



Growing stronger together

SECTION 4 - SANITARY

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FIGURES

Figure 4.1 - Sanitary Sewer Design Sheet

Figure 4.2 – Hydraulic Elements of Circular Pipe

Figure 4.3 – Maximum Pipe Sizes for Precast Maintenance Holes

DETAILS

D 1812-1-2007: Rigid Board Insulation – Slab Type

D 1847-1-2011: Low Pressure Sanitary Sewer Cleanout

D 1849-1-2011: Low Pressure Sanitary Service

D 1850-1-2011: Grinder Pump and Sewer Lateral Connection Detail

D 1850-2-2011: Grinder Pump and Sewer Lateral Connection with Cleanout

D 1854-1-2011: Gravity Sanitary Sewer Cleanout

PART 1 - LOCATION AND DESIGN

The current Ontario Provincial Standards and Ministry of the Environment and Climate Change 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 Non-Permitted Flows

Connection from foundations, weeping tile drainage or roof drainage is not permitted to enter the sanitary sewer system, as per the County of Oxford Sewer Use By-law 2719-87, or any hazardous waste as defined under the EPA Regulation 347.

1.2 Location and Alignment

In some areas of new construction and reconstruction, design constraints may limit the ability for gravity flow basement drainage. In these instances a low pressure sewer with a grinder pump may be necessary. The County of Oxford does not guarantee basement drainage.

Sanitary sewers are to be located in front of, or are accessible to each lot and block facing a City street. Sanitary sewers are also 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, sanitary maintenance holes are not permitted to be located within the grassed area of the roundabout. Sanitary maintenance holes must be located in the asphalt area of the street, for maintenance purposes.

In areas where sanitary sewer or services will be located in existing road surfaces or through driveways and entrances, the existing pavement, curbs, sidewalks and driveways shall be saw-cut in clean straight lines to minimize over-break prior to repair or construction. All concrete and asphalt driveways, curbs, and sidewalks shall be restored to existing or better conditions within construction limits. Interlocking brick driveways shall be carefully disassembled to proposed construction limits and reassembled to existing or better conditions. Coloured and/or impressed concrete is extremely difficult to match when replacing parts of driveways, curbs, or sidewalks. The County or the County of Oxford's service providers are not responsible for an exact match of these areas.

Sanitary 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 are to contain and follow the lot/block lines to the proposed maintenance holes located on the R.O.W.

Note: All areas and populations are to 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 sewershed limits.

1.5 Design Chart

Sanitary sewer design calculations for approved drainage area plans are to be completed on the standard design chart, as per Figure 4.1 for details and additional design information.

1.6 Peaking Factor Calculation

Peaking factor calculations are to be determined based on the Harmon formula:

$$\text{Harmon formula } M = 1 + \frac{14}{4 + P^{1/2}}$$

Where M= ratio of peak flow to average flow

P= tributary population in thousands

1.7 Design Criteria

For Sanitary Sewer Design Guidelines refer to Chapter 5, Section 5.5 of the Ministry of the Environment Design Guidelines for Sewage Works.

1.8 Mannings Roughness Coefficient

A coefficient of 0.013 is to be used for all concrete and polyvinyl chloride (PVC) pipe for pipe sizes 200 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 (m³/sec)
- n = Manning's roughness coefficient
- A = cross sectional area of flow (m²)
- R = hydraulic radius (area/wetted perimeter)
- S = slope of pipe (m/m) - %

The minimum allowable size of a sanitary sewer shall be 200 mm.

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

1.10 Flow Velocity

Velocities in sanitary 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 (m²)

1.10.1 Minimum and Maximum Velocities

The minimum velocity permitted in sanitary sewers is 0.6 m/s

The maximum velocity permitted in sanitary sewers is 4.5 m/s

To determine velocities based on actual flow, as per Figure 4.2 “Hydraulic Elements of Circular Pipe”.

1.10.2 Minimum Grade of Sanitary Sewer

- a) The minimum grade on a 200 mm diameter sanitary sewer main is 0.33%. Where there are only a few dwellings units connected to the upper section of a 200 mm sanitary sewer main, the minimum grades shall be adjusted as follows:

1 to 5 units	0.61%
6 to 8 units	0.52%
9 to 12 units	0.43%
13 or more units	0.33%

On the first upstream section of sewer (i.e. cul-de-sac) a minimum grade of 1.00% shall be required

- 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 0.6 m/s.

1.10.3 Minimum Size and Grade of Sanitary Services

All residential, commercial, industrial, and institutional private drain connections shall be sized according to the design criteria or as required by Part 7 of the OBC. Services shall be placed 1.0 m past property line.

Cleanouts will be placed on private property as per the OBC. Where service lengths on municipal property are 45 m in length or greater a cleanout must be installed.

Details 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 diameter of pipe shall be 100 mm with a minimum allowable grade of 1.0%.
- b) For multi-family block, the minimum diameter of pipe is 150 mm with a minimum grade of 1.0%
- c) For commercial, the minimum diameter of pipe is 150 mm with a minimum allowable grade of 2.0%.
- d) For institutional and industrial, the minimum diameter of pipe is 200 mm with a minimum allowable grade of 2.0%.

1.11 Pipe Depth

1.11.1 Minimums

The minimum depth of a sanitary sewer on new development shall be determined based on a service depth of 2.4 m below finished grade at property line 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.

- c) Where sanitary sewers are installed at depths of 3.5 m or greater, sanitary service 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.

1.11.3 Casings and Spacers

Where casings are required for sanitary sewers crossing bridges, roadways, railways, rivers, streams, or creeks, casing specifications shall be as set out by the governing authority.

Casings shall be steel plate ASTM A 139 Grade B welded joint. Casing materials other than steel must be approved by the County Engineer prior to installation.

Steel casings shall use the following inside diameters and wall thicknesses as listed below;

Nominal Pipe Size	Minimum Casing Size (I.D.)	Minimum Casing Wall Thickness
100 mm (4")	315 mm (12.4")	6.35 mm (0.25")
150 mm (6")	356 mm (14")	7.94 mm (0.3125")
200 mm (8")	454 mm (17.875")	7.94 mm (0.3125")
250 mm (10")	546 mm (21.5")	7.94 mm (0.3125")
300 mm (12")	584 mm (23")	9.53 mm (0.375")
350 mm (14")	686 mm (27")	9.53 mm (0.375")
400 mm (16")	762 mm (30")	12.70 mm (0.500")
450 mm (18")	787 mm (31")	12.70 mm (0.500")
500 mm (20")	838 mm (33")	12.70 mm (0.500")
600 mm (24")	991 mm (39")	12.70 mm (0.500")

Where casings containing forcemains are used in the above locations, valving shall be required at each end of the casing for isolation purposes. When a forcemain is placed inside a casing, it shall be supported by spacers using the centered configuration. Where a forcemain is located between proposed residential dwellings, it shall require a casing with fusible pipe placed inside the casing. The casing shall extend the entire length of the property. Valves should be located a minimum of 3.0 m from each end of the end of the casing. Where casings containing forcemain are located within easements between residences, the casing shall be offset a minimum of 1.0 m from the property line to avoid fence posts.

If a sewage forcemain is placed inside a casing using bell and spigot PVC material, all pipe bell joints inside the casing shall be restrained using approved restraints. All restraints shall be wrapped with a Petrolatum Coating System. Mechanical joints inside the casing are not permitted.

When a gravity sanitary sewer is placed inside a casing, the sewer shall be supported by spacers using the centered configuration. The casing shall be installed at the same design grade as the sewer to facilitate the use of the centered configuration method for spacer placement. The size, location, and number of spacers will be as per the manufacturer's recommendation. Joint restraint for gravity sewers will be at the discretion of the County Engineer.

Both ends of the casing will be covered using an approved rubber end seal to prevent backfill from entering the casing.

The Contractor shall submit certified shop drawings showing casings, spacers, pipe and any specials required giving details, design, and method of construction, type of joints, etc., of the casing, spacers and pipe before construction commences.

1.11.4 Vertical Separation

In all cases this is measured from outside wall diameter to outside wall diameter. When crossing over or under a storm sewer, a 0.30 m clearance shall be maintained between the two pipes. Where it is necessary to cross over a watermain, a minimum clearance of 0.50 m shall be maintained between the two pipes. When crossing under a watermain, a minimum of 0.15 m clearance shall be maintained between the two pipes. This practice must also be followed when sanitary laterals are in conflict with any watermain. Insulation may be required. Refer to Detail D1812-1-2007, D1832-1-1993, and D1833-1-1993.

Water services require a minimum of 0.50 m separation vertically from sewers and laterals.

1.11.5 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 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. A maximum spacing between sanitary maintenance holes shall be no more than 120 m measured horizontally from center of chamber to center of chamber.

Sanitary maintenance holes must be placed in the asphalt area of the street for maintenance purposes. Should there be a need for a maintenance hole through an easement, it shall be located on a hard surface where available.

When placing a maintenance hole in the vicinity of a roundabout, maintenance holes are not permitted to be located within the grassed area of the roundabout. Maintenance holes must be located in the asphalt area of the street for maintenance purposes.

1.12.1 Sampling / Inspection Maintenance Holes

Sampling / Inspection maintenance holes are typically required where Industrial, Commercial, and Institutional developments outlet to sanitary sewers owned and maintained by the County and the County of Oxford's service providers.

Flow in excess of 200 m³/day will require an inspection manhole for process flow. The Chief Building Official for the municipality must be notified during the preliminary design stages.

Flows less than 200 m³/day should refer to Sewer Use By-Law 2719-87 – Section 4

If required, the Sampling / Inspection maintenance holes shall be located at property line, or a location approved by the County Engineer.

The minimum size of the Sampling / Inspection maintenance hole shall be 1200 mm diameter.

1.12.2 Precast Maintenance Hole Sizing Criteria

All sizing of sanitary precast maintenance holes are based on incoming and outgoing pipe sizes and should be sized and conform to Figure 4.2. Only pre-benched maintenance holes complete with gasket and strap at openings will be accepted.

1.12.3 Maintenance Hole Diameter

Precast maintenance hole diameter requirements shall be as per OPSD Section 700.

1.12.4 Maintenance Hole Frame and Cover

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

Watertight maintenance hole lids are required when the maintenance holes are located in areas where overland water might cause infiltration as per OPSD 401.030. These areas are defined as: flood plain, within gutter locations, an easement and/or open space where overland flow is directly over or adjacent to the maintenance holes. Watertight maintenance hole lids are required where there is the possibility of sanitary surcharge conditions.

Watertight lids are not required when the proposed profile of a street with continuous grade has a maintenance hole located in the low point of an overland flow route, but may be submerged under a greater than two year storm event.

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 where there is a sanitary sewer present or if a pumping station may be required as per OPSD 401.060.

1.12.5 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

1.12.6 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 channel exists. 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.

1.12.7 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.

1.12.8 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.

1.12.9 Benching

As detailed in the Precast Maintenance Hole Sizing Criteria section, only pre-benched maintenance holes will be accepted. Should a new sewer intersect an existing sewer at a maintenance hole, then benching shall be required as per OPSD 701.021.

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.

1.12.10 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 permitted. The number and type of adjustment rings 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 sanitary 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 sanitary 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 sanitary 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 Low Pressure Sanitary Sewer

Low pressure sanitary sewers will be considered where traditional gravity sewers are unable to service certain developments or lots. Areas that are not large enough to provide economic justification for gravity sewers, contain poor soil conditions, or topography that is not suitable for a gravity sewer, a low pressure sewer system may be considered. This system will comprise of an on-site pumping unit for each individual property which outlets to a common force main or gravity sewer.

The County of Oxford does not guarantee basement drainage.

1.14.1 System Layout

The preliminary layout of a proposed low pressure system should be approved by the County Engineer before detailed design proceeds.

a) Preliminary Design

The following information is required for preliminary design submission:

- Plan of the entire area to be served by the proposed system, including adjacent areas currently and potentially served by gravity sewers and community sewage pump stations
- Topographic plan
- Report on soil conditions
- Preliminary layout
- Area development sequence and timetable
- Pump unit power requirements

b) Design Development

Basic data and design criteria for detailed system layout shall include the following:

- Location, elevation, and design flow for each pump unit
- Location and direction of flow of each lateral, branch, and main, plus details of the system discharge point. Lay out of system to minimize length of runs, avoid abrupt changes in direction and avoid loops.
- Location and elevation of high points. Adjust pipe profiles where possible to avoid high points

1.14.2 Pipe

All low pressure sanitary sewers and services shall require tracer wire. All low pressure sanitary sewers directional drilled shall require two (2) tracer wires. All low pressure sanitary services directional drilled shall require a single tracer wire. Tracer wire material shall be as per Part 2 – Material, Section 2.1 Pipe, Fittings, Tracer Wire and Spacers. At any location where joints in the wire must occur only approved connectors will be used.

The use of Thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted.

Tracer wire will be installed along the top of the pipe, and bound at 6-meter intervals. The wire must be installed between each valve and/or the end of the sewer. At the ends of capped low pressure sewers, a minimum of 2 m of tracer wire shall be extended beyond the end of the pipe, coiled and secured for future connection. The end of the tracer wire shall be spliced to the wire of a 5.5 kg zinc anode and is to be buried at the same elevation as the sewer.

At service saddles, tracer wire is not allowed to be placed between the saddle and the sewer. Joints in the wire shall only occur at ends of rolls or repairs.

Verification of conductivity of the tracer wire shall be performed upon completion of rough grading and prior to placement of base coat asphalt on all streets before substantial completion of the project. An additional locate shall be performed prior to expiration of the warranty period before final acceptance.

A locate or conductivity test with the new tracer wire shall be performed by the contractor and completed in the presence of a licensed water operator from the County or the County of Oxford's service provider. The tracer wire shall be installed in such a manner as to be able to trace all components without loss or deterioration of signal or without the signal migrating off of the tracer wire. This test shall be conducted using the industry standard low frequency (512 Hz) line tracing equipment. If it is not continuous from valve to valve, the contractor shall at his own expense replace or repair the wire. If a dispute arises as to the ability to trace all components, an independent 3rd party may be required to resolve the dispute and will be done at the contractors expense. Continuity testing in lieu of actual line tracing shall not be accepted.

Minimum pipe sizes are as follows:

Main

The low pressure sewer shall be sized to have a flow velocity between 0.80 to 2.50 m/s with the lower limit preferred for the initial phase. Size of the low pressure sewer will be based on design flow requirements as well as number, and type of lots to be serviced. Minimum size of low pressure sewer is 50 mm diameter.

Services

For residential servicing from the grinder pump on private property to the low pressure sewer the service size shall be a minimum 32 mm diameter copper tubing size. Service valves will be placed on the property line. The minimum depth of cover shall be 1.80 m of cover to the top of pipe.

For industrial, commercial, or institutional servicing from the grinder pump on private property to the low pressure sewer, the service size shall be a minimum 32 mm copper tubing size, or as determined by ICI design flow rates. Service valves will be placed on the property line.

The minimum depth of cover shall be 1.80 m to the top of pipe. Depths less than 1.80 m of cover shall require insulation as per Detail D 1812-1-2007 for Rigid Board Insulation – Slab Type.

Services shall be installed as per D1849-1-2011. Where the low pressure sanitary service connects to a gravity lateral at property line the connection will be as per D1850-1-2011 and D1850-2-2011

1.14.3 Grinder Pumps

Pumps shall be a Simplex (single pump) for single family residential applications. Pumps for multi-family units, industrial, commercial, or institutional applications may require Duplex (two pumps) depending on estimated design flow requirements.

Pumps shall be located on private property outside the building in a location convenient for maintenance.

Grinder Pump RequirementsResidential

For residential applications the grinder pump holding tank shall have a minimum capacity of 265 L and accommodate flows of a minimum 2650 L/d.

The pump shall have a minimum 0.75 kilowatt, 1725 rpm, high torque, capacitor start, thermally protected, 240 or 120 volt, 60 hertz, 1 phase. The inlet shall be sized to accommodate a 100 mm diameter pipe. The discharge shall be sized to accommodate 32 mm diameter pipe.

Acceptable pumps are DH071 as manufactured by E/One or approved equal.

Industrial, Commercial, or Institutional

For Industrial, Commercial, or Institutional applications the size of the grinder pump and grinder pump holding tank will be based on estimated design flow requirements.

For light ICI applications the grinder pump holding tank shall have a minimum capacity of 570 L and accommodate flows of a minimum 11,360 L/d. The pump shall have a minimum 0.75 kilowatt, 1725 rpm, high torque, capacitor start, thermally protected, 240 or 120 volt, 60 hertz, 1 phase. The inlet shall be sized to accommodate a 100 mm diameter pipe. The discharge shall be sized to accommodate 32 mm diameter pipe.

Acceptable pumps are DH152 as manufactured by E/One or approved equal.

1.14.4 Valves

- a) Valves shall be located at all intersections. At cross intersections a minimum of 3 valves shall be installed and a minimum of 2 valves shall be installed at tee intersections. Depending on location of other utilities, and where possible, the valve locations shall be on the extension of the street line.

At each valve the tracer wire must be brought up outside the valve box to the top of the box and inside the box through a drilled hole. Tracer wire to be installed as per Detail D1846-1-2009.

Prior to acceptance of the completed work the contractor shall perform a locate or conductivity test with the new tracer wire. The inspector shall be present when the tracing wire is tested.

If it is not continuous from valve to valve, the contractor shall at his own expense replace or repair the wire.

- b) In residential areas valve spacing shall not exceed 250 m (820 ft) apart. In high density residential, commercial, or industrial areas valve spacing shall not exceed 150 m (500 ft) apart. Valves will be located in such a manner that no more than 60 services will be isolated by operating no more than 4 valves.

1.15 Sewage Forcemain

The following specifications are for Ductile Iron (DI), Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE).

- a) The forcemain shall be sized to have a flow velocity between 0.60 to 4.0 m/s with the lower limit preferred for the initial phase. Minimum size of forcemain is 100 mm diameter.
- b) The design profile and size of the forcemain shall minimize the excessive negative head to the system.
- c) On curves, the main location may deviate slightly from the standard by using the maximum allowable deflection in the pipe joints. Refer to manufacture's specifications regarding pipe deflection. A minimum number of special bends should be used.
- d) The minimum cover of the forcemain shall typically be 1.80 m. The forcemain in some cases may be required to be deeper to avoid conflicts with other infrastructure.
- e) Air-relief valves shall be located at all high points in the system.
- f) For non-metallic direct bury forcemain, the size of tracer wire to be installed will be Solid #12 TWU copper tracer wire or Solid #12 AWG 21% conductivity, high strength, copper-clad hard drawn high carbon steel (CCS) tracer wire, 30 mil. HDPE insulation jacket complying to ASTM-D-1248, minimum break load 452 lbs, 30 volt rating, green in colour.

For directional boring two (2) solid #8 TWU copper tracer wires or (2) Solid #12 AWG 21% conductivity, high strength, copper-clad hard drawn high carbon steel (CCS) tracer wire, 45mil. HDPE insulation jacket complying to ASTM-D-1248, minimum break load 1150 lbs, 30 volt rating, green in colour.

The use of Thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted. Tracer wire will be installed along the top of the pipe, and bound at 6-meter intervals. The wire must be installed between each valve and/or the end of the forcemain. Joints in the wire between valves will not be allowed. At any location where joints in the wire must occur (i.e. end of roll) only approved connectors will be used.

At each main valve a continuous loop of tracer wire must be brought up outside the valve box to the top of the box and inside the box through a drilled hole complete with rubber grommet.

Tracer wire will loop inside valve box and return outside and back to the mainline location. The length of tracer wire inside the valve box shall be +/- 500mm and coiled to not interfere with valve operation.

Prior to acceptance a locate or conductivity test with the new tracer wire shall be performed by the contractor and completed in the presence of a licensed water operator from the County or the County of Oxford's service provider.

The tracer wire shall be installed in such a manner as to be able to trace all components without loss or deterioration of signal or without the signal migrating off of the tracer wire. This test shall be conducted using the industry standard low frequency (512 Hz) line tracing equipment. If it is not continuous from valve to valve, the contractor shall at his own expense replace or repair the wire. If a dispute arises as to the ability to trace all components, an independent 3rd party may be required to resolve the dispute and will be done at the contractors expense. Continuity testing in lieu of actual line tracing shall not be accepted.

- g) Mechanical thrust restraint is required on **all** fittings, bends, tees, valves, crosses, reducers and plugged or capped dead-ends. In addition all forcemain repairs shall require mechanical restraints.

Mechanical thrust restraint is also required in areas of engineered fill. In areas of engineered fill an additional restrained length of pipe shall apply to the requirements below.

In calculating restrained distances a **safety factor = 2 to 1**, with a **test pressure = 150 psi** is to be used with reference to pipe manufacturers specifications.

Prior to construction all thrust restraint design shall be submitted to the County Engineer for review. The results should be shown on the contract drawings along with the type of restraint to be used.

The following are minimum requirements;

All fittings, bends, tees, valves, crosses, reducers up to 200 mm shall be restrained to the pipe along with a minimum of 3 full pipe length joints (18 m) measured from each side of appurtenance.

All 250 to 300 mm fittings, bends, tees, valves, crosses, reducers shall be restrained to the pipe along with a minimum of 4 full pipe length joints (24 m) measured from each side of appurtenance.

Plugged or capped dead-ends up to 200 mm shall be restrained to the pipe along with a minimum of 4 full pipe length joints (24 m) measured from the end of pipe.

All 250 to 300 mm plugged or capped dead-ends shall be restrained to the pipe along with a minimum of 6 full pipe length joints (30 m) measured from the end of pipe.

All plugged or capped ends shall be tapped to relieve pressure prior to removal if necessary.

In addition to manufacturer's specifications and where possible full lengths of pipe shall be placed each way from all fittings to the lengths listed above.

Any joints encountered in the above restrained lengths mentioned above from fittings, bends, tees, valves, crosses, reducers and plugged or capped ends shall be restrained.

Pipe larger than 300 mm shall be restrained as per the pipe manufacturer's recommendations. PVC Shop Drawings submitted by the pipe manufacturer shall include:

- Letter of Compliance
- Pipe design calculations
- Summary of fittings and method of restraint
- Installation Guide
- Tabulated Layout Drawings indicating restrained lengths for fittings and valves - stamped and signed by a Professional Engineer licensed to practice engineering in the Province of Ontario

On vertical offsets due to conflicting utilities such as sewers, the pipe shall be backfilled before the forcemain is re-pressurized. The County of Oxford reserves the right to specify the use of mechanical and/or concrete thrust blocks.

1.16 Valves

- a) Valves shall be located at all intersections. At cross intersections a minimum of 3 valves shall be installed and a minimum of 2 valves shall be installed at tee intersections. If necessary, adjustments in the field can be made to avoid curbs or other obstructions that may interfere with valve placement.

At each valve the tracer wire must be brought up outside the valve box to the top of the box and inside the box through a drilled hole complete with rubber grommet. Tracer wire will loop inside valve box and return outside and back to the mainline location. The length of tracer wire inside the valve box shall be +/- 500 mm and coiled to not interfere with valve operation. Tracer wire to be installed as per Detail D1846-1-2009.

- b) Valves on forcemains in rural areas shall be located at all road crossings or at the discretion of the County Engineer. Test stations for locating purposes shall be installed a maximum 500 m after each valve. Test stations to be located a maximum 500 m apart.

PART 2 - MATERIAL**2.1 Pipe Material**

Both rigid and flexible pipe are permitted in the construction of sanitary sewer systems including private drain connections. These materials include PVC, concrete, and HDPE pipe. HDPE pipe shall be used for directional drilling only unless otherwise approved by the County Engineer. All materials shall be CSA and ASTM certified.

On private property, materials for sanitary sewers and private sewers shall comply with Part 7 of the OBC.

Field cut tees will only be permitted with approved materials and methods as set out by the County Engineer.

New and replacement sanitary sewers and related pipes that are deemed as significant drinking water threats (under the Clean Water Act) within Wellhead Protection Areas are to be constructed of materials and with joints that are equivalent to watermain standards of construction. The County may upon review of these sewers specify pipe material and colour. Associated costs are the sole responsibility of the proponent.

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

Gravity Sewers**PVC**

Polyvinyl chloride (PVC) pipe – smooth wall (CSA B182.2)
100 mm – 600 mm inclusive.

Gravity sanitary PVC main shall be SDR 35 as per OPSS 1841. Sanitary services shall be PVC SDR 28 (green) in colour and have a factory placed tee at the main. All PVC and fabricated moldings shall be CSA certified.

Concrete

Trench conditions to 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/CSA 257.1 Class 3 concrete for pipes 450 mm or less in diameter.
- b) Reinforced – CAN/CSA 257.2 65-D concrete for pipes more than 450 mm in diameter.

Forcemain

Where possible or as directed by the County Engineer all PVC forcemain pipe shall be “Green” in colour. HDPE pipe 100mm and larger shall be manufactured with “Green Stripe”. All forcemain pipe regardless of material shall be installed with “Green” tracer wire.

Open Cut Installation

PVC AWWA C900 (CIOD), CSA B137.3 - PC 235 DR 18 (complete with green tracer wire) 100 mm through 300 mm diameter colour coded “Green”.

PVC AWWA C900 (CIOD), CSA B137.3 - PC 165 DR 25 (complete with green tracer wire) 100 mm through 300 mm diameter colour coded “Green”.

PVC Series (IPS) 160 SDR26, CSA B137.3 - (complete with green tracer wire)

50 mm through 300 mm diameter gasketed ends

Trenchless Installation

PVC AWWA C900 (CIOD), CSA B137.3 - PC 235 DR 18, with mechanically restrained joints (complete with green tracer wire) 100 mm through 300 mm diameter

PVC AWWA C900 (CIOD), CSA B137.3 - PC 235 DR 18, fusible pipe (complete with green tracer wire) 100 mm through 300 mm diameter

PVC AWWA C900 (CIOD), CSA B137.3 - PC 200 SDR21, fusible pipe CSA B137.3 - (complete with green tracer wire) 150 mm through 300 mm diameter

PVC AWWA C900 (CIOD), CSA B137.3 - PC 165 DR 25, fusible pipe (complete with green tracer wire) 150 mm through 300 mm diameter

High Density Polyethylene (HDPE)

HDPE material for forcemain is to be used for directional drilling only unless approved in writing by the County Engineer.

Unless specified otherwise all HDPE pipe will be Ductile Iron Pipe Size (DIPS).

HDPE AWWA C901 and C906, DR 11 Pressure Class 160 psi (1103 kPa), PE 3408/3608 DIPS “Green Stripe” (complete with “Green” tracer wire).

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

Note: Low pressure sewer and services less than 100 mm dia. shall be copper tubing size (C.T.S.) Series 200.

2.2 Directional Drilling Material

Unless otherwise specified all HDPE material shall be Ductile Iron Pipe Size (DIPS) or Copper Tubing Size depending on the diameter of the pipe being used. Pipe material used for directional drilling shall be HDPE DR11 Pressure Class 160 psi (1103 kPa) DIPS (Green 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 Casing Spacers

When sanitary sewer is placed inside a casing, the sewer pipe shall be supported by spacers using the centered configuration. The size, location, and number of spacers will be as per the manufacturer’s recommendation.

Approved Casing Spacers are as follows:

- CCI #304 Stainless Steel
- PSI Ranger II
- Cascade

2.4 Bedding Material

As per OPSS 1010

PART 3 - INSTALLATION

The installation of sanitary 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 sanitary 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 grade stakes shall be marked and placed 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) The discharge of water from the construction site into sanitary sewers is strictly prohibited. The costs for cleanup of the sewer or other affected areas will be the responsibility of the Contractor / Developer.

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 deemed necessary will order the installation of special fittings 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 during the progress of the work and until the completion and final acceptance thereof.
- 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, and not more than 75 mm from grade.
- l) Sanitary sewers installed at a depth of 3.5m or greater will require the use of settlement control joints on all service laterals. When the lateral is installed between 45° and 67.5° the controlled settlement joint shall be installed at the sewer tee. The settlement control joint permits axial movement of the riser when laterals are placed in deep excavations. These fittings shall be installed as per the manufacturer's specifications.

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 center 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 center 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 ± 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 Tracer Wire

Refer to Part 1 – Location and Design, 1.15 (f) Sewage Forcemains.

When Directional Drilling is used for forcemains and low pressure sewer installation, two (2) tracer wires will be installed simultaneously. The second wire will be used as a backup if the other tracer wire is broken during installation. Tracer wire shall be installed along the top of the pipe, and bound at 6-meter intervals. The wire must be installed between each valve and/or the end of the watermain.

Joints in the wire between valves will not be allowed. At any location where joints in the wire must occur (i.e. end of roll) only approved connectors will be used. Tracer wires shall have sufficient slack to be knotted together prior to placement of connector. Petrolatum tape shall then be wrapped around connection and compressed by hand around connector. Tracer wire connections to be installed as per Detail D1858-1-2016.

At each valve, a loop of tracer wire must be brought up outside the valve box to the top of the box and inside the box through a drilled hole. Tracer wire to be installed as per Detail D1846-1-2009. Prior to acceptance of the completed work the contractor shall perform a locate or conductivity test with the new tracer wire.

The inspector shall be present when the tracing wire is tested. If it is not continuous from valve to valve, the contractor shall at his own expense replace or repair the wire.

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 sanitary 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.

SECTION D – CORROSION PROTECTION AND INSULATION**3.16 Petrolatum Coating System – Forcemain**

Material requirements shall be as per AWWA C217, CSA Z245.30-14, and be ISO 9001 and ISO 14001 compliant. The installation of the petrolatum coating system shall be in strict conformity with the manufacturer's specifications with the following exceptions/amendments.

- a) All flanged surfaces, nuts, bolts, tie rods, clamps, valves, sleeves, Victaulic couplings, joint restraints, etc., shall be protected using petrolatum materials. Prior to application all surfaces shall be free of dirt, grease, oil, paint, or foreign material. The minimum acceptable application of a petrolatum coating system is a two-step process consisting of a primer and petrolatum tape. Where voids or other surface irregularities are encountered, filler material is required where the tape will not come into full contact with surfaces. Placement of petrolatum tape only is not acceptable.
- b) All surfaces of pipes, valves and appurtenances in valve chambers shall be coated using petrolatum materials. Valves or appurtenances that are epoxy coated do not require this procedure.
- c) Petrolatum coatings shall be DENSO or approved equivalent. After final inspection of the applied coating system any defects in the application process shall be repaired at the contractors expense.

3.17 Cathodic Protection - Forcemain

As per the General Section of the Design Guidelines and Supplemental Specifications 1.4 Subdivider and Consultant responsibilities item b), the size and type of anodes shall be determined through the Geotechnical report. Anode locations shall be clearly shown on the Construction and as-built drawings. In addition, a tabular listing of the stations at which the anodes are to be installed shall be provided.

Sacrificial anodes shall be installed at all valves, ductile iron, cast iron pipe and fittings, and joint restraints. At the ends of forcemain the tracer wire shall be spliced to the wire of a 5.5 kg zinc anode and is to be buried at the same elevation as the forcemain.

Valves or appurtenances that are epoxy coated do not require this procedure. Anodes shall be installed as per OPSS 442 and OPSD 1109.011. Attaching anodes to restraint nuts or gland pack nuts is not permitted.

Connections to valves, fittings, and joint restraints will be done using the “cad weld” method and coated with mastic. Installation shall be as per the manufacturer’s specifications and recommendations.

Minimum Anode Sizing

Zinc – ASTM B-418 Type II

For new installations of valves, fittings, and restraints - 11 kg (24 lb) Z-24-48.

Magnesium – ASTM B-843 Type M-1C

For existing valves, fittings, and restraints, or connection between cast iron / ductile iron forcemains and PVC pipe - 14 kg (32 lb) M-32-22.

3.18 Thermal Insulation

Rigid Board Insulation – Slab Type

If minimum cover of 1.80 m cannot be achieved due to underground obstructions or changes in surface grade, thermal insulation must be used. No forcemain, gravity sewer, low pressure sewer, or services shall have a ground cover less than 1.0 m deep from ground surface to the top of pipe. Where crossings of underground obstructions and utilities occur insulation shall be installed to a minimum of 1.0 m from the outside wall of the obstruction on both sides. 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 4 – SERVICE INSTALLATION

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 sanitary services on lots in the City of Woodstock and the Town of Tillsonburg may vary from Figure 1.1. Location must be confirmed with the City of Woodstock and 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).

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.

Services located in existing driveways, sidewalks, or curbs shall be saw-cut in clean straight lines to minimize over-break prior to repair or construction. All concrete and asphalt driveways, curbs, and sidewalks shall be restored to existing or better conditions within construction limits only. Interlocking brick driveways shall be carefully disassembled to proposed construction limits and reassembled to existing or better conditions. Coloured and/or impressed concrete is extremely difficult to match when replacing parts of driveways, curbs, or sidewalks. The County or the County of Oxford's service providers are not responsible for an exact match of these areas

If the property owner cannot agree to the methods and materials required to reinstate all concrete and asphalt driveways, curbs, and sidewalks to existing or better conditions the County will undertake a quotation for reinstatement to the construction limits according to existing materials. Based on the quotation the property owner may receive monetary compensation to pursue other alternatives. Prior to receiving compensation the property owner will sign an agreement with the County or the County of Oxford's service providers acknowledging acceptance. Included in the agreement will be a holdback to ensure that where sanitary service cleanouts exist they are placed to proper grade and are fully functional after the property owners restoration has been completed.

4.2 Connections to Maintenance Holes, Sewers, and Services

When connecting PDC's to existing sewers in a lot infill situation, connections must be made with an approved saddle or pre-manufactured 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 and 150 mm in diameter must be connected to the main sewer.

b) Multi-family, Commercial, Institutional and Industrial

PDC's of 200 mm in diameter or larger are to be connected to the main sewer at maintenance holes.

c) Connections to Existing Sewers

In situations of a lot severance or lot infill where a new sanitary 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 or the County of Oxford's service provider 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.

d) Connection to Existing Services

When connecting to existing sanitary laterals and size on size connection cannot be achieved, only eccentric couplings shall be used.

When connecting PVC to PVC pipe, only gasketed PVC repair sleeves shall be used. When connecting other dissimilar sizes and materials it may be necessary to use a "Fernco" or equivalent rubber coupling for connection. All materials used to connect existing services to new services shall be approved by the County or the County of Oxford's service provider.

All connections shall be inspected by the County or the County of Oxford's service provider.

4.3 Grinder Pumps

Refer to Part 1 – Location and Design, 1.14.3 Grinder Pumps

4.4 Vertical Clearance

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

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

When crossing over a watermain, a minimum of 0.50 m clearance is required between the two pipes. Where the sewer crosses under a watermain a minimum of 0.15 m separation is required.

Where there is conflict in crossing existing utilities, and the utility is unable to relocate, a minimum 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 cleanouts are required, they shall be located off of the R.O.W. For private PDC cleanouts, Part 7 of the OBC takes precedence.

For properties that require sewage grinder pumps connecting to a gravity sewer lateral, a cleanout shall be installed at 1.0 m past the property line. Cleanout and lateral connection to be installed as per Detail D1850-1-2011 and D1850-2-2011.

4.7 Depth

The minimum depth of a sanitary PDC in new construction and development shall be 2.4 m from the finished proposed grade at property line to 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.

4.8 Marking and Recording of PDC Service Connections

Green painted surface stakes 50 mm x 100 mm shall be placed during trench restoration to mark the termination of the sanitary PDC. These stakes shall extend from PDC invert to minimum 500 mm above finished grade at property line.

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 include any bends and sweeps between the tee and the R.O.W. tie-in or stub. Also required on the drawing is the pipe invert elevation at property line.

PART 5 – FIELD TESTING

5.1 General

Field testing described in this section shall be conducted as per OPSS 409, and OPSS 410 for gravity sanitary sewers. All testing shall be performed in the presence of the County or the County of Oxford's service provider.

For sanitary sewers in new developments leakage and deflection testing is required. In areas of reconstruction only deflection testing is required.

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.

5.3 Leakage Testing

Leakage tests shall be performed as infiltration or exfiltration tests and as outlined in OPSS 410.

Infiltration tests shall be conducted when the groundwater at the time of testing is 600 mm or more above the crown of the pipe for the entire length of the test section.

Exfiltration tests shall be conducted when the groundwater level is lower than 600 mm above the crown of the pipe or the highest point of the highest service connection included in the test section.

Testing shall be carried out on completed pipe sewers 1200 mm in diameter and smaller. There shall be no visible leakage for pipe sewers larger than 1200 mm in diameter.

Testing shall be carried out from maintenance hole to maintenance hole. Tests may be carried out prior to service connections being installed in the section being tested.

The construction of new mainline pipe sewers shall not proceed when three previously placed sections of the pipe sewer have not been tested or have been tested and are unsatisfactory.

Pressure Testing of Forcemain, Low Pressure Sewers, and Gravity Sewers

Pressure testing of forcemain and low pressure sewer shall be done at 2 times the design system pressure to a maximum of 827 kPa (120 psi) or as directed by the County Engineer.

The test section shall be subjected to the specified continuous test pressure for two (2) hours.

All sanitary sewers and related pipes that are deemed as significant drinking water threats (under the Clean Water Act) within Wellhead Protection Areas are to be pressure tested in accordance with Division 441 (formally 701) of the Ontario Provincial Standards Specifications (OPSS). If a portion of sewer is located between manholes, the entire section from manhole to manhole shall be sealed and pressure tested according to OPSS 441. Costs associated with the testing are the sole responsibility of the proponent.

5.4 Mandrel Deflection Testing of Sewer Pipe

Mandrel deflection testing shall be performed on all pipe sewers constructed using plastic pipe. The allowable deflection for pipes 100 to 750 mm in diameter is 7.5% of the base inside diameter of the pipe. For pipes greater than 750 mm in diameter, 5.0% of the base inside diameter is allowable. Base inside diameter is defined by the CSA or ASTM standard to which the pipe is manufactured.

A suitably designed device as defined by OPSS 410 shall be pulled through the pipe sewer to demonstrate that the pipe deflection does not exceed the allowable deflected diameter. The device shall be pulled manually through the pipe not sooner than 30 days after the completion of backfilling and installation of service connections.

Any section of pipe that does not allow the mandrel to pass shall be considered to have failed the deflection test. All sections of pipe that fail the deflection test shall be repaired and retested.

5.5 Closed-Circuit Television (CCTV) Inspection

The Contractor shall undertake a video inspection after cleaning and flushing as per OPSS 409 for all sewers upon completion of installation.

SECTION 4 - SANITARY

The Contractor 30 days prior to the completion of the 2 year maintenance period shall conduct a secondary video review of the sewers 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. Videos and reports are to be submitted directly to the County of Oxford Customer Service Department or the County of Oxford's service provider.

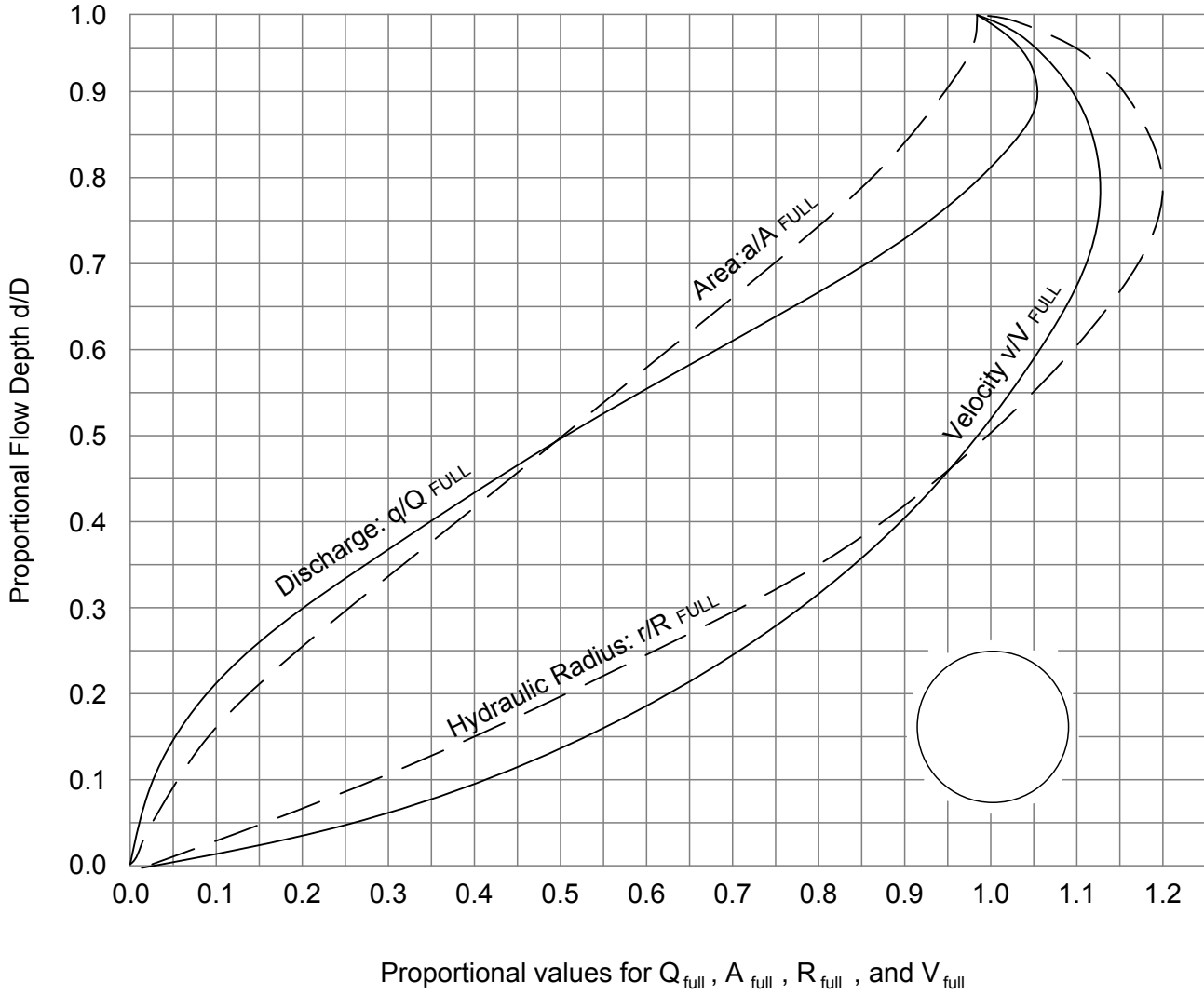
New and replacement sewers and related pipes that are deemed as significant drinking water threats (under the Clean Water Act) within Wellhead Protection Areas are required to establish operational procedures which include CCTV inspections every 5 years with records made available for inspection by the Ministry of the Environment and Climate Change. Costs associated with the testing are the sole responsibility of the proponent.



Growing stronger together

SECTION 4 – SANITARY

FIGURES



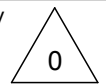
OXFORD COUNTY

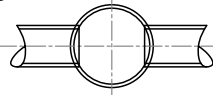
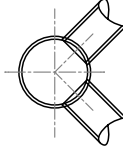
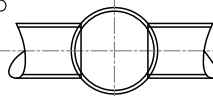
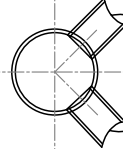
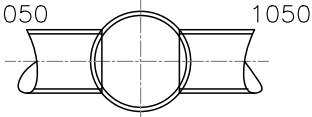
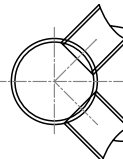
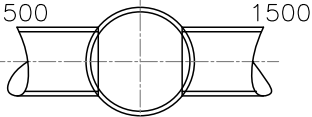
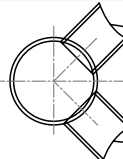
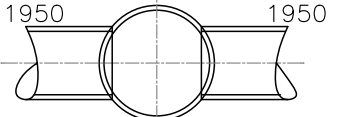
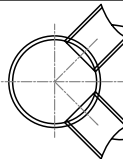
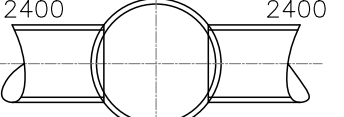
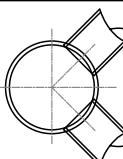
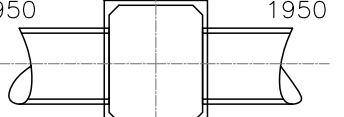
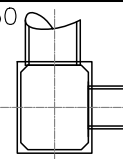
HYDRAULIC ELEMENTS OF CIRCULAR PIPE

DWG FIG 4.2

DATE DEC. 2008

REV



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. 4.3

DATE NOV 2008

REV



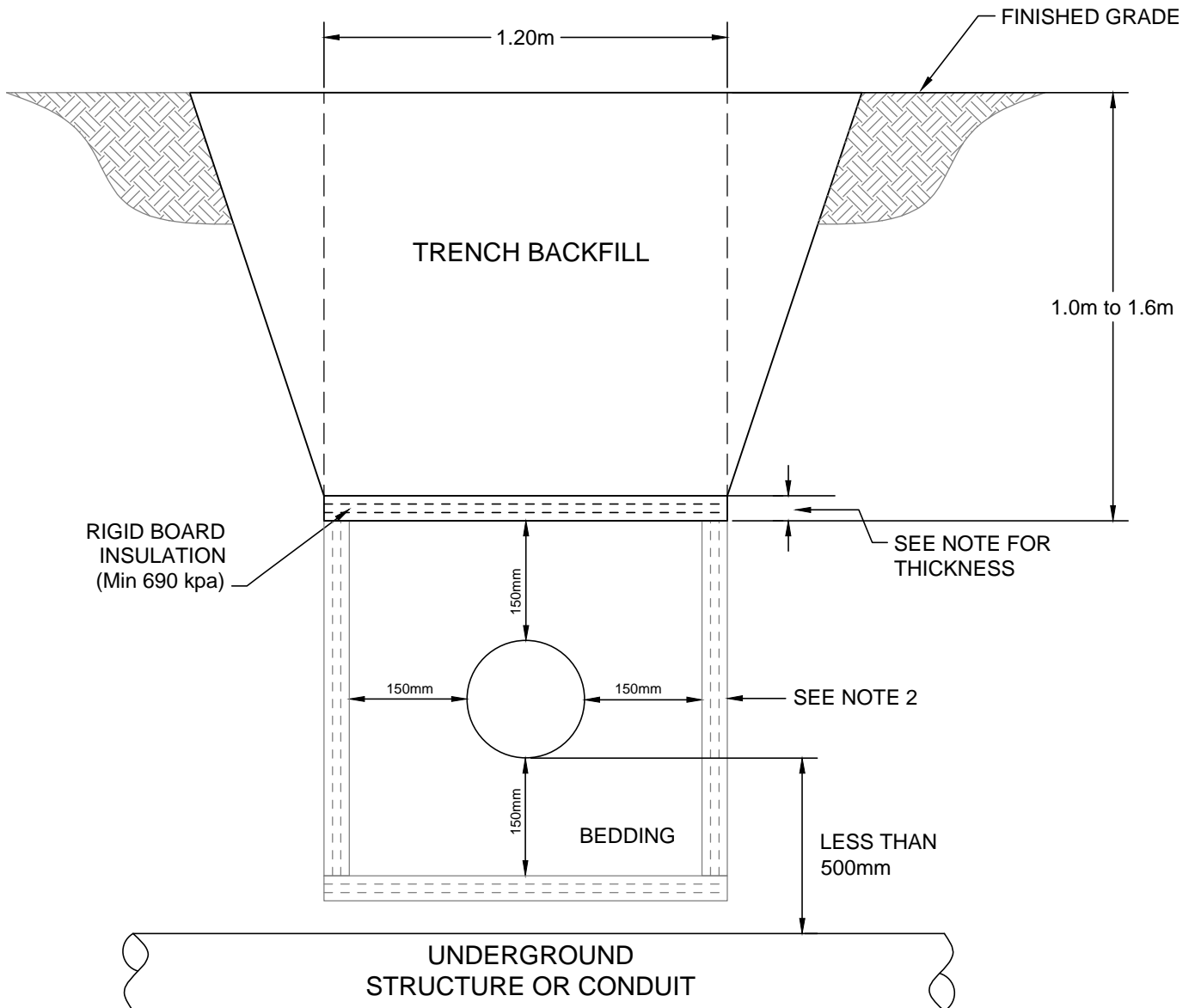


Growing stronger together

SECTION 4 – SANITARY

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.



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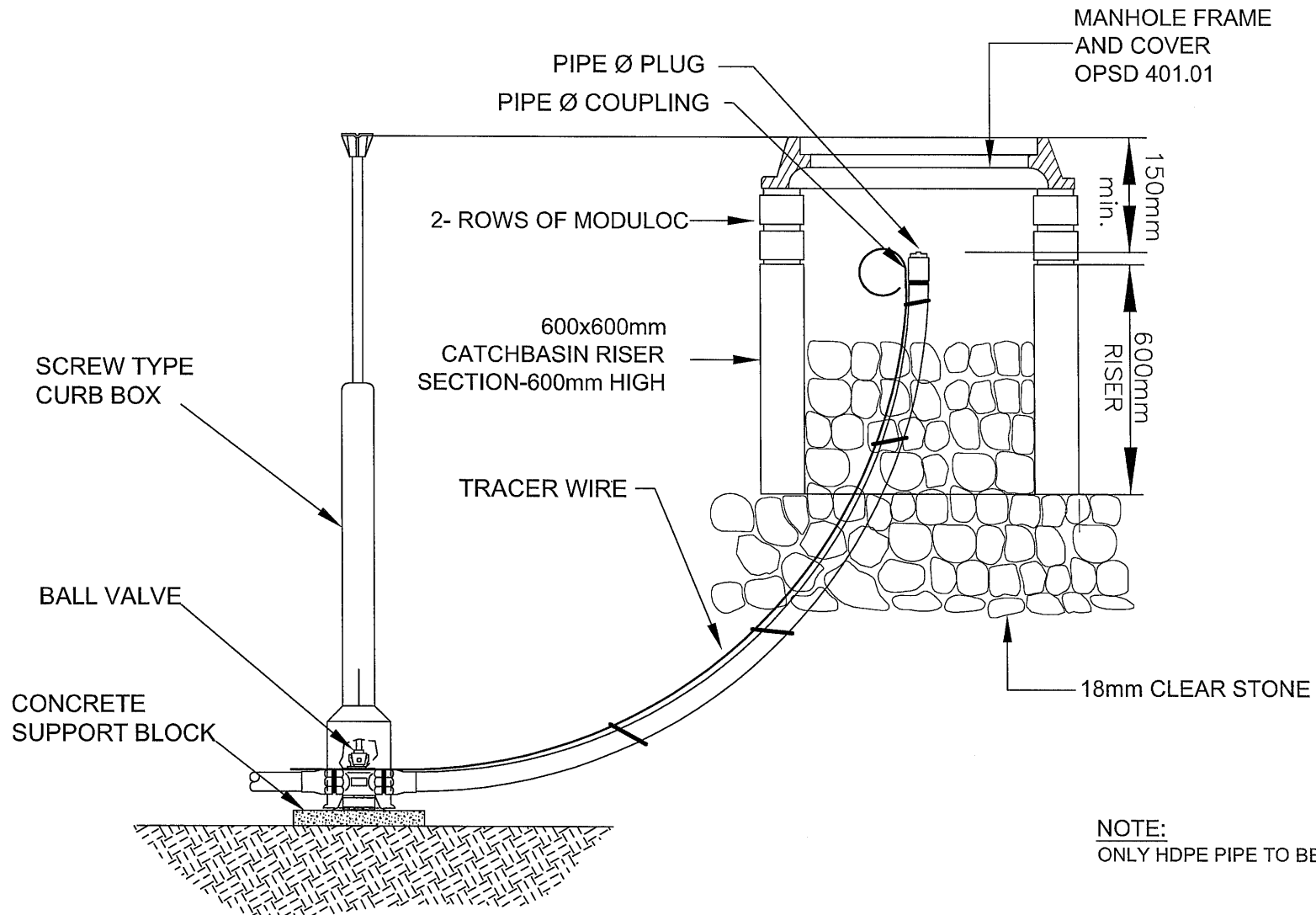
RIGID BOARD INSULATION-SLAB TYPE FOR WATERMAIN AND SERVICES/LOW PRESSURE SANITARY SERVICES

DWG D 1812-1-2007

DATE NOV. 2007

REV





NOTE:
ONLY HDPE PIPE TO BE USED.

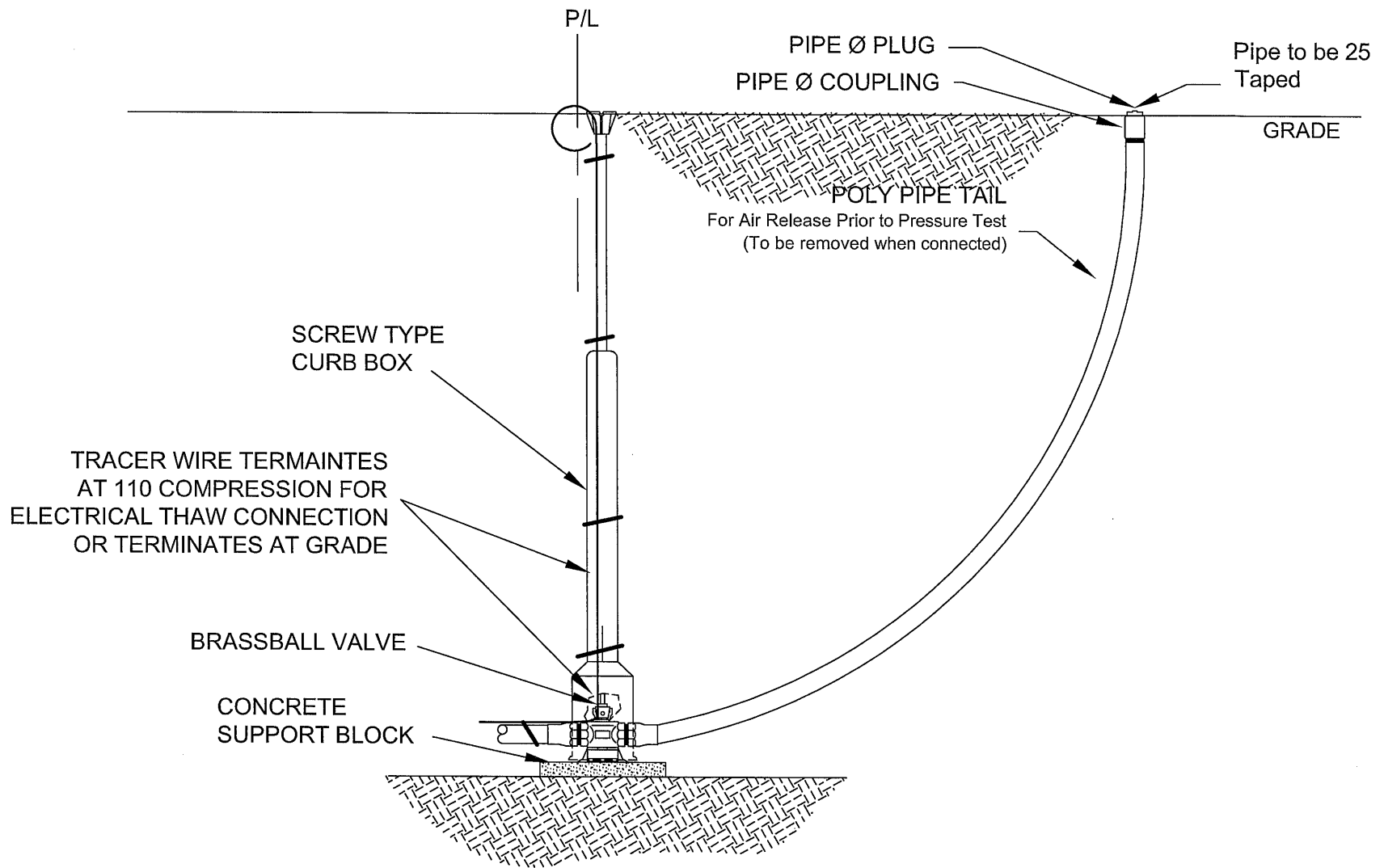
OXFORD COUNTY

LOW PRESSURE SANITARY SEWER CLEANOUT

DWG D 1847-1-2011

DATE APRIL 2011

REV
1



OXFORD COUNTY

LOW PRESSURE SANITARY SERVICE

DWG D 1849-1-2011

DATE AUGUST 2011

REV

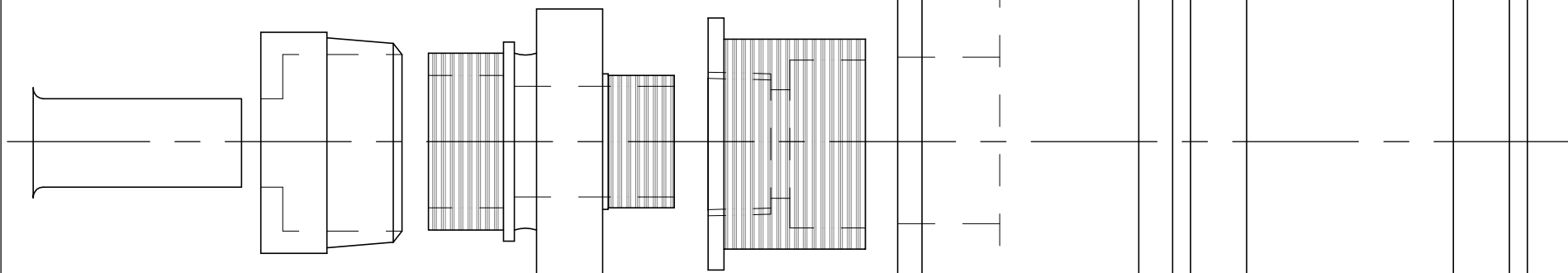
3



Complete Assembly

Fernco Coupling & PVC Bushing

Brass Coupling w/ insert



Cambridge 1/4"
CTS Insert
or approved equal

1/4" MIP x 1/4" Brass
Compression Bushing for PEP
*
Cambridge Brass series
117(117-PE5F5)
or approved equal

2" MIP x 1/4" FIP
Sch80 PVC Bushing

4" male Socket x 2" FIP
Sch80 PVC Bushing

Fernco Coupling 1056-44
4" CI/Plastic to 4" CI/Plastic
or approved equal

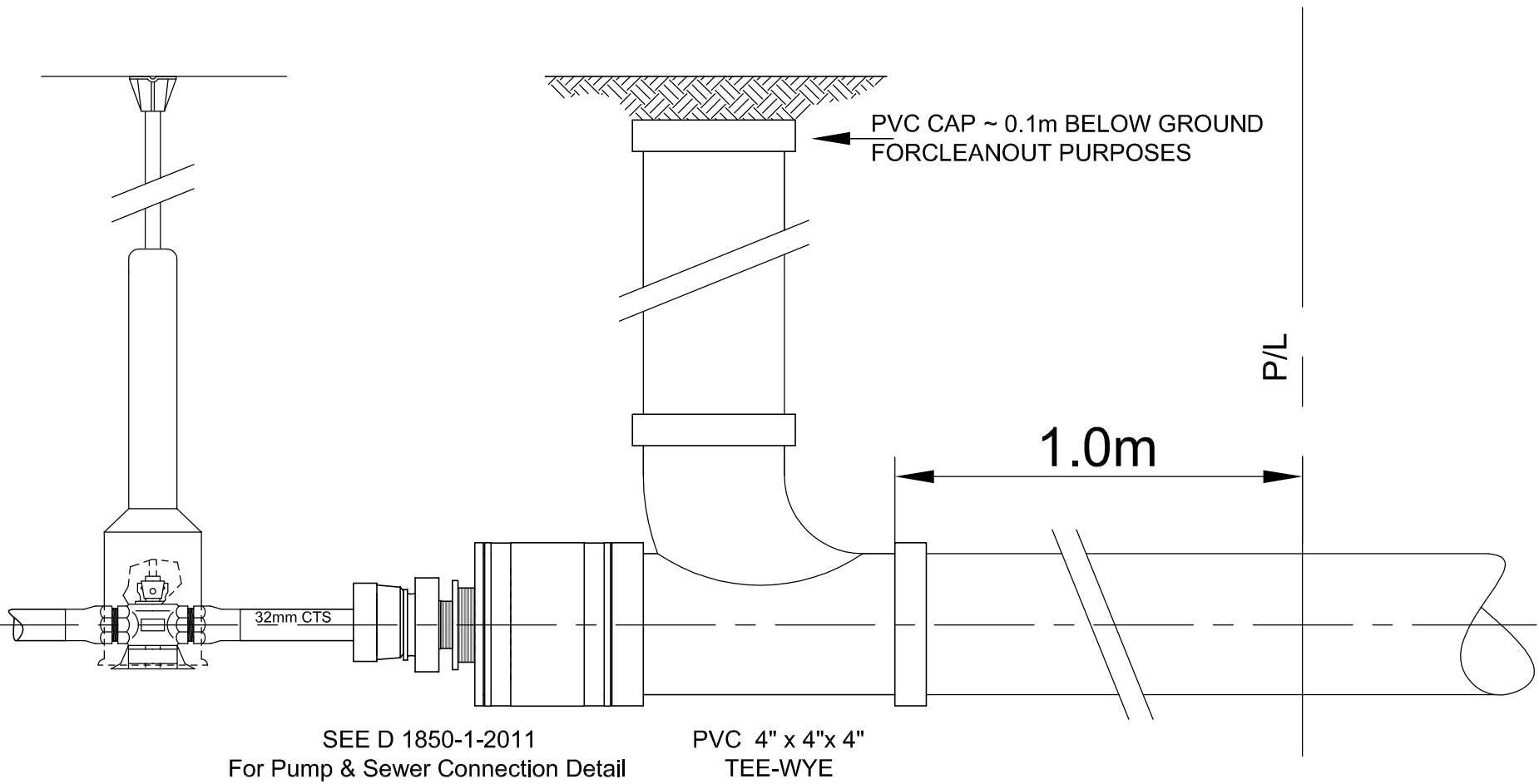
OXFORD COUNTY

Grinder Pump & Sewer Lateral Connection Detail

DWG D 1850-1-2011

DATE August 2011

REV
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SEE D 1850-1-2011
For Pump & Sewer Connection Detail

PVC 4" x 4" x 4"
TEE-WYE

PVC CAP ~ 0.1m BELOW GROUND
FOR CLEANOUT PURPOSES

1.0m

P/L

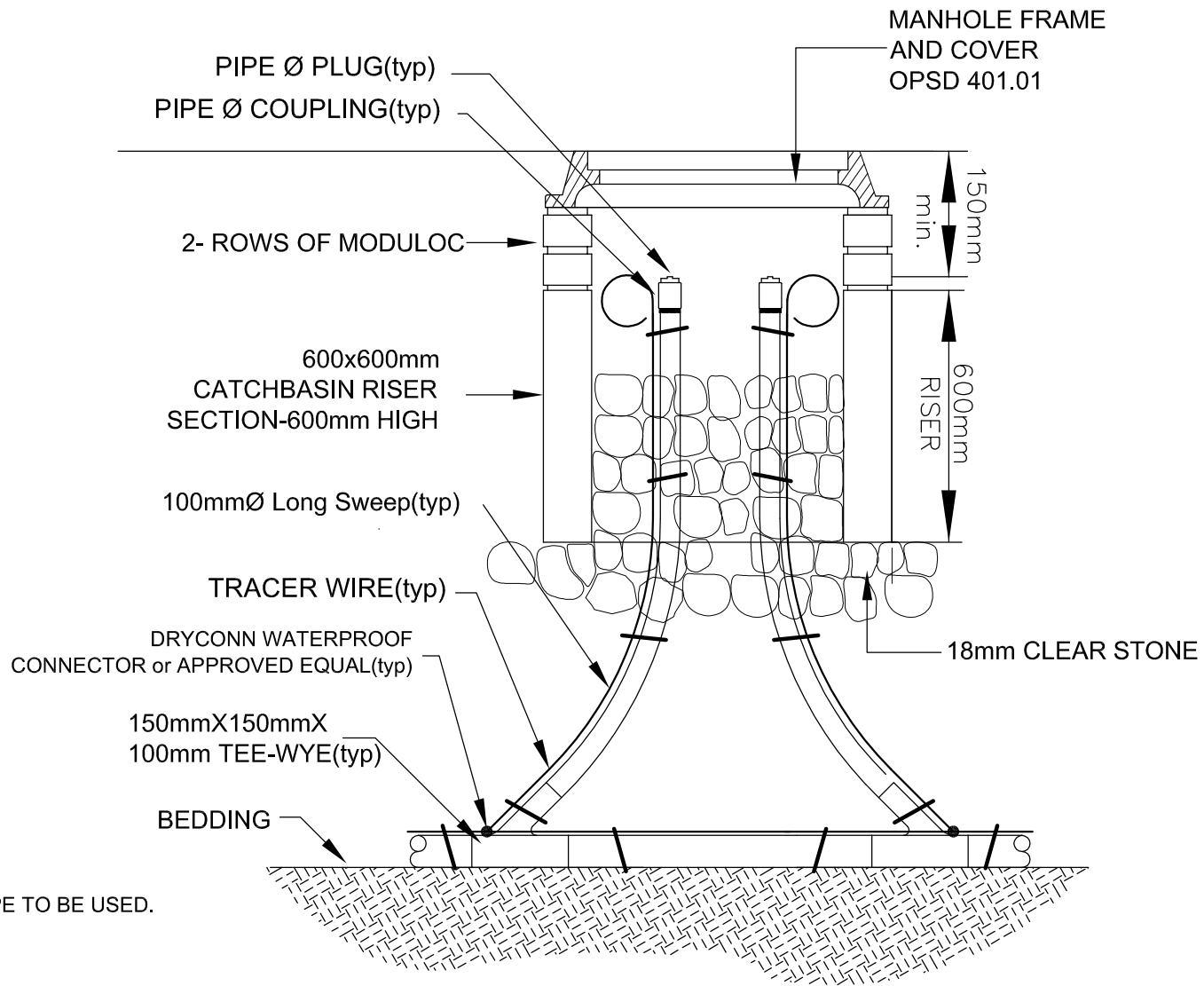
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Grinder Pump Sewer Lateral Connection w/ Cleanout

DWG D 1850-2-2011

DATE August 2011

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OXFORD COUNTY

GRAVITY SANITARY SEWER CLEANOUT

DWG D 1854-1-2011

DATE JULY 2012

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