Oxford County

Growing stronger together

SECTION 3 -WATERMAIN

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DETAILS

PART 1 - LOCATION AND DESIGN

The current Ontario Provincial Standards, American Water Works Association Standards, Canadian Standards Association, and Ministry of Environment and Climate Change (MOECC) Guidelines for the Design of Water Distribution Systems 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.

In areas of suspected soil contamination a geotechnical investigation will be required. The cost of required geotechnical testing and placement of suitable material will be the responsibility of the Consultant or Developer.

The City of Woodstock and Town of Tillsonburg are service providers for the County of Oxford. The Service providers shall inspect all watermain and service installation on both public and private property in their respective locations. Inspection fees as set out by the local municipality will apply.

1.1 Mains

The following specifications are for Ductile Iron (DI), Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE) and Concrete Pressure Pipe (CPP).

Molecular Oriented PVC pipe (PVCO) is an accepted material however this material may only be used in new subdivisions and new development areas. This material is not permitted for use in the reconstruction of existing areas. The use of this material will be reviewed on a case by case basis.

In areas of reconstruction where existing metallic watermain is being replaced with PVC or HDPE, the property owner should be advised that the grounding of electrical systems to the water service may not be adequate. It will be the property owner’s responsibility to ensure adequate grounding after reconstruction is complete.

HDPE pipe over 50 mm in diameter is to be used for directional drilling only unless approved in writing by the County Engineer.

All pipes up to and including 600 mm diameter shall be delivered to the Work Area with end covers. End covers shall be factory installed on both ends with a tamper evident seal. Components shall adhere sufficiently to withstand the stresses caused during shipment.

a) Mains shall be located as per Section-1 General, Figure 1.2. These drawings indicate the location of the main on municipal streets. Any deviation from these standards must be submitted in writing to the County Engineer or local Municipality for approval.

b) In areas of construction where watermain 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 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.

c) It is recognized that the above standards apply where straight runs are being installed. 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 watermain and services shall typically be 1.80 m. Watermain and services may be required to be deeper to avoid conflicts with other infrastructure.

e) No mains less than 150 mm in diameter or dead-end mains shall be installed unless approved by the County Engineer.

f) Watermains shall be arranged in a looped pattern for mutual support and reliability. Dead ends shall be avoided wherever practical. Watermains on dead end streets where the watermain length would exceed 150 m shall be looped, where possible. In new residential subdivision developments no more than 40 units with individual water services on a proposed or future phased street may be serviced without looped connections to existing or proposed streets. On new streets where lots are serviced without looping, the watermain design shall provide a minimum fire flow based on the type of buildings (i.e residential, industrial, commercial, or institutional).

g) All non-metallic direct bury watermain and services shall require tracer wire. All non-metallic directional drilled watermain shall require two (2) tracer wires. All non-metallic directional drilled services 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 watermain. At the ends of capped watermain, 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 watermain.

At service saddles, tracer wire is not allowed to be placed between the saddle and the watermain. Joints in the wire shall only occur at ends of rolls or services that are 100 mm diameter or larger.

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.

For services 25 mm to 50 mm, tracer wire shall be connected at the main stop using the electrical thaw nut and to the curb stop electrical thaw nut. Each connection will be wrapped in petrolatum tape and compressed tightly by hand around the connection and fitting. For services that are 100 mm diameter or larger a connection will be permitted to the main line tracer wire using only approved connectors.

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.

h) Mechanical thrust restraint is required on **all** fittings, bends, tees, hydrant tees, valves, hydrants, crosses, reducers and plugged or capped dead-ends. In addition all watermain repairs shall require mechanical restraints as listed 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.

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

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, hydrant 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, hydrant 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, hydrant tees, valves, hydrants, 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 watermain is pressurized. The County of Oxford reserves the right to specify the use of mechanical and/or concrete thrust blocks.

1.2 Easement

Easements are required for all watermains 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 County or the County of Oxford's service provider. An easement provides the right to use private land for a specific purpose which is in the public's interest.

1.2.1 Type of Easement

a) Municipal (Servicing) Easement

Is required for watermains 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) Temporary Easements and Working Easements

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

1.2.2 Minimum Easement Widths

Easement widths are determined by the depth of cover from the centerline of the road/ground to the invert of the watermain or a minimum width of 5.0 m assuming no other services are located within the easement. Where watermains are located within easements between residences, the watermain shall be offset a minimum of 1.0 m from the property line to avoid fence posts.

1.3 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. The valve locations shall be on the extension of the street line. If necessary, adjustments in the field can be made to avoid curbs or other obstructions that may interfere with valve placement.

b) 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 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.

c) 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.

   Valves on transmission mains 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.

d) Watermains crossing rivers, bridges, railways, controlled access highways, and between residential dwellings shall be valved on each side of the crossing.

e) Hydrants shall be valved with the valve located 1.0 m from the street side of the hydrant barrel. Valving as per Detail D1828-1-1993.

1.4 Blow-Offs/ Swab Launches

When dead end mains are encountered, a fire hydrant or blow-off is required near this dead end. The blow-off must be designed in such a manner as to convey the water to a suitable drain and must be operable without the need for excavating. Stop and Drain type valves are permitted. Blow offs or Swab launches where possible shall be installed in "soft surface" grassy areas with 19 mm clear stone bedding.

Blow offs or Swab launches installed in "hard surface" asphalt or concrete areas will require 300 mm thick granular "A" bedding compacted mechanically in two (2) lifts of 150 mm thick.

Blow-offs will be 50 mm diameter for mains up to and including 200 mm diameter. Blow-offs will be 100 mm diameter and use the swab launch detail for 250 mm and 300 mm mains.

In areas that do not have fire hydrants, permanent swab launches will be installed for swabbing and flushing. Blow-offs and swab launches to be installed as per Detail D1803-1-2013 and Detail D1822-1-2005.

1.5 Casings and Spacers

Where casings are required for watermain 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 watermain is located between proposed residential dwellings, it shall require a casing with fusible watermain pipe placed inside the casing. The casing shall extend the entire length of the property with valves placed on the watermain at each end of the casing for isolation purposes. Valves should be located a minimum of 3.0 m from each end of the end of the casing. Where casings containing watermain 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 the watermain material used inside the casing is PVC or Ductile Iron bell and spigot, 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. Both ends of the casing will be covered using an approved rubber end seal to prevent backfill from entering the casing.

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

1.6 Water Services

The use of copper water service material in the municipal road allowance is not permitted except where existing watermain material is Cast Iron or Ductile Iron. **Copper services are not permitted in new construction.** The minimum size permitted for water services is 25 mm diameter except in areas of low pressure as designated by the County of Oxford, setbacks from the main greater than 30 m (100 ft) and ends of cul-de-sacs. In areas of low pressure, setbacks greater than 30 m (100 ft), and ends of cul-de-sacs, the minimum size of water service allowed may be larger than 25 mm diameter.

Water services larger than 25 mm diameter must be hydraulically modelled for sizing based on required demand as supplied by the property owner, developer, or contractor.

All non-metallic water services shall require tracer wire.

Electrical Grounding

i. *Effective June 30, 1993 electrical systems of all new developments shall not be grounded to the water system. Refer to the Ontario Hydro Electrical Safety Code (Section 10) for grounding requirements.*

ii. *Where an existing metallic watermain or service is replaced or upgraded with PVC or HDPE material, the grounding of electrical systems to the water service may not be adequate. It will be the property owner's responsibility to ensure grounding is adequate after the watermain or service upgrade is complete.*

All existing or new copper water services located and exposed or, replaced in the municipal road allowance that will remain in service after reconstruction shall require cathodic protection as per SECTION- D Corrosion Protection and Insulation.

Water services shall be installed as per Detail D1838-1-2007 and D1839-1-2007 with a minimum 1.80 m of cover from the watermain to the property line. If a minimum cover of 1.80 m cannot be achieved due to underground obstructions or changes in surface grade, thermal insulation must be used. Water 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.

a) No services shall be installed until stakes have been provided to indicate the proper line and grade of the lot or lot boundaries or the exact location of the service laying line.

   The contractor shall satisfy himself as to the accuracy of all lines and grades. Errors in service locations shall be corrected to the satisfaction of the Engineer at the expense of the Developer. The service pipe is to be laid at right angles to the main and will extend in a straight line to the property line. Services shall be placed on property line and marked with a 50 mm X 100 mm blue stake extending from the curb stop to 600 mm above finished grade. Maintain separation between services as per Figure 1.1 Section 1.

b) Under no circumstance will a single service be permitted to supply more than one dwelling unit.

c) Where a fire service is required for a building, its installation must conform to the National Building Code. One (1) service is to be taken to the property line. Domestic service must be tapped off the fire service outside the building with separate shut off valves. Valves for the domestic and fire service should be located as per Detail D1857-1-2016. Fire services are not metered.

d) Water services shall be installed along with watermain and tested under 1034 kPa (150 psi) standard test pressure. Service material used must be rated to minimum 1034 kPa (150 psi).

e) For all non-metallic water services tracer wire will be installed and attached to the electrical thawing nut on the main stop and to the electrical thawing nut on the curb stop at property line. Splices into the main line tracer wire are not permitted unless the service size is 100 mm or larger. The use of Thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted. The tracer wire to be used for services shall be of the same size and type used for watermain placement. At any location where joints in the wire must occur (i.e. end of roll) only approved connectors will be used.

f) All services located at the end of a cul-de-sac shall be minimum 25 mm diameter regardless of material used and installed as per Detail D1835-1-2006.

g) 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 the construction limits only. Interlocking brick driveways shall be carefully disassembled to proposed construction limits and reassembled to existing or better conditions. Coloured and/or impressioned concrete is extremely difficult to match when replacing parts of driveways, curbs, or sidewalks. The County or its service provider is not responsible for an exact match of these areas.

   The County or the County of Oxford's service provider require a minimum of 48 hours notice prior to placement of finished grade materials surrounding the curb stop. Curb stops shall be inspected and raised to the level of finished grade. All service boxes located in concrete, asphalt, or interlocking brick surfaces shall have a 100 mm inside diameter PVC pipe 300 mm in length placed around the cap and flush with the surface. After placement of final grade material the curb stop shall be flush with the surface and in a fully accessible and operable state.

h) 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 or its service provider 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 provider acknowledging acceptance. Included in the agreement will be a holdback to ensure that the curb stop is placed to proper grade and is fully functional after the property owners restoration has been completed.

1.7 Meters

As stated in Bylaw No. 5514-2013, One (1) County meter will be placed in each single family residential, multi-family residential, commercial, industrial and institutional building. Generally this means one meter per individual property except for apartment condominiums which will only have one meter. Accompanying all water meters will be an Electronic Radio Transmitter (ERT) device used for collecting water usage data.

All water used in the above mentioned buildings will pass through such meter and the owner of the premises shall be held liable for water charges.

As of January 1, 2016 all customers connected to municipal water systems in the County of Oxford will require a water meter and ERT device. Water meters shall be installed by a licensed plumber.

The ERT device shall be installed by the County or the County of Oxford's service provider prior to turning water on. Water meters and ERT device will be installed as per Detail D1807-1-2004 and D1856-1-2016. Secondary meters may be purchased from the County for the convenience of the owner, as in apartment houses or multiplex units, at the owner's request and expense.

All secondary meters shall be installed in a manner so that all water supplied passes through the County meter prior to passing though the secondary meter. Secondary meters shall not be read or billed separately or maintained by the County.

a) Meters will generally be sized one size smaller than the size of the service. The size of the meter must be negotiated with the Engineer in accordance with the flow requirements.

Contact your local municipality to purchase the water meter and ERT device.

Township of Blandford –Blenheim	519-463-5347
Township of East Zorra-Tavistock	519-462-2697
Township of Norwich	519-879-6568 or 519-863-2709
Township of South West Oxford	519-877-2702 or 519-485-0477
Township of Zorra	519-485-2490
Erie Thames Power Lines (Ingersoll)	519-485-1820
Town of Tillsonburg	519-842-9200
City of Woodstock	519-539-1291
County of Oxford	519-539-9800

The meter shall be installed immediately inside the wall of the building. Sufficient space for installation and maintenance must be provided.

The meter must be protected against freezing and be accessible for meter reading. In areas of the County that have not begun the universal metering program, meters shall be installed as per Detail D1805-1-2004, D1806-1-2004, D1807-1-2004.

b) For Industrial, Commercial, and Institutional properties where the meter is 75 mm or larger, a lockable by-pass for this meter must be installed. For Industrial, Commercial, and Institutional properties with meters smaller than 75 mm, a lockable by-pass will be installed where the customer cannot tolerate a shut-down of the water service during business hours.

Such locations would include coin operated equipment such as laundromats, services in which there is water-cooled equipment, production line(s) where a shut-down of approximately one hour would create problems. Residential by-passes are not permitted.

c) Meter by-passes shall be installed according to Detail D1811-1-2004 or D1818-1-2005.

1.8 Backflow Prevention

A backflow prevention device shall be required for all industrial, commercial, and institutional developments. Such a device will be installed by the Developer, Contractor, or property owner at their expense. These devices shall be as per AWWA standards and approved by the County Engineer. A current test/calibration certificate shall be provided to the County upon installation. On an annual basis the backflow prevention device shall be retested/calibrated and certificates shall be submitted to the County. Installation and calibration will be done in the presence of a licensed water operator from the County or the County of Oxford's service provider.

In the City of Woodstock all residential services shall require the installation of a dual-check backflow preventor. Installation shall be as per Detail D1807-1-2004.

1.9 Service Valves

a) Where the service is 50 mm in diameter or less, a corporation stop shall be installed at the main and a curb stop at the property line. The curb stop and service box will placed on a 200x200x100 mm concrete support block. Wooden support blocks are not acceptable.

b) For services larger than 50 mm in diameter, a single valve will be installed at the property line if the main can be closed down during its installation.

If the main cannot be closed down, then a tapping sleeve and valve will be installed at the main.

c) In building complexes such as town housing developments or shopping plazas, where individual services are connected to a larger common service, a valve shall be placed on each individual service where it joins the common service. Valves must be easily accessible for operation and must be in accordance with drawings approved by the County Engineer. Sectionalizing valves on the common service may also be required.

1.10 Hydrants and Hydrant Testing

Hydrant laterals shall be a minimum of 150 mm diameter. Hydrant spacing will not be approved in excess of 90 m from the face of a building as per the latest revision of the Ontario Building Code, Part 3, Section 3.2. Hydrants placed adjacent to buildings with siamese connections shall be located a maximum of 45 m away from the connection.

Hydrant spacing on streets may range between 90 m and 180 m. Hydrants located in residential areas shall be located on a common lot line.

Hydrants located near entrances shall be located a minimum of 1.5 m away from residential driveways and utilities, and 2.5 m away from driveways in industrial, commercial, or institutional areas. Where possible, hydrants should be located at the high point of the watermain. The County reserves the right to request additional hydrants if necessary.

Hydrant valves to be located 1.0 m from the street side of the hydrant barrel. Tracer wire shall be brought up on the outside of the valve box, then looped inside the box through a drilled hole with rubber grommet at the top of the valve box, then return to the outside of the valve box and return to the watermain. Tracer wire is not required to be installed to the hydrant. Hydrants shall be installed according to Detail D1828-1-1993

Public hydrants shall have the hydrant body painted YELLOW. The bonnet and caps shall be painted according to the National Fire Protection Association (NFPA) 291colour coding based on flow testing. Colour coding is for the purpose of indicating available flows at 140 kPa (20 psi) residual pressure.

Upon completion of each phase of development, the County of Oxford requires that all fire hydrants be flow tested. Records of field test data must be submitted prior to commencement of the maintenance period. Testing will be completed in the presence of a licensed operator from the County or the County of Oxford's service provider. It is understood that as phasing of developments progress, hydrant flow rates may change (i.e. dead-ends to looped connections). These locations will be re-evaluated by the County or the County of Oxford's service provider.

It is the responsibility of the consultant or developer to confirm hydrant flow rates of all hydrants in the development prior to final acceptance. All costs associated with testing will be the responsibility of the consultant or developer.

When necessary and required by the Fire Department or as arranged by property owners, hydrants will be located on private property. Hydrants located on private property shall have the hydrant body painted RED.

The bonnet and caps shall be painted according to the National Fire Protection Association (NFPA) 291 colour coding based on flow testing. Private hydrant testing and colour coding will be the responsibility of the property owner.

When hydrants are located on private property, a maintenance agreement shall be entered into with the County.

(Exceptions for maintenance agreements are the City of Woodstock and the Town of Tillsonburg)

Note: Hydrants shall not be placed in non-fire rated distribution systems.

1.11 Temporary Watermain and Services

This section is to be read in conjunction with OPSS 493.

When service interruption is likely to be greater than 24 hours for 2 or more residential units and or buildings, temporary watermain must be installed. Each home or business shall have its own temporary water service connection. Shared services shall not be permitted. An approved back-flow preventer device shall be installed at the point of connection. The backflow preventer shall be placed above ground level with the excavation backfilled.

Prior to construction the Contractor shall submit a written detailed procedure outlining methods, materials, connection points to existing mains, connections to supply customers, and disinfection process for approval by the County Engineer. A drawing showing the proposed layout of the temporary water supply system indicating connection points to the existing watermain must also accompany the submission. Contractors 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 existing watermain. It will be the responsibility of the Contractor to maintain the temporary watermain and services in a safe operating condition at all times.

When a hydrant is removed from service, a temporary hydrant may be required. Temporary hydrants will be installed with the necessary valves and fittings and shall be installed where existing hydrants have been removed or where spacing requirements dictate. Hydrants out of service will be bagged and clearly marked with a "HYDRANT OUT OF SERVICE" tag.

Closed loop temporary systems (i.e. hydrant to hydrant) will not be permitted. Each dead-end branch will have fittings in place to facilitate flushing and sampling of the temporary watermain.

Temporary watermain shall be a minimum of 50 mm diameter Aquamine high impact, ASTM PVC 1120, D 2241, DR 17, 1720 kPa, or approved equal. The diameter of the temporary watermain shall be based on the number of services in the affected area. This main shall be certified for potable water use as per ANSI/NSF Standard 14 and Standard 61.

Service piping shall be a minimum of 19 mm inside diameter KuriTec Series K6136 reinforced PVC flexible connection or approved equal. Service piping shall be certified for potable water use as per ANSI/NSF Standard 61. Customer connections to external hose bibs shall require a brass wye fitting with dual shut-offs.

Prior to customer connection, all temporary watermain and temporary service piping shall be tested and disinfected. Testing of the temporary watermain and services will be at system pressure. Once testing of the temporary watermain is complete with no leakage, service piping shall be connected to the temporary watermain. There shall be no leakage in service piping.

Services shall be plugged, capped, or valved off at the end of the service pipe once flushing has been completed. Temporary watermain and services shall then be disinfected by removing plugs, caps, or opening valves to flow super-chlorinated water for the disinfection process. Plugs and caps shall be replaced and valves closed once the disinfection process has begun. Taping ends of service piping is not permitted.
All piping, hoses, valves, plugs, caps, and fittings for all connections shall be the responsibility of the Contractor. Flushing, swabbing, disinfecting and commissioning of the temporary system shall meet the requirements of Part 5 and Part 6 of this specification.

When a replaced section of watermain is restored to service, the Contractor shall remove any corresponding temporary pipe and house service connection and shall leave the street, sidewalk and adjacent property in a neat and orderly condition.

PART 2 - MATERIAL

NOTE: All chemicals and materials used in the operation of the drinking water system that come into contact with water within the system shall meet all current applicable standards set by the American Water Works Association ("AWWA"), Canadian Standards Association ("CSA"), the American National Standards Institute ("ANSI") safety criteria standards, American Society for Testing and Materials (ASTM), NSF/14, NSF/60 and NSF/61.

In areas of suspected soil contamination a geotechnical investigation will be required. The cost of required geotechnical testing and placement of suitable material will be the responsibility of the Consultant or Developer.

Materials shall remain consistent throughout projects. Mixing of materials is not permitted. The County or the County of Oxford's service provider reserves the right to select any material or product it deems appropriate for the application.

All pipes up to and including 600 mm diameter shall be delivered to the work area with end covers.

End covers shall be factory installed on both ends and a tamper evident seal on the bell end only. Components shall adhere sufficiently to withstand the stresses caused during shipment.

The Contractor will get approval for all materials selection from the County Engineer prior to delivery to the site.

2.1 Pipe, Fittings, Tracer Wire and Spacers

Joint lubricants shall be as supplied by the pipe manufacturer and approved by the County Engineer. Acceptable watermain pipe material:

a) **Ductile Iron (DI)**

Ductile Iron Cement Mortar Lined CL 52 as per AWWA C104, C150 and C151.

Fittings shall be mechanical joint only as per AWWA Specifications C110, C150 and C153. **Fittings are required to be cement mortar lined**.

All fittings, mechanical joints, and restraints are to be protected using a petrolatum corrosion protection system. Refer to Section D, Corrosion Protection and Insulation, 3.17 Petrolatum Coating System.

Installation of Tyton joint watermain pipe and mechanical joint fittings shall conform strictly to the manufacturer's instructions.

b) **Polyvinyl Chloride (PVC)**

PVC AWWA C900, CSA B137.3 - Class 235 DR 18 (complete with tracer wire) 100 mm through 300 mm diameter colour coded blue.

PVC AWWA C905, CSA B137.3 - Class 235 DR 18 (complete with tracer wire) 350 mm through 1200 mm diameter colour coded blue.

*PVCO AWWA C909, CSA B137.3 – Class 235 C.I.O.D. (complete with tracer wire) 100mm through 300mm diameter colour coded blue.

*This material may only be used in new subdivisions and new development areas. This material is not permitted for use in reconstruction of existing areas.

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", "Diamond Lok-21", or fusible PVC jointing process shall be permitted.

PVC Push-on fittings are permitted with the exception of service tees and main valves. All PVC fittings shall be injection molded as per AWWA C907, CSA B137.2 colour coded blue. **All** push-on fittings shall require mechanical restraint. All restraints are to be protected using a petrolatum corrosion protection system. Refer to Section D, Corrosion Protection and Insulation, 3.17 Petrolatum Coating System.

The use of fabricated fittings will not be permitted unless approved in writing by the County Engineer.

Ductile Iron fittings used in PVC watermain systems shall be cement mortar lined mechanical joint only as per AWWA Specifications C110 and C153. All fittings, mechanical joints, and restraints are to be protected using a petrolatum corrosion protection system. Refer to Section D, Corrosion Protection and Insulation, 3.17 Petrolatum Coating System.

All Ductile Iron fittings in PVC watermain systems shall require cathotic protection as listed in Section – D, 3.18 Cathodic Protection for PVC Watermain.

c) **High Density Polyethylene (HDPE)**

HDPE pipe 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, PE 3408/3608 DIPS "Blue Stripe" (complete with 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: Watermain less than 100 mm dia. shall be copper tubing size (C.T.S.)

d) **Concrete Pressure Pipe (CPP)**

Concrete Pressure Pipe and fittings as per AWWA C301 (L) Class 14 or C303 Class 150.

The Contractor shall submit certified shop drawings for all pipe and specials giving details, design, and method of construction, type of joint, etc., of the pipe, before fabrication commences. Cathotic protection measures shall be submitted in accordance with shop drawing requirements.

e) **Tracer Wire and Connectors**

Tracer wire for direct bury shall be Solid #12 AWG (0.0808" diameter), 21% conductivity, high strength (HS), copper-clad hard drawn high carbon steel (CCS) tracer wire, 30 mil. HDPE insulation jacket complying with ASTM-D-1248, minimum break load 452 lbs, 30 volt rating, blue in colour.

For directional boring two (2) Solid #12 AWG (0.0808" diameter), 21% conductivity, extra high strength (EHS), copper-clad hard drawn high carbon steel (CCS) tracer wire, 45 mil. HDPE insulation jacket complying with ASTM-D-1248, minimum break load 1150 lbs, 30 volt rating, blue in colour.

Tracer wire shall be manufactured to CAN/CSA B137.3.The use of thermoplastic High Heat-resistant Nylon coated wire (THHN) is not permitted.

Tracer wire connected to existing cast iron or ductile iron pipe shall be properly connected with a thermite weld or approved equivalent. Welds will be completely sealed with a mastic type sealer. The mastic shall be TC mastic or approved equal.

All connections or repairs in the tracer wire system shall be made using a copper split-bolt connector with DRYCONN Direct Bury Waterproof Split-Bolt Housing (Aqua), DRYCONN 3-Way Direct Bury Waterproof connector (DB Lug Aqua) or approved equal. Tracer wires at ends of rolls, repairs, or water services 100 mm diameter or larger shall have sufficient slack to be knotted together prior to placement of connector. All connections shall be wrapped with petrolatum tape and compressed tightly by hand around wire and connector. Tracer wire connections to be installed as per Detail D1858-1-2016.

f) **Casing Spacers**

When watermain is placed inside a casing, the watermain 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

2.2 Pre-Cast Valve Chambers

a) All chambers are to be precast, complying in all respects with the design requirements of OPSS 441 and OPSD 1101 chambers, including concrete materials and joint waterproofing. Manufacturer's design drawings, calculations and certification shall be submitted at least 10 working days prior to commencing work. Certification shall be marked on units.

Shop drawings for precast chambers will include all details, and be reviewed and stamped by a registered Ontario Professional Engineer retained by the contractor.

b) All chambers are to be designed to counteract full buoyancy forces as if the groundwater level is at the ground surface. All buried external surfaces of the chambers are to be waterproofed as specified herein.

c) All chambers are to be fitted with frost straps. Each strap shall run continuously from the bottom slab to the top section.

d) Pipe supports are to be adequately sized to support the valves, pipes and appurtenances that will be supplied by the contractor. The supports will be reinforced concrete and tied to the base with properly sized dowels.

e) Units shall be constructed in accordance with details indicated, plumb and true to alignment and grade. Complete units as pipe laying progresses.

Precast concrete base shall be set on a minimum of 75 mm granular bedding compacted to 95 % Standard Proctor Maximum Dry Density (SPMDD) or as indicated on Contract Drawings.

f) Each joint shall be watertight with approved rubber ring gaskets. Clean surplus mortar and joint compounds from interior surfaces of unit.

All lifting holes shall be filled with non-shrink grout. Floor of chamber will be sloped to sump pit at 1 in 20.

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

2.3 Chamber Piping and Fittings

The piping, valves and fittings to be incorporated into the chambers will comply in general with all requirements of the buried watermain, with the additional requirements below.

a) The Contractor shall submit shop drawings for review of all chamber piping, fittings, and valves, clearly showing all proposed materials, dimensions, details of thrust restraint (thrust blocks not permitted). Piping and fittings of all diameters shall meet the applicable AWWA standards.

b) Chamber piping and fittings 400 mm or larger shall be concrete pressure pipe of the same rating as the main. Chamber piping and fittings less than 400 mm will be ductile iron, Class 52.

c) All exposed metal surfaces not otherwise coated with approved AWWA epoxy coatings will receive corrosion protection as described in Section D, 3.17 of this specification or as per manufacturers recommendations.

d) Vent piping and fittings shall be stainless steel, manufactured from type 304 L stainless steel produced from parent metal conforming to ASTM-A240 and AWWA Manual M11 (pressure limit 1035 kPa). All vents shall have a minimum of two bands of 50 mm wide high reflective yellow tape.

e) Tracer wire within the chambers shall be secured to the inside wall and shall be accessible from the surface.

f) All other materials which are not specifically described herein or noted on the Contract Drawings, but required for the completion of the work (such as couplings, gaskets, jointing materials, fasteners, other accessories) shall be as selected by the contractor, subject to approval of the County Engineer.

2.4 Gate Valves & Rods

a) Valves shall be gate valves manufactured to AWWA C509 Specifications. Tapping valves and sleeves must be approved by the County Engineer.

The number of turns to operate the valve shall be 3 times the valve diameter in inches plus 2 to 3 turns. Valves with number of turns in excess of this will not be permitted.

NOTE: All gate valves and tapping valves must be resilient seat, epoxy coated gate valves.

b) Valve boxes as supplied by Canada Valve, Mueller Ltd. or approved equal will be acceptable. All boxes shall be screw type.

c) Valve rods shall be manufactured as per Detail D1834-1-1993.

Valves must be mechanical joint and must open Counter-Clockwise.

All valves connected to the City of Woodstock water system shall open Clockwise.

2.5 Combination Air / Vacuum Valves

Air release/vacuum relief valves should be installed at high points on distribution and transmission watermains where air can accumulate. Automatic air release valves should not be used in situations where flooding of the access hole or chamber may occur. Air release/vacuum valves shall conform to AWWA C512.

Air valves shall be combination air valve with cast iron or plastic boot and cover, stainless steel internal parts, class 125 flange inlet boot rated to 1378 kPa W06, 0 to 1034 kPa working pressure. Seat to be bronze with Buna-N seat. Under Ground Air Valve Systems must be approved by the County Engineer. Air / Vacuum valves for direct bury to be installed as per D1852-1-2011 and D1852-2-2011. The Contractor shall submit shop drawings for review of all piping, fittings, and valves, clearly showing all proposed materials, dimensions and locations. The final number and location of these valves will be reviewed by the County Engineer prior to construction. Piping and fittings of all diameters shall meet the applicable AWWA standards.

a) Exterior surface of valve body shall be epoxy coated

b) Adequate support shall be provided for the valve

Valves shall be Valmatic, Apco, ARI, or approved equal.

2.6 Waterproofing of Chambers and Manholes

Waterproofing membrane shall be supplied and installed on all exterior concrete surfaces of the watermain chambers, 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. 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. This product is supplied by Form and Build Supply Ltd (London / Kitchener) and Wiegand Sales Ltd. (Cambridge).

2.7 Service Material

The County of Oxford will accept cross-linked polyethylene (PEX) or high density polyethylene (HDPE) service material manufactured to Copper Tube Size (CTS). Copper service material is no longer accepted unless it is to be connected to an existing Cast Iron or Ductile Iron watermain. **Copper is not permitted in new construction.**
All existing copper service material connected to PVC watermain that has been exposed and not replaced during construction shall require cathodic protection as per Section D Corrosion Protection and Insulation. All non-metallic services shall be a minimum of 25 mm diameter and require a tracer wire. All service material shall conform to NSF 61.

a) Cross-linked polyethylene (PEX) service material may be used from minimum 25 mm diameter up to and including 50 mm diameter nominal size. Material shall be pressure rated to a minimum of 1103 kPa (160 psi). Pipe shall be manufactured using the high pressure peroxide (Engel) method of cross linking in accordance with AWWA C 904, ASTM D3350 and a minimum degree of cross-linking of 80% in accordance with ASTM D 2765, Method B.

   Pipe to have a co-extruded UV Shield made from UV resistant high-density polyethylene, colour blue.

   Pipe to be certified to standards ASTM F 876, F 877, F 2023, CSA B137.5, NSF 14, and 61.

   Pipe connecting to AWWA C 800 compression joint valves and fittings shall be installed using stainless steel support liners inside pipe at each joint according to manufacturer's specifications.

b) High Density Polyethylene (HDPE) service material may be used from minimum 25 mm diameter up to and including 50mm diameter.

   Material shall be pressure rated to a minimum of 1379 kPa (200 psi). Pipe shall be PE 3408/3608 Pressure Class 200 Copper Tube Size (CTS), colour black with copper stripe, manufactured in accordance with AWWA C901, CSA B137.1, NSF 14, and 61.

   Pipe connecting to AWWA C 800 compression joint valves and fittings shall be installed using stainless steel support liners inside pipe at each joint according to manufacturer's specifications.

2.8 Main Stops

Fittings for 25 mm to 50 mm Services

All main stops shall be Lead-Free Brass and conform to AWWA C800 and NSF 61.

Acceptable fittings shall be Ball Valve style and as listed below:

Size	Main Stops Inlet	Outlet
25 mm	AWWA Thread	Copper Compression
32 mm x 38 mm	AWWA Thread	Copper Compression
38 mm x 50 mm	AWWA Thread	Copper Compression

Note: All fittings used on non-metallic service lines shall be manufactured to accommodate tracer wire. Acceptable fittings for tracer wire are Mueller 110 compression for electrical thaw connection or approved equal.

Service Saddles

Note: Service Saddle Bands shall be double bolt type 304 Stainless Steel of minimum 20-gauge thickness.

Approved service saddles for PVC watermain are Concord D-71, Rockwell 371, or approved equal.

2.9 Curb Stops

All curb stops shall be Lead-Free Brass and conform to AWWA C800 and NSF 61.

Size	Curb Stops General Description	Copper Connections
25 mm	Ball Valve	Compression
38 mm	Ball Valve	Compression
38 mm	Ball Valve	Compression
50 mm	Ball Valve	Compression
50 mm	Ball Valve	Compression

Note: All fittings used on non-metallic service lines shall be manufactured to accommodate tracer wire. Acceptable fittings for tracer wire are Mueller 110 compression for electrical thaw connection or approved equal.

Curb stops shall be installed with electrical thaw nuts on the private side facing away from the watermain. Inverted Key type curb stops and "Stop and Drain" types are **not** permitted.

2.10 Curb Boxes

All curb boxes shall be manufactured with metallic composition. All curb boxes must be able to be located using a magnetic locating device. Curb box length to be manufactured to accommodate minimum 1.80 m depth of bury.

Curb Boxes	
25 mm to 50 mm services	20 mm hexagon head plugs

Note: Operating rod to have modified top to enable use of same key as used on the A726 box with stainless steel operation rods and connecting pins.

2.11 Fittings

All fittings shall be Lead-Free Brass and conform to AWWA C800 and NSF 61.

Size	**General Description**
38 mm	St. Elbow - Rough Brass
50 mm	St. Elbow - Rough Brass
38 mm	90 degree Elbow – Rough Brass
50 mm	90 degree Elbow – Rough Brass
38 mm	Copper to Iron
50 mm	Copper to Iron
25 mm	Copper to Copper
38 mm	Copper to Copper
50 mm	Copper to Copper

Note: All fittings used on non-metallic service lines shall be manufactured to accommodate tracer wire where required.

2.12 Mechanical Restraint

(For thrust restraint design see Part 1.1 f)

All restraint devices shall be approved by the County or the County of Oxford's service provider prior to installation.

Restraint devices for PVC, Ductile Iron, and HDPE pressure pipe of all sizes shall be manufactured of high strength ductile iron, ASTM A536, grade 65-45-12, and shall incorporate a series of machined serrations on the inside diameter to provide contact to the pipe and support the pipe wall.

Connecting bolts shall be of high strength, low alloy material, ANSI/AWWA C111/A21.11. All mechanical restraints shall have corrosion protection as per Section – D Corrosion Protection and Insulation.

Restraint devices shall meet or exceed the requirements of ASTM 1674 and Uni-B-13-92 recommended performance specification for joint restraint devices for use on PVC pipe and shall be FM approved. Notarized original certification shall be included with submittal documents.

Restraint devices for PVC

Joint restraints for PVC pipe and fittings shall be either serrated ring or wedge action type as manufactured by Uniflange, EBAA, Star, Sigma, Romac or approved equal.

Restraints for Molecular Oriented PVC pipe (PVCO) shall be as per the pipe manufacturer's recommendation. It should be noted that Romac "grip ring" restraints are not permitted for use with PVCO pipe.

Restraint devices for Ductile Iron

Joint restraints for Ductile Iron pipe and fittings shall be either serrated ring or wedge action type as manufactured by Uniflange, EBAA, Star, Sigma, Romac or approved equal.

Restraint devices for HDPE

Restraint devices shall be designed to resist pull out forces based on the maximum working pressure rating of the pipe. Forces experienced due to expansion and contraction of the pipe require special consideration.

Internal pipe wall stiffeners must be used when restraining HDPE. The stiffeners must be sized to encompass the entire bearing length of the restraint device. Pipe systems must be engineered to prevent movement causing the fitting to slide or rotate on the pipe.

Joint restraints for HDPE pipe and fittings shall be either serrated ring or wedge action type as manufactured by EBAA, Star, Sigma, or approved equal.

2.13 Hydrants

Fire hydrants shall be Canada Valve (Darling), Century, MacIvity M67, East Jordan Iron Works Watermaster 5CD250 or approved equal.

Public hydrants shall have the body painted YELLOW with bonnet and caps painted in accordance with the National Fire Protection Association (NFPA) 291colour coding based on flow testing.

Private hydrants shall have the body painted RED with bonnet and caps painted in accordance with the National Fire Protection Association (NFPA) 291colour coding based on flow testing.

All hydrants shall have a brass to brass seat and open Counter-clockwise. All hydrants shall be equipped with a 100 mm STORZ pumper connection (cap painted black) and two (2) 63.5 mm hose connections 180° apart.

Hydrants shall be plugged when installed in areas of high groundwater. Plugs to be installed by manufacturer. Hydrants with plugged drains must be clearly marked and pumped dry after each use.

All hydrants attached to the City of Woodstock Water System shall be plugged and open Clockwise.

2.14 Granular Material

As per OPSS 1010.

2.15 Testing

Supply test certificates in accordance with the appropriate specification, for following materials:

a) Pipe
b) Valves
c) Fittings
d) Hydrants

2.16 Delivery

Materials found to be defective in manufacture or damaged in handling after delivery, shall be replaced. Materials found to be damaged upon installation shall be replaced, which will include the costs of furnishing of material and labour required for the replacement.

2.17 Handling

Load and unload materials so as to avoid shock or damage. The lining and coating of pipes shall not be damaged.

Extra precautions and care must be taken at temperatures below freezing to eliminate the possibility of impact damage to the pipe.

2.18 Storage

Place materials in a safe storage area. Keep interiors of pipes and fittings clean.

2.19 Non Shrinkable Fill Concrete

25 kg/cu m Portland cement
Aggregates Per Can 3-A23.1 specifications
Slump 150 mm to 200 mm
28 day strength must not exceed 0.4 MPa
24 hour strength - at least 0.07 MPa

PART 3 - INSTALLATION OF WATERMAINS

The Contractor shall, unless specified otherwise furnish all material, equipment, tools, and labour necessary to complete the installations. The installation of watermain shall be as per AWWA Standards and Specifications and OPSS 401, 404, 441, 517, 1010, and Ontario Health and Safety Association OHSA Reg. 213/91 with the following exceptions/amendments.

Contractors shall give the County or the County of Oxford's service provider a minimum of 48 hours notice prior to commencing construction. A licensed operator or Inspector from the County or the County of Oxford's service provider shall be present for all watermain construction.

SECTION - A OPEN CUT

3.1 Line and Grade

a) Contractors shall provide stakes to indicate the line and grade of the watermain as well as the location of fittings, bends, tees, valves, hydrants, crosses, 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 meters to a maximum of 50 meters apart. Minimum cover to top of pipe shall be 1.80 m. In areas where joint deflections or offsets require pipe to be laid with less than 1.50 m of cover, insulation shall be placed over the pipe to prevent freezing as per Detail D1812-1-2007.

   Mains shall be laid and maintained to the required grades and locations with all valves, fittings, hydrants, 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 exploratory excavations 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.

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 proper procedures.

d) The sub grade shall be removed where it has been adversely changed by construction operations or cannot adequately support the pipe. Where poor soil conditions exist, the excavated material will be replaced 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 excavations into sanitary sewers is strictly prohibited. The cost for cleanup of the sewer or other affected areas will be the responsibility of the Contractor or 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 Engineer. No water shall be allowed to run through installations during construction.

Note: If trench flooding occurs that enters the main, contact the Inspector and/ or the Engineer to determine the course of action for disinfection.

d) Cutting of the pipe for inserting valves, fittings or closure pieces 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. Where 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 in accordance with the manufacture's specifications. If in the opinion of the Inspector, the deflection is excessive he or she 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 necessary deflection.

Thrust restraints shall be installed on all offsets according to manufacturer's specifications. Offset locations and details shall be shown on Construction and As-Constructed Plans. Such installations shall be made as per Detail D1832-1-1993 and D1833-1-1993.

g) When the new main shall cross 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, or 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 watermain 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, trenches 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 and 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 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 (as per OPSS 518). 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 “Terra Brute”, “Cobra Lock”, “Diamond Lok-21”, fusible PVC, or approved 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 HDPE pipe shall be prepared for butt fused flanged connections. All joints shall be restrained. Use of concrete thrust blocks for restraint shall not be permitted.

3.13.7 Tracer Wire

Refer to Part 2 – Material, 2.1 (e) Tracer Wire and Connectors.

When Directional Drilling is used for watermain 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.

3.13.8 Testing

As per PART 5 of this specification.

3.13.9 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 MOE guidelines, policies and regulations.

SECTION - C CONNECTIONS

3.14 Connections to Existing Mains & Jointing Watermain & Fittings

NOTE: All chemicals and materials used in the operation of the drinking water system that come into contact with water within the system shall meet all applicable standards set by both the American Water Works Association ("AWWA") and the National Standards Institute ("ANSI") safety criteria standards NSF/60 and NSF/61.

a) Contractors 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 existing watermain. Contractors shall locate and make connections to existing watermain as shown on the Drawings in the presence of a licensed operator from the County or the County of Oxford's service provider.
The method of connecting shall be determined by the County Engineer. Where connections are to be made to concrete or steel mains, the installation will be such as to bare all coatings and materials in a proper manner. The Contractor shall submit a program for this work which shall be approved by the County Engineer before work commences.

b) Contractors shall not operate existing valves. Contractors shall notify any existing customers of shut downs. Notices and customer lists of the affected area will be supplied by the County or the County of Oxford's service provider.

c) The jointing of pipe shall be made in accordance with the manufacturer's instructions or as per AWWA Standards C600.

NOTE: No substitution of accessories will be permitted and only lubricants as supplied by the manufacturer will be permitted. The deflection of mechanical joint pipe, in order to form long radius curves, shall not exceed the manufacturer's recommendations.

d) Extreme care shall be taken to prevent contamination of the existing watermain and new closure fittings. All new piping and appurtenances placed in the connection of the new main and existing waterworks system must be disinfected with a 1-% solution of sodium hypochlorite or equivalent method. All connections to existing watermain shall be 6 m in length or less. Connection requirements longer than 6 m shall be flushed, pressure tested, and disinfected as per Part 5 – Testing of this specification.

3.15 Jointing of Push on Joint Pipes

a) The jointing of Push On pipes will be in accordance with the pipe manufacturer's specifications or as per AWWA Standard C600.

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.

3.16 Valves, Hydrants & Fittings

a) Valves, valve boxes and hydrants shall be installed plumb at all locations. The valve box will be installed on every valve in such a manner that no shock or stress shall be transmitted to the valve. The box shall be centered and plumb over the operating nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed.

Valve extension rods shall be installed on every valve when deeper than 1.8 m according to Detail D1834-1-1993.

b) Bends, crosses, tees and other fittings shall be installed where shown. Mechanical thrust restraint is required. Mechanical restraints to be installed as per 1.1 f) and manufacturers specifications. Any joints less than 6 m or one full length of pipe from fittings, etc. shall be restrained.

c) Prior to installation hydrants should be cycled to full open and full closed positions to ensure no internal damage or breakage has occurred during shipping and handling.

d) Hydrants shall be installed according to D1828-1-1993. Hydrant valves to be located on the street side of the hydrant 1.0 m from hydrant barrel unless otherwise approved by the County Engineer. Hydrants shall be set with the barrel vertical, outlets parallel to the roadway and at a depth suitable for the finished grade at the hydrant location. Temporary extension pieces may be necessary. Hydrants shall be installed using mechanical restraints.

e) Hydrants shall be set on concrete blocking, as shown on OPSD 1105.010. The excavation around the hydrant shall be filled to a minimum of 150 mm above the hydrant drain, with at least 0.50 cubic metres of 19 mm clean crushed stone, free from fine material, which shall be covered with filter cloth before backfilling. Hydrants shall not be backfilled before being inspected by the County Engineer.

f) Cast iron plugs or caps shall be installed on all dead-ends with the dead-end being equipped with a suitable blow-off.

g) Hydrants installed in areas of high water table may require drain outlets to be plugged to prevent contamination. Hydrants with plugged drains must be clearly marked and pumped dry after each use.

SECTION - D CORROSION PROTECTION AND INSULATION

3.17 Petrolatum Coating System

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 surfaces of fittings, flanged connections, 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, fittings, 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.

3.18 Cathodic Protection for PVC Watermain

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. The list below indicates the minimum anode requirements. 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 ductile iron, cast iron pipe fittings, joint restraints, copper water service lines, and attached to tracer wire at the ends of watermain. At the ends of watermain 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 watermain.

In areas of reconstruction where new non-metallic services are connected to existing copper services at property line, anodes shall be connected to the existing copper service pipe behind the curb stop on private property. Where existing metallic water service materials other than copper are encountered on private property, the home owner should be advised of replacement.

In subdivisions that have undeveloped lots with existing copper service lines on municipal property, an anode shall be installed on the copper service line during the connection inspection.

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 fittings, and joint restraints will be done using the "cad weld" method and coated with mastic. Anodes attached to copper services will be done using a silicon bronze ground clamp attached to the service pipe. The clamped connection shall be wrapped with DENSO tape or approved equal and compressed by hand around the connection. Installation shall be as per the manufacturer's specifications and recommendations.

Minimum Anode Sizing

Zinc – ASTM B-418 Type II

For new installations of fittings, joint restraints, and services.

Fittings and joint restraints	11 kg (24 lb) Z-24-48
Water Services 38 mm and over	11 kg (24 lb) Z-24-48
Water Services under 38 mm	5.5 kg (12 lb) Z-12-24

Magnesium – ASTM B-843 Type M-1C

For existing metallic watermain, services, or connection between cast iron / ductile iron watermains and PVC pipe.

Fittings and joint restraints	14 kg (32 lb) M-32-22
Water Services 38 mm and over	14 kg (32 lb) M-32-22
Water Services under 38 mm	7.7 kg (17 lb) M-17-20

3.19 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 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.

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.

Pre-Insulated Pipe

Pre-insulated watermain pipe may be used as an alternative. This option should be presented in the initial design phase prior to construction. The watermain pipe shall consist of a factory applied rigid polyurethane foam minimum 50 mm thick and an outer protective jacket. The outer protective jacket shall consist of a tape wrap – Scapa #366 polyethylene with UV inhibitor, or, a factory applied extruded black HDPE copolymer with UV inhibitor. Pre-insulated pipe shall be Urecon or approved equal, and shall be installed in strict conformity with the manufacturer's recommendations. Pre-insulated watermain pipe shall be approved by the County prior to installation.

PART 4 - SERVICE INSTALLATION

4.1 Connecting Services to Mains

Contractors shall give the County or the County of Oxford's service provider a minimum of 48 hours notice prior to connecting services. A licensed operator from the County or the County of Oxford's service provider shall be present for all connections.

All new water services 100 mm diameter and larger on private property must be tested and disinfected as per Part 5 – Testing and Part 6 – Disinfection of this specification. Private services will not be connected unless testing and sampling has been completed. A licensed operator from the County or the County of Oxford's service provider shall be present for the testing and sampling procedure. The installation of services shall be as per OPSS, OPSD and AWWA standards with the following exceptions/amendments.

a) **Direct tapping of services to PVC watermain is not permitted**. Water service connection main stops shall be tapped into the main at a 45 degree angle. All service connections shall be tapped in with the main under working pressure.

   One continuous piece of service pipe shall run from the watermain to the curb stop and service box at the street line.

Curb stops shall be installed with electrical thaw nuts on the private side facing away from the watermain.

Services of 25 mm shall be installed as per D1838-1-2007. Services of 32 mm, 38 mm and 50 mm in diameter shall be installed as per D1839-1-2007. Couplings shall not be permitted unless the service length exceeds 30 m (for copper) between the main and the curb stop. The minimum cover shall be 1.8 m below final grade from the watermain to the building.

b) Services of 100 mm diameter and larger shall be connected by either cutting out a section of the main and installing a tee with a cut-in sleeve or by using a tapping sleeve and valve. The type of connection will be determined by the County or the County of Oxford's service provider.

c) Non-metallic services shall have inside diameters matching typical C.T.S. service size requirements.

Tracer wire is required on all non-metallic service material and shall be bound to the electrical thaw nut on the main stop and to the electrical thaw nut on the curb stop. The tracer wire to be used for services shall be of the same size and type used for watermain placement.

d) The County or the County of Oxford's service provider will make all connections unless otherwise agreed in writing. The Contractor will install service connections in subdivisions or new developments.

e) All tapping machines and other required equipment to be used onsite shall be satisfactory to the County or the County of Oxford's service provider.

f) For repairs or replacement of copper services to Ductile Iron pipe, tapping to the following maximum sizes will be allowed:

on 100 mm mains	19 mm only
on 150 mm mains	up to 30 mm maximum
on 200 mm or larger mains	up to 38 mm maximum

NOTE: Saddles should be used on all taps > 25 mm (on ductile pipe).

Stainless Steel Double bolt saddles shall be used on all services for PVC watermain from 25 mm to 50 mm dia. Saddles for PVC pipe shall be full circumference wide band with stainless steel band, nuts, bolts, and outlet.

g) When connections are to be made to mains other than cast iron or ductile iron, they shall be done under special instructions from the County Engineer.

4.2 Services

Cathodic protection if required shall be as per SECTION – D Corrosion Protection and Insulation.

a) Curb boxes shall be installed vertically, flush with finished grade, and located on the property lines. If extensions are required only threaded couplers shall be used. **Set-screw type extensions are not permitted.**

b) All service boxes located in concrete, asphalt, or interlocking brick surfaces shall be clean and operable upon assumption. All service boxes located in concrete, asphalt, or interlocking brick surfaces shall have a 100 mm inside diameter PVC pipe 300 mm in length placed around the cap and flush with the surface.

c) Blue painted stakes 50 mm x 100 mm shall be placed during trench restoration to mark the termination of the water service. These stakes shall extend from service invert to a minimum of 600 mm above finished grade.

A record of service location must be produced for the As-Constructed drawings and provided digitally to the County.

Water services are to be located on these drawings by showing proper plan view locations which includes any bends and sweeps between the connection at the watermain and the right-of-way, tie-in or curb stop. **Depth below existing ground and invert elevation shall be indicated on the service locate sheet drawing.**

d) All services shall require extensions from the curb stop to a minimum of 600 mm above finished grade. These tail pieces will be used for testing and air relief purposes only. Material used for tail pieces shall be PEX, PE 3408/3608 Series 200 CTS, or approved equal and shall conform to AWWA C901.

Upon completion of testing, service tails will be capped and fastened to marker posts.

4.3 Alignment and Grade

a) Water services shall be installed perpendicular to the property line.

b) New water services shall be located to connect to existing services and/or as detailed on Figure 1.1 Section 1.

c) All services shall have a minimum depth of 1.80 m from the watermain to the property line. When replacing existing services located at lot corners, curb stops should be placed a minimum of 1.50 m away from lot corners in a manner as not to disturb survey markers.

4.4 Service Terminations

Terminations shall be as per OPSD 1104.010 and 1104.020. For 100 mm and larger the service shall terminate with a restrained cap threaded with a 50mm plug for air release.

PART 5 – TESTING

5.1 Testing General

The Contractor shall give the County or the County of Oxford's service provider a minimum of 48 hours notice prior to testing. A licensed operator from the County or the County of Oxford's service provider shall be present for the testing procedure, and is required to fill out and submit the Watermain Inspection Report. Submission of Form F035 Watermain Inspection Report is required as final acceptance of the testing procedure. Testing shall be conducted as per OPSS and AWWA requirements with the following exceptions/amendments.

a) The Contractor shall test all watermain, in such lengths or sections as directed by the County Engineer. The Contractor shall provide all labour, water, pumps, gauges, caps, stoppers, air release cocks, pipe work and other apparatus required to complete the tests.

b) The Contractor shall supply the County Engineer with the pressure gauges intended to be used prior to the first test in order that they may be checked for accuracy.

All equipment used by the Contractor in carrying out the testing shall be approved by the County Engineer.

c) Under no circumstances will the test lengths be permitted to exceed 600 m unless approved by the County Engineer.

d) Pipe crossings on bridges, under rivers, creeks, railway tracks, Provincial roads, and other right-of-ways shall be tested separately.

5.2 Initial Flushing and Swabbing

Prior to testing and disinfection, and under the supervision of the County or the County of Oxford's service provider, all dirt and foreign matter in the system shall be removed. Pipelines shall be cleaned by flushing and swabbing.

On projects supervised by the City of Woodstock or the Town of Tillsonburg swabs may be inserted as construction progresses. On County supervised projects swabs shall be inserted after initial flushing is complete. The placement of swabs during construction on County projects is not permitted unless authorized by the County Engineer. All new and rehabilitated watermains shall be cleaned and swabbed after the water services have been tapped.

Swabbing

- Swab diameter is 1.25 times the outside diameters up to and including 300 mm and 1.50 times the outside pipe diameters greater than 300 mm.

- each branch of the new mains will be swabbed using three sequentially numbered swabs.

- velocity of the swabs shall not be less than 0.76 m/sec.

5.3 Test Pressure

Test pressure shall be 1035 kpa (150 psi). This will be measured at the highest elevation in the test section. The test section shall be filled slowly with water and all air shall be removed from the pipeline. A period of 24-hours for absorption should be allowed before starting the test. The test section shall be subjected to the specified continuous test pressure for 2 hours.
In areas where watermain has been rehabilitated with structural or cement mortar lining, pressure testing to 1035 kPa (150 psi) is not required. Rehabilitated watermain shall be tested at system pressure.

A visual inspection is required for all fittings, valves, and connection points where entry into the piping has occurred, prior to backfilling, to verify there is no leakage.

Testing and inspection will be completed to the satisfaction of the County or the County of Oxford's service provider.

5.4 Blocking & Blanking

Once the Contractor has been notified by the Engineer to test a section of the pipeline the Contractor shall check that all relevant open ends are capped off and that all bends, tees, crosses, etc. are adequately restrained to safely withstand the test pressure.

5.5 Air Release Taps

The Contractor may be directed by the County Engineer to excavate certain portions of the pipeline in order to provide taps for the release of air without additional payment.

Air release taps shall be installed at all high points to accomplish this before the test pressure is applied.

5.6 Filling Pipe

The section of the pipeline to be tested shall be slowly filled with water obtained by the Contractor at his own expense from a source approved by the Engineer. The Contractor shall ensure that all air has been removed from the section of the pipeline to be tested.

5.7 Leakage Test

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

b) The Contractor shall provide the County Engineer with the necessary equipment for measuring the exact quantity of water added in order to maintain the test pressure throughout the duration of the test.

c) The County or the County of Oxford's Service Provider shall calculate the allowable leakage for testing purposes. Allowable leakage for Polyethylene shall be as per OPSS 441.07.24.

If any section under test discloses a leakage greater than that allowed, the Contractor shall locate and repair the defective area or areas at his own expense.

PART 6 - DISINFECTION

6.1 General

a) After the conclusion of flushing, swabbing, pressure and leakage tests to the complete satisfaction of the County Engineer, the Contractor shall disinfect the newly constructed or rehabilitated water system including all sumps and chambers that are intended to hold potable water as per MOECC Watermain Disinfection Procedure, AWWA Standard for Disinfecting Watermain, C651, OPSS 441.07.25. and the National Standards Institute ("ANSI") safety criteria standards NSF/60 and NSF/61.

The two acceptable methods are:

1) *A known quantity of water and a known quantity of Chlorine* mixed in an approved tanker truck to achieve the required concentration of chlorine. This mixture will then be used to fill the new water main.

2) *A modified continuous feed method*. This will be a known flow of water in the new water main injected with a known flow of chlorine to achieve the required concentration of chlorine.

Note: The method, materials, quantities, and equipment to be used will be submitted to the County Engineer for approval before the construction starts. Equipment used should be specific to testing and disinfecting and not used for any other purposes.

b) The Contractor shall complete the disinfection within ten days of being directed to do so.

c) The Contractor shall give the County or the County of Oxford's service provider a minimum of 48 hours written notice prior to disinfecting. A licensed operator from the County or the County of Oxford's service provider shall be present for the disinfecting procedure.

6.2 Contractor to Supply

The Contractor shall supply all labour, water, materials, chemicals, flushing taps, disinfecting agents, etc. necessary to complete the disinfection and final flushing of the system to the satisfaction of the County Engineer.

6.3 Point of Application

The new watermain shall be kept isolated from the existing waterworks system using a physical separation until satisfactory bacteriological testing has been completed and accepted by the County or the County of Oxford's service provider. Water required to fill the new main for hydrostatic pressure testing, disinfection and flushing may be supplied through a temporary connection between the existing water system and the new main. Temporary connections shall be as per Detail D1836-1-2006.

The temporary connection shall include an appropriate testable reduced pressure zone (RPZ) check valve assembly used **ONLY** above ground along with isolation valves located on each side of the device.

The County or the County of Oxford's service provider staff will require the Contractor to provide written certification of the backflow prevention device's operation in accordance with CAN/Canadian Standards Association-B64 Series Manual each time the device is installed. See also Part-1 Section 1.6 Backflow prevention. The backflow prevention device shall be isolated from the new main during the hydrostatic pressure test by placing the isolation valves in the "closed" position.

It will be necessary to re-establish the connection after completion of the hydrostatic pressure test to disinfect and flush out the chlorinated water prior to the final connection of the new main to the waterworks system.

6.4 Disinfection

Chlorination methods for disinfecting newly constructed watermains shall be as per AWWA C651. Minimum contact times, initial chlorine concentrations, and maximum allowable decreases in chlorine concentration shall be as per MOECC Watermain Disinfection Procedure.

For the slug method the initial chlorine concentration shall be equal to or greater than 100 mg/L. The maximum allowable decrease in chlorine concentration shall be not less than 25 mg/L.

For the continuous feed method the initial chlorine concentration shall be equal to or greater than 25 mg/L. The maximum allowable decrease in chlorine concentration shall be not less than 40% of the initial chlorine concentration to a maximum of 50 mg/L.

Water entering the system shall be controlled to flow slowly during the application of the chlorine solution. The use of Dole valves may be required.

The County or the County of Oxford's service provider shall record the duration of disinfection, as well as the initial dose and remaining residual at the end of the contact time.

6.5 Final Flushing

After the 24 hour retention period, heavily chlorinated water should not remain in prolonged contact with pipe.

In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main, fittings, valves, hydrants, blow-offs, branches and all service tails.

It is unacceptable to allow heavily chlorinated water to remain in a main over a weekend or a 48 hour period.
Disposing of the heavily chlorinated water:

Dechlorination of water shall be as per AWWA C655.

The environment to which the chlorinated water is to be discharged shall be inspected prior to final flushing. All chlorinated water used for testing, flushing, and disinfecting watermains shall be disposed of safely. Any discharge of chlorinated water that will cause damage to the environment, including aquatic and terrestrial species shall require a neutralizing chemical to be applied to thoroughly neutralize the residual chlorine.

When necessary, Federal, Provincial, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water. Chlorinated water may not be discharged to any water body.

Discharge of heavily chlorinated water into sanitary sewers is not permitted.
Acceptable means of disposal is by discharge into a storm sewer or open environment (drainage ditch) with a free chlorine residual of 0.0 mg/L (i.e. no detectable level of chlorine). The concentration of chlorine in the water leaving the main will be approved by a certified operator from the County or the County of Oxford's service provider on site. When discharging into the open environment or storm sewer, it will be the responsibility of the contractor to ensure the effectiveness of the dechlorinating process.

The contractor shall provide a written plan for the dechlorinating process which will be submitted to the County or the County of Oxford's service provider for approval prior to discharge.

6.6 Connection Samples

The free chlorine residual must be between 0.50 mg/l to 1.50 mg/l. After final flushing and before the new watermain is approved for connection to the existing water system, two sets[1] of water samples shall be taken at least 24 hours apart.

[1] The minimum for a section of water main under 350 m. long is two results each for EC and TC taken 24 to 48 hours apart.

Samples shall be collected every 350 meters, from the end of the line, and from each branch.

Only a certified municipal operator or person designated by the Municipality (OWRA Reg. 128/04) shall collect bacteriological samples.

Initial samples as described above will be paid for by the County. Contractors shall contact the County of Oxford for information regarding current approved laboratory services.

All water samples are to be analyzed at a laboratory that is accredited and licensed to perform microbiology tests on regulated municipal drinking water. If additional samples are required they will be done at the Contractor's expense.

The results should be emailed to water_analytical@oxfordcounty.ca directly from the laboratory or may also be faxed directly to the County of Oxford at 519-421-4711.

For sampling performed in the City of Woodstock or the Town of Tillsonburg results should be forwarded to the Water Operations Manager at these locations.

Samples will be taken by an operator employed by the County or the County of Oxford's service provider who will also provide the sample container, complete the appropriate paperwork (chain of custody) for samples going to the laboratory and seal the container or sample bottles.

The requested tests, free chlorine residual, time the sample was taken, location and the operator's name must be on the chain of custody. Samples submitted without appropriate paperwork (i.e. chain of custody) will be rejected by the testing laboratory and not analyzed.

Contractors will arrange for delivery of samples to the lab if a pick up cannot be conveniently arranged.

Samples should be transported in a container with ice or cold packs to maintain a temperature between 4^{o} and 10^{o} Celsius, until delivered to the laboratory.
Samples must be received at the laboratory within the holding time required for the type of sample. Samples taken from water mains isolated from the municipal consumers are identified as NR (not regulated under Reg. 170/03).

The minimum acceptable requirements for bacteriological tests are:

E. coli	0 colonies per 100 ml
Total coliform	0 colonies per 100 ml

If background bacteria are reported, the result shall not be accepted above 200 colonies per 100 ml. If an HPC (heterotrophic plate count) is analyzed, the result shall not be accepted above 500 colonies per 1 ml.

6.7 Commissioning of New Main

Contractors must provide in writing, a method of dewatering in order to protect the final connection from contamination of the new or existing watermain with foreign material or groundwater. Should contamination occur, the entire cost of disinfecting the mains will be at the Contractor's expense.

One method of dewatering is to provide a crushed stone sump in the trench and sufficient pumps to control the water being drained from the main, assuring no backflow into the pipes from the trench.

All new piping and appurtenances placed in the connection of the new main and existing waterworks system must be disinfected with a 1-% solution of sodium hypochlorite or equivalent method.

When all of the initial tests including the bacteriological samples are satisfactory, approval from the County or the County of Oxford's service provider must be obtained prior to connecting the main to the existing water system.

Contractors shall give the County or the County of Oxford's service provider a minimum of 48 hours notice prior to connecting.

A licensed operator from the County or the County of Oxford's service provider must be present on site during the removal of the temporary connection and until the connection to the existing waterworks has been completed.

6.8 Contractor's Liability

The Contractor shall be liable for all damage to equipment, property, persons, etc. caused by or as a result of the pressure and leakage tests performed and the flushing, disinfection and cleansing of the system, pipeline and accessories.

6.9 Removal of Equipment

Upon completion of the testing and disinfection of each section, the Contractor shall remove all ancillary equipment and plug all holes left by the air release taps in a manner satisfactory to the County Engineer.

6.10 Defects in Pipework

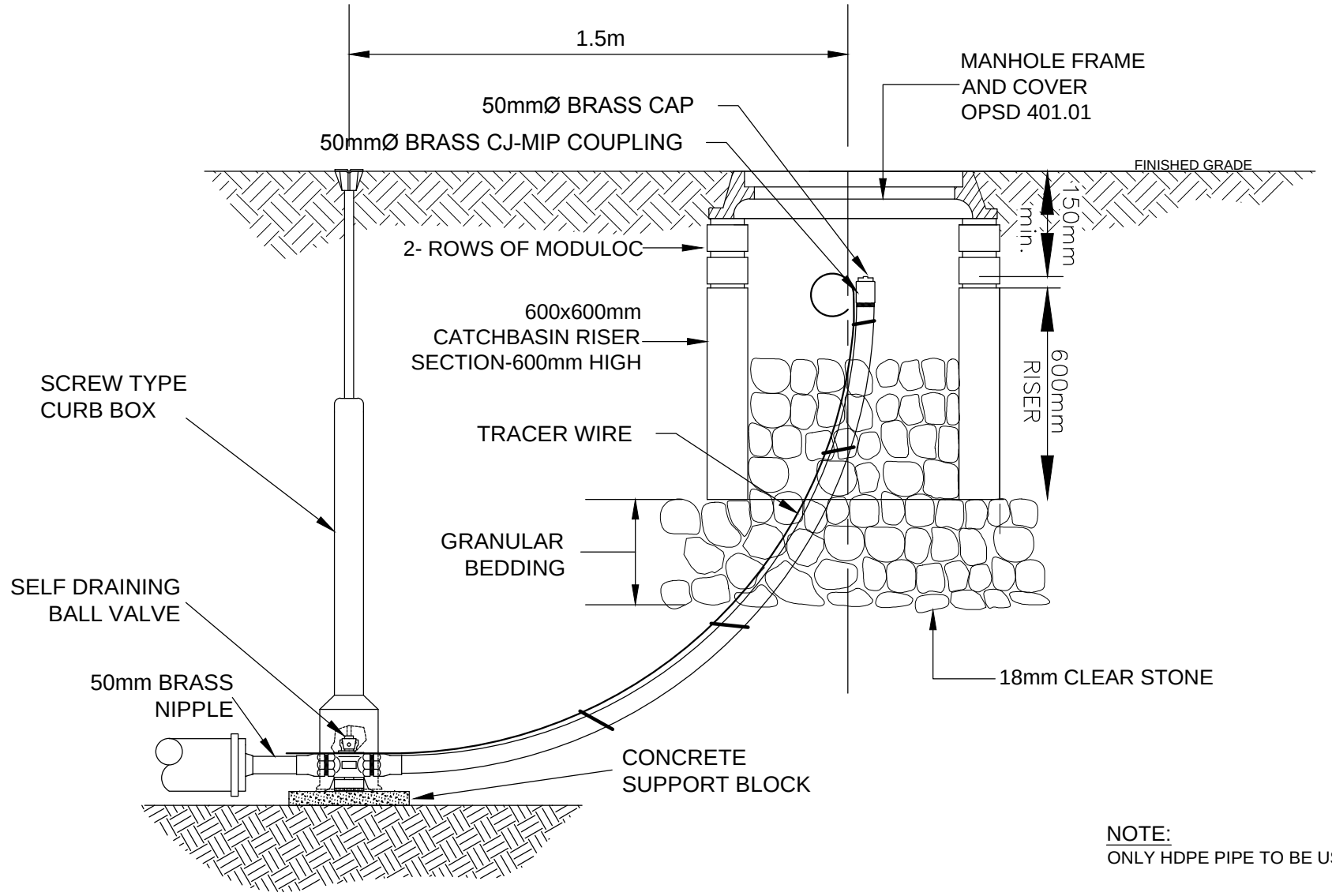
The Contractor shall, at his own expense, carry out all remedial work necessary to rectify any defects revealed in watermain, pipelines and pipe work.

Oxford County

Growing stronger together

SECTION 3 – WATERMAIN

DETAILS

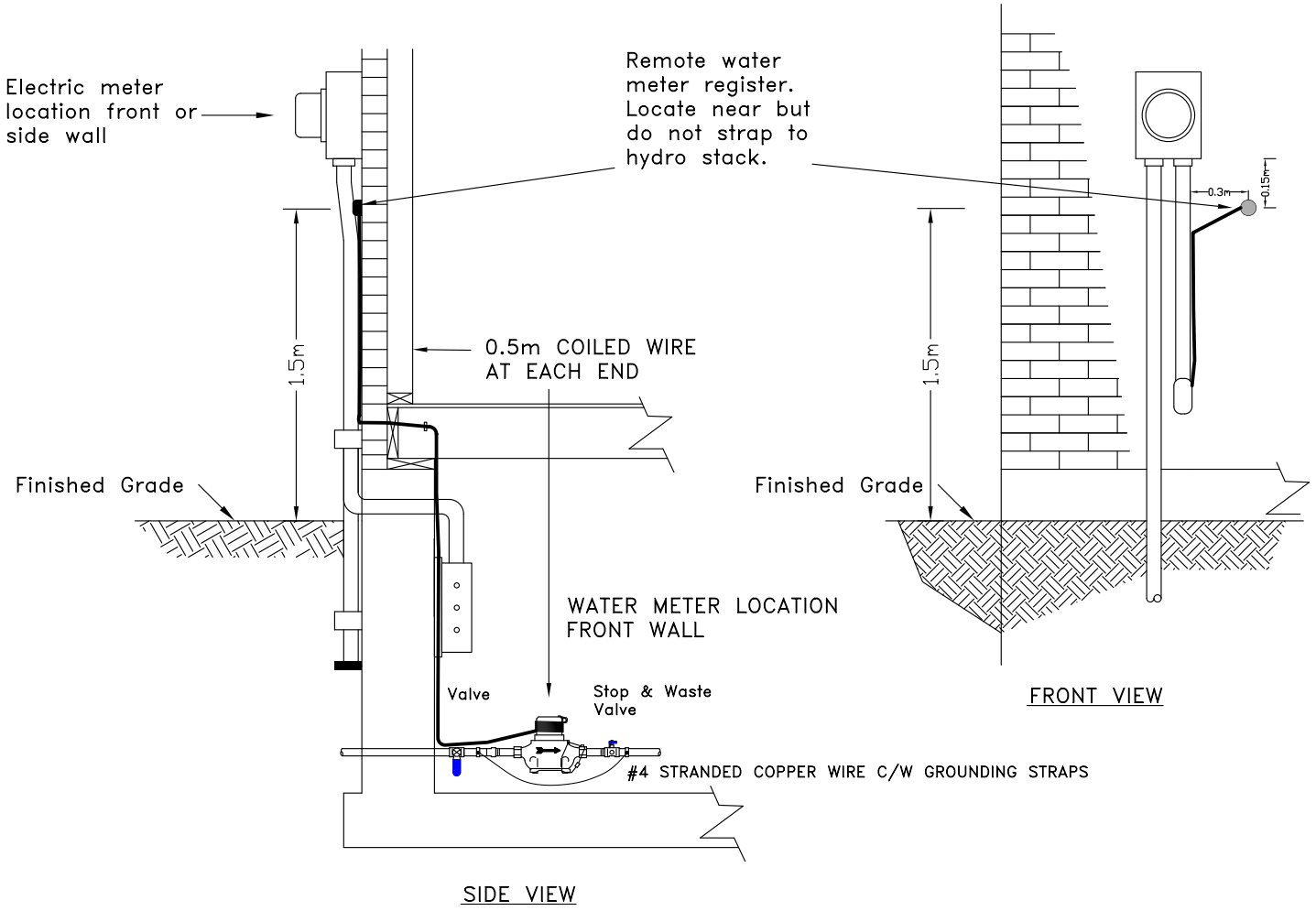


NOTE:
ONLY HDPE PIPE TO BE USED.

OXFORD COUNTY

50mm BLOW OFF-MANHOLE COVER

DWG	D 1803-1-2013	DATE	SEPT. 2013	REV	2



NOTES:

1) ONE SERVICE PER RESIDENTIAL UNIT (1.7m MINIMUM COVER FROM FINISHED GRADE).

2) WATER METER TO BE INSTALLED BY CONTRACTOR/OWNER (SUPPLIED BY LOCAL MUNICIPALITY AT OWNERS EXPENSE) COMPLETE WITH BALL VALVES ON BOTH SIDES OF METER (VALVE ON DOWNSTREAM SIDE SHOULD BE DRAINING TYPE). WATER METERS MUST BE INSTALLED IN **HORIZONTAL POSITION**.
METER GAPS (SPACERS) TO BE INSTALLED IN COMMUNITIES WITHOUT WATER METERS. CONTRACTOR/OWNER MUST ENSURE METER/SPACER IS ACCESSIBLE IN FUTURE FOR METER CHANGES/READS ETC.

3) REMOTE WATER METER REGISTER TO BE LOCATED IMMEDIATELY BELOW ELECTRIC METER BUT NOT SECURED TO STACK. REGISTER SUPPLIED WITH METER BY COUNTY OF OXFORD/TOWNSHIP OFFICE. WE REQUEST THE CONTRACTOR/ELECTRICIAN INSTALL THE WIRE FROM THE ELECTRIC METER LOCATION TO THE WATER METER LOCATION. THE 22 GAUGE - 3 COND. SOLID COPPER WIRE IS TO BE OBTAINED AT THE COUNTY OF OXFORD/TOWNSHIP OFFICE. NO SPLICES, NO DIRECT BURY OF REMOTE WIRE.

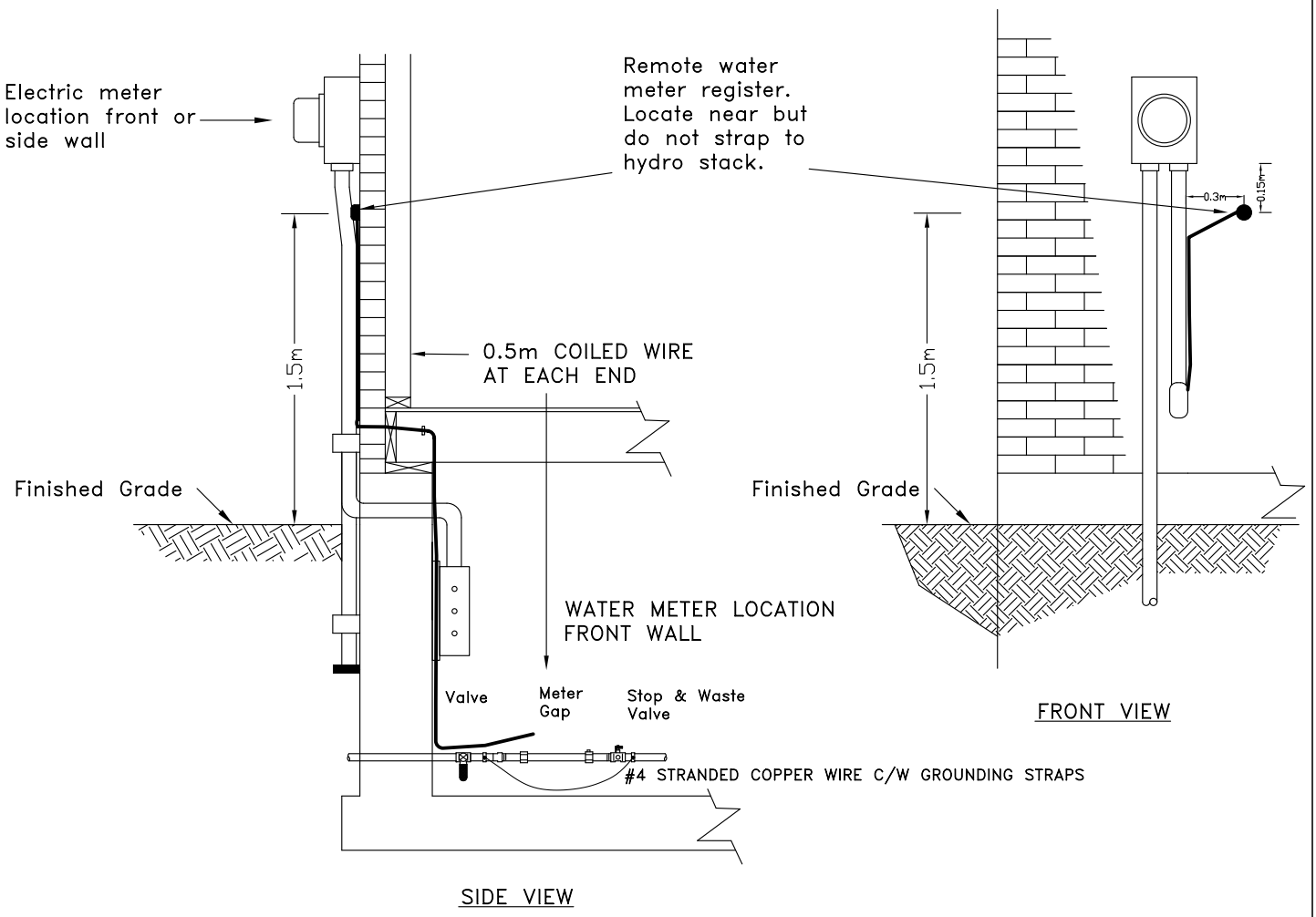
4) WATER METER, REMOTE, REMOTE WIRE AND CONNECTION AT PROPERTY LINE TO BE INSPECTED BY THE COUNTY OF OXFORD WHEN COMPLETED. CALL 539-9800, 48 HOURS IN ADVANCE TO SCHEDULE AN APPOINTMENT.

5) COMMERCIAL/INDUSTRIAL SERVICES WILL BE ASSESSED ON AN INDIVIDUAL BASIS.

OXFORD COUNTY

WATER METER AND REMOTE REGISTER

DWG D 1805-1-2004	DATE NOV. 2008	REV 1



NOTES:

1) ONE SERVICE PER RESIDENTIAL UNIT (1.7m MINIMUM COVER FROM FINISHED GRADE).

2) WATER METER TO BE INSTALLED BY CONTRACTOR/OWNER (SUPPLIED BY LOCAL MUNICIPALITY) COMPLETE WITH BALL VALVES ON BOTH SIDES OF METER (VALVE ON DOWNSTREAM SIDE SHOULD BE DRAINING TYPE). WATER METERS MUST BE INSTALLED IN **HORIZONTAL POSITION**.
METER GAPS (SPACERS) TO BE INSTALLED IN COMMUNITIES WITHOUT WATER METERS. CONTRACTOR/OWNER MUST ENSURE METER/SPACER IS ACCESSIBLE FOR FUTURE METER CHANGES/READS ETC.

3) REMOTE WATER METER REGISTER TO BE LOCATED IMMEDIATELY BELOW ELECTRIC METER BUT NOT SECURED TO STACK. REGISTER SUPPLIED WITH METER BY COUNTY OF OXFORD/TOWNSHIP OFFICE. WE REQUEST THE CONTRACTOR/ELECTRICIAN INSTALL THE WIRE FROM THE ELECTRIC METER LOCATION TO THE WATER METER LOCATION. THE 22 GAUGE - 3 COND. SOLID COPPER WIRE IS TO BE OBTAINED AT THE COUNTY OF OXFORD/TOWNSHIP OFFICE. NO SPLICES, NO DIRECT BURY OF REMOTE WIRE.

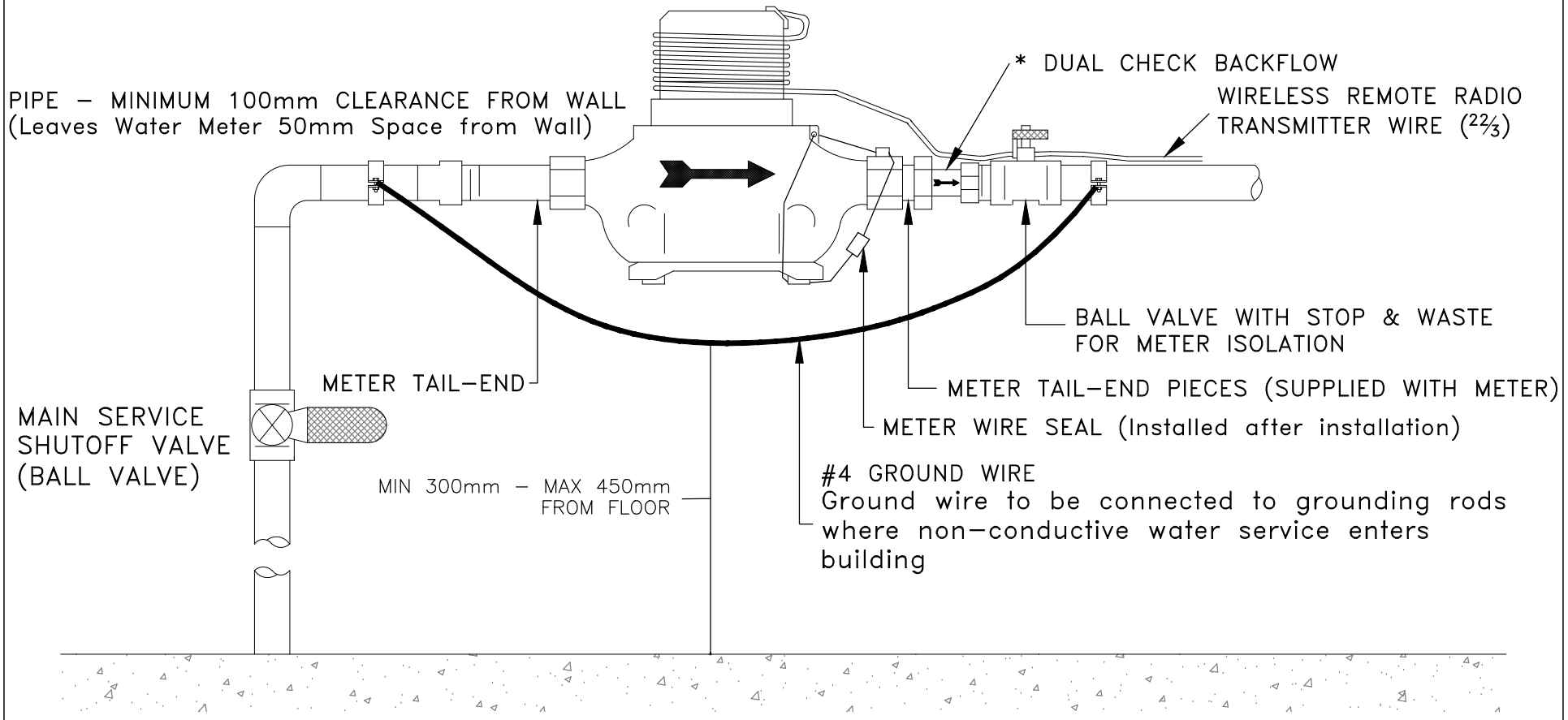
4) WATER METER, REMOTE, REMOTE WIRE AND CONNECTION AT PROPERTY LINE TO BE INSPECTED BY THE COUNTY OF OXFORD WHEN COMPLETED. CALL 519-539-9800, 48 HOURS IN ADVANCE TO SCHEDULE AN APPOINTMENT.

5) COMMERCIAL/INDUSTRIAL SERVICES WILL BE ASSESSED ON AN INDIVIDUAL BASIS.

OXFORD COUNTY

WATER METER GAP AND REMOTE WIRE INSTALLATION

DWG D 1806-1-2004	DATE NOV. 2008	REV 1

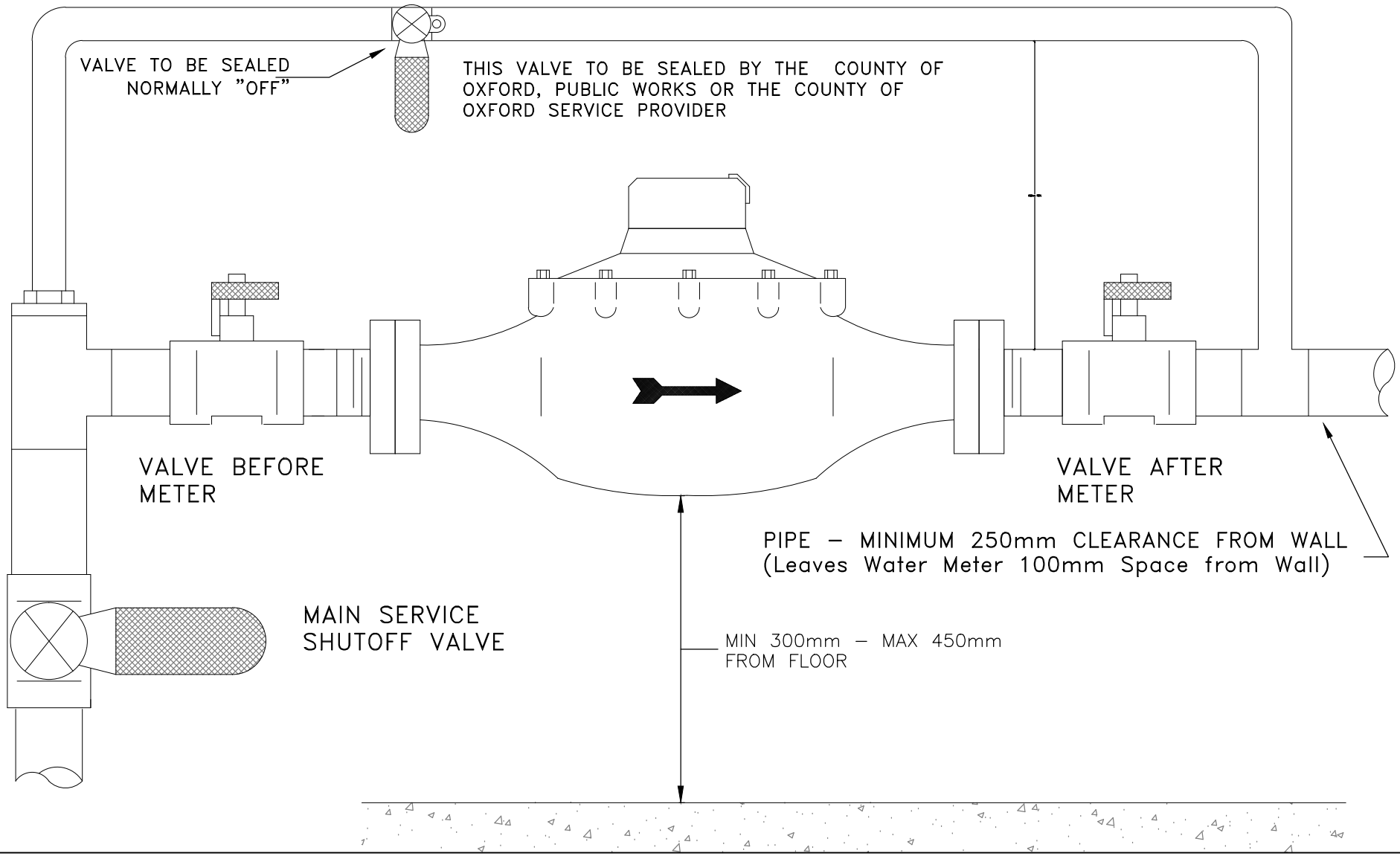


* -CITY OF WOODSTOCK REQUIREMENT

OXFORD COUNTY

5/8" to 1" WATER METER WITH VALVES ON BOTH SIDES-RESIDENTIAL & COMMERCIAL

DWG	D 1807-1-2004	DATE	NOV 2008	REV	2



OXFORD COUNTY

1" to 2" WATER METER WITH BY-PASS RESIDENTIAL & COMMERCIAL

DWG	D 1811-1-2004	DATE	NOV. 2008	REV	2

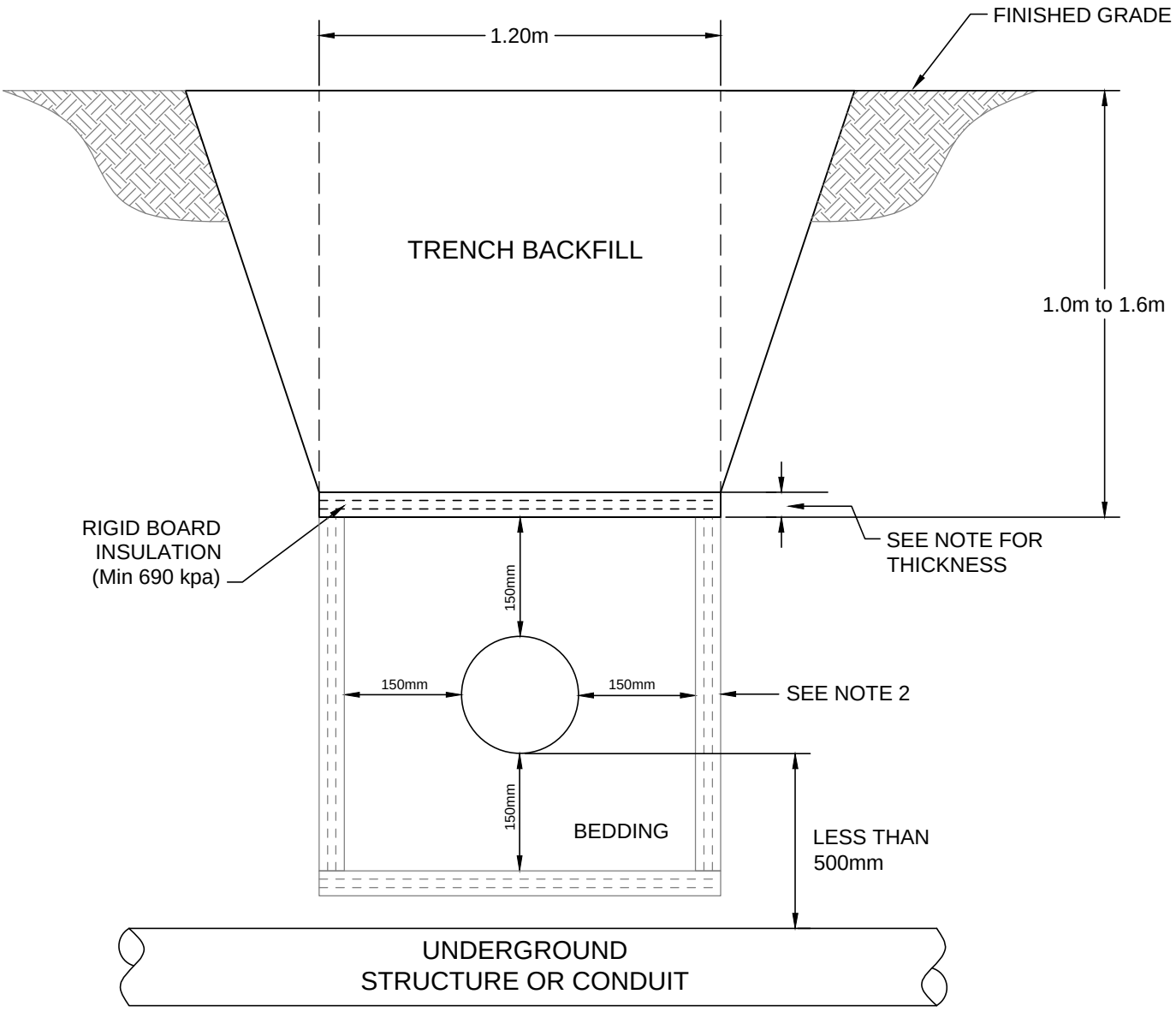
1.

- 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.

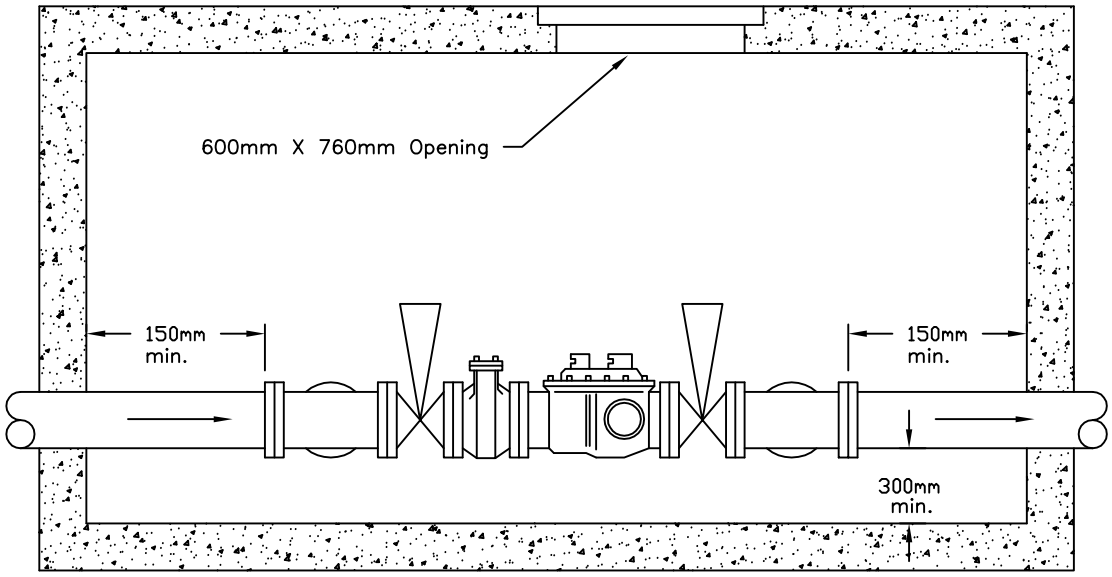
4. INSULATION IS REQUIRED ON ALL NEW OR RECONSTRUCTED WATER SERVICES IF ADEQUATE COVER AS LISTED ABOVE CANNOT BE ACHIEVED.



OXFORD COUNTY

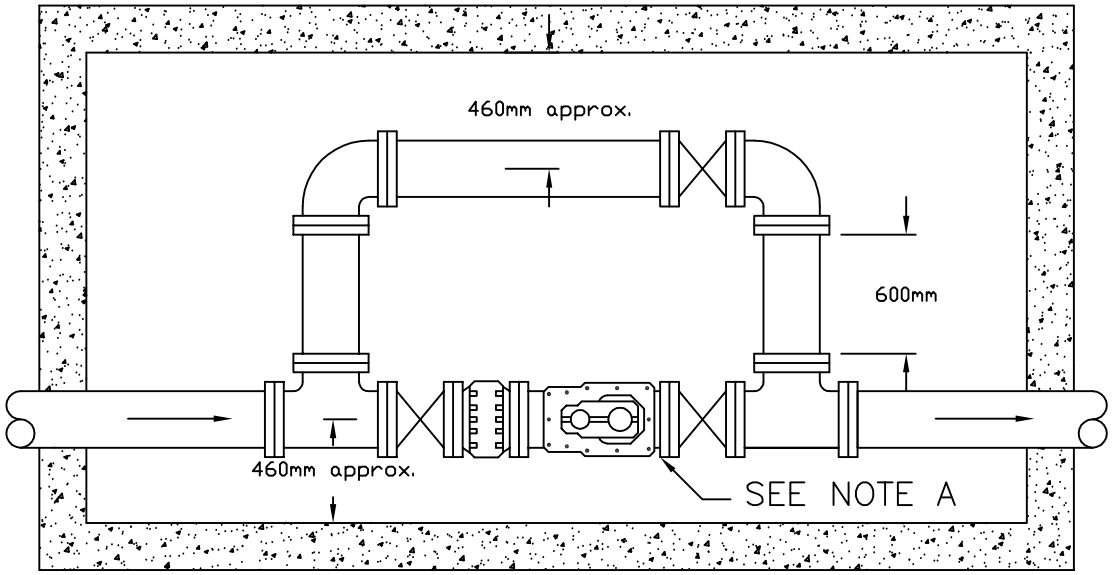
RIGID BOARD INSULATION-SLAB TYPE
FOR WATERMAIN AND SERVICES/LOW PRESSURE SANITARY SERVICES

DWG	D 1812-1-2007	DATE	NOV. 2007	REV	1



General
Notes:

- Minimum size pit is: 1.83m High
  3.05m Long
  1.83m Wide
- Valving, bypass and manhole to be supplied by customer
- Inquiries may be directed to the water meter supervisor.
- The County of Oxford requires shut–off valves on both sides of all water meters.
- Meters should be installed in a location no more than 450mm from the floor and in an open position for ease of reading and maintenance.



Note A:

- 6" Turbine Meter required
- 6" Fire Flow Strainer
- 6" Uniflange connection on victaulic coupler spacer in line with meter/strainer required (minimum 200mm required)
- 8"to6" reducer may be made outside of chamber

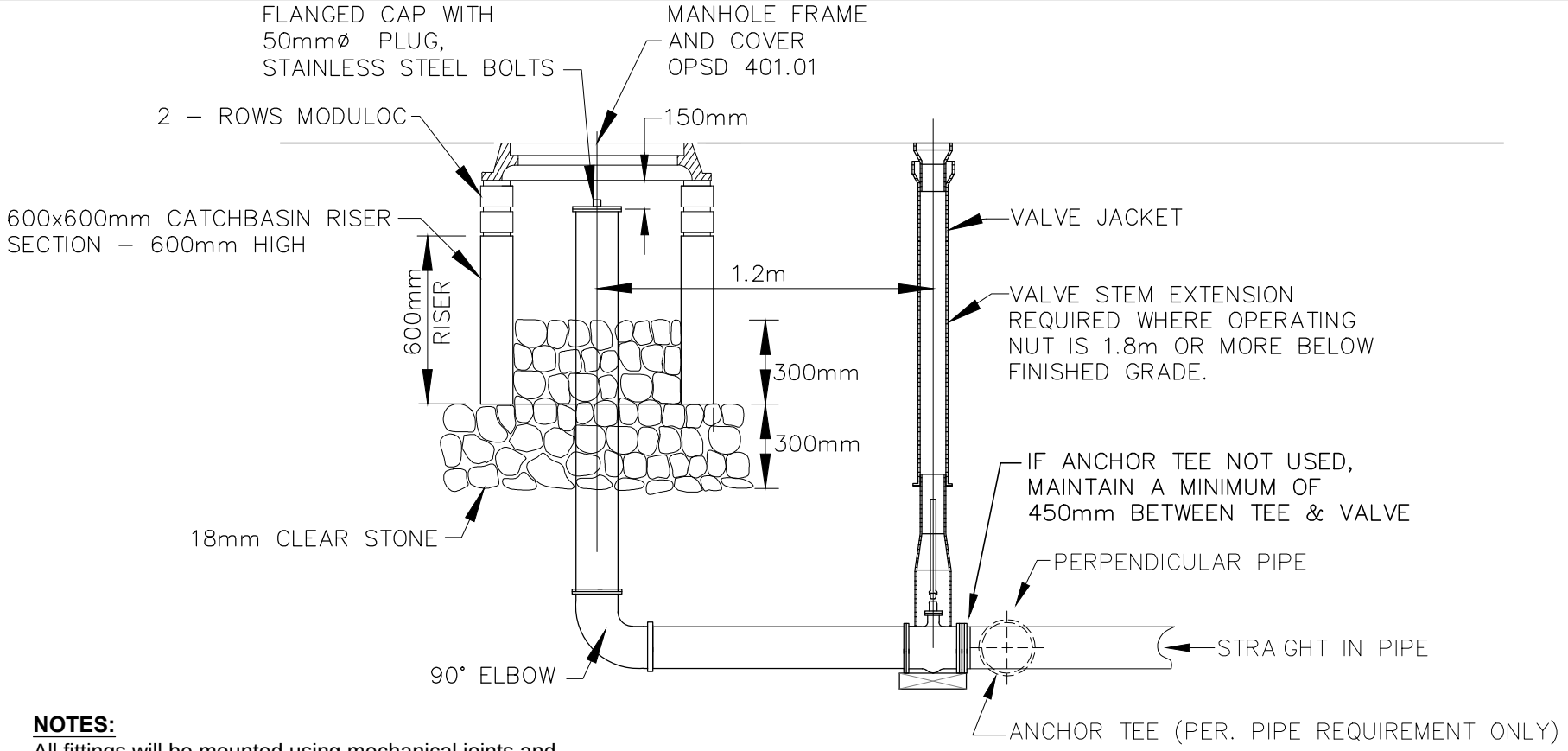
OxfordCounty
Growing stronger together

REV#: 1
12/2005

D1818-1-2005

OXFORD COUNTY STANDARD DRAWING

TYPICAL WATER METER IN CHAMBER



NOTES:

All fittings will be mounted using mechanical joints and will be restrained using Uni-Flange restraints or approved alternative at all thrust restraint locations.

This detail is applicable for 100mm Ø to 200mm Ø launch size.

Swab launches 250mm and larger shall be as directed by Oxford County.

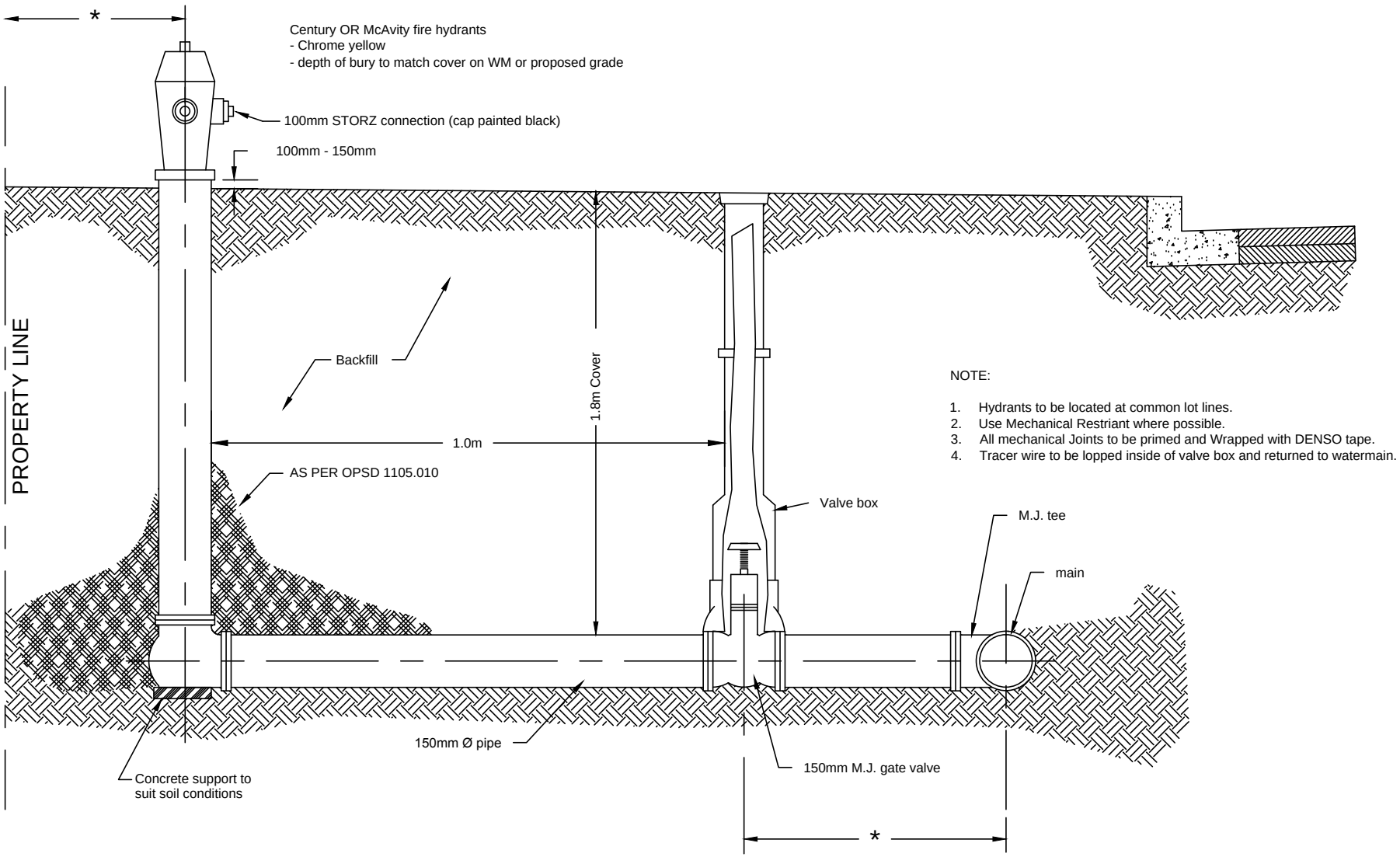
MAIN SIZE	LAUNCH SIZE	TEE TYPE
100mm	100mm	STANDARD
150mm	150mm	ANCHOR
200mm	150mm	ANCHOR
250mm	200mm	STANDARD
300mm	200mm	STANDARD

OXFORD COUNTY

100 TO 200mm SWAB LAUNCHER DETAIL

DWG	D 1822-1-2005	DATE	MARCH 2005	REV	2

* DIMENSIONS ARE AREA SPECIFIC



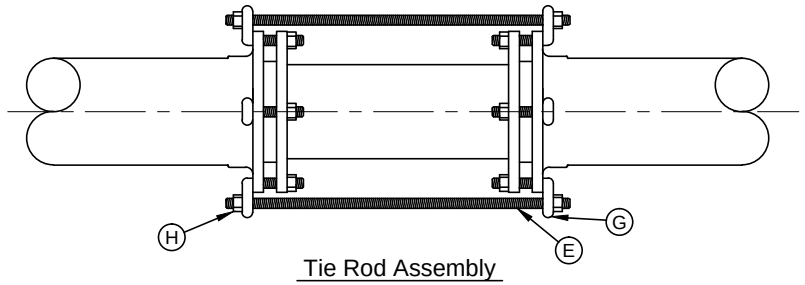
NOTE:

1. Hydrants to be located at common lot lines.
2. Use Mechanical Restriant where possible.
3. All mechanical Joints to be primed and Wrapped with DENSO tape.
4. Tracer wire to be lopped inside of valve box and returned to watermain.

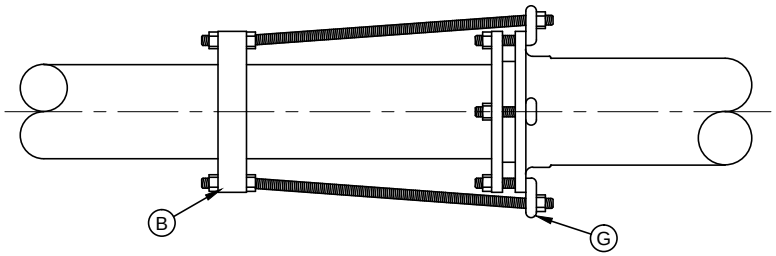
OXFORD COUNTY

FIRE HYDRANT & VALVE INSTALLATION

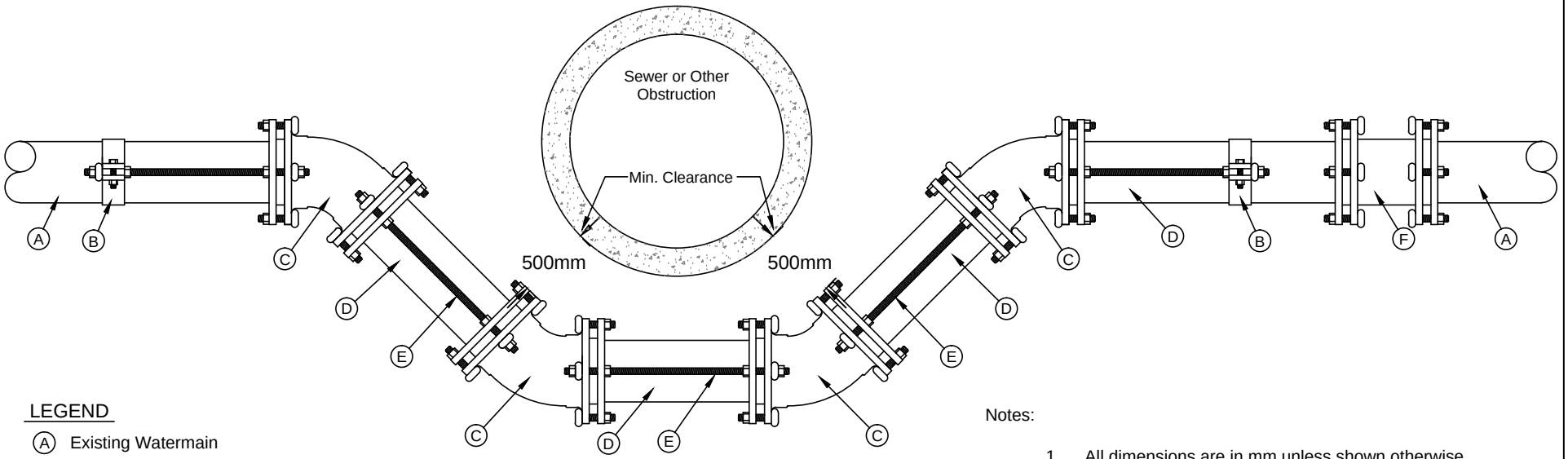
DWG	D 1828-1-1993	DATE	04/2007	REV	4



Tie Rod Assembly

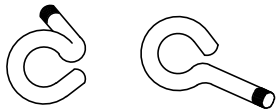


Tie Rod Assembly Using Clamp



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

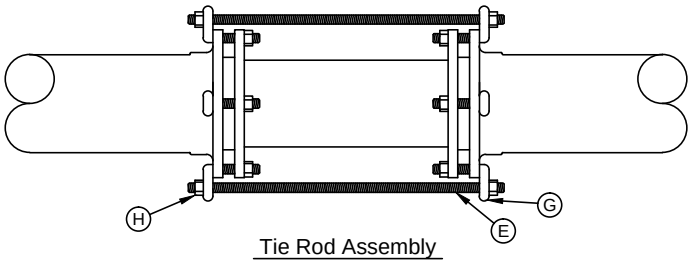
Notes:

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

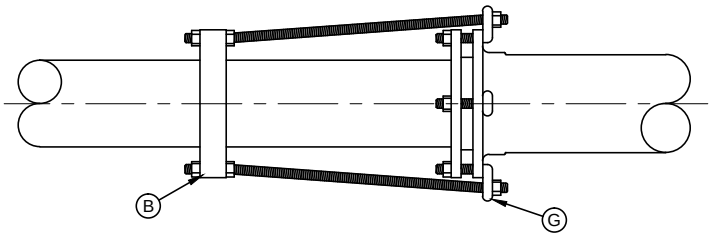
OXFORD COUNTY

MECHANICAL JOINT OFFSET INSTALLATION-UNDER

DWG	D 1832-1-1993	DATE	NOV. 2008	REV	2



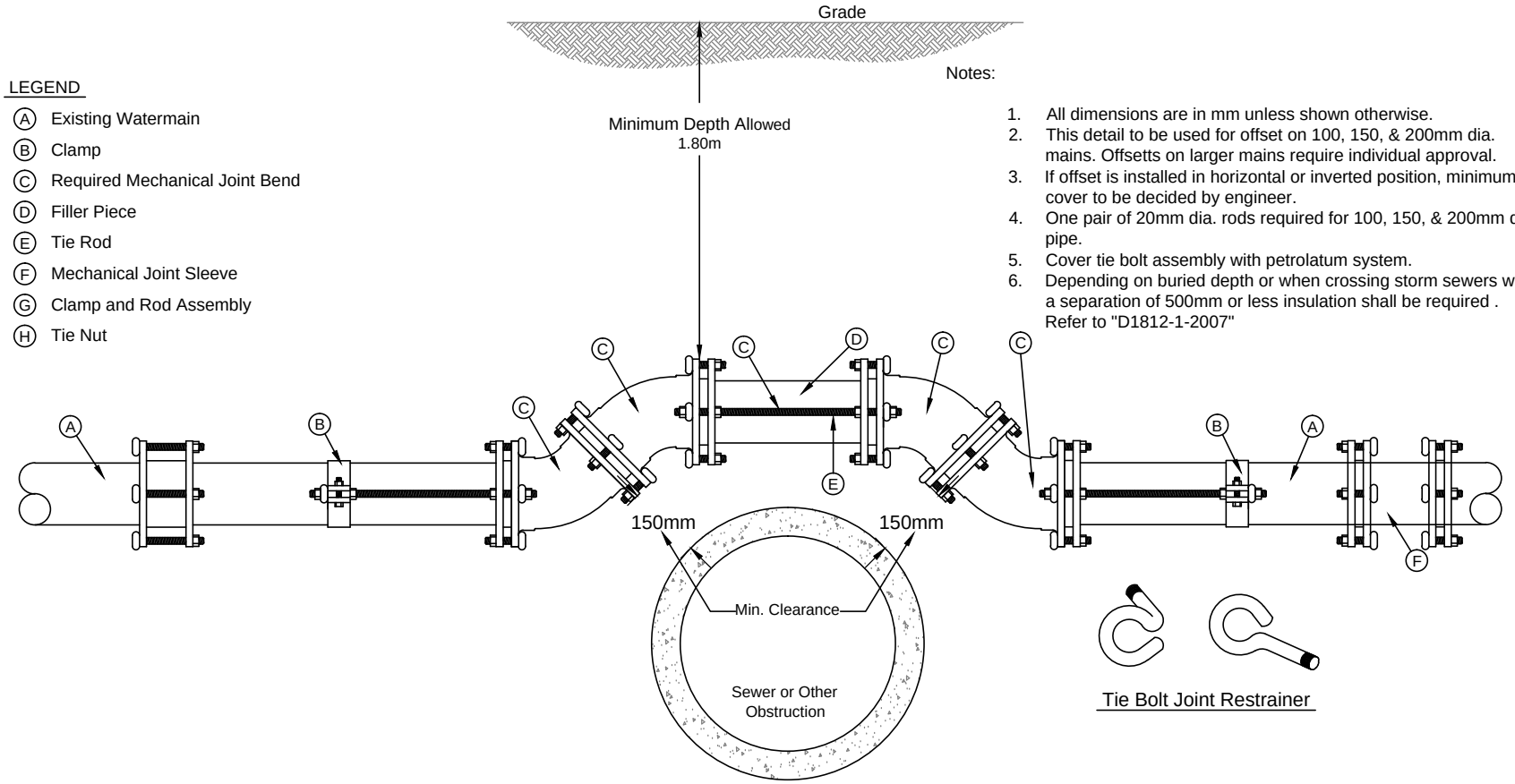
Tie Rod Assembly



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) Clamp and Rod Assembly
- (H) Tie Nut



Notes:

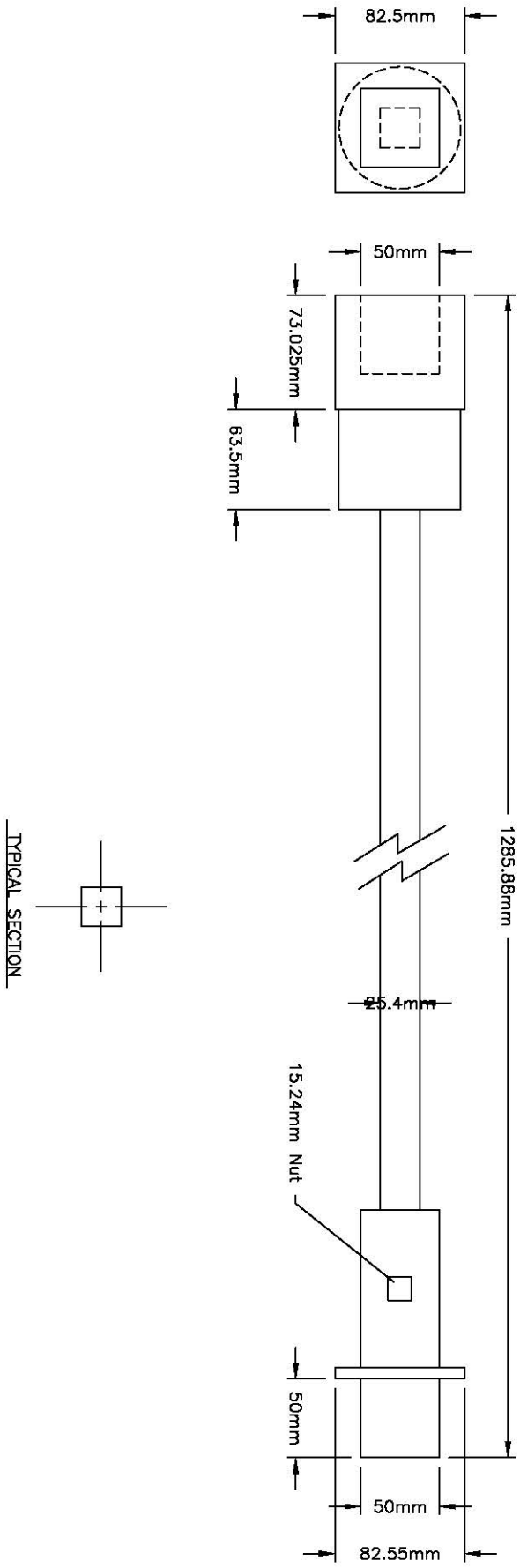
1. All dimensions are in mm unless shown otherwise.
2. This detail to be used for offset on 100, 150, & 200mm dia. mains. Offsetts on larger mains require individual approval.
3. If offset is installed in horizontal or inverted position, minimum cover to be decided by engineer.
4. One pair of 20mm dia. 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"

Tie Bolt Joint Restrainer

OXFORD COUNTY

MECHANICAL JOINT OFFSET INSTALLATION-OVER

DWG	D 1833-1-1993	DATE	NOV. 2008	REV	2



OXFORD COUNTY STANDARD DRAWING

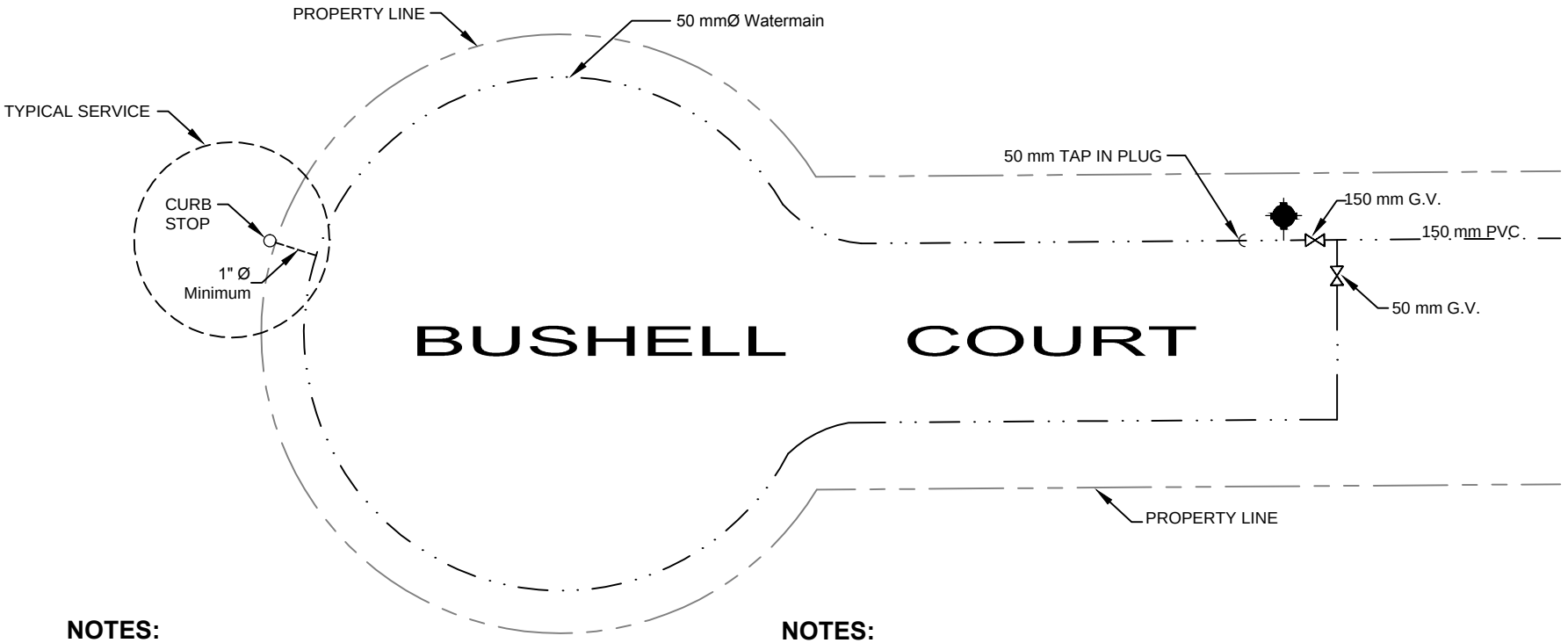
STANDARD VALVE ROD EXTENSION PIECE FOR 100mm & LARGER VALVES

REV#:

MM/YYYY

OxfordCounty
Growing stronger together

D1834-1-1993



NOTES:

1. Minimum service size is 25mm.
2. Maximum of 7 services off of 50mmØ.
3. All fittings shall be brass compression, copper tubing size.
4. Restrain joints where required.
5. Material shall be PEX or P.E. series 200.

NOTES:

6. All Non-Metallic pipe shall require stainless steel inserts.
7. Tracer wire to be installed as per oxford County design guidelines and supplement specifications.

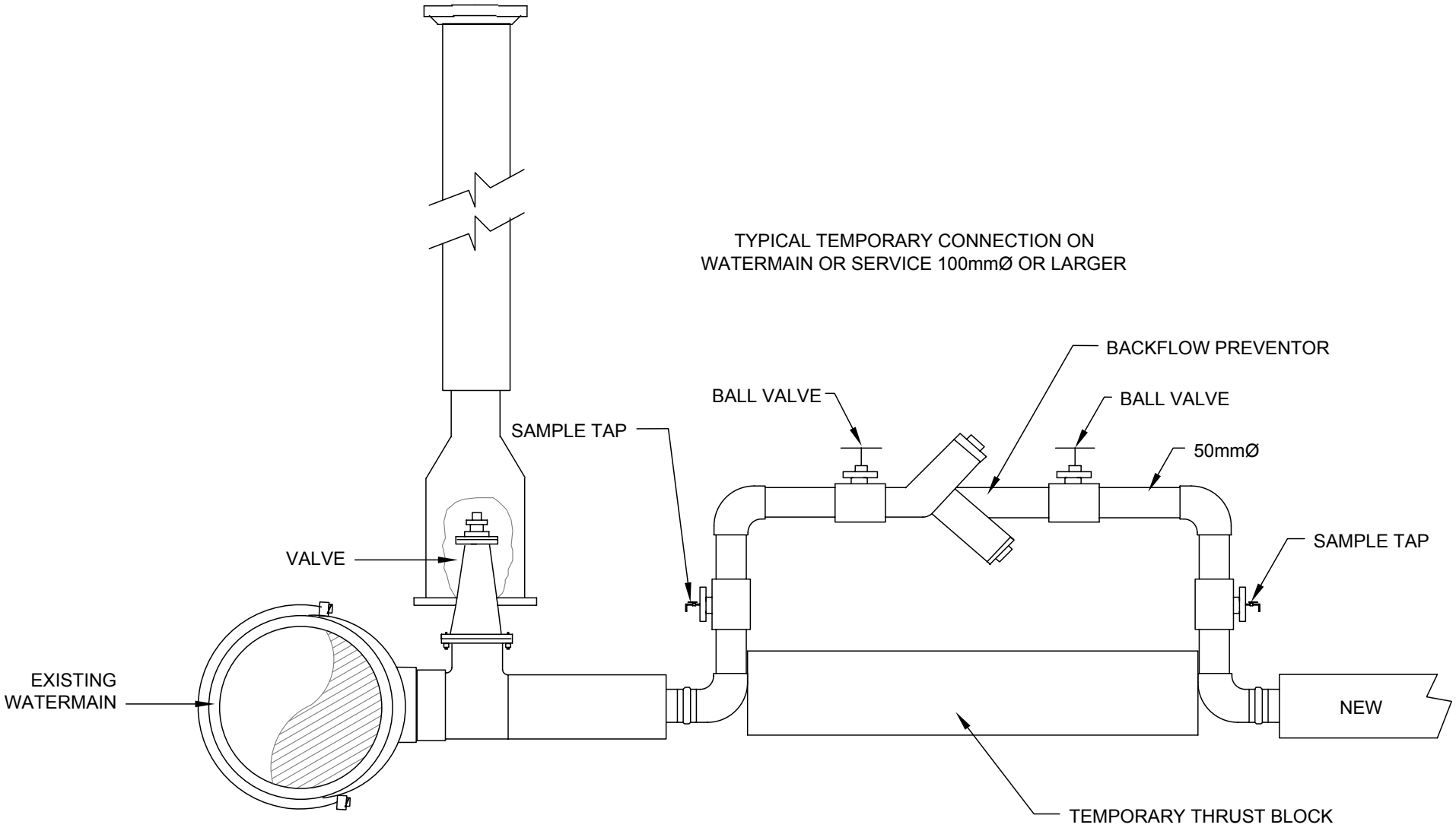
OXFORD COUNTY STANDARD DRAWING

50mm WATERMAIN DETAIL FOR CUL-DE-SAC

REV#: 3

04/04/16

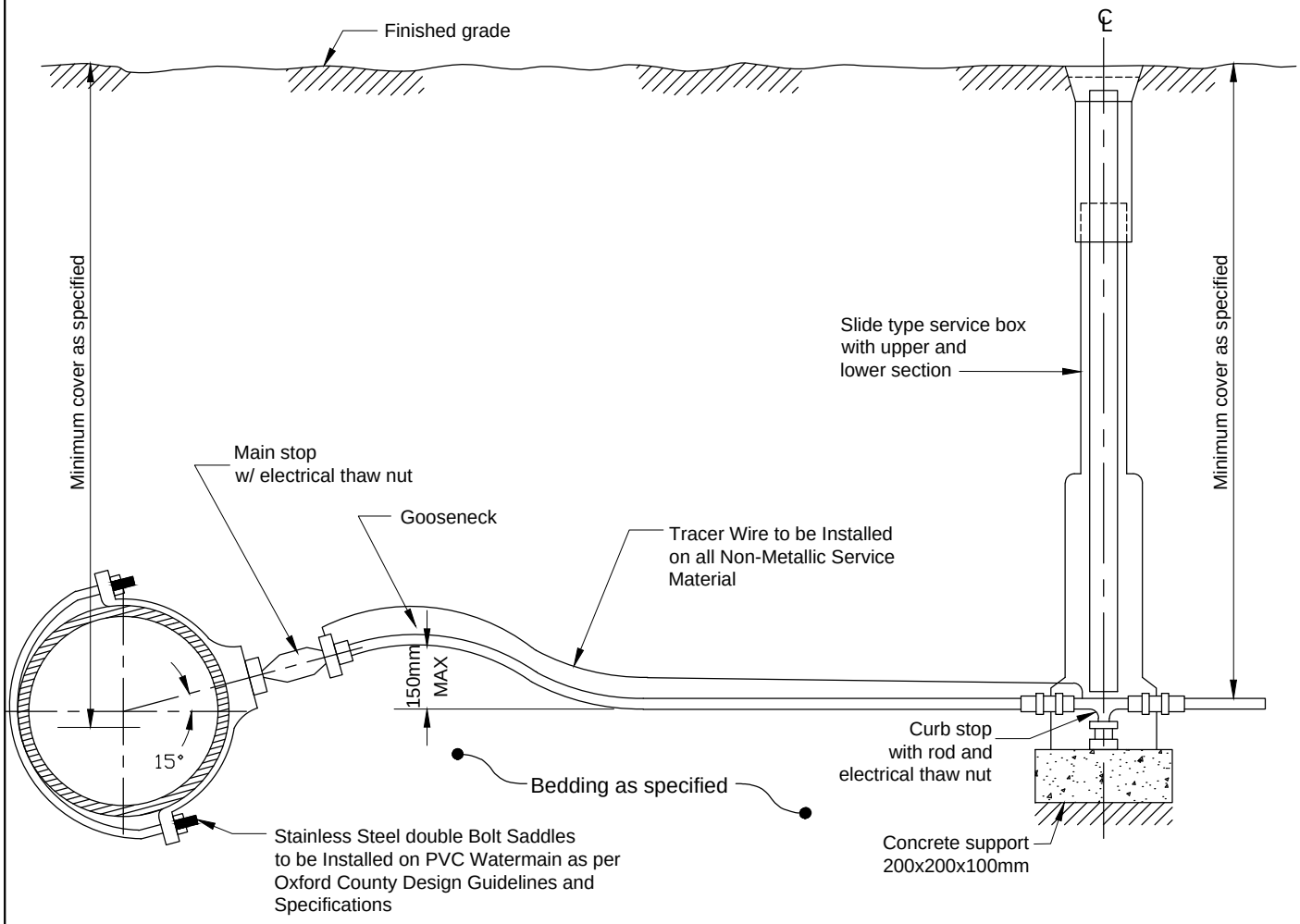
D1835-1-2006



OXFORD COUNTY

BACK FLOW PREVENTOR-EXISTING TO NEW WATERMAIN

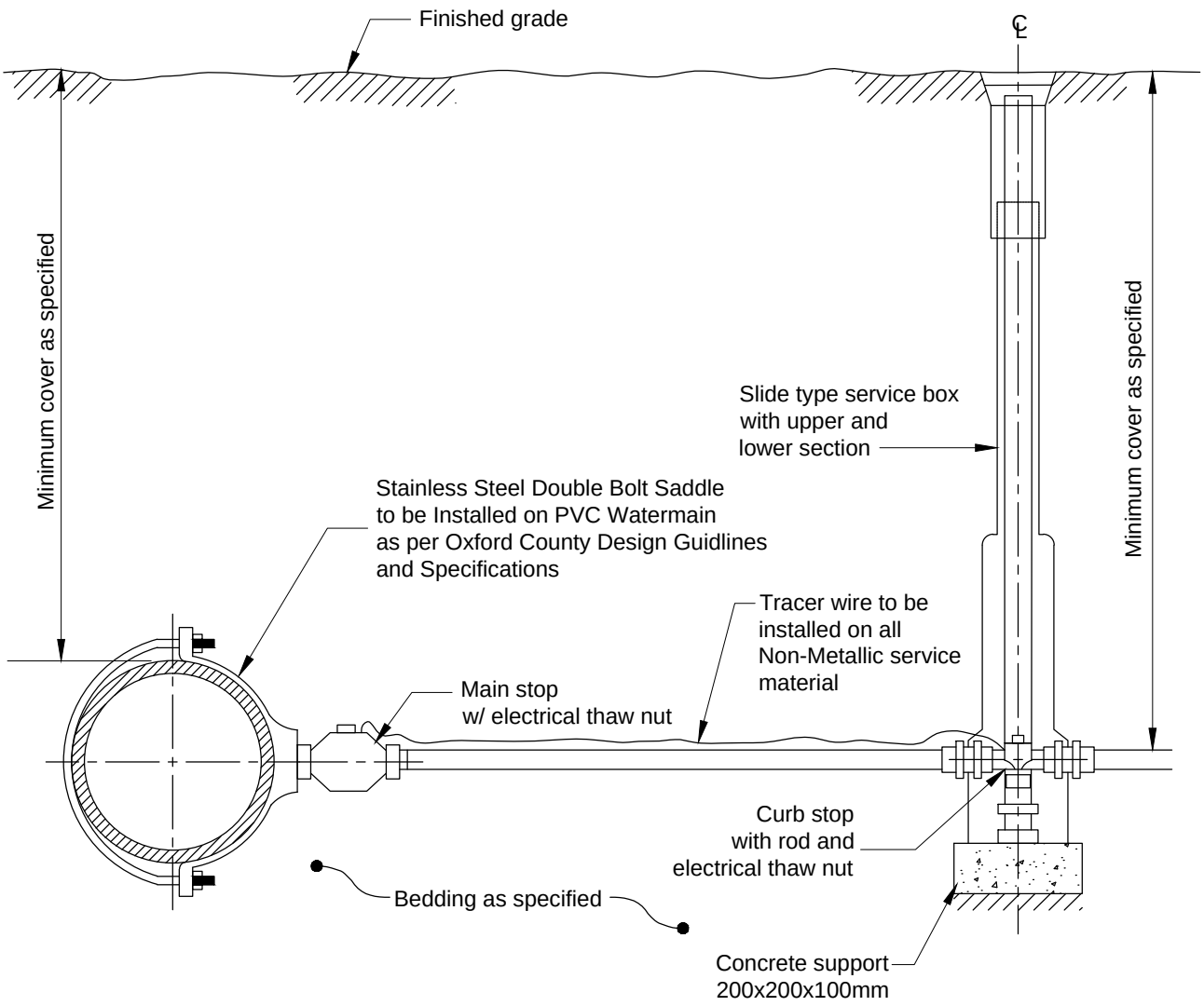
DWG D 1836-1-2006	DATE NOV. 2008	REV 1



NOTES:

1. Non-Metallic Service shall Be Minimum 25mmØ.
2. For Plastic service pipes, install main stop at 15° above horizontal with a minimum 1.2m long gooseneck.
3. Service connections to plastic watermains to be made using Stainless Steel Double Bolt service saddle.
4. Couplings shall not be permitted between the main stop and the curb stop.
5. Direct Tap Ductile Iron pipe with approved tool with standard AWWA inlet thread.
6. All water services to be Installed 90° to the longitudinal axis of the watermain.
7. All dimensions are in millimeters unless otherwise shown.
8. Non-Metallic services require tracer wire to be installed as shown above.
9. Service Material as per Oxford County Design Guidelines and specifications.

OXFORD COUNTY STANDARD DRAWING	REV#:	OxfordCounty Growing stronger together
WATER SERVICE CONNECTION 25mm DIAMETER	Dec 2013	D1838-1-2007

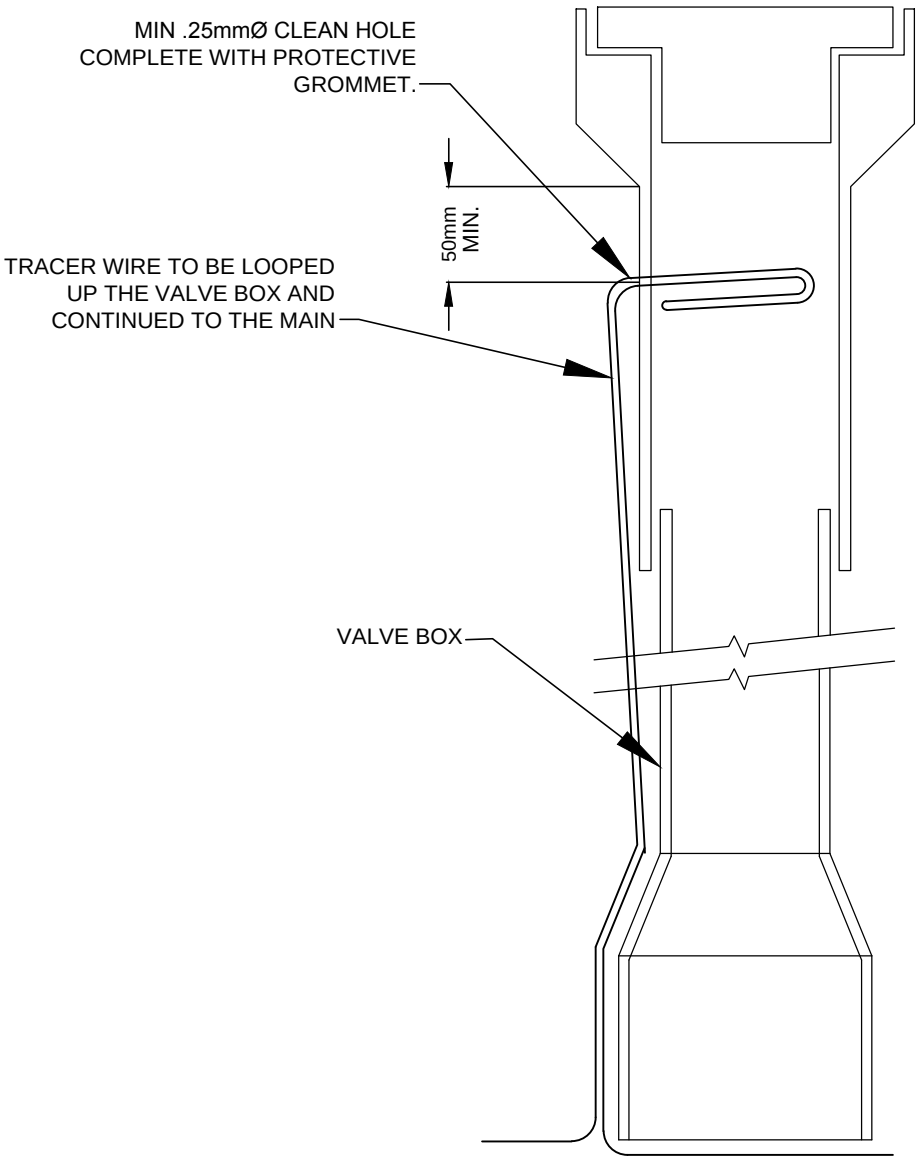


NOTES:

1. Service Material as per Oxford County Design Guidelines and Specifications.
2. Any Junction made in service pipe between main stop and curb stop to be made with approved couplings.
3. All water services to be installed 90° to the longitudinal axis of the watermain.
4. All dimensions in millimeters unless otherwise shown.
5. Non-Metallic services require tracer wire to be installed as shown above.

OXFORD COUNTY STANDARD DRAWING	REV#:
WATER SERVICE CONNECTION 32mm, 38mm & 50mm DIAMETER SIZES	Dec 2013
	D1839-1-2007

Oxford County
Growing stronger together



NOTES:

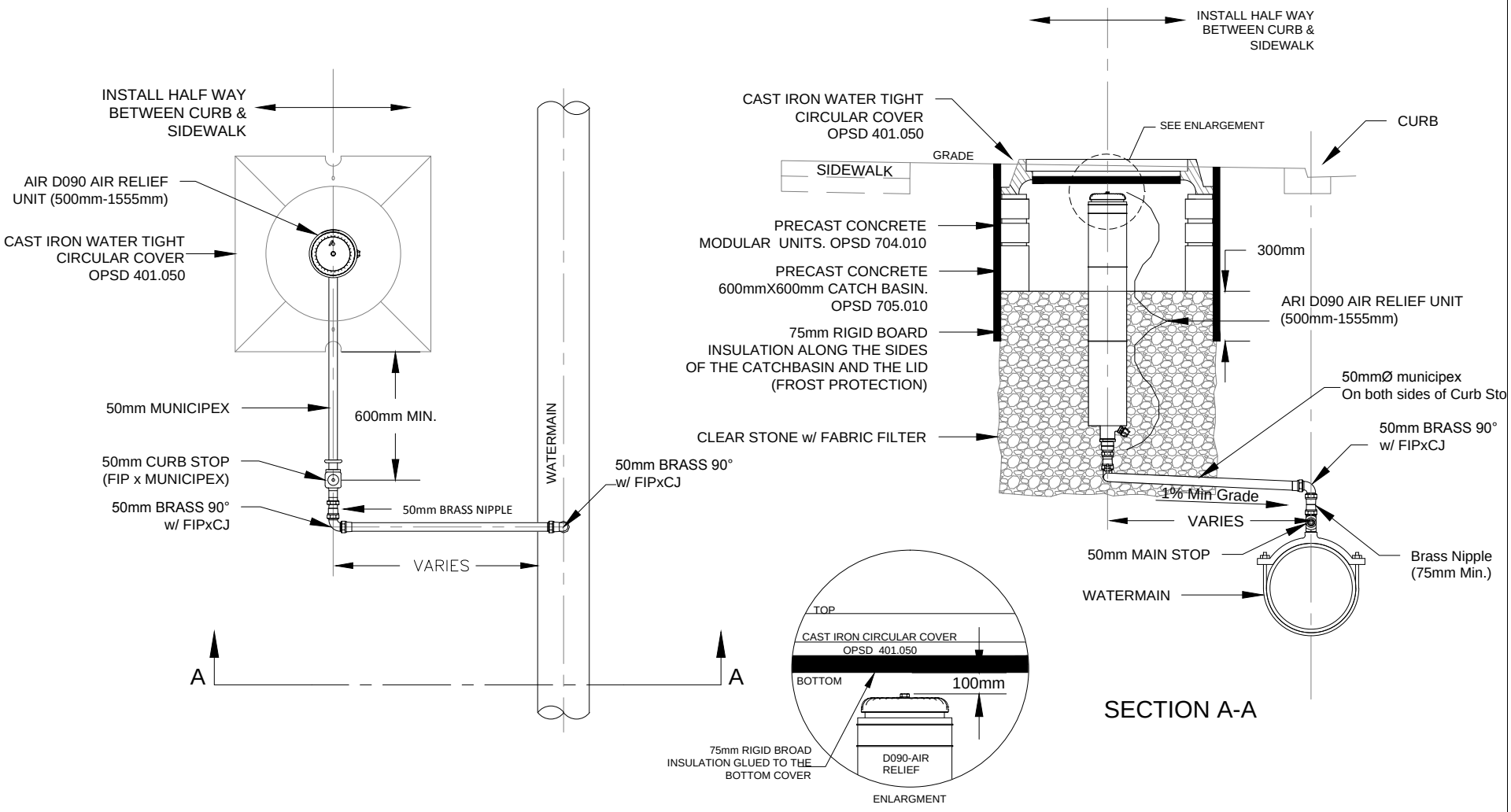
1. TRACER WIRE- #12 AWG SOLID CCS TRACING WIRE AS PER OXFORD COUNTY DESIGN GUIDELINES AND SUPPLEMENT SPECIFICATIONS.

2. TRACER WIRE SHOULD BE LOOPED UP THE OUTSIDE OF ALL VALVE BOXES AND EXTENDED INTO THE VALVE BOX BY AT LEAST 500mm THROUGH HOLE 50mm BELOW THE BOTTOM OF THE COVER BELL.

OXFORD COUNTY

TRACER WIRE VALVE BOX INSTALLATION

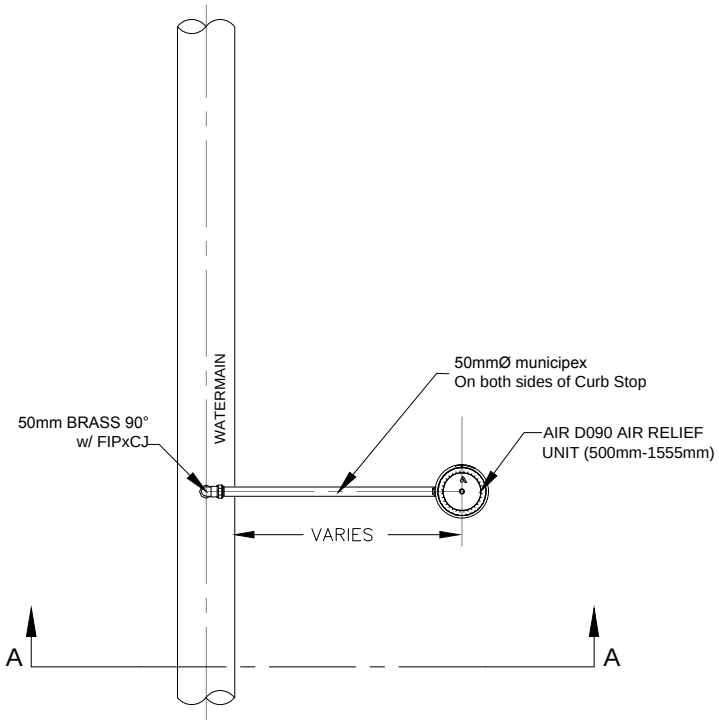
DWG	D 1846-1-2009	DATE	MARCH 2009	REV	1

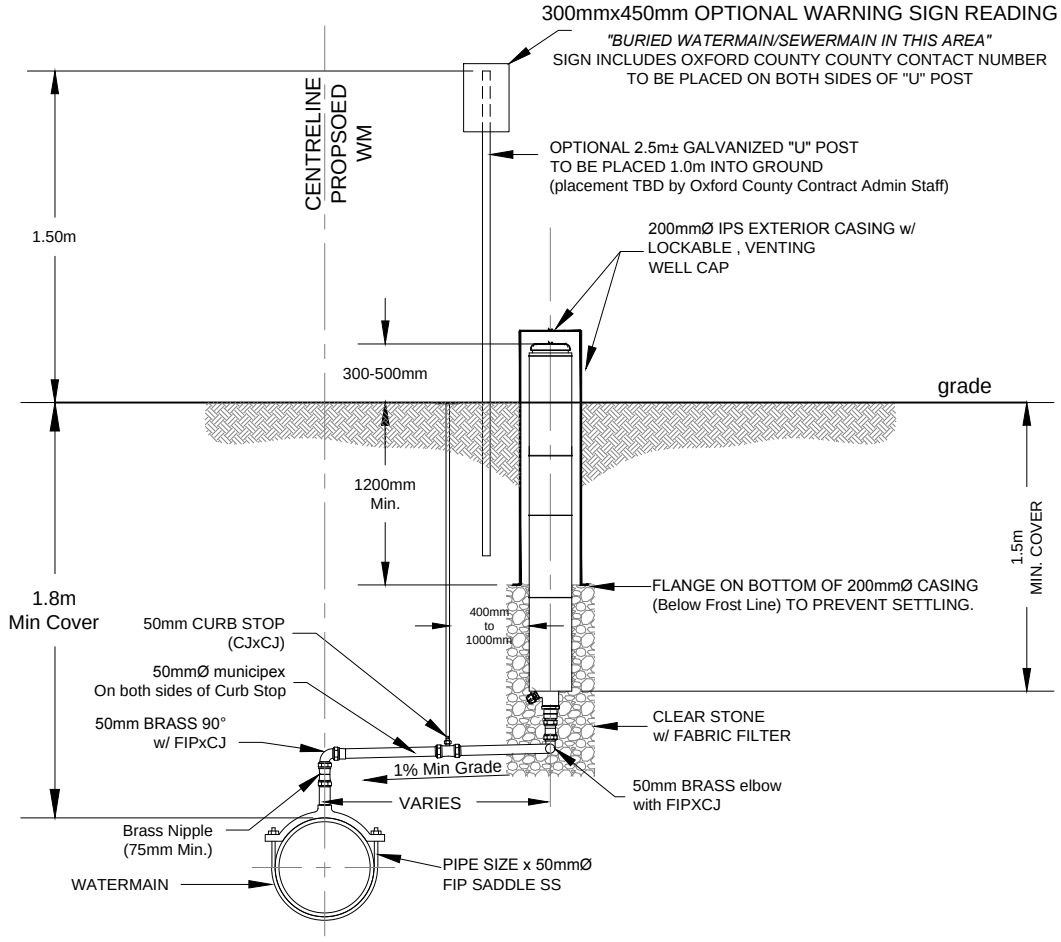


OXFORD COUNTY

ARI D090 AIR RELIEF w/ OPSD 704.010 CATCHBASIN

DWG	D 1852-1-2011	DATE	OCTOBER 2011	REV	1



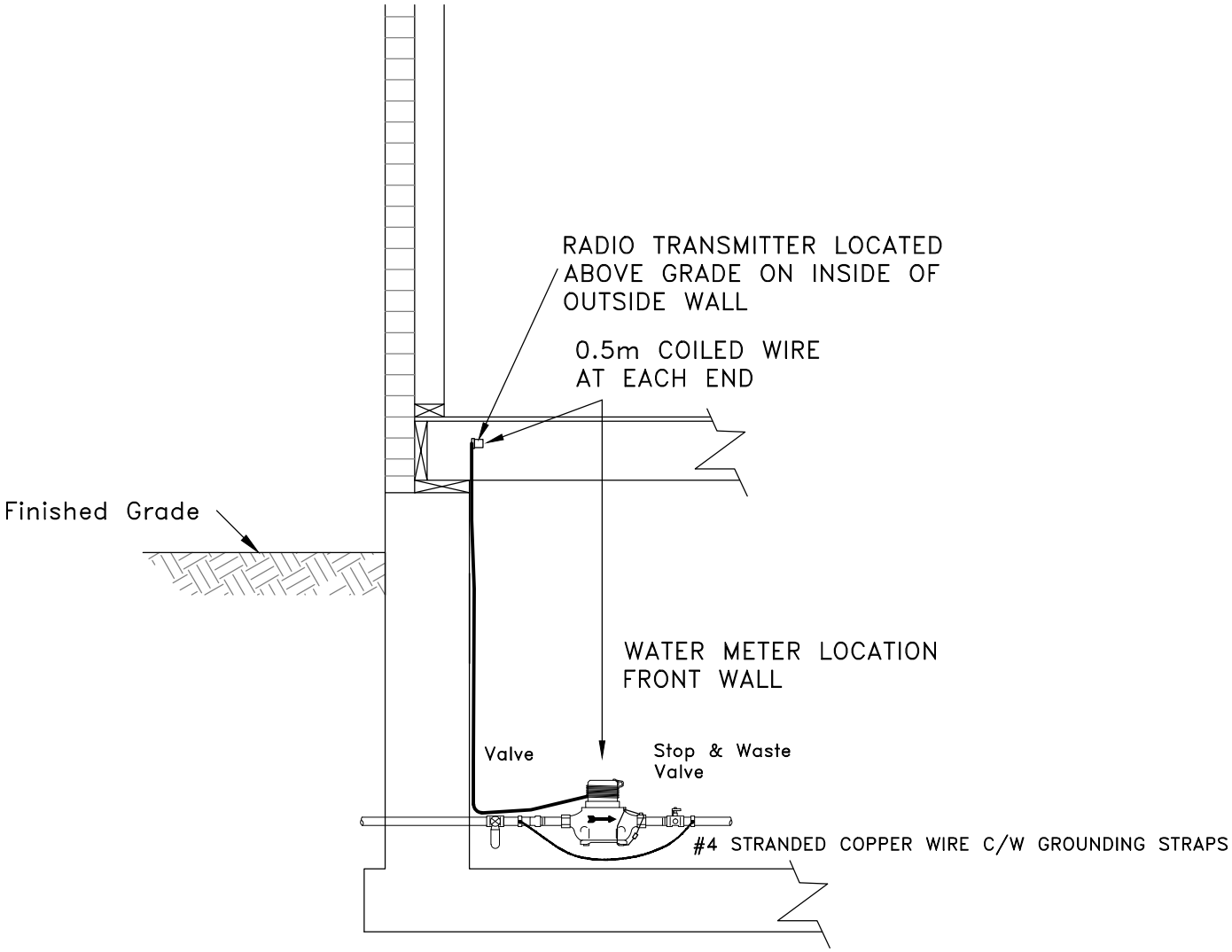


SECTION A-A

OXFORD COUNTY

ARI D090 AIR RELIEF w/ CASING

DWG	D 1852-2-2011	DATE	DECEMBER 2012	REV	1



SIDE VIEW

NOTES:

1. ONE SERVICE PER RESIDENTIAL UNIT (1.8m MINIMUM COVER FROM FINISHED GRADE).
2. WATER METERS MUST BE INSTALLED IN **HORIZONTAL POSITION**. CONTRACTOR / OWNER MUST ENSURE METER IS ACCESSIBLE FOR FUTURE MAINTENANCE.
3. RADIO TRANSMITTER MUST BE LOCATED ABOVE GRADE AND SECURELY FASTENED INSIDE ON AN OUTSIDE WALL. 22 GAUGE - 3 COND. SOLID COPPER WIRE MUST BE USED TO CONNECT THE WATER METER TO THE ROAD.
4. RADIO TRANSMITTER MUST BE INSTALLED AS PER MANUFACTURER SPECIFICATIONS.
5. COMMERCIAL / INDUSTRIAL SERVICES WILL BE ASSESSED ON AN INDIVIDUAL BASIS.

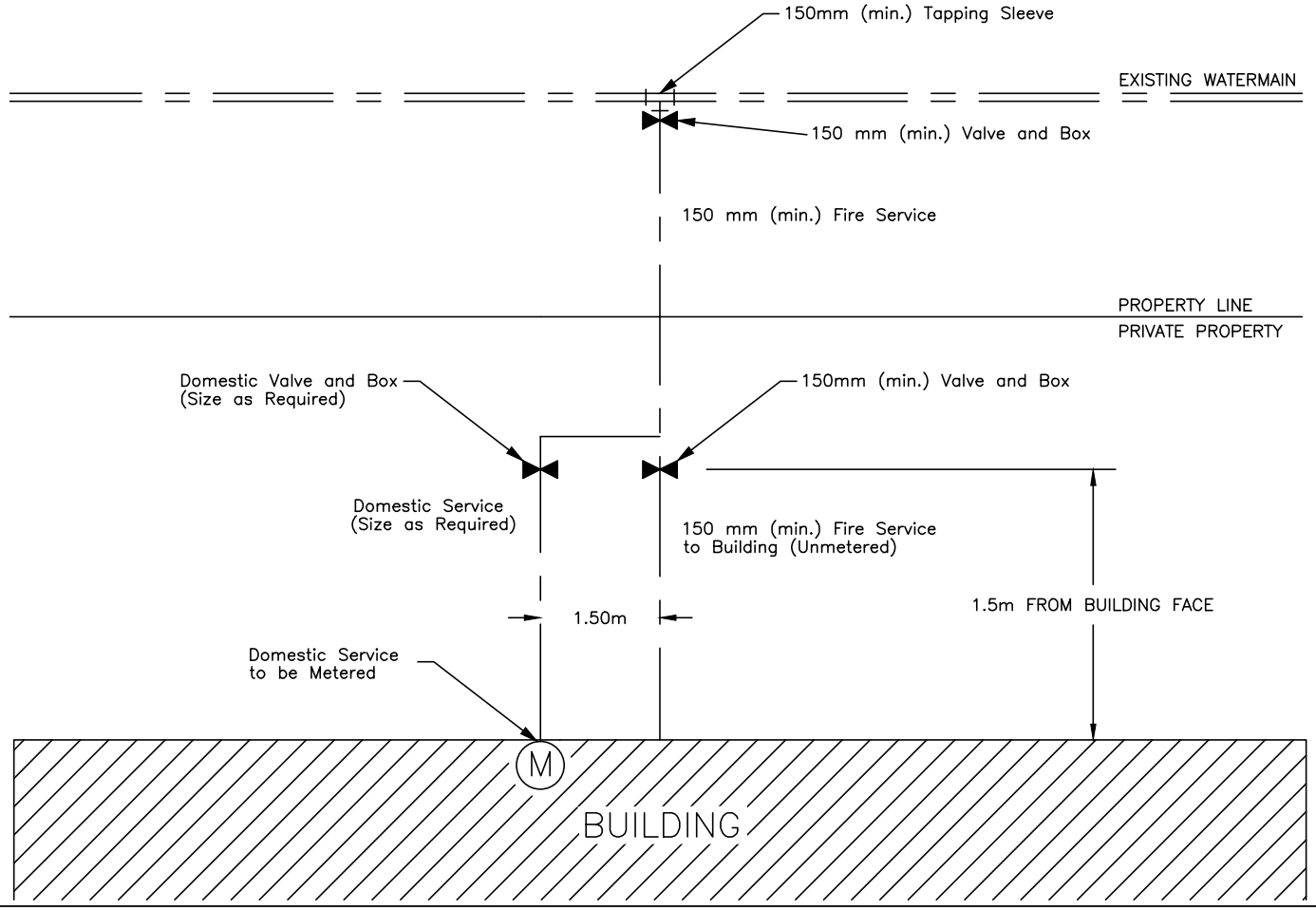
OXFORD COUNTY

WATER METER AND REMOTE RADIO TRANSMITTER

DWG D 1856-1-2016	DATE APRIL. 2016	REV 0

NOTES:

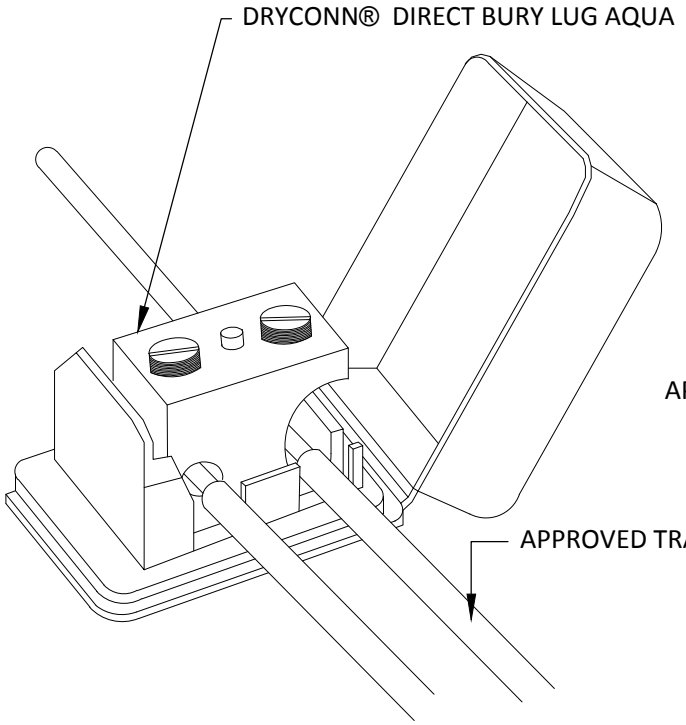
1. TRACER WIRE TO BE INSTALLED AS PER OXFORD COUNTY DESIGN GUIDELINES AND SUPPLEMENT SPECIFICATIONS
2. WHERE WATERMAINS CAN BE SHUT DOWN AND A TEE INSTALLED DOMESTIC AND FIRE SERVICE VALVES TO BE PLACES ON PROPERTY LINE.
3. VALVE LOCATION AT WATERMAIN OR PROPERTY LINE WILL BE REVIEWED ON A CASE BY CASE BASIS WHERE NECESSARY.

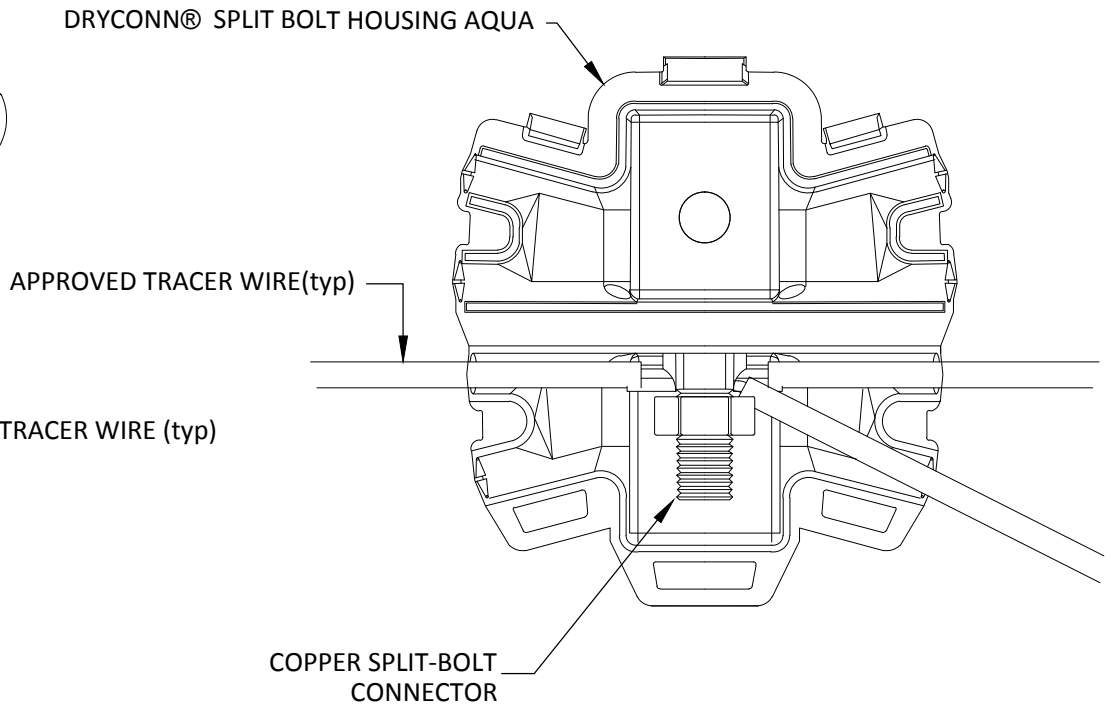


OXFORD COUNTY

DOMESTIC AND FIRE SERVICE DETAIL

DWG	D 1857-1-2016	DATE	APRIL 2016	REV	0





NOTES: ALL CONNECTORS TO BE WRAPPED WITH DENSO TAPE OR APPROVED EQUAL AND COMPRESSED TIGHTLY BY HAND AROUND CONNECTOR.

OXFORD COUNTY

TRACER WIRE CONNECTOR DETAILS

DWG	D 1858-1-2016	DATE	APRIL 2016	REV	0

Watermain Inspection Report

F035 Rev 1.0 01 May 2013

Development
Private ☐
City ☐

Location: _____

Contractor: _____ Contact: _____

Fax: _____ Phone: _____

Start date of Watermain Construction: _____

Size & Type of Watermain: _____

Main Pressurized (charged) ☐ Okay Date: _____
Mains Swabbed at same time: ☐ Yes ☐ N/A

PRESSURE & LEAKAGE TEST Date: _____ Time: _____
Pressure Test (150 PSI - 2 hrs.) ☐ Okay
Leakage Test ☐ Okay

Allowable leakage: 0.082 litres X mm of pipe diameter X kilometre of pipe for 2 hour test period = ??

_____

Chlorination: Feed Type: _____

Chlorine Residual: Free _____ mg/L Total _____ mg/L ☐ Okay

Flushed: ☐ Okay Date: _____ Time: _____

BACTERIOLOGICAL TESTING
1st Samples Taken On: _____ Results: _____
2nd Samples Taken On: _____ Results: _____

MAIN TURNED ON Date: _____
REMARKS _____

_____

Inspection Completed by: _____

Sketch of Works