PIPE

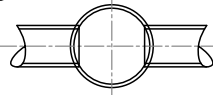
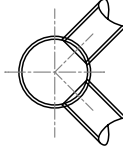
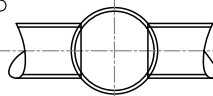
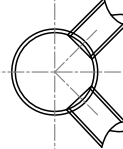
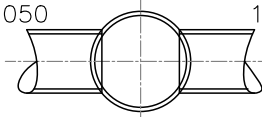
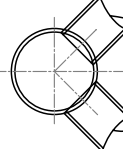
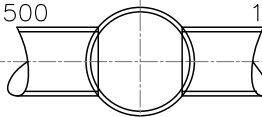
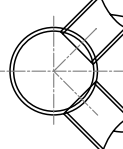
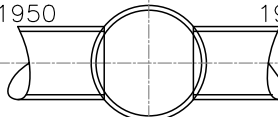
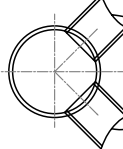
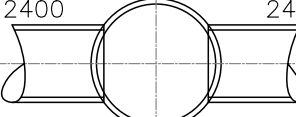
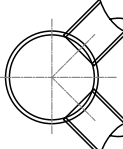
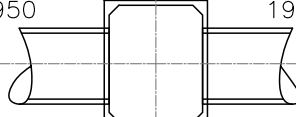
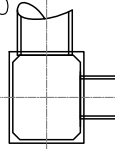
DWG FIG 5.2

DATE DEC. 2008

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MAINTENANCE HOLE INSIDE DIAMETER (mm)	MAX. PIPE SIZE FOR STRAIGHT THROUGH INSTALLATION (mm)	MAX. PIPE SIZE FOR RIGHT ANGLE INSTALLATION (mm)
1200	600 	450 
1500	825 	600 
1800	1050 	825 
2400	1500 	1050 
3000	1950 	1500 
3600	2400 	1950 
3000 x 2400	1950 	1950 

1. ALL DIMENSIONS ARE FOR CONCRETE PIPE.
2. ALL DIMENSIONS ARE IN MILLIMETRES
3. KNOCKOUTS FOR SMALL DIAMETER CATCH BASINS LEAD SIZES 300mm OR LESS  
COULD BE PROVIDED IN ADDITION TO WHAT IS SHOWN
4. INFORMATION TAKEN FROM ONTARIO CONCRETE PIPE ASSOCIATION (O.C.P.A.)

## OXFORD COUNTY

### MAXIMUM PIPE SIZES FOR PRECAST MAINTENANCE HOLES

DWG FIG. 5.3

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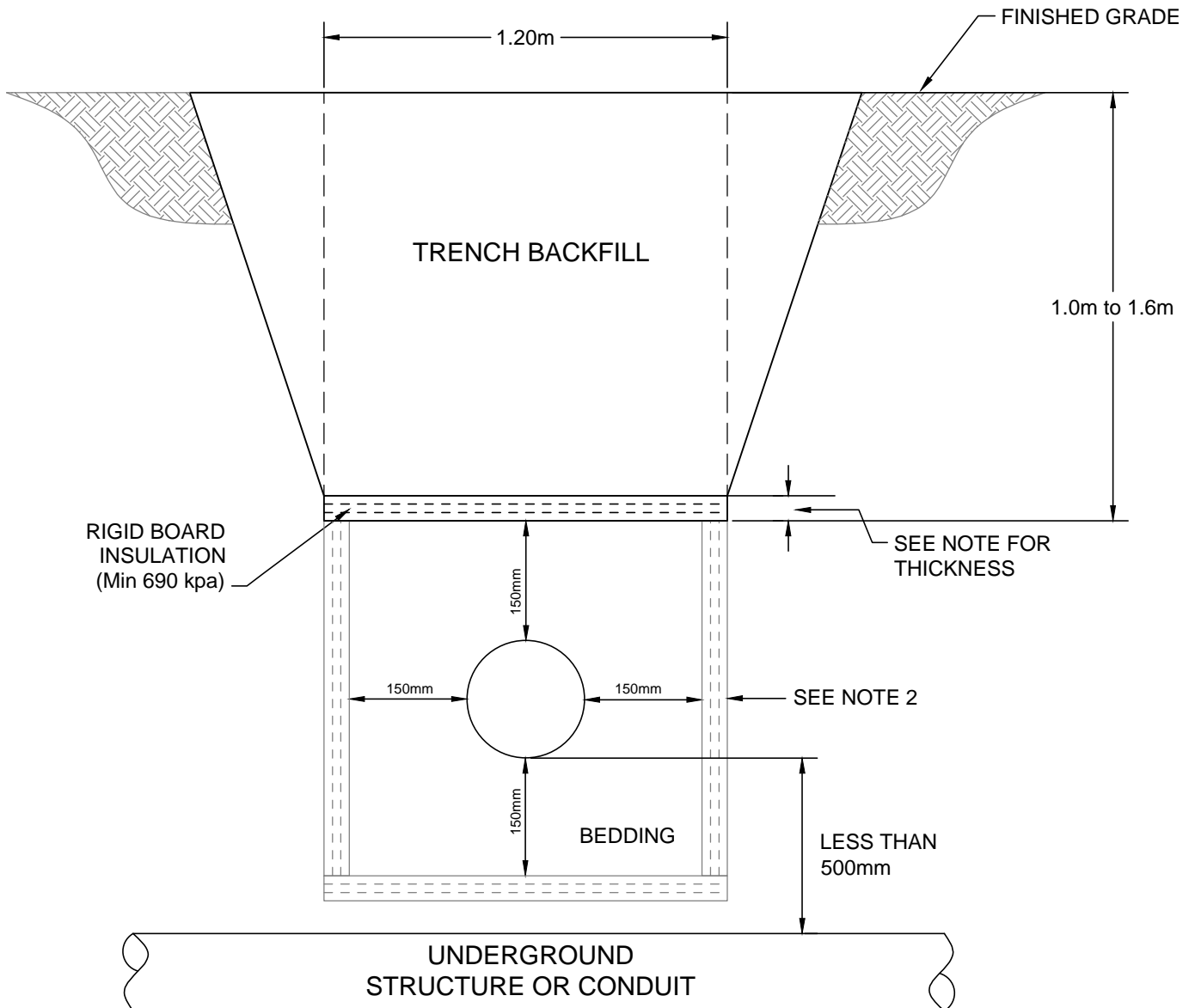
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**SECTION 5 – STORM  
DETAILS**

1.
  - IF GROUND COVER IS LESS THEN 1.0m LOWER WATER MAIN TO 1.8m.
  - IF GROUND COVER IS 1.0m-1.3m USE 75mm THICK INSULATION.
  - IF GROUND COVER IS 1.3m-1.6m USE 50mm THICK INSULATION.
2. FOR CROSSING OR UNDERGROUND STRUCTURES OR CONDUIT A "FROST BOX" IS REQUIRED.
3. FOR WATERMAIN AND SERVICES LOCATED 500mm OR LESS HORIZONTALLY ADJACENT TO MANHOLES OR CATCHBASIN REQUIRES A MINIMUM 50mm INSULATION IS REQUIRED.
4. INSULATION IS REQUIRED ON ALL NEW OR RECONSTRUCTED WATER SERVICES IF ADEQUATE COVER AS LISTED ABOVE CANNOT BE ACHIEVED.



## OXFORD COUNTY

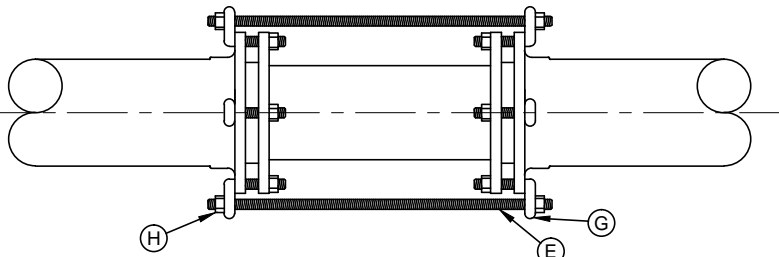
### RIGID BOARD INSULATION-SLAB TYPE FOR WATERMAIN AND SERVICES/LOW PRESSURE SANITARY SERVICES

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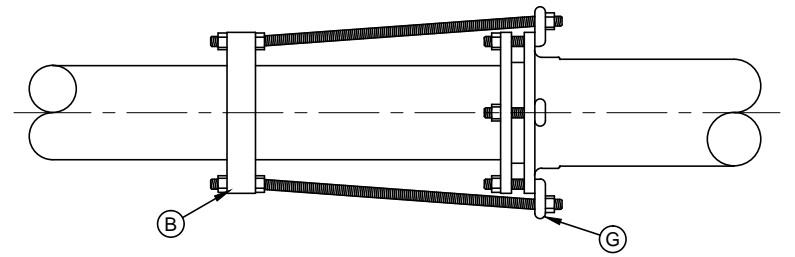
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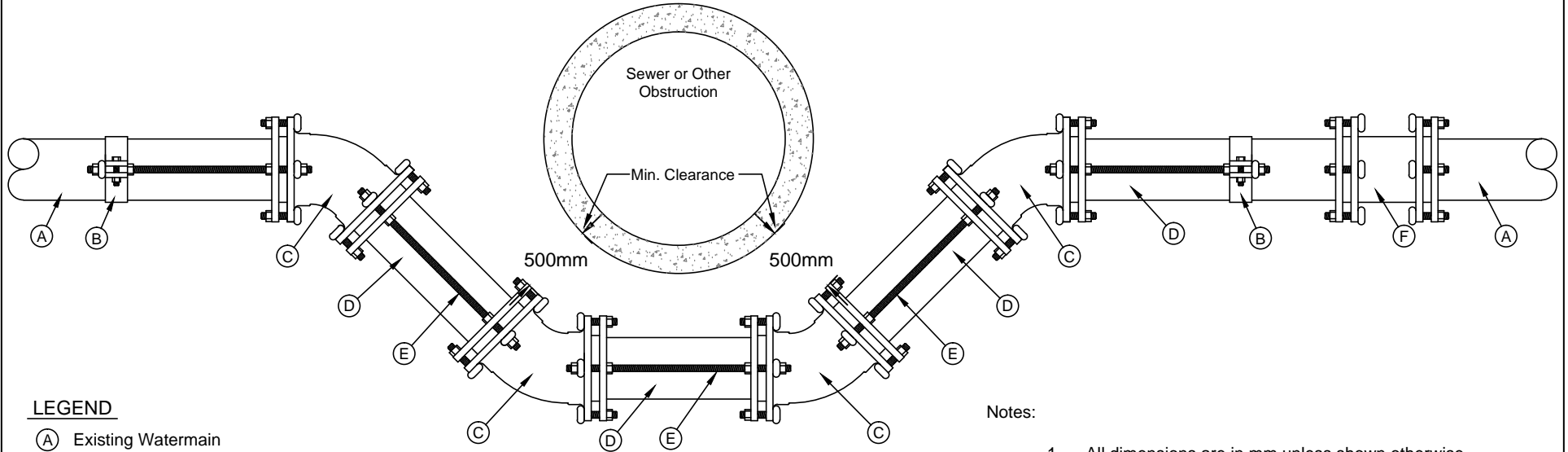




Tie Rod Assembly

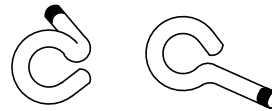


Tie Rod Assembly Using Clamp



**LEGEND**

- (A) Existing Watermain
- (B) Clamp
- (C) Required Mechanical Joint Bend
- (D) Filler Piece
- (E) Tie Rod
- (F) Mechanical Joint Sleeve
- (G) Tie Bolt Joint Restrainer
- (H) Tie Nut



Tie Bolt Joint Restrainer

**Notes:**

1. All dimensions are in mm unless shown otherwise.
2. This detail to be used for offset on 100, 150, & 200mm dia. mains. Offsets on larger mains require individual approval.
3. If offset is installed in horizontal or inverted position, minimum cover to be decided by engineer.
4. One pair of 20mm dia. rods required for 100, 150, & 200mm dia pipe.
5. Cover tie bolt assembly with petrolatum system.
6. Insulation may be required, Refer to D1812-1-2007

**OXFORD COUNTY**

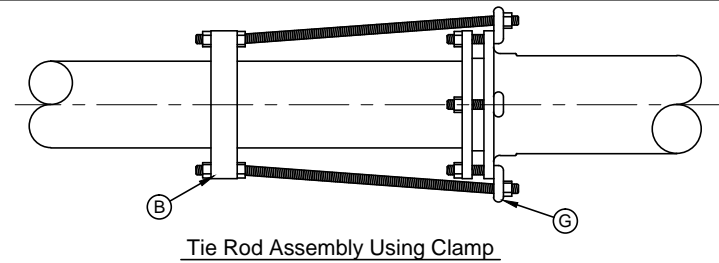
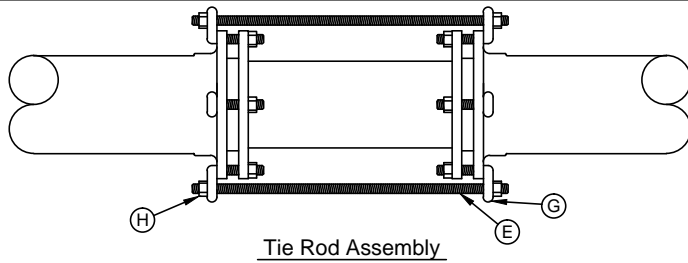
**MECHANICAL JOINT OFFSET INSTALLATION-UNDER**

DWG D 1832-1-1993

DATE NOV. 2008

REV



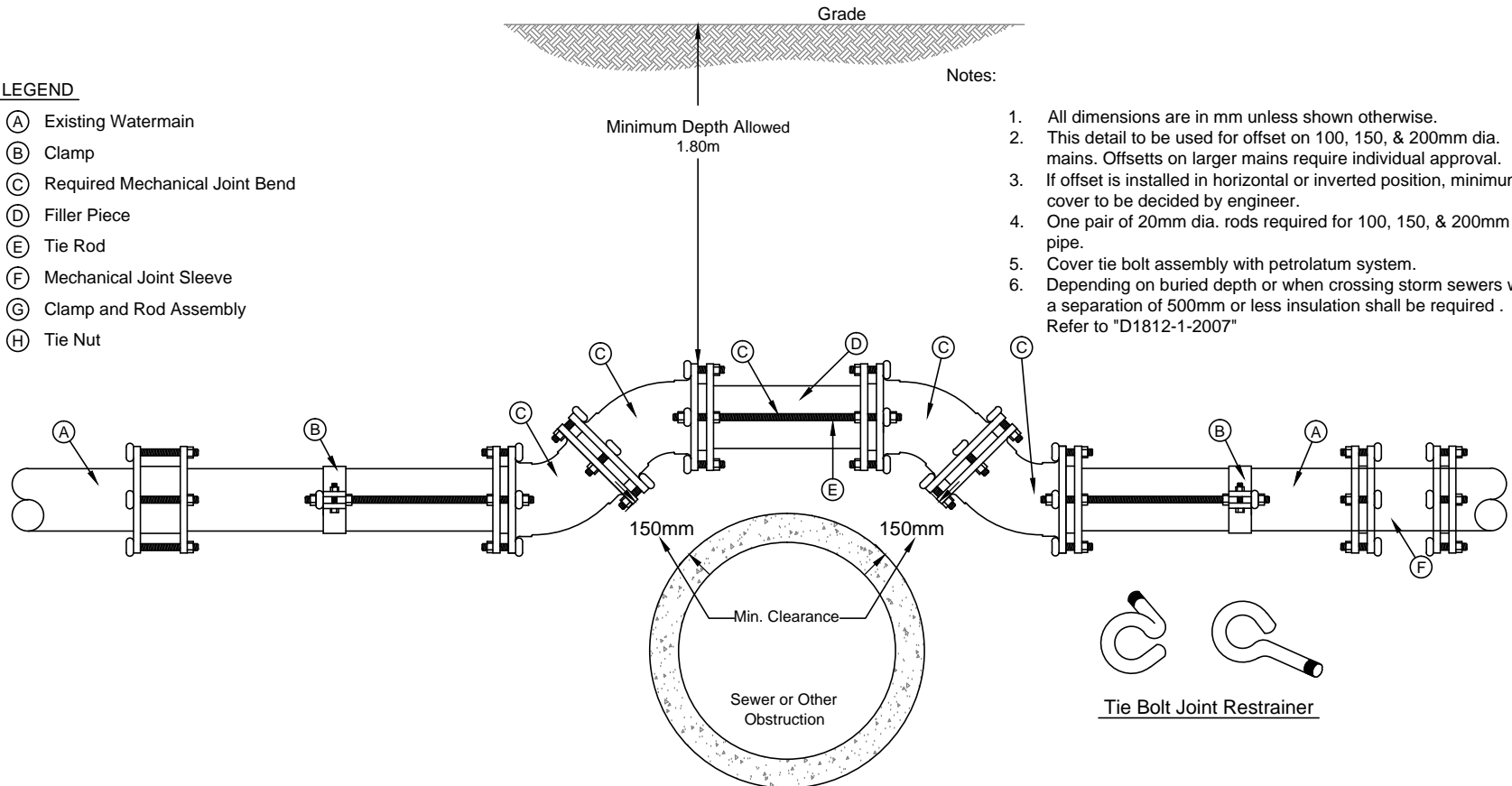


**LEGEND**

- (A) Existing Watermain
- (B) Clamp
- (C) Required Mechanical Joint Bend
- (D) Filler Piece
- (E) Tie Rod
- (F) Mechanical Joint Sleeve
- (G) Clamp and Rod Assembly
- (H) Tie Nut

**Notes:**

1. All dimensions are in mm unless shown otherwise.
2. This detail to be used for offset on 100, 150, & 200mm dia. mains. Offsets on larger mains require individual approval.
3. If offset is installed in horizontal or inverted position, minimum cover to be decided by engineer.
4. One pair of 20mm dia. rods required for 100, 150, & 200mm dia pipe.
5. Cover tie bolt assembly with petrolatum system.
6. Depending on buried depth or when crossing storm sewers with a separation of 500mm or less insulation shall be required. Refer to "D1812-1-2007"



**OXFORD COUNTY**

**MECHANICAL JOINT OFFSET INSTALLATION-OVER**

DWG D 1833-1-1993

DATE NOV. 2008

REV 2