

Section B – Part 2 – Supplemental Standards for Sewer and Water (SW)

401 Construction Specification for Trenching, Backfilling and Compaction

401.05 Materials

401.05.04 Granular Materials

Subsection 401.05.04 is amended by the addition of the following:

Granular material shall be one of the following: Granular A, B, M, B select, Granular C and Coarse Sand shall conform to the requirements of O.P.S.S. 1010, unless otherwise specified in the Special Provisions.

401.05.05.02 Native and Imported Material

Subsection 401.05.05.02 is amended by the addition of the following:

Native backfill material shall be used as trench backfill unless otherwise specified in the contract or as directed by the Contract Administrator.

All sewer and watermain trenches are to be backfilled and compacted with suitable native material from road, trench or imported granular 'C' as directed by the Contract Administrator and compacted to the required density.

If native material from road or trench is not suitable for trench backfill, imported granular 'C' shall be used and shall include to the cost of disposing unsuitable native material.

401.07 Construction

401.07.10 Backfilling and Compacting

401.07.10.03 Bedding

Subsection 401.07.10.03 is amended by the addition of the following paragraph:

Where trench conditions exhibit seeping water in silt or fine sand, a change from specified bedding to geotextile wrapped 19mm crushed stone is required, as determined by the Contract Administrator.

Once this change is made (mid run), this bedding system will be maintained until the next maintenance hole location regardless if the trench conditions improve. Trench conditions will be re-evaluated at the beginning of each run to determine if geotextile wrapped crushed stone is warranted.

401.07.10.05 Backfill

Subsection 401.07.10.05 is amended by adding the following:

Trench backfill material placed in a zone from 1.0 metres below road subgrade, to road subgrade, shall be compacted to a minimum density of 98% of the maximum dry density.

401.09 Measurement for Payment

Section 401.09 is amended by the addition of the following:

401.09.01.02 Native and Imported Material

Payment shall be made for each tonne of imported granular 'C' trench backfill placed if directed by the Contract Administrator. Weigh tickets are to be provided to the Contract Administrator for payment.

401.10 Basis of Payment

Section 401.10 is amended by the addition of the following:

401.10.04 Native and Imported Material

The unit price shall include the off-site disposal to a Contractor supplied disposal site of the native backfill material that the granular 'C' fill replaced.

404 Construction Specification for Support Systems

404.07 Construction

404.07.01 General

Subsection 404.07.01 is amended by the addition of the following requirements:

The requirements stated on the Supplemental Standard Drawings W-CS-69, sheets #1 and #3 shall be adhered to.

404.07.03 Removal, Backfilling and Compacting

Subsection 404.07.03 is amended by the additional requirements stated on Drawings

W-CS-69, sheets #2 and #3 in the Standard Drawings for Sewer and Water.

404.09 Measurement for Payment

404.09.01.01 Support System Left in Place

Subsection 404.09.01.01 is deleted in its entirety.

405 Construction Specification for Pipe Subdrains

405.07 Construction

405.07.01 General

Subsection 405.07.01 is amended by the addition of the following:

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

All subdrains shall be 150mm diameter, minimum 3.0m long with 19mm clear stone wrapped in terrafix 270R or approved equal, either of perforated corrugated steel pipe or PVC pipe. Where the catch basin is at a depth within the road Granular 'B' sub-base then the 150mm diameter filter wrapped (terrafix 270R or approved equal) perforated subdrain could be install directly in the granular sub-base (refer to Standard Drawing SW-3.1).

Perforations shall consist of 6mm holes in four rows positioned at 4, 5, 7 and 8 o'clock and 75mm apart longitudinally in both materials, or approved equivalent.

Pipe subdrains shall be connected to the 200mm knockout provided in the catch basin pot, typically at subgrade elevation, at a 0.5% minimum grade into the catch basin. Pipe subdrains shall be capped at the upstream end with a pre-manufactured end cap or with cement brick and non-shrink grout.

Shoulder Drains:

Perforated Corrugated Polyethylene Pipe pre-wrapped with Geotextile Knitted Sock. The tile shall be 100mm (4") diameter perforated tubing of a minimum weight of 165 gram/ft. (95-100lbs/250ft. roll).

The shoulder drain shall be installed by a plowing method to a minimum depth of 700 mm at a location of 800mm from the pavement edge. Minimum grades shall be 0.25% and grades shall be set using a laser where the pavement grades are flat.

One track of the dozer must have rubber or wooden pads so as not to damage the pavement.

407 Construction Specification for New Maintenance Hole, Catch Basin, Ditch Inlet and Valve Chamber Installation

407.05 Materials

407.05.05 Adjustment Units

Subsection 407.05.05 delete paragraph 2 and 3.

407.05.07 Frames With Covers or Grates

Frames with covered or grates shall be according to OPSS 1850. Covers shall be as per OPSD 401.01 – Type A and grates shall be as per drawing SW 5.5, or as directed by the Contract Administrator.

407.07 Construction

407.07.01 General

Subsection 407.07.01 is amended by the addition of the following:

407.07.01.01 Interim and Final Installation of Catch Basin's

Where top asphalt is to be deferred over a winter season or longer, catch basin grates shall be constructed to base asphalt elevation, and an asphalt curb setback shall be installed around the grate. Prior to top asphalt being applied, catch basins shall be raised to finished grade and concrete curb setbacks installed.

407.07.13 Installation of Inlet and Outlet Pipes Into Concrete Structures

Subsection 407.07.13 paragraph c) is amended by the addition of "Use of this type of connection system must be pre-approved by the City Engineer"

Subsection 407.07.13 paragraph 8 is deleted in its entirety and replace with the following:

Regardless of the connection system utilized, a), b), c) or d) above all pipes, except in valve chambers, shall be flush with the inside walls of the structure and shall be fully parged to a smooth steel trowel finish.

407.07.15 Installation of Adjustment Units

Subsection 407.07.15 amended by adding the following:

A minimum of one adjustment unit and a maximum height of 300mm at each structure.

High Density Polyethylene (HDPE) Adjustment Units is deleted in its entirety.

Rubber Adjustment Units is deleted in its entirety.

407.07.16 Installation of Frames with Grates or Covers

Subsection 407.07.16 is amended by the addition of the following:

A 3mm thick HDPE maintenance hole insert shall be installed under every sanitary maintenance hole frame and cover. The maintenance hole insert shall be manufactured by Parson Environmental (or approved equal). The maintenance hole insert shall be basic style complete with nylon lifting straps and 2 ventilation holes.

No separate payment will be made for the maintenance hole insert, their cost shall be included in the cost of the maintenance hole. The maintenance hole insert are to be removed upon completion of the top surface asphalt.

Subsection 407.07.16 paragraph 1 deleted in its entirety and replaced with the following:

When precast adjustment units are used, frames with grates or covers shall be set in a full mortar on the precast concrete adjustment units. Additionally, the precast concrete adjustment units shall be fully parged complete with a smooth and neat steel trowel finish.

Subsection 407.07.16 paragraph's 2 and 3 are deleted in its entirety.

407.07.18 Installation of Extension Stems and Boxes for Valve Chambers

Subsection 407.07.18 is amended by the addition of the following:

All service boxes that fall within a concrete sidewalk or driveway shall have a 100mm piece of 10M (#3 bar - 0.375 dia.) rod welded horizontally to the underside of the service box cover, approximately 40mm below the surface, to prevent frost heave.

407.07.25 Leakage Test

Subsection 407.07.25 is amended by deleting the first paragraph and replacing the following:

Sanitary sewer maintenance holes within new subdivisions shall be tested for leakage. Storm sewer maintenance holes within new subdivisions shall be tested for leakage when specified in the Contract Documents. Leakage shall not exceed a rate of 3 litres per hour per metre of head above the lowest pipe invert in the maintenance hole.

407.09 Measurement for Payment

407.09.01.01 Maintenance Hole, Catch Basin, Ditch Inlet and Valve Chamber

Clause 407.09.01.01 is amended by the addition of the following:

For the purpose of relocating existing catch basins, the requirements of O.P.S.S. 407 and 510 shall apply and will be paid under the appropriate item in the Form of Tender. Measurement for payment of the installed salvaged catch basin will be paid by the unit (each).

407.10 Basis of Payment

- 407.10.01 Maintenance Hole – Item**
- Catch Basins – Item**
- Ditch Inlets – Item**
- Valve Chambers – Item**
- Maintenance Hole Leakage Testing – Item**

Subsection 407.10.01 is amended by the addition of the following:

- Relocate Existing Catch Basin – Item**
- Relocate Existing Ditch Inlet Catch Basin – Item**

Subsection 407.10.01 2nd paragraph is deleted entirely and replaced with the following:

If the average maintenance hole, catch basin, ditch inlet or valve chamber depth (invert to design grade) differs from those shown on the drawings or in the Form of Tender for any reason, an adjustment will be made to the contract only if the difference is more than 0.3m (12”).

408 Construction Specification for Adjusting or Rebuilding Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers

408.07 Construction

408.07.01 General

Subsection 408.07.01 is amended by deleting the 1st line in paragraph 6 and replacing with the following:

Additional steps or boarder extension are required when the distance from the adjusted cover or grate reference elevation to the first step exceeds 600mm.

Paving shall begin within 72 hours of the first maintenance hole or utility adjustment.

408.07.08 Adjusting

Subsection 408.07.08 delete 2nd line in 1st paragraph and replace with the following:

A minimum of one adjustment unit up to maximum heights of 300mm shall be installed on top of the structure as per SW 5.0.

408.07.08.02 High Density Polyethylene (HDPE) and Expanded Polystyrene (EPS) Adjustment Units

Subsection 408.07.08.02 deleted in its entirety

408.07.08.03 Rubber Adjustment Units

Subsection 408.07.08.03 deleted in its entirety

408.07.09 Rebuilding

408.07.09.01 General

Subsection 408.07.09.01 delete 2nd paragraph and replace with the following:

The completed rebuilt structure shall have a minimum of one adjustment unit up to a maximum height of 300mm on the top of the structure prior to placing the frame with grate or cover.

408.10 Basis of Payment

Subsection 408.10.01 is amended by the addition of the following: All work under this item is to include the cost to cut/patch, remove, and dispose of waste material off site.

**409 Construction Specification for Closed Circuit Television (CCTV)
Inspection of Pipelines**

409.07 Construction

409.07.05 Final Documentation

409.07.05.01 Inspection Reporting

Subsection 409.07.05.01 is amended by the addition of the following:

All interim reports and video records shall be made available to the Contract Administrator at any time during or after the video inspection process and cannot be withheld from the Contract Administrator for any period of time for any reason.

The Contractor is required to surrender all videos or other video evidence of any kind at any time or at any stage of the videotaping process if requested by the Contract Administrator.

Provisions shall be made for the Contract Administrator to witness the pipeline video during the videoing process, if requested.

Final reports shall be submitted to the Contract Administrator and the City of London – Annual CCTV Program Manager within 10 working days of the completion of the field work and prior to placement to the pavement or base asphalt as a condition of authorization to pave base asphalt with the noted number of copies.

In addition to the hardcopy reports and DVD/USB flash drives, reports must also be provided in a digital format (Microsoft Access MDB file) that will enable direct downloading of the data into the City

Data Management System. The inspection reports provided under this contract shall be prepared in accordance with NASSCO PACP.

409.08 Quality Assurance

Section 409.08 is amended to include the following:

Pre-Construction and Post-Construction Videos of Existing Sewers

On projects where the existing sanitary or storm sewer is preserved and where new or replacement PDC/CB's are required to be connected to the existing sewer, the Contractor is required to provide the Contract Administrator with a pre-construction video inspection, unless the City agrees it is not necessary, of the existing sewer and a post PDC/CB installation sewer video prior to the pavement of base asphalt as a condition of authorization to pave base asphalt.

If an existing sewer is not replaced and there were no PDC/CB installations, the Contractor is not required to submit a pre-construction video but will be required to CCTV inspect the remaining sewers to demonstrate no damage was done and/or no debris was allowed to enter the main.

Post-Construction Private Drain Connection Videos

The Contractor is required to provide the Contract Administrator with a post-construction video of all sanitary and storm private drain connections (PDC) installed, prior to the placement of base asphalt, and as a condition of the authorization to pave base asphalt. The PDC videos are to be laterally launched from the main sewer to a minimum of 1.0m past the connection point of the new PDC to the original PDC (or building sewer). At the discretion of the Contract Administrator, the PDC video may be launched from a clean-out where site conditions do not allow the PDC video to be laterally launched from the main sewer.

409.09 Measurement for Payment

409.09.01 Actual Measurement

Subsection 409.09.01 is amended to include the following:

Pre-Construction and Post-Construction Videos of Existing Sewers

Measurement for this tender item shall be by the unit meter of sewer pipe inspected.

Post-Construction Private Drain Connection Videos

Measurement for this tender items shall be by each PDC videoed.

Payment at the contract price for the above item shall be full compensation for all labour, equipment and material to do the work.

409.10 Basis of Payment

409.10.01 CCTV Inspection - Item

Subsection 409.10.01 is amended by the addition of the following:

Payment at the contract price for the above item shall be full compensation for all labour, equipment and material to do the work.

410 Construction Specifications for Pipe Sewer Installation in Open Cut

410.03 Definitions

Section 410.03 is amended by the addition of the following definitions:

Bedding Material: means the material placed from the earth subgrade to the springline of the pipe.

Cover Material: means the material placed from the springline of the pipe to 300 mm above the pipe.

Granular 'C' Provisional Quantity: means the material to be used as trench backfill between the cover material and the road or earth subgrade, as a substitute for unsuitable native backfill, as directed by the Contract Administrator.

410.05 Materials

410.05.01 Pipe Materials

410.05.01.01 General

Subsection 410.05.01.01, first paragraph, is deleted in its entirety and replaced by the following:

Pipe size, class, material and type shall conform as shown in the contract. The following is an overall list of sewer pipe approved for use on City projects by the Owner for sizes certified by CSA. A substitution from that specified in the contract may be considered in accordance with the General Conditions.

(a) polyvinyl chloride (P.V.C.) pipe - smooth wall (CSA B182.2) - 100mm - 600mm inclusive

1. IPEX
2. Royal
3. Northern Pipe
4. Diamond
5. National

(b) polyvinyl chloride (P.V.C.) pipe – smooth wall (CSA B182.2) – 100mm – 375mm inclusive

1. NEXT Polymers – DURALOC

(c) ribbed polyvinyl chloride (P.V.C.) pipe - 200 mm to 600 mm inclusive (CSA B182.4)

1. IPEX
2. Royal Pipe Co. (KOR-FLO) - 200mm to 450mm inclusive
3. RauRib ribbed PVC pipe - 375mm, 450mm, and 600mm

All PVC fabricated and moulded fittings shall be **C.S.A. certified**.

(d) high-density polyethylene (HDPE) annular profile pipe – for use on storm sewers only, 200mm to 600mm. inclusive with integral bell and spigot (CSA B182.8)

1. ARMTEC
2. Soleno – Solflo Max
3. ADS/HANCOR –N-12/SURE-LOK/BLUE SEAL (c/w bell and spigot)
4. IDEAL Pipe-Challenger 3000 (c/w gasketed bell and spigot)

All HDPE fabricated pipe and moulded fittings shall be CSA certified.

(e) HP Propylene Sewer Pipe (size 750mm – 1500mm, triple wall with smooth exterior), for storm and sanitary. CSA B182-13

1. ADS Sanitite

All HP Polypropylene sewer pipe and fittings shall be CSA certified.

(f) Concrete pipe material must comply with the following C.S.A. requirements.

1. Non-Reinforced - CAN/CSA257.1 100mm - 600mm
2. Reinforced - CAN/CSA257.2

(g) Clay pipe – vitrified clay gasketed sewer pipe and fittings (ASTM C700, C425, C12, C828), c/w spigot-o-ring for storm and sanitary, sizes 100mm (4”) to 1050mm (42”)

1. Logan Clay Products – conditional approval only; use to be approved by EESD prior to installation

410.07.03 Preservation and Protection of Existing Facilities

Clause 410.07.03 is deleted in its entirety.

410.07.12 Pipe Installation

Subsection 410.07.12 is amended by the addition of the following:

Design

The following design standards are to be used on all design, construction and reconstructive maintenance of the City's infrastructure program, and including new subdivisions and developments.

Storm drains (including sewer laterals) connected to a maintenance hole shall be not more than 0.91m above the invert of the outlet sewer. Sanitary PDC's shall NOT be connected to a maintenance hole.

Catch basins installed within 15.0 m of a maintenance hole may have their leads connected into the maintenance hole or into the main sewer by an approved connection.

Catch basin leads 15.0 m to 30.0 m in length may be constructed by:

- (i) having a catch basin at one end and the other connected into a maintenance hole or a sewer 900 mm in diameter or larger, or by
- (ii) having the lead connected into a sewer 825 mm in diameter or smaller at one end with a maintenance hole catch basin at the other end

Catch basin leads over 30.0 m in length are to be connected into a maintenance hole or a sewer 900 mm in diameter or larger at one end and have a maintenance hole catch basin at the other end

Catch basin leads connected to a maintenance hole shall not exceed 1.80 m above the invert of the outlet sewer.

- (i) minimum size of storm sewers - 300 mm (12 in.)
- (ii) minimum size of catch basin leads - 250 mm (10 in.)
- (iii) minimum size of rear yard maintenance hole catch basin leads - 300 mm (12 in.)

Catch basin leads and PDC's shall be installed horizontally at 90° to the flow in the main line sewer or less. Under no circumstances will flow from the catch basin lead or the PDC enter the main against the flow unless as directed by Contract Administrator

Catch basin leads shall be installed vertically at 45° or less. If catch basin leads are to be installed at greater than 45° on a retrofit project, the mainline material must be concrete pipe of proper class, and catch basin lead material will be specified as Class D140 concrete pipe bedded in a concrete saddle.

Where horizontal or vertical bends are required, long radius sweeps shall be used. Short bends are not acceptable.

Sanitary service connections (PDC's) shall conform to one of the following materials: concrete, and polyvinyl chloride (P.V.C., SDR 28)

410.07.12.01 General

Subsection 410.07.12.01, paragraph 5 is deleted in its entirety and replaced with the following:

If the average maintenance hole or sewer depth (invert to design grade) differs from those shown on the drawings or in the Form of Tender for any reason, an adjustment will be made to contract price only if the difference is more than 0.3m (12").

410.07.13 Service Connections

Except for paragraph 4, Subsection 410.07.13 is deleted in its entirety, and replaced by the following:

1. Service Connections for New Sewer Construction

Concrete Pipe

Where applicable, concrete pipe main may be core drilled and fitted with a KOR - N –TEE Flexible Connector or a Core Bell Concrete Adaptor (for sizes 100mm – 250mm only).

Factory tees for PVC pipe connections shall be manufactured with a two-step/gasket system and grouted around the PDC on the outside of the tee after the connection is made.

PVC and HDPE Pipe

Compatible fabricated tees shall be used for all service connections on new sewer main construction, including sewer mains for new subdivisions prior to assumption.

2. Service Connections For Retro-fit Construction

Connections to Concrete Pipe

Concrete Pipe sewer main shall be core drilled and fitted with a "KOR-N-TEE" Flexible Connector, iron saddle (when pipe diameters allow) or Core Bell Concrete Adaptor (for sizes 100mm – 250mm only). If conditions restrict the use of these connections types, a sand fitted PVC "T" may be used with the permission of the Environmental Services Department.

Connections to PVC Smooth Wall Pipe

The PVC pipe shall be core drilled and fitted with an "Inserta T", or Royal Pipes "Fowler" connector.

Connections to PVC Ultra Rib and Royal KOR-FLO

Manufactured tees shall be used for connections to PVC Ultra Rib and Royal KOR-FLO pipe. When conditions do not permit, an "Inserta T" or Royal Pipes "Fowler" connector shall be used.

Connections to HDPE Annular Profile Pipe

Manufactured tees shall be used for connections to HDPE annular profile pipe. When conditions do not permit, an “Inserta T” connector shall be used.

Connections to Vitrified Pipe

For all connections to the existing pipe a manufactured boot and a fabricated PVC ‘T’ shall be used.

Connections to Asbestos Cement

The main shall be cut with a hole saw, and fitted with a cast iron saddle.

Connections to Lined Vitrified Clay or Asbestos Cement Pipe

For use with lined VC or AC main sewer pipe where an existing private drain connection is to be removed and replaced, the existing hole in the main sewer pipe is to be trimmed smooth and a saddle tee (Fernco EZ Tap Sewer Saddle or approved equal), shall be used to make the connection for a new private drain connection. A sand/cement (250mm slump) mixture is to be placed around the void that was made to slip the strap around the main sewer pipe to mitigate settlement.

410.07.14 Marking and Recording Service Connections

Clause 410.07.14, second paragraph, is deleted in its entirety and replaced by the following:

Green and brown painted surface stakes 40mm X 90mm X 450mm (standard 2" X 4") long shall be placed after trench restoration to mark the termination of storm and sanitary services (P.D.C.'s) respectively.

Plugged or capped service connections shall be marked on the top surface of the last 3 meters of the upstream end pipe with following:

- a) for sanitary connections: Yellow PVC adhesive tape (50mm wide) labelled continuously in black lettering (40mm wide) “**CAUTION SANITARY SEWER**”
- b) for storm sewer connections: Orange PVC adhesive tape (50mm wide) labelled continuously in black lettering (40mm wide) “**CAUTION STORM SEWER**”

410.07.16 Field Testing

410.07.16.01 General

Clause 410.07.16.01 is amended by the addition of the following:

The Contractor shall undertake a video inspection in compliance with O.P.S.S. 409 for **all** sewers installed. Video Inspections shall be submitted to the contract administrator on CD, in .mpeg or .mpg format, capable of being viewed with Windows Media Player.

All sanitary sewers within new subdivisions which are to be constructed are to be subject to an Infiltration Test, an Exfiltration Test or Low Pressure Air Test as determined by the Contract Administrator and the Contractor based on the situation. Detailed results of the testing are to be provided to the Contract Administrator. Where the sanitary sewers constructed are within new subdivisions, detailed testing results are to be provided to the City for review and acceptance as part of the Conditional Inspection process prior to receiving a Conditional Certificate of Approval.

410.07.17 Cleaning and Flushing of Pipe Sewers

Clause 410.07.17 is amended by the addition of the following:

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

410.09 Measurement for Payment

410.09.01 Actual Measurement

Subsection 410.09.01 is amended by the addition of the following:

When excavated on-site material is approved for use by the Contract Administrator for bedding or pipe cover material (when imported granular materials are specified), an adjustment in the Contract Price shall be made, in accordance with Subsection GC 5.04

Substitutions - The volume of granular material substituted will be based on actual field measurements.

- 410.10** **Basis of Payment**
- 410.10.01** **Pipe Sewers – Item**
- Utility Supports – Item**
- Infiltration / Exfiltration Tests – Item**
- Testing with Water – Item**
- Low Pressure Air Testing – Item**
- Deflection Testing of Pipe Sewers – Item**

Subsection 410.10.01 is amended by the addition of the following:

When pre-qualification leakage, infiltration, exfiltration, deflection and low pressure air tests are required, payment will be made under the appropriate item in the Form of Tender.

When imported Granular 'C' trench backfill is specified in a Special Provision, and the Contract Administrator directs that native, selected native material, and/or selected native site material be used as trench backfill, the credit to the Corporation shall be based on the current market price of Granular 'C' materials delivered to the job site, and the volume in tonnes of native materials that is substituted.

Partial payment will be made on pipe sewer installed only.

412 Construction Specifications for Forcemain Installation in Open Cut

412.05 Materials

412.05.01 General

Subsection 412.05.01 is amended by the addition of the following:

Before a product is allowed for use in the City of London, it must have been presented to and approved in writing by the Product Approvals Committee.

Pipe size, material and class shall be according to the requirements specified in the Contract Documents.

Fittings shall be suitable for and compatible with the pipe material and class with which they will be used.

412.05.04 Polyvinyl Chloride (PVC) Pressure Pipe

Subsection 412.05.04 is amended by the addition of the following:

All PVC pipe and fittings shall be white in colour.

412.05.05 Polyethylene (PE) Pressure Pipe

All polyethylene plastic pipe is only approved for use on a site specific basis only as directed by the Wastewater and Drainage Engineering Division. Polyethylene Plastic Pipe shall be according to OPSS 1842, AWWA C901 and AWWA C906. Fittings shall be according to AWWA C906 and B137.1. The pipe and fittings shall be supplied from a plant approved by an organization accredited by the Standards Council of Canada. The pipe shall be manufactured with green colour striped indicating it conveys sanitary sewage.

412.07 Construction

412.07.17 Hydrostatic Testing

412.07.17.01 General

Hydrostatic testing shall be conducted under the supervision of the Wastewater Representative.

A test section shall be either a section between valves or the completed forcemain. The forcemain that is to be tested shall be backfilled before testing commences. Test pressure shall be 150 psi.

The test section shall be filled slowly with water and all air shall be removed from the pipeline. A 24-hour absorption period may be allowed before starting the test. The test section shall be subjected to the specified continuous test pressure for two hours.

412.07.18 Cleaning and Flushing Forcemains

Subsection 412.07.18 is deleted in its entirety and replaced with the following:

Cleaning, Swabbing and Flushing Forcemains

All forcemains shall be cleaned and flushed. Sewage forcemains shall be cleaned by use of a minimum of two (2) foam swabs in order to remove debris which may have entered the forcemain during construction. Cleaning shall be repeated until consecutive swabs are clean and the discharge water is clear. Site Restoration and Management of Excess Material shall be as per OPSS 701.07.26 and 701.07.27. In general, the flushing and swabbing procedure shall follow the protocol identified in the City of London Standard Contract Documents Section 441.07.25.

441 Construction Specification for Watermain Installation in Open Cut

441.01 Scope

441.02 References

Clause 441.02 is amended by adding the following:

City of London

City of London General Requirements and Design Specifications for the Water Distribution System

Ontario Provincial Standard Specifications

OPSS 501 Compacting

Ontario Safe Drinking Water Act

Procedure for Disinfection of Drinking Water in Ontario

Canadian Standards Association Standards

B137.2 PVC Injection - Moulded Gasketed Fittings for Pressure Applications

B137.3 Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications

CAN/CSA-A5/A8/A362-M88 Portland Cement/Masonry Cement/Blended Hydraulic Cement

American Society for Testing and Materials Standards

A 183-89(R90) Carbon Steel Track Bolts and Nuts

A 276-90 Stainless and Heat-Resisting Steel Bars and Shapes

B 88-M89 Seamless Copper Water Tube

B 766-86 Electrodeposited Coatings of Cadmium

C 361 M90 Reinforced Concrete Low-Head Pressure Pipe (Metric)

D 1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D 3035-89a Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter

D 3139-89 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

D 3350-84 Polyethylene Plastics Pipe and Fittings Materials

F 1674 Test Method for Joint Restraint Products for Use with PVC pipe

American Water Work Association

Version of AWWA Standards is the current version at the time of tender close.

C104/A21.4	ANSI Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
C105/A21.5	ANSI Standard for Polyethylene Encasement for Ductile Iron Systems
C110/A21.10	ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water
C111/A21.11	ANSI Standard for Rubber - Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
C907	Polyvinyl Chloride (PVC) Pressure Fittings for Water 100mm through 200mm
M9	Concrete Pressure Pipe
M11	Steel Pipe – A Guide for Design and Installation
M23	PVC Pipe – Design and Installation
M41	Ductile Iron Pipe and Fittings
C116/A21.16	ANSI Standard for Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Services
C151/A21.51	ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
C153/A21.53 Service	ANSI Standard for Ductile-Iron Compact Fittings, 3" through 24" for Water
C200	Steel Water Pipe 6 inches and Larger
C205	Cement Mortar Lining of Pipe and Fittings
C206	Field Welding of Steel Water Pipe
C207	Steel Pipe Flanges for Waterworks Service – Sizes 100mm through 3600mm
C208	Dimensions for Fabricated Steel Water Pipe Fittings
C209	Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel water Pipelines

American Water Work Association (continued)

C210 Pipelines	Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water
C213 Pipelines	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water
C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
C301	Pre-stressed Concrete Press Pipe, Steel Cylinder Type
C302	Reinforced Concrete Pressure Pipe, Non-Cylinder Type
C500	Metal Seated Gate Valves for Water supply Services
C502	Dry-Barrel Fire Hydrants
C504	Rubber-Seated Butterfly Valves
C509	Resilient-Seated Gate Valves for Water Supply Service
C550	Protective Epoxy Interior Coatings for Valves and Hydrants
C600	Installation of Ductile Iron Watermains and Their Appurtenances
C602	Cement Mortar Lining of Water Pipelines in Place – 100mm and Larger
C605	Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
C651	Disinfecting Watermains
C800	Underground Service Line Valves and Fittings
C900	Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 100mm through 300mm for Water Distribution
C602	Cement Mortar Lining of Water Pipelines in Place – 100mm and Larger
C605	Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
C651	Disinfecting Watermains
C800	Underground Service Line Valves and Fittings
C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4in. through to 60in. (100mm through to 1,500mm)

American Water Work Association (continued)

C904	Crosslinked Polyethylene (PEX) Pressure Tubing, ½ in. (13mm) through to 3in. (76mm), for Water Services
C906	Polyethylene (PE) Pressure Pipe and Fittings, 4in. through to 65in. (100mm through to 1,650mm), for Waterworks
C907	Injection Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4in. through to 12in. (100mm through to 300mm) for Water, Wastewater, and Reclaimed Water Service
C909	Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4in.(100mm) and larger

Canadian General Standards Board Standards:

41-GP-25M (October 1977) - Pipe, Polyethylene, for the Transport of Liquids

NSF International

NSF Standard No. 60 – Drinking Water Treatment Chemicals – Health Effects

NSF Standard No. 61 – Drinking Water System Components – Health Effects

UNI/BELL Plastic Pipe Association

UNI-Bell Handbook of PVC Pipe - Design and Construction

441.03 Definitions

Clause 441.03 is amended by the addition of the following:

Centre Line: means a line horizontally bisecting the pipe.

Watermain: means an installation designed for the conveyance of potable water under pressure and fire protection, using pre-formed or pre-cast pipe sections, circular in cross-section, laid end to end using suitable jointing materials.

Weakly Cemented Fill: means any combination of granular material with low percentages of cement and/or other cementations material such that the strength is in the order of 0.4 Mpa at 28 days.

441.05 Materials

441.05.01 General

Clause 441.05.01 is amended by the addition of the following:

Note: Before a product is allowed for use in the City of London, it must have been presented to and approved in writing by the product approvals committee.

Pipe size, material and class shall be according to the requirements specified in the Contract Documents. (Refer to GC2.02 Order of Precedence)

Unless otherwise specified, watermain test pressure shall be 1030 KPa (150 p.s.i.).

Fittings shall be suitable for and compatible with the pipe material and class with which they will be used.

441.05.02 Ductile Iron Pipe

Clause 441.05.02 is deleted in its entirety and replaced by the following:

Ductile iron (DI) with cement mortar lining and polyethylene encasement. Pipe shall be new and shall conform to AWWA C151 up to and including 450 mm diameter. Cement mortar lining shall conform to AWWA C104. Polyethylene encasement shall conform to AWWA C105.

Pipe shall have push-on joints. Thickness class shall be class 52 for all diameters up to and including 300 mm diameter and Class 51 for 400 mm and 450 mm diameter. Joint gaskets and lubricants shall conform to AWWA C111. Copper strips, wedges or other approved devices to provide electrical continuity shall be supplied by the pipe manufacturer and approved by the City of London Water Operations Representative.

Approved Ductile Iron Pipe:

Canada Pipe Company Ltd

Ductile Iron Fittings

All DI fittings shall have distinctly cast on them the pressure rating, nominal diameters of openings, manufacturers identification and have "DI" or "Ductile" cast on them in accordance with AWWA C110 and AWWA C153. All DI fittings shall be cement mortar lined in accordance with AWWA C104. Joints shall be in accordance with AWWA C111 with bell sockets designed to receive pressure pipe O.D.'s as specified in AWWA C151 and AWWA C900.

All DI fittings that are not epoxy coated (including fire hydrant boots) shall have a 14.5kg (32lbs) High Purity Magnesium Anode. Anode must be attached to fitting using a CADWELD and coated with mastic all in accordance with OPSS 442. Anodes and installation must be approved by the City of London Water Operations Representative.

The working pressure rating shall be 350 psi. Rubber rings shall be furnished by the fitting manufacturer.

Approved Ductile Iron Fittings

Bibby Ste-Croix (Tyler Union)
Sigma Corporation
Star Pipe Products

Approved Joint Restraints for Ductile Iron Pipe Products

(a) Joint Restraint Device for DI Pipe To Mechanical Joint Fittings

100mm(4") to 300mm(12")	Smith Blair Model 981 (colour code blue)
	Romac "Grip Ring" (with black grip ring)
	**250mm to 300mm (not to be used on PVC pipe)
	EBAA Iron Series 1100 Megalug
	Star Series 1000 Tie Rod System
100mm (4") to 600mm (24")	Star Allgrip Series 3600
	Star Stargrip Series 3000
	Smith-Blair 111 Series

Restraining glands shall be manufactured of high strength ductile iron conforming to the requirements of ASTM A536, Grade 65-45-12 (minimum) , (400 mm to 600 mm) shall be manufactured of structural steel conforming to the requirements of ASTM A36. All nuts, bolts, washers and rods to be wrapped in Denso mastic, paste and tape as per manufacturers recommendations. (or approved equal)

(b) Joint Restraint Device for DI Pipe to Push On Fittings

100mm (4") to 300mm (12")	Uniflange Series 1300
	Smith Blair Model 982 (colour code blue)
	Clow Series 1300

441.05.02.01 Self-Restrained Ductile Iron Fittings

All fittings shall have distinctly cast on them the pressure rating, nominal diameter, manufacturers name and AWWA Standard. All fittings shall be fusion bonded epoxy coated inside & out to NSF-61 standard and come capped from the factory to prevent contaminants inside the fitting. Joints and Fitting shall be in accordance with AWWA C111 & C153 latest revisions.

Self-restrained fittings will be rated for 350PSI and can be used on PVC/PVCO and HDPE DIPS sizes.

Approved Ductile Self-Restrained Fittings

RCT Flex-Tile

441.05.03 Concrete Pressure Pipe

Clause 441.05.03 is deleted in its entirety and replaced by the following:

Manufacture: to AWWA C301

Joints: bell and spigot to AWWA C301 and bonded together.

Fittings: to AWWA C301.

Pipe class: as specified elsewhere with minimum of Class 16 Outlets are to be fabricated such that there is no increase in the outside diameter of the pipe. Outlets are to be shop fabricated by the supplier.

Flanges: to AWWA C207, Class D unless otherwise noted

Protective coating: exposed portion of joint rings, two coats of Rust-Oleum No. 745 or approved equal.

Submissions:

- A soils investigation report to determine the corrosiveness of the native soils including recommendations on cathodic protection methods shall be completed during the design of the project by the Contract Administrator and the appropriate measures for corrosion protection are to be incorporated in the contract. The soils investigation is to be made available to the Contractor
- Affidavit of Compliance
- Design calculations
- Details of specials and fittings
- Details of materials and methods of welding
- Rubber Gasket Material Test Reports
- Steel Test Reports
- Restraint Length Calculations Stamped by a Professional Engineer licenced by the Professional Engineers of Ontario (PEO) (for watermains greater than 300mm diameter)
- Aggregate samples
- Tabulated Layout Schedule

Type of Cement: use Type HS (High Sulphate) cement (formerly known as Type 50) on the outside of all manufactured pipes and fitting and use Type GU (General Use) (formerly known as Type 10) cement on the inside of all manufactured pipes and fittings. All in accordance with the pipe manufacturers specifications and OPSS 1301.

Restrained Joints: Restrain all joints as determined by the manufacturer and approved by the Contract Administrator.

Welded Joints & Testing: All welded joints shall be tested using Magnetic Particle Inspection procedures as per AWWA C206 and Radiographic Inspection (X-ray).

Joints shall be designed for the same design, test and surge pressure ratings as the pipeline in accordance with AWWA - M9 Concrete Pressure Pipe.

Restrained joints to be snap-ring type, hold fast coupling or flexible welded joints.

Increase pipe reinforcement as required to transmit thrust forces. Advise Contract Administrator if increase pipe reinforcement length extends beyond last restrained joint shown on the Contract Drawings.

Adaptors, make-up pieces and spacers: fabricate from steel pipe and line, in accordance with this Specification.

Closures: two fabricated short pipes with plain steel ends connected by a split welding sleeve coupling.

All joints to be grouted and encapsulated with diaper provided by the manufacturer.

A #12 AWG Solid (.0808" diameter), as per 441.05.24 must be supplied along the full length of the pipe to provide electrical continuity for location purposes.

441.05.04 Polyvinyl Chloride Pipe

Clause 441.05.04 is deleted in its entirety and replaced by the following:

PVC pipe and fittings shall be of good quality and strength and be homogenous throughout, with inside and outside surfaces being free of sticky or tacky material. PVC pipe and fittings shall be free of blisters, cracks, cuts, foreign inclusions, holes, nicks, significant scratches, voids, rippling and other defects that may affect overall integrity of PVC pipe and fittings. PVC pipe or fittings having any indication of cracking or crazing or rippling inside or outside shall be rejected. PVC pipe shall be straight and true circle in section with concentric inner and outer surfaces.

PVC pipe or fittings which are not uniform in colour, visibly discoloured or faded shall be rejected and removed from the construction site at no cost to the City.

Joints shall be SBR rubber gasket push-on type. For PVC water main and fittings located within petroleum hydrocarbon and/or chlorinated solvent contaminated soils, gaskets shall be made of oil resistant Buna-N (Nitrile) rubber. When contaminated soil is encountered unexpectedly in the field, Contractor shall immediately notify the Contract Administrator and Project Manager.

441.05.04.01 Polyvinyl Chloride (PVC) AWWA C900 Pipe

Polyvinyl Chloride (PVC) pipe 100mm to 300 mm diameter shall conform to AWWA C900, bell wall thickness shall conform to AWWA C900 Section 4.3.2.2a., to be certified by the Canadian Standards Association to CSA Standard B137.3, shall be DR18, with Cast Iron O.D. dimensions and, the words 'Factory Capped' shall be included in the print line of every pipe.

Polyvinyl Chloride (PVC) pipe from 400mm up to and including 600mm diameter shall conform to AWWA C905, DR25, PR 165 psi (minimum) as determined by the Design Engineer, bell wall thickness shall conform to AWWA C905 Section 4.3.2.2a, to be certified by the Canadian Standards Association to CSA Standard B137.2 and have Cast Iron O.D. dimensions and, the words "Factory Capped" shall be included in the print line on every pipe. Polyvinyl Chloride (PVC) pipe greater than 600mm diameter is not approved for use in the City of London.

Approved AWWA C900 Pipe

IPEX:	Blue Brute DR18 (100mm to 300mm) Centurian DR25 (400mm to 600mm)
NAPCO:	CIOD Pressure Pipe DR18 (100mm to 300mm) CIOD Pressure Pipe DR25 (400mm to 600mm)

441.05.04.03 Molecularly Oriented Polyvinyl Chloride (PVCO) AWWA C909 Pipe

Molecularly Oriented Polyvinyl Chloride (PVCO) pipe, sizes 100mm to 400mm diameters CIOD, PR 235 psi shall conform to AWWA C909, ASTM F1488, shall be NSF 61, CSA certified to **B137.3.1** and, words 'Factory Capped' shall be included in the print line of every pipe.

Approved AWWA C909 Pipe

IPEX	Bionax PR 235 psi (100mm to 400mm)
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441.05.04.04 General Requirements

A tracer wire (as per 441.05.24) must be supplied along the full length of the pipe to provide electrical continuity for location purposes.

All PVC pipe and PVC fittings shall be blue in colour.

For construction of watermain 400mm and greater- Submittals by the pipe manufacturer in the form of a Construction Report will include the following:

- a) Letter of Compliance including date of manufacture (pipe manufactured more than 24 months prior to delivery to the project site will not be accepted for use and will be removed from site at no expense to the City.)
- b) Summary of fittings and specials
- c) Restrained length calculations and drawings signed and stamped by a Professional Engineer licenced by the Professional Engineers of Ontario (PEO).
- d) Installation Manual
- e) Copy of CSA Certification and NSF 61 Certification

Fittings shall be:

PVC injection moulded fittings with push on joints (for use with PVC and PVCO pressure pipe conforming to AWWA C900, CSA B137.3 and AWWA C909, CSA B137.3.1 having cast iron O.D)., shall conform to AWWA Standard C907, shall be UL listed and FM approved, and shall be certified by the Canadian Standards Association to CSA Standard B137.2;

Approved AWWA C907 Fittings

Ipex
NAPCO
Harco

Ductile Iron push-on fittings are not approved for use with PVC pipe except for self-restrained DI fitting described in section 441.05.02.01 of this document.

Mechanical joint Ductile Iron AWWA C110 as described in Section 441.05.02 shall be used when they are an integral part of the restraining system.

Joint Thrust Restraints:

All joint thrust restraint devices must meet or exceed the minimum requirements of ASTM F 1674-96 (Standard Test Method for Joint Restraint Products for use with PVC Pipe), be UL listed and FM approved. Restraining glands (100 mm to 300mm) shall be manufactured of high strength ductile iron conforming to the requirements of ASTM A536, Grade 65 45 12 (minimum), (400 mm to 600 mm) shall be manufactured of structural steel conforming to the requirements of ASTM A36.

Joints shall be designed for the same design, test and surge pressure ratings as the pipeline in accordance with AWWA-M23 PVC Pipe Design and Installation

All fittings and joints shall be restrained in accordance with the City of London specification.

All restraints are to be torqued to manufacturer's specifications using a calibrated torque wrench. If power equipment is used during installation, it is to be set as not to over tighten the bolts before they are properly torqued.

Refer to section 441.07.23 Thrust Restraints, of this section.

Restrained Pipe Joint System

Approved Restrained Pipe Joint Systems

100mm (4") to 300mm (12")	Ipex TerraBrute AWWA C900 NAPCO Cobra Loc System
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Approved Restrainers for PVC AWWA C900 and PCVO AWWA C909 Pressure Pipe

a) Restraining PVC / PVCO Pipe to PVC Injection Moulded Fittings

100 mm (4") to 300 mm (12")	Clow 360C EBAA Iron Series 2600 Sigma PV-LOK Model PWPF Star PVC 3500PF with Series 1200 bell follower Uni-Flange Series UFR 1369 Star 1200G2 (Hamess)
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b) Restraining PVC / PVCO Pipe Standard Bell and Spigot Push On Joints

100 mm (4") to 300 mm (12")	Clow 390C EBBA Iron Series 1900 Sigma PV-LOK PWP Star PVC 3500C Series Uni-Flange Series UFR 1399 Star 1100G2 (Hamess)
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c) Restraining PVC / PVCO Pipe to Mechanical Joint Fittings

100 mm (4") to 300 mm (12")	Clow 300C Clow Tuf Grip EBBAA Iron Series 19MJ00 Sigma PWM Sigma PV-LOC SLC Star PVC 3500 Series Star All Stargrip Series 4300 Uni-Flange 1500 Star 1000GS Clow Tyler Dual Wedge Tuf Grip
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Approved Restrainers for PVC AWWA C900 DR25 PR165 Pressure Pipe 400mm to 600mm

a) Restraining PVC AWWA C900 DR25 Pipe to PVC Injection Moulded Fittings

400 mm (16") to 600 mm (24")	Clow 360C
	EBAA Iron Series 2500
	Sigma PV-LOK Model PWPF
	Star Series 1200C
	Uni-Flange Series 1390

b) Restraining PVC AWWA C900 DR25 Pipe Standard Bell and Spigot Push On Joints

400 mm (16") to 600 mm (24")	Clow 390C
	EBBA Iron Series 2800
	Romac Series 470SJ
	Sigma PV-LOK PWP
	Star Series 1100C
	Uni-Flange Series 1390C

c) Restraining PVC AWWA C900 DR25 Pipe to Mechanical Joint Fittings

400 mm (16") to 600 mm (24")	Clow 300C
	EBBAA Iron Series 2000PV
	Romac Series 470MJ
	Sigma PV-LOC PWM
	Star Series 1000C
	Uni-Flange 1500

441.05.05 Polyethylene Pipe

Clause 441.05.05 is deleted in its entirety and replaced by the following:

Polyethylene plastic pressure pipe is approved for use on a site specific basis only as directed by the Water Engineering Division.

Polyethylene plastic pressure pipe shall be according to OPSS 1842, AWWA C906, CSA B137.1 and supplied from a plant approved by an organization accredited by the Standards Council of Canada. The pipe shall be manufactured with blue colour stripes indicating potable water.

Fittings shall be: flanged ductile iron according to AWWA C110/A21.10 or AWWA C153/A21.53; polyethylene according to OPSS 1842; heat fusion according to CSA B137.1.

441.05.05.01 Cross Linked Polyethylene (PEX)

Cross-Linked Polyethelene (PEX) potable water service tubing for secure connections shall be in accordance with AWWA C904 ASTM F876-05, ASTM F877-05, CSA-B137.5 and NSF 61.

PEX water service tubing is to be used with standard copper O.D. brass fittings. PEX tubing ends to be installed with stainless steel insert and be installed with a copper tracer wire (as per 441.05.24) for its entire length.

Approved PEX sizes are 25mm to 50mm

REHAU	Municipex
IPEX	BLUE 904

441.05.05.02 Polyethylene of Raised Temperature (PE-RT)

Polyethylene of Raised Temperature (PE-RT) potable water service tubing shall be in accordance with AWWA C901, ASTM F2769, CSA B137.18 and NSF 61.

PE-RT water service tubing (SDR-9 – CTS Pipe Size) is to be used with standard copper O.D. brass fittings. PE-RT tubing ends to be installed with stainless steel insert and to be installed with tracer wire (as per 441.05.24) for its entire length.

Approved PE-RT sizes are 25mm to 50mm

American Legend Manufacturing	AquaPure
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441.05.06 Steel Pipe

Clause 441.05.06 is deleted in its entirety and replaced by the following:

Manufacture to: AWWA C200 manufactured to meet the requirements of ASTM A139C;

Steel plate: to ASTM A572, Grade 42;

Bell and spigot pipe: 6.35mm (1/4") minimum wall thickness unless otherwise specified in the Contract Documents;

Field weld pipe: 6.35mm (1/4") minimum wall thickness unless otherwise specified in the Contract Documents

Nominal pipe sizes: to be actual inside diameters after cement mortar lining, for watermain inside diameter for chamber piping 300 mm and under, and outside diameter for chamber piping 350 mm and over;

Watermain: Bell and spigot joints, push-on, with rubber gaskets to AWWA C200. Joints to have a safe working pressure equal to the pipe class. Bends forming each bell shall have a radius of at least 12 times the pipe wall thickness.

Rubber gaskets to: AWWA C200. Rubber gasketed joints to be bonded with electrical cables in accordance with the manufacturer's recommendations.

Restrained Joints: Restrain all joints as determined by the manufacturer and approved by the Contract Administrator. Flexible welded joints or harnessed joints shall be fabricated by pipe manufacturer in accordance with AWWA Manual M11, “Steel e – A guide for Designing and Installation”.

Welded Joints & Testing: Bevel end, lap joint or butt-strap to the requirements of AWWA C206. Field welded joints shall be tested using magnetic particle testing procedures as per AWWA C206.

Fittings to: AWWA C208.

Flanges to: AWWA C207, Class D unless otherwise noted in the Contract Documents.

Design stress 50% of minimum yield point.

Coatings: Cement mortar interior lining of pipe and fittings to AWWA C205.

Tape coating of exterior surfaces of joints, specials and fittings to AWWA C216. Coating thickness to be 70 mils, consisting of primer and two 35 mils layers.

Polyurethane surface exterior coating per AWWA C222.

Steel Pipe Epoxy Coating:

- a) Chemically cured, 2 part epoxy
- b) Direct to metal application
- c) NSF61
- d) Rated for continuous water (including salt water) submergence
- e) Generally chemical and solvent resistant
- f) Low VOC
- g) Application by spray, brush, or roller (for field touch-ups)
- h) Other performance and physical properties to equal the Devoe or Tnemec Products

Field Repairs: Cement mortar lining of interior surfaces to AWWA C205. Polyurethane surface coating repairs shall be as per AWWA C222 and paint manufacturer’s recommendations.

Chamber piping:

- a) 300 mm diameter and smaller shall be schedule 40
- b) 350 mm diameter and larger shall be 10 mm
- c) Paint interior of pipes and fittings to AWWA C210
- d) Coat exterior pipes and fittings with two coats Rust-Oleum No.745 or approved equal

Submissions Required:

- a) Affidavit of Compliance
- b) Design Drawings and calculations for pipe wall thickness and restrained joint system shall be stamped and signed
- c) Details of materials and methods of welding
- d) Rubber gasket material test reports
- e) Length of pipe ends
- f) Details of specials and fittings
- g) Hydrostatic proof-test reports
- h) Method for repairing damaged pipe, linings and coatings

441.05.07 Copper Pipe

As of July 01, 2013 copper pipe is no longer allowed for use in the City of London.

A 5.5kg (12lb) high purity anode conforming to ASTM B418-73 Type II must be installed on all copper pipes encountered during construction. Zinc anodes to be supplied with a 3m AWG 12 solid copper lead wire TWH insulation and attached to the copper pipe with a silicon bronze clamp.

Refer to: *OPSS 442, Construction Specifications for Corrosion Protection of New and Existing Watermain.*

441.05.08 Composite Pipe

Clause 441.05.08 is deleted in its entirety and replaced by the following:

As of June 31, 2007 composite pipe will no longer approved for use in the City of London.

441.05.09 Valves

441.05.09.01 General

Clause 441.05.09.01 is deleted in its entirety and replaced by the following:

Valves shall be capable of a seat differential test pressure equal to the Design Pressure and to a hydrostatic shell test pressure at least 50% in excess of the design pressure. Valves for buried installation sizes 100mm to 200mm shall have bell ends.

Valves for buried installation sizes 250mm to 400mm shall have mechanical joint ends to provide adequate mechanical thrust restraints.

Valves located in chambers must be flanged faced and supplied with 304 stainless steel nuts, bolts and washers.

All flanges, bonnet nuts, nuts, bolts and washers shall be protected from corrosion by using Denso paste, profiling mastic and petrolatum tape (or approved equal).

Shaft spindles shall have O-ring seals of resilient materials.

Valves shall open clockwise.

All valves must be supplied with 304 stainless steel nuts, bolts and washers on the bonnet.

All valves greater than 300mm located inside of a chamber must be supplied with a geared operator (spur or bevel) as required and operational from the surface.

441.05.09.02 Service Line Valves (Curb Stops)

Valves shall be in accordance with AWWA C800. Type, Pressure class, and end connections shall be as specified in the Contract Documents. Refer to Section 441.05.12.03 of this document.

441.05.09.03 Gate Valves

Clause 441.05.09.03 is amended by the following:

Valves shall be gate valves conforming to AWWA C500 or resilient seat gate valves conforming to AWWA C509 / C515.

All valves must be epoxy coated inside and out (minimum of 3 mm thickness) and conforming to AWWA C-550.

Epoxy coated gate valves do not require anodes.

All valves must open right (Clockwise) and have stainless steel nuts and bolts.

All valves up to 200mm diameter may be push-on joint, valves 250mm to 400mm must be mechanical joints to allow for adequate mechanical thrust restraints.

Valves shall work equally well with full pressure applied on either side of valve.

Approved AWWA C500 gate valves

Kennedy	C571/F-5065
Clow	F5000 Series

Approved AWWA C509 / C515 resilient seat gate valves

Clow	R/WF6100Series
Mueller	A-2360
AVK	Series 45 / 65
Bibby	
EJIW	

Valve boxes shall be CI 130 mm screw type.

Approved boxes for 1.2 m to 1.65 m depth

Bibby VB3000 Series
Star Pipe Product VB-5007 Series (30" bottom)

Approved boxes for 1.5 m to 1.9 m depth

Bibby VB3000 Series
Star Pipe Product VB-5007 Series (36" bottom)

Extension pieces must be used for depths greater than 1.9 m.

Valve rods shall be made by the Corporation according to Drawing Number W-CS-6.

There will be a charge for labour and material.

Geared operators shall consist of carburized alloy steel spiral bevel or spur gears with shafts operating in anti-friction bearings. Geared operators are to be self-contained units, permanently lubricated and totally enclosed in an impact resistant cast iron housing.

441.05.09.04 Butterfly Valves

Clause 441.05.09.04 is deleted in its entirety.

441.05.09.05 Air Release and Air / Vacuum Valves

Clause 441.05.09.05 is deleted in its entirety and replaced by the following:

Air release valves to be combination air release valves, employing Kinetic operating principle.

Shall be flanged faced and drilled.

Shall have a cast iron body.

Shall have stainless steel or plastic balls.

Shall be epoxy coated inside and out.

Each air release valve shall be provided with an isolation gate valve with bevel gear and shall be operated from the surface.

Bolts, washers and nuts shall be stainless steel Type 304 and wrapped in Denso paste, mastic and tape as per manufacturers recommendations (or approved equal).

Approved Air Release Valves

G. A. Industries Inc.
Crispin
CLA – VAL
VENT-O-MAT
ARI (D-060-C HF & D-060-C HF NS)
Val-Matic

441.05.09.06 Tapping Sleeves and Valves

Unless written approval has been given by Water Engineering, size on size taps are not allowed. The outlet must be at least one size smaller than the watermain that is being tapped into.

Tapping valves shall conform to AWWA C500 and must open right. (Clockwise)

An Engineer designed thrust block is required to be installed behind all tapping sleeves and valves. Thrust block shall be approved by the Water Engineering Division before installation. Refer to Drawing W-CS-43

Approved Resilient Seat Tapping Valves may be substituted by Resilient Seat Gate Valves.

Approved tapping valves

Mueller	T2360 – 19
Darling (Canada Valve)	No. 565
Kennedy	950X

Approved resilient seat tapping valves

McAvery	No. 20675R
Mueller	T2360
Clow R/W	F-6114
AVK	Series 65

Approved tapping sleeves for DI, CI and PVC pipe, epoxy coated steel front and back half with 3/4" NPT test plug

Ford Model	No.FTSC
Meuller	Model No. H-604
Smith Blair	Model No. 622
Cambridge Brass	Powerseal Series 3460
Robar	6906
Romac	Model No. FTS420 (not for PVC pipe)
Romac	Model No. FTS419

For all concrete and steel watermains, the Contractor will supply the tapping sleeve and valve. The City of London will install the tapping sleeve and valve and complete the tap.

Approved tapping saddle for concrete cylinder pipe (outlet sizes 25mm to 50mm) including epoxy coated straps or epoxy coated steel bands (no stainless steel straps)

Hanson / Ayotte	A-900 with Thermoplastic Coating
Smith-Blair	625 H

Approved tapping sleeve for concrete cylinder pipe (outlet sizes 100mm to 900mm) including epoxy coated solid back half or epoxy coated steel bands and ¾" NPT test plug (no stainless steel straps)

Hanson / Ayotte	A-600 with Thermoplastic Coating
Smith-Blair	625 with Flexi-coat Epoxy Coating
Cambridge Brass	Powerseal Series 3431

441.05.09.07 Check Valves

Check valves shall be swing type gravity operated with flanged ends.

Shall have an external adjustable weight and swing arm.

Shall comply with AWWA C508.

Shall be flanged faced and drilled

Shall have a cast iron body

Shall be epoxy coated inside and out

Each check valve shall be provided with isolation gate valve(s) with appropriate gearing

Bolts, washers and nuts shall be stainless steel Type 304 and wrapped in Denso paste, mastic and tape as per manufacturers recommendations (or approved equal).

Approved Check Valves

CLOW	1106LW Series
Mueller	8001 Series

441.05.10 Hydrants

Clause 441.05.10 is deleted in its entirety and replaced by the following:

Refer to W-SC-1 for installation specifications.

Hydrants shall conform to AWWA C502 for dry barrel hydrants.

Hydrants must open right (Clockwise).

Hose connections threads and operating nut to be to Ontario Provincial Standard Specifications and comply to all ULC Standards.

Fire hydrant laterals shall be PVC only.

Fire hydrant extensions as required for deeper bury are to be obtained from the fire hydrant manufacturers.

A maximum of one (1) 300mm extension is permitted per hydrant.

Fire hydrants shall have a chrome yellow high gloss exterior paint over quick dry red oxide primer.

Hydrants shall be installed a minimum of 1.5m from the edge of a driveway and from any other physical obstruction which could interfere with the operation of the fire hydrant.

The hydrant shall have mechanical joints.

All new fire hydrants shall be three-way with two (2) standard hose connections and one (1) STORZ connection with blue cap. STORZ nozzle to be bronze ASTM B584, nozzle cap to be cast iron and painted Multiguard No. 2500 Blue 50005.

All new fire hydrants shall be installed with the appropriate coloured Mark-A-Hydrant reflector as per the requirements of the City of London Design Specifications & Requirements Manual, Water Design Standards Section 7.8.

The City of London Fire Department reserves the right to select the required hydrant(s), appurtenances, and location of hydrant(s) depending on the fire risk of the area.

Approved hydrants:

Canada	ValveCentury
McAvity	M-67 with break flange
EJIW	Watermaster, 5CD250

441.05.12 Service Connections Fittings and Appurtenances

As of January 01, 2013 all brass fittings are to be 'no lead' CSA Classified to NSF Standard 61.

Clause 441.05.12 is deleted in its entirety and replaced by the following:

441.05.12.01 Service Saddles

25 mm services may be direct tapped into all sizes of DI and CI mains except a service saddle must be used for a 25 mm service into a 100 mm main. Service saddles must be used for all sizes of service into PVC pipe and for 40 mm and 50 mm services into CI and DI pipe.

All saddles shall have AWWA thread outlet. Saddles for DI and CI and AC pipe shall have ductile iron epoxy body with electro galvanized steel double straps and bolts. Shall be installed as per the manufactures specifications using torque wrench.

Saddles for PVC pipe shall be full circumference wide band with stainless steel band, nuts, bolts and outlet. Band shall be Type 304 Stainless Steel of minimum 18 gauge thickness and, a minimum of 150mm wide. All saddles including all bolts, washers and nuts shall be wrapped in Denso paste, mastic and tape in as per manufacturer specifications.

Refer to section 441.05.09.06 for approved Tapping Saddles and Tapping Sleeves for use on concrete cylinder pipe.

Approved service saddles

Romac	style 304 for 25 mm outlets style 306 for 40 to 50 mm outlets
Cambridge Brass	Series 403 for 50mm (Double Bolt) Powerseal Series 3412AS / 3416AS
Ford	FS 303 (Double Bolt)
Smith-Blair/ Rockwell	375 Service Saddle for 50mm outlets 376 Service Saddle, Wide Body for 25mm outlets
Robar	2616 for 50 mm outlets (double bolt) (For use on DI and CI) 2606 for 50 mm outlets (double bolt) (For use on DI and CI)
Mueller	521 - 529 Service-Seal Clamps for 100 mm to 300 mm main

Approved Stainless Steel Saddles with integral Corporation Stop Integrated

Cambridge Brass	8410 TECK
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Approved PVC Injection Moulded Tap Tee for 150 mm and 200 mm PVC C900 pipe

Ipex	C907 for 50 mm outlets
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Connections to steel mains for 100 mm and larger services and private mains shall be made using Maloney Insulating sets. Refer to Standard Drawings W-CS-24.

441.05.12.02 Main Stops (No-Lead Brass)

Main stops shall be brass ball style with inlet AWWA thread and outlet flared or compression. Main stops shall be manufactured and tested to AWWA C800 Standard and to operate at 150 psi. Main stops are to be CSA Classified to NSF Standard 61.

Approved (Ball Style) main stops for 25mm to 50mm copper are:

Cambridge Brass	Series 301
Ford	1000 Series
Mueller	300 TM-series

For connecting to steel mains approved insulated stops are:

Cambridge Brass	Series 301 - Compression only 25mm
Ford	Copper Service Insulator (all sizes must be used with Ford 1 000 flared outlet main stop)

Insulators have flared outlets and 25 mm also are available with compression outlets.

441.05.12.03 Curb Stops (No-Lead Brass)

Curb stops shall be brass ball valves with both inlet and outlet flared or compression to operate at 150 psi. Curb stops are to be CSA Classified to NSF Standard 61.

Approved curb stops for 25mm to 50mm PEX water service tubing

Cambridge Brass	Service 202
Ford	FB-Series (B66-344-HST-Q-NL)
Mueller	300 TM-Series

441.05.12.04 Couplings (No-Lead Brass)

Couplings shall be brass with both inlet and outlet compression. Manufactured to comply with AWWA C800. Couplings are to be CSA Classified to NSF Standard 61.

Cambridge Brass	Series 119 (Full Bore) Series 120 Two Part Cast Connect
Ford	C44 (Quick Joint)
Dresser	Style 88 Brass Coupling
Mueller	110 Compression Connections

441.05.12.05 Service Boxes and Rods

Shall be CI type to suit curb stop and shall have 25 mm hexagonal brass lid plug. Length shall be adjustable to suit depth of service.

Approved boxes for 25 mm curb stops are:

Mueller	A726
Bibby	VSB1
Clow	D1-9
Sigm	CBA 178
Star	SB-5001

Refer to DWG: **W-CS-8**

Approved boxes for 40 mm and 50 mm curb stops are:

Mueller	A728 - Operating rod to have modified top to enable use of same key as used on the A726 box
Bibby	VSB2
Cambridge Brass	Series 161-1

Refer to DWG: **W-CS-22**

Service rods shall be stainless steel of minimum 20 mm diameter including stainless steel cotter pins.

Bottom boards shall be made according to DWG: **W-CS-8, Sheet 3**.

441.05.15 Straps, Tie-Rods, Angles, Nuts and Bolts and Sleeve Couplings

Clause 441.05.15 is amended by the following:

1. Bolts, Washers and Nuts used with:

For flanged joints:	to AWWA C207
For mechanical joints:	to AWWA C111/A21.11

All bolts, washers and nuts shall be wrapped in Denso paste, mastic and tape (to manufacturer specifications) or approved equal.

2. Sleeve Couplings:

Sleeves shall be:	ductile iron to ASTM A-536 fusion bonded epoxy to an average 0.3 mm thickness, suitable or potable water system.
Followers shall be:	malleable iron ASTM A-47 ductile iron ASTM A-536, or steel. shop coat enamel
Gaskets shall be:	rubber suitable for cold water service.

Approved Sleeve Couplings:

Dresser	Style 253
Romac	Style 501
	ALPHA, Two-bolt wide range restraint coupling
Smith-Blair/Rockwell	411 (100mm to 600mm)
	413 (100mm to 600mm)
	421 top bolt
	441 (100mm to 400mm)
Baker/Robar	Powerseal Series 3501 (transitioning coupling)
Cambridge Brass	Powerseal Series 3506 (transitioning coupling)

All bolts, washers and nuts shall be wrapped in Denso paste, mastic and tape (to manufacturer specifications) or approved equal.

441.05.16 Corrosion Protection

Material used to electrically insulate connections to steel mains shall be as listed and applied per supplier's recommendation.

Petrolatum tape systems shall be comprised of three components; paste, mastic and tape and meet the requirements of AWWA C217, CSA compliant, meet ISO 9001 and ISO 14001 and CFIA approved. Mastic must contain polystyrene beads and paste and tape must be of the same manufacturer as mastic to ensure compatibility. The three components provided shall be from the same manufacturer to ensure compatibility and optimal performance AND MUST meet CSA, ISO and CFIA requirements.

All Cast iron (CI) and Ductile Iron (DI) fittings must be installed with a 14.5kg (32lbs) high purity magnesium anode. Anode must be attached to fitting using a CADWELD and coated with mastic (Handy Cap IP). Anodes and installation must meet the requirements of OPSS 442 and be approved by the Contract Administrator.

All Copper Service Pipe encountered during construction must have a 5.5kg (12lbs) high purity anode conforming to ASTM B418-73 Type II installed. Zinc anodes to be supplied with a 3m AWG 12 solid copper lead wire TWH insulation and attached to the copper pipe with a silicone bronze clamp. Refer to OPSS 442, Construction Specifications for Corrosion Protection of New and Existing Watermain.

Item	Description	Supplier
Flange Gasket Sets	"Maloney"	Corrosion Service
Petrolatum Protective Systems to AWWA C217	Denso Petrolatum Tape System	Denso North America Inc
Caps for Anode Weld Corrosion Protection	Chase/Royston Handy Cap IP	Chase Specialty Coatings
Polyethylene for use on Ductile Iron Watermain	8 mil thickness per AWWA C105	Pipe Supplier
14.5kg (32lbs) Magnesium Anodes to ASTM B843, Grade M1C; ASTM G97; ASTM E35; NACE RPO 169; NACE RPO 289	14.5kg (32lbs) High Purity Magnesium Anode, in 200mm x 700mm water permeable cardboard tubing	Interprovincial Corrosion Control (ICCC) Bren Integrity Anode Corporation (IAC)
5.5kg (12lbs) Zinc Anodes to ASTM B418, Type II	5.5kg (12lbs) High Purity Zinc Anode, in 100mm x 700mm cardboard tubing	Interprovincial Corrosion Control (ICCC) Bren Integrity Anode Corporation (IAC)

441.05.17 Thermal Insulation

Material used to thermally insulate mains and services shall have a minimum compressive strength of 690 kPa. Approved material is STYROFOAM HI 100 BRAND by Dow Chemical or approved equal. Installation as per DWG: **W-CS-68**.

441.05.18 Blow Offs

Blow off curb valves shall be stop and drain with inside I.P. thread on inlet and outlet. Refer to W-CS-5 for the Standard 50mm Blow Off Installation.

Approved curb stops are:

Mueller	H – 10284
Cambridge Brass	Series 1121 - 7 – 08670
Ford	No. B11 - 677 SW

Approved automatic blow offs:

Kupferle #9800 Eclipse Auto Flushing Device

441.05.19 Pipe Bedding Materials

Granular materials greater than 19 mm in size shall not be used for pipe bedding.

Bedding material shall be as specified in the Contract.

Concrete for bedding shall conform to OPSS.

441.05.20 Chambers

Section 441.05 Materials, shall be amended to include the following subsection 441.05.19 – Chambers.

Refer to OPSD 1100 and 1101 for the minimum requirements of cast in place and precast chambers.

Refer to W-CS-74 and W-CS-75 for typical air valve and typical check valve chambers.

Chambers shall be designed for all check valves, drain valves, air release valves, inline valves 450mm and greater, swab chambers and anywhere the City deems necessary for the specified project.

All chamber pipe and fitting shall be flanged as per AWWA C207 (Class D unless otherwise specified).

Chamber piping shall be AWWA C301 Concrete Pressure pipe as per 441.05.03 or AWWA C200 Steel as per 441.05.06. Flanged DI Pipe (up to 300mm) maybe used in check valve chambers as per section 441.05.02 Ductile Iron Pipe Products.

All valves greater than 300mm located inside a chamber must be supplied with a geared operator (spur or bevel) as required and operational from the surface. Refer to 441.05.09.

All valves inside a chamber must be supplied with stainless steel nuts, bolts, washers and then wrapped in Denso paste, mastic and tape or equivalent.

441.05.20.01 Water Tightness

Sealing gaskets placed between pre-cast sections to be continuous. Clean all mating surfaces where separate access hatches in top slab are not provided for equipment removal.

Use only dry (non-adhesive) gaskets for top slab. Use butyl type seal for all other riser joints or equivalent.

Chamber construction shall be water tight. Volclay sealant or equivalent and no shrink grout for all pipe penetrations through precast concrete (Typ). Membrane water proofing on complete chamber exteriors to the satisfaction of the City of London including underside of base slab. Caulking/sealant

prior to membrane as specified. On exterior of wall/pipe penetrations use grout. Extend waterproofing minimum of 150mm on to pipe and 250mm on to chamber wall.

Adhesive membrane water proofing on all pre-cast and top surfaces (Mel-Rol by Meadows). Provide purpose made protection board for membrane where not covered by insulation.

Where access frame and cover is at the same level as nominal grade, or within a roadway, provide a minimum of 1-75mm thick grade ring. Do not stack more than 3-75mm thick rings. Instead use 300mm thick units. Place grade rings with butyl based sealant between all mating surfaces. Grade ring openings must match access frame and cover opening size.

441.05.21 Self Restraining Casing Spacers

Carrier pipes to be installed inside casings shall be installed with self-restraining casing spacers. Casing spacers shall provide axial thrust restraint to prevent pipe joint separation during and after installation. They shall also provide dielectric insulation between the carrier pipe and the casing and facilitate installation of the carrier pipe into the casing.

Restrained casing spacers shall be manufactured of high strength ductile iron, ASTM A536, Grade 65-45-12.

Restraining rods shall be of high strength, low alloy material meeting the requirements of ANSI/AWWA C111 / A21.11. Casing spacer runners shall be of ultra-high molecular weight polymer.

Restrained casing spacers shall be provided at all pipe bell joints. In addition, casing spacers shall be installed at the spacing as according to manufactures specifications to support the pipe barrel and the weight of its contents.

Refer to DWG: **W-CS-12 sheet 3**

Approved Casing Spacers:

Ford UFRCS	1300 (pipe barrel)
Ford UFRCS	1390 (pipe bell joints)

Approved End Seals:

APS	Model AM
PSI	Model S

441.05.22 Plastic Meter Pit

Plastic meter pits are approved for use on a site specific basis and only as directed by the Water Engineering Division.

Approved Meter Pit & Lid:

Ford Meter Box Company Plastic pit for cold climates
For 5/8" to 1" meters
Wabash double Lid Cover
250mm Cast Iron Locking Lid

441.05.23 Swabs

All swabs must be open cell polyurethane foam, having a density of 24 kilograms per cubic meter. The diameter of the swab shall be:

- 2 times the outside for pipe diameters up to and including 300mm;
- 2 times the outside for pipe diameters greater than 300mm
- The length of the swab shall be 2 times the pipe diameter.

Approved Swabs Manufacturers:

Foamco Industries Corporation
Fomite Industries Inc
Integrity Pipe Products Ltd

441.05.24 Tracer Wire

Tracer wire shall be installed on all non-metallic watermain, hydrant laterals and water services except where such water service pipe is of copper material. The wire shall be installed in such a manner as to be able to properly trace all watermain, hydrant laterals and water services without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire.

Tracing wire shall be Direct Burial #12 AWG Solid (.0808" diameter), 21% conductivity annealed copper-clad high carbon steel high strength tracer wire, 452lb average tensile break load, 30 mil. high molecular weight-high density polyethylene jacket (Blue) complying with ASTM-D-1248, 30-volt rating.

Approved tracer wire for open cut application:

Copperhead 12.30 BHS
Pro-Trace HS-CCS PE30

Approved Direct Bury Connectors:

SnakeBite Locking Connector LSC 1230
Pro-Trace TW Connector

For trenchless installations refer to OPSS 450. #12 AWG Solid (.0808" diameter), steel core hard drawn extra high strength horizontal directional drill tracer wire, 1150lb. average tensile break load,

45 mil high molecular weight-high density Blue polyethylene jacket complying with ASTM-D-1248, 30 volt rating.

All tracer wire welds onto existing cast of ductile iron pipe shall be completely sealed with the use of Chace/Royston Handy Cap IP. In all cases, the pipe is to be properly cleaned and material shall be applied in accordance with the manufacturer's instructions.

All splices or repaired wire connections in the tracer wire system shall be made using waterproof connectors specifically rated for underground applications. Tracer wire shall have a Zinc anode installed as per OPSS 442 Table 5. Tracer wire shall be terminated as per drawing W-CS-1 sheet 2.

441.07 Construction

441.07.04 Preservation and Protection of Existing Facilities

Clause 441.07.04 amended as following:

Where it is required that a trench must cross under an existing main or where an existing main will be undermined during excavation, the Contract Administrator shall specify the method to be used. In general, the following methods may be used:

1. Where the main is cast iron crossing a trench it shall be cut back 1.2 m into solid ground on either side of the trench and be replaced with new ductile iron pipe with exceptions as specified below.

The maximum unsupported length of cast iron watermain that can be allowed with no joint exposed

before replacement with ductile iron pipe is required may be selected from the following tables:

**Stable Soil (Clays And Clayey Soils)
Maximum Allowable Unsupported Length Of Watermain (No Joint Exposed)**

W.M. Diameter	W.M. at 1.5 m Cover	W.M. at 2.5 m Cover
100 mm	1.37 m	1.07 m
150 mm	1.68 m	1.37 m
200 mm	1.98 m	1.68 m
250 mm	2.44 m	1.83 m
300 - 450 mm	2.74 m	1.98 m

**Unstable Soil (Fill, Gravel, Sand, Silt And Granular Soils)
Maximum Allowable Unsupported Length Of Watermain (No Joint Exposed)**

W.M. Diameter	W.M. at 1.5 m Cover	W.M. at 2.5 m Cover
100 mm	1.07 m	0.84 m
150 mm	1.37 m	1.14 m
200 mm	1.68 m	1.45 m
250 mm	1.98 m	1.68 m
300 - 450 mm	2.13 m	1.52 m

Allowable unsupported lengths for depth of watermain between 1.5 m and 2.5 m may be interpolated from the tables.

For depth of watermain greater than 2.5 m, the Contract Administrator will specify the method to be used.

In the foregoing, if a joint is within the unsupported watermain length, the allowable length is to be reduced by 50%.

2. Where a cast iron main running parallel to a trench is undermined it shall be replaced with new ductile iron pipe in its original location or in a new location as approved by the Contract Administrator.
3. Where the main outlined above is ductile iron or PVC it must be temporarily supported during excavation and the trench may be backfilled with well compacted granular fill.
4. In hard stable soil tunneling under watermain is acceptable. The minimum length of tunnel is to be 1.5m, the vertical separation from tunnel roof to watermain is to be a minimum of 1.0 m and the void in the tunnel is to be filled with 19 mm crushed stone. Tunneling in soft, loose and unstable soil is not acceptable.
5. Large cast iron, ductile iron, asbestos cement and concrete mains may require special supports, concrete support beams or trench sheeting or shoring. These cases will be treated individually as approved by the Contract Administrator.
6. If any lead joint pipe or fitting are encountered they are to be removed and replaced with ductile iron push-on pipe and fittings. In all cases where pipe is laid on backfilled material, the backfill shall consist of granular material compacted in 150 mm layers to 95 percent Standard Proctor Density.

441.07.07 Transporting, Unloading, Storage and Handling Pipe

Clause 441.07.07 is deleted in its entirety and replaced by the following:

Delivery and unloading of pipes and fitting at the job site shall cause the least possible delay to traffic.

All watermain pipe delivered to the City of London or to any Contractor working in the City of London (including on private property) shall be delivered with factory sealed end covers. The end covers shall only be installed by the pipe manufacturer at the pipe production facility and, words 'Factory Capped' shall be included in the print line of every pipe. The end covers shall be held securely in place by a tamper evident seal. Tamper evident seals shall display the manufacturers name or logo or both.

Seals shall straddle the end cover and the pipe. Removal of the cover shall render the tamper evident seal unusable either by breaking the seal or by leaving a message such as "VOID" on the pipe.

Any pipe delivered to the site with damaged end covers will be evaluated by the Contract Administrator and City of London Water Operations Representative to determine its suitability for use.

If some of the end seals have been damaged and there is any dirt or debris in the pipe, the Contractor, if he chooses to accept the shipment, at their expense, will take whatever measures are necessary to clean the pipe and insure it is the same condition as it was when it left the manufacturer or it will be rejected by the Contract Administrator and City of London Water Operations Representative. Once on site, the watermain must be stored in a location to prevent damage to the end covers. The inside of the watermain must be free of any dirt and debris before it is lowered into the trench and installed, to the satisfaction of the Contract Administrator and City of London Water Operations Representative.

It should be noted that the requirement of end seals was put in place to ensure a clean pipe is delivered to the site to assist the Contractor in installing a clean product and minimize the time and effort required to swab, chlorinate and pass the bacteriological tests.

All pipes, specials, fitting and gaskets that are unsound or damaged shall be removed from the site and replaced.

Mechanical equipment shall be used to unload the pipe.

Materials shall be placed in safe storage.

Manufacturer's handling and storage recommendations shall be followed.

441.07.12 Temporary Potable Water Supply Services

Temporary potable water supply services shall be in accordance with OPSS 493.

441.07.13 Backfilling and Compacting

Clause 441.07.13 is amended as follows:

Where concrete or weakly cemented fill bedding is specified, the pipe shall be supported on grade and aligned by solid concrete blocks having the same minimum compressive strength as the specified bedding, spaced so that no movement of the pipe occurs during concrete or weakly cemented fill placing. Weakly cemented fill shall be 0.7mpa or less.

If necessary, concrete bedding may be placed in two pours. The level of the first pour shall not be higher than 75 mm below the bottom of the pipe. The first pour shall be cured a minimum of 24 hours before the second pour is started.

At pipe joints, bedding materials shall be left clear of the joints to permit their completion as specified elsewhere. After the connection has been completed, approved bedding material shall be placed under the joint and thoroughly tamped to the compaction specified. Bedding material shall not be taken from completed portions of the trench for this purpose. A 6mil poly bond breaker shall be installed around any mechanical fixtures if cement or weakly cemented fill is to be used.

Granular bedding shall be dimensioned as shown on Drawing SW-1. Granular bedding shall be uniformly compacted in layers not exceeding 150 mm in thickness. Compaction shall conform to OPSS 501 with a density of not less than 95 percent of the maximum dry density.

441.07.14 Installation of Pipes

Clause 441.07.14 shall be amended to include the following:

Pipes shall be handled with special care during temperatures below freezing. Pipes shall not be exposed to localized high temperatures except as required for the jointing process.

Only full length (6.1m) of pipe are to be used for mainline construction. It is not permitted to install watermain pipe less than 6.1m in length unless it is required to tie in to existing pipe, at hydrants, tees, bends or valves. The pipe can be cut and the spigot end chamfered as per manufacturers specifications when shorter pieces of pipe are required.

Fire hydrants located on Arterial Roads or roads with wide right-of-ways that will have fire hydrant laterals greater than 6.1m must be swabbed using a minimum of four (4) foam swabs as per MOE requirements.

Pipe shall be lowered into the trench carefully.

Pipes shall be laid on the prepared bed, true to the line and grade as shown on the contract drawings. The barrel of each pipe shall be in contact with the shaped bed throughout its full length. The ends of the pipe shall abut against each other so that there is no unevenness along the inside.

Pipe shall be kept clean as work progresses. Water shall not be allowed to flow through pipe during construction. A removable watertight bulkhead shall be installed at the open end of the last pipe laid whenever work is suspended.

Pipe shall not be laid until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.

For DI pipe refer to AWWA C600 (Installation of Ductile Iron Watermain and Their Appurtenances) and AWWA M41 (Ductile Iron Pipe and Fittings). For PVC pipe refer AWWA C605 (Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water), AWWA M23 and UNI-B-3.

Pipe shall be laid with the bell ends facing in the direction of laying.

At grades above 10 percent for PVC and DI pipe and 5 percent for concrete pressure pipe and steel bell and spigot pipe, laying shall start at the bottom with the bell ends facing upgrade.

Pipe shall not be laid when, in the opinion of the Contract Administrator, trench conditions are unsuitable.

The objective when designing and installing watermain is to have watermain which is below the frost line and protected from freezing as well as watermain which is constructed with as few offsets or joint deflections as possible. Standard watermain depth is 1.7m to 1.9m, however a depth of 2.2m will be permitted in order to avoid conflicts with other utilities.

Offsets must be made according to Drawing W-CS-12. Use of offsets must be indicated on the approved plans or in the case of unforeseen obstructions written approval of the Contract Administrator must be obtained.

Where joint deflection (on all pipe except PVC) or offsets on all pipes require pipe to be laid with less than specified cover insulation shall be placed to prevent freezing. Refer to Drawing W-CS-68, for insulation requirements.

For the purpose of locating PVC and concrete pressure pipe, a #12 AWG Solid (.0808" diameter), (as per 441.05.24) must be installed along the top of the pipe, strapped to it at six (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 each valve a loop of wire must be brought up inside the valve box to the top of the box. The Inspector may test the tracing wire for conductivity. If it is not continuous from valve to valve, the Contractor shall, at their expense, replace or repair the wire.

Where a connection is being made between the existing watermain system and new watermain being constructed, the new watermain is to be commissioned fully before the connection is made in accordance with 441.07.25 Disinfection.

The existing pipe is to be protected at all times from damage and from the potential of contamination to the system. Any opening made to the existing watermain system for a future connection is not to be made until such time as the connection can be made. Alternately the opening is to be protected at all times by a waterproof removable bulkhead/factory supplied night cap.

441.07.15 Jointing

441.07.15.02 Ductile Iron Pipe

Clause 441.07.15.02 shall be amended as follows:

Refer to AWWA C600 - Section 3.4.

441.07.15.03 Concrete Pressure Pipe

Clause 441.07.15.03 is deleted in its entirety and replaced by the following:

Refer to AWWA M9 (Concrete Pressure Pipe)

Bell and Spigot Joints

Cement mortar consists of one part Portland cement conforming to CAN3-A5-M and three parts mortar sand conforming to OPSS 1004 shall be poured around the assembled joint. Ensure that the diaper is carefully placed around joint recess.

Grout internal joints coincident with the pipe laying operation.

Restrained Joints

Restrained joints to be hold fast coupling, snap-ring type or flexible welded joints.

Install joints to manufacturer's instructions.

Installation of Flanged Joints

Flange faces to bear uniformly on the gasket.

Tighten bolts uniformly.

Take care to prevent bending or torsional strains on the flanges.

Align accurately and properly restrain connecting pipes and flanged fittings, valves and specials.

Clean all bolts, nuts, couplings, gaskets and connecting pieces thoroughly before installation.

Support all flanged joints.

441.07.15.04 Polyvinyl Chloride Plastic Pressure Pipe

Clause 441.07.15.04 is deleted in its entirety and replaced by the following:

a) Bell and Spigot Joints:

Joint Pipe in accordance with UNI-B-3-92 and manufacturer's specifications.

Axial bending (bending of the pipe barrel) is prohibited. For PVC pipe any change in direction of the watermain in excess of 50% of the pipes manufacturer's allowable joint deflection shall be made using an appropriate fitting.

If elastomeric gaskets are supplied separately, they shall be inserted into the groove of the bell end of the pipe.

Clean the gasket, the bell, the groove area (except when gasket is permanently installed) and the spigot area with a clean rag to remove any dirt or foreign material before assembling.

Insert the gasket into the groove and seal it firmly.

Apply lubricant to beveled spigot end.

Push the lubricated end past the gasket into the bell until reference mark is even with bell.

b) Restrained Joints:

Restraining Joints as per UNI-BELL, AWWA M23, ASTM F1674 and manufacturer's specifications and City of London "Design Specifications and Requirements Manual" – Section 7. See also section 441.07.21 of this document

Restraining collars shall be attached to the fitting bell behind the gasket face.

Tie-rods can be run from the collar to a suitable collar on the connecting pipe.

Tie-rods bolts, nuts and collars are to be protected from corrosion using Denso paste, mastic and tape in accordance with manufacturer specifications. An approved equal may be used.

441.07.15.05 Polyethylene Plastic Pressure Pipe

Clause 441.07.15.05 shall be amended as follows:

Approved only in special applications.

441.07.15.06 Steel Pipe

Clause 441.07.15.06 is deleted in its entirety and replaced by the following:

Joint pipe in accordance with AWWA Manual M11, Steel Pipe, Chapter 12.

Bell and spigot joints:

Follow procedure recommended by pipe manufacturer.

Field welded joints:

To AWWA C206

Expansion and contract joints in accordance with AWWA Manual M11, Steel Pipe, Chapter 8.

Restraint:

Flexible welded joints or harness fabricated by pipe manufacturer in accordance with AWWA Manual M11, Steel Pipe, Chapter 13.

Conform to AWWA C206, for field welding.

Installation of Flanged Joints:

Flange faces to bear uniformly on the gasket.

Tighten bolts uniformly.

Take care to prevent bending or torsional strains on the flanges.

Align accurately and properly restrain connecting pipes and flanged fittings, valves and specials.

Clean all bolts, nuts, couplings, gaskets and connecting pieces thoroughly before installation.

Support all flanged joints.

Cement mortar lining for field joints to AWWA C205, Appendix A.

441.07.18 Installation of Valves and Fittings

441.07.18.01 General

Clause 441.07.18.01 is deleted in its entirety and replaced by the following:

The work of installing valves shall include the valves, valve boxes and rods. Valves shall be installed at the locations shown in the Contract. Valves and connecting pipes shall be aligned accurately and supported as specified.

Damage to Epoxy coating shall be repaired prior to installation, as per manufacturer's recommendations and certified correct by the manufacturer. Other alternatives may be considered the City of London Water Operations Representative.

441.07.19 Installation of Hydrant Sets

Clause 441.07.19 is deleted in its entirety and replaced by the following:

The work of installing hydrant sets shall include the placing of hydrants, hydrant isolations valves, hydrant leads and restraining devices.

Hydrants shall be installed at locations as shown in the Contract or as directed by the Contract Administrator.

Fire hydrants are to be installed at a grade, whereby the fire hydrant boot has a minimum bury of 1.7m to a maximum bury of 1.9m, measured from the base of the fire hydrant boot to finished grade.

Fire Hydrant laterals to be PVC or DI as directed by the Contract Administrator and as required as per DWG: **W-CS-1**

In cases where the depth of the watermain is greater than 1.9m, bends may be used to offset the hydrant lateral (past the gate valve) to achieve the standard fire hydrant boot depth.

A 300mm (maximum) fire hydrant barrel extension may also be used.

All offsets and extensions must be approved and inspected by the Contract Administrator.

The hydrant shall be plumb with the nozzles parallel to the edge of pavement or curb line and the pumper connection facing the roadway.

Damage to the fire hydrant paint coating shall be repaired prior to installation, as per manufacturer's recommendations.

Hydrant installation shall be according to DWG: **W-CS-1**.

Hydrants shall be set at a grade whereby the final grading of the street or area shall be a minimum of 75mm to a maximum of 150mm from the break flange of the hydrant. Grading which results in a depression or ponding at the hydrant will not be accepted.

Hydrant laterals shall be manually swabbed using a chlorine slurry as directed by the City of London Water Operations personnel.

441.07.20 Installation of Services Connections

Clause 441.07.20 is deleted in its entirety and replaced by the following:

441.07.20.01 General

For all concrete and steel watermain the Contractor will supply the tapping sleeve and valve on site. The City of London will install the tapping sleeve and valve and complete the tap.

All watermain tapping to commissioned City of London watermain shall be made by City of London forces only.

Competent Contractors may tap watermain that is not yet in service.

A service connection shall consist of a service connection pipe and a service connection appurtenance set and shall be installed at all specified locations.

All connections must be approved and inspected by the City of London Water Operations Representative.

Water service connections shall be installed from the watermain to the property line at locations as shown in the Contract or as directed by the City of London Water Operations Representative.

A surface stake painted blue, 40mm X 90mm X 450mm long (standard 2"x 4"), shall be placed after trench restoration to mark the termination of a water service.

Curb stop valve and boxes shall be installed vertically and flush with final grade elevation.

All service boxes that fall within a concrete sidewalk or driveway, shall have a 100mm piece of 10M (#3 bar-0.375dia.) reinforcing rod welded horizontally to the underside of the service box cover, approximately 40mm below the surface, to prevent frost heave.

No service extensions to any users or use of the water from a main will be permitted until the main has been cleaned and passed pressure, leakage and disinfection tests.

All tapping must be undertaken by competent workmen equipped with tapping machines and other required equipment satisfactory to the City of London Water Operations Representative.

If plastic water services are installed, this material must be used continuously from the main to the water meter and installed with a tracer wire (as per 441.05.24) its entire length.

Service Connections of 25mm Diameter

Services of 25 mm diameter shall be installed according to DWG: **W-CS-8, Sheets 1 to 3.**

Service Connections of 40mm and 50mm Diameter

Services of 40 mm and 50 mm diameter shall be installed according to DWG: **W-CS-22.**

Service Connections of 100mm in Diameter and Larger

For services of 100mm in diameter and larger, the method of connection shall be prescribed by the City of London Water Operations Representative. The method shall either cut out and install a tee, or use a tapping sleeve and valve.

The Contractor shall supply and install the tapping sleeve and valve for the City of London Waterworks forces to complete the tap to the existing watermain.

In all cases, the City of London Waterworks forces shall make the tap to the commissioned watermain at the Contractor's expense, unless an agreement is made in writing between the Contract Administrator and the Contractor.

Size on size taps are not permitted unless written approval has been given by Water Engineering.

On a reconstruction project, when the city portion of the water service is replaced with plastic and being connected to a metal service on private property, then, connect the tracer wire to the metallic.

441.07.21 Shutting Down or Charging Mains

Clause 441.07.21 is deleted in its entirety and replaced by the following:

At no time shall watermains that are in service be shut down or charged, or operate any gate valve or other control for any purpose. Operation of valves, hydrants, blow-offs and curb stops shall be performed solely by the City of London Waterworks forces.

At least 24 hour notice must be given to the Corporation when valves which will shut off services to consumers are required to be operated.

The Contractor shall give notice of interruption of service to consumers at least twelve (12) hours before the interruption occurs. The Contractor shall obtain notice cards from the Corporation and shall distribute them at no expense to the City of London.

441.07.22 Connection to Existing Watermain

Clause 441.07.22 is deleted in its entirety and replaced by the following:

All connections to existing watermains shall be made under the supervision of the City of London Water Operations Representative. Dewatering and removal of any plugs, caps, blow offs and/or thrust blocks from an existing watermain or fitting and reconstruction of the joint will be considered part of the work of constructing the new watermain.

Where connections are to be made to steel mains, approved insulated flange insulation kits shall be used according to Drawing W-CS-25. All disturbed coating shall be replaced and all bare metal between the insulator and the steel main shall be given a protective mastic coating and the entire assembly shall be encased with 8-mil thick loose polyethylene film in accordance with AWWA C105.

Where connections are to be made to DI pipe using steel tapping sleeves the installation must be mastic coated.

Clean sand bedding shall be used at least 300 mm above and 150 mm beneath the installation. Tapping of PVC pipe must be done as recommended by the pipe manufacturer. The sleeve must be

supported and blocked during tapping and supports for the sleeve and valve must be left in place. Thrust blocks must be used.

Connecting to PVC Water Mains: Refer to UNI-BELL - Section 5.3.6. Direct tapping is not permitted.

In all cases, the City of London Waterworks forces shall make the tap to the existing watermain at the Contractor's expense, unless an agreement is made in writing between the Contract Administrator and the Contractor.

441.07.23 Thrust Restraints

Clause 441.07.23 is deleted in its entirety and replaced by the following:

441.07.23.01 General

All thrust restraint shall be designed to adequately provide the minimum amount of pipe/joint restraint required by mechanical restraint device alone. Concrete thrust blocks will no longer be an accepted method of thrust restraint in the City of London except for connections to an existing main as directed by the City Engineer or their designate.

Restrain lengths for watermain 100mm to 300mm shall be in accordance with the requirements outlined below. Restrained length calculations for watermains 400mm and greater shall be supplied by the pipe manufacturer using the design criteria set out below.

Thrust restraint shall be provided at all fittings, bends, tees, valves, hydrants, crosses, reducers, and plugged or capped dead ends.

For DI pipe refer to AWWA C600 – Section 3.8. For PVC pipe refer to UNI-BELL, AWWA M-23 and ASTM F1674.

Hydrants shall be restrained with mechanical thrust restraints as shown on drawing W-CS-1.

Tie rods and clamp assemblies shall be wrapped in Denso paste and Tape (to manufacture specifications) or approved equal and installed accordance with Drawing W-CS-12. Tie rods, washers and bolts are to be a minimum of 19mm (3/4") stainless steel type 304.

This specification is to be used in the design of all new infrastructure. Exceptions may apply when designing Infrastructure Lifecycle Renewal projects and will be identified on the construction drawings and specifications.

DEFINITIONS

Design Criteria

Thrust restraints shall be designed to be adequately provided by mechanical restraint devices. The following chart displays the minimum restraint length for horizontal bends and can be used to assist in design of mains of a maximum diameter of 300mm.

For mains larger than 300mm diameter or installation situations not included in the table, the restrained length shall be shown on the shop drawings as recommended by the pipe manufacturer.

Minimum Length to be Restrained on Each Side of Fittings (m)

Diameter of Main (mm)	Minimum No. of Steel Rods	11¼°	22½°	45°	90°	Dead End
100	2	4	4	4	4	20
150	2	4	4	4	5.5	20
200	2	4	4	4	7	20
250	4	4	4	4	8.5	30
300	4	4	4	4	10	30

1. Steel Rods are to be a minimum of 20mm in diameter
2. If any joint is encountered in the above restrained length it must be restrained
3. Refer to section 441.05.05 for thrust restraint material specification
4. 5° Bends (bell & spigot fitting). Must be restrained at joints.

All branch valves shall be treated as dead end watermains and shall be restrained according to the above mentioned dead end watermain criteria.

Note: If any joint is encountered in the above restrained lengths it must also be restrained.

For watermains larger than 300mm or installation situations not included in the above, the restrained lengths shall be shown on the shop drawings as recommended by the pipe manufacture and reviewed and or approved by the Water Engineering Division.

When calculating thrust restraints for watermain greater than 300mm use the following design criteria:

Hydrostatic test pressure is 1035kpa (150psi);

For poly wrapped DI pipe refer to AWWA C600;

For PVC pipe refer to AWWA C900, UNI-BELL and pipe suppliers manuals;

Depth of bury is at a minimum of 1.7m (5.5ft);

Stainless steel rods are to be a minimum of 20mm in diameter;

Trench type shall be Type 3 as per AWWA C150 Trench Conditions (Pipe bedded in 100mm minimum loose soil. Backfill lightly consolidated to top of pipe);

Joints shall be designed for the same design test and surge pressure rating as the pipeline;

Factor of Safety shall be 2:1;

Soil type shall be CL as per "Unified Soils Classification Systems. ASTM Standard D248.

If in the opinion of the designer it is deemed necessary to provide a thrust block the designer shall provide specific drawings and calculations for thrust blocking. Drawings and calculations shall be submitted to the Water Engineering for approval at the time of preliminary drawing review.

441.07.24 Hydrostatic Testing

Clause 441.07.24 is deleted in its entirety and replaced by the following:

441.07.24.01 Hydrostatic Testing

Hydrostatic testing shall be conducted under the supervision of the City of London Water Operations Representative upon completion of the watermain including services and backfilling.

Hydrostatic testing of new watermain and appurtenances (fire hydrants and laterals, etc.) including water services to the curb box shall be done on new subdivision watermain infrastructure only. All other hydrostatic testing of new watermain replacements shall include the testing of all appurtenances including the installed service saddle 25mm main stops only. All services over 25mm shall be tested to the curb box.

All caps and / or plugs used for testing process to be supplied, same for tap and ball valve.

Hydrostatic pressure and hydrostatic leakage tests may be conducted either simultaneously or separately.

Duration of test shall be two (2) hours or longer if so directed by the City of London Water Operations Representative, if tests are performed simultaneously.

If two tests are performed separately, conduct hydrostatic pressure test before hydrostatic leakage test. Duration of pressure test shall be one (1) hour or longer if so directed by City of London Water Operations Representative. Duration of leakage test shall be two (2) hours or longer if so directed by City of London Water Operation Representative.

The Contractor shall assume all responsibility when testing against existing or new line valves. The Contractor is to provide all bulkheads, taps, fittings and pipe thrust restraint necessary to undertake pre-qualification or final testing.

Testing for Polyethylene Pipe shall be in accordance with the manufactured specifications and AWWA M55.

The Contractor is to provide means of obtaining water.

Fill test section slowly with water making sure that all air is removed from pipeline. Allow a period of 24 hours before starting test. Subject test section to continuous test pressure specified for one hour or as directed by City of London Water Operations Representative and in accordance with the Contract Administrator.

Test pressure shall be 1035 kPa or as specified in the Contract. No pressure drop is allowed during the hydrostatic pressure test period.

Examine all parts of test section while under pressure. If test pressure is maintained with no pressure drop for specified test duration, test result is satisfactory.

If test result is not satisfactory, repair all deficient parts of section and retest until satisfactory result is attained.

441.07.25 Flushing and Disinfecting Watermain

Clause 441.07.25 is deleted in its entirety and replaced by the following:

441.07.25 Swabbing, Flushing, Disinfection and Bacteriological Testing of Watermain

Swabbing, flushing and disinfecting operations shall be under the direct control of the City of London Water Operations Representative and in accordance with the Contract Administrator. The City of London Water Operations Representative shall be notified at least four days in advance of the proposed date on which such operations are to commence. Swabs are to be supplied by the contractor in accordance with section 441.05.23

Swabbing and Flushing

Watermains shall be swabbed and flushed in a sequence and in accordance with procedure approved by the City of London Water Operations Representative and in accordance with the Contract Administrator. The Contractor must submit a swabbing, flushing and disinfection procedure to the City of London Water Operations Representative for approval two (2) weeks prior to the operation for approval.

All watermains, 40mm up to 450 mm diameter shall be cleaned by the use of a minimum of four (4) foam swabs introduced at special entry sections or as directed by City of London Water Operations Representative and forced by water pressure through the main to exit points approved by the City of London Water Operations Representative and in accordance with the Contract Administrator. Cleaning shall be repeated until 2 consecutive clean swabs (no discolouration of swab) and the discharge water is clear and approved by the City of London Water Operations Representative and in accordance with the Contract Administrator.

Hydrants laterals (maximum length 6.1m) shall be manually swabbed using a chlorine slurry as directed by the City of London Water Operations Representative.

Method for swabbing watermains larger than 450 mm in diameter shall be as specified in the Contract.

Mains shall be cleaned or flushed before hydrostatic testing and disinfection is done.

Disinfection

The watermain (40mm and greater) shall be disinfected according to Ontario's "Watermain Disinfection Procedure", and the "Procedure for Disinfection of Drinking Water in Ontario" as adopted by reference by Ontario Regulation 170/03 under the Safe Drinking Water Act. Backflow device certification is to be witnessed by the City of London Water Operations representative and/or the Contract Administrator. The Contractor must supply all labour and materials necessary for the disinfection of the main. Inspection of the disinfection procedure will be provided at no cost by the City of London for the initial disinfection. Locations where flushing may be performed, rates of flushing and location of discharge points must be approved by the City of London Water Operations representative and in accordance with the Contract Administrator prior to the operation as noted above.

The City of London Water Operations representative may permit or require the swabbing, flushing and disinfection to be carried out in stages as sections of the system are completed. Swabbed, flushed and disinfected sections shall be protected from contamination.

Microbiological Testing

All samples shall be taken by the City of London Water Operations representative.

After the watermain has final flushing of the chlorine solution and refilled with water from the City distribution system, it will sit for a minimum of 16 hours before the first sample is collected and sent to the lab for testing. After the first sample has been taken, the second will be taken in 24 hours from the first.

If any of the two samples fail, then the disinfected sections will be redone to the City of London Water Operations Inspectors discretion with further charges pending.

The new watermain shall not be connected to the City's distribution system until all microbiological samples show the absence of Total Coliform, E. coli and Background bacteria. Once all sample results are to the satisfaction of the City of London, clearance will be given to connect to the City's distribution system.

The Contractor will not be reimbursed for any down-time associated with awaiting test results.

441.07.27 Management of Excess Material

Clause 441.07.27 is deleted in its entirety and replaced by the following:

441.07.27.01 General

Management and disposal of excess material shall be according to OPSS 180.

441.07.27.02 Disposal of Chlorinated Water

All chlorinated water used for testing, flushing and disinfecting watermain shall be disposed of safely. Acceptable means of disposal are by discharge to storm sewer or open environment (drainage ditch or receiving water) with a free chlorine residual of 0.0 mg/L (i.e. no detectable level of chlorine).

Discharge of chlorinated water directly to sanitary sewer is no longer acceptable as of January 1, 2003.

When discharging to the open environment or storm sewer, it will be the responsibility of the Contractor to ensure the effectiveness of the dechlorination process. The Contractor shall provide a written plan for the dechlorination process which is to be submitted to the contract administrator and approved. As a minimum this shall include:

- i) The chemical proposed to be used to dechlorinate, the proposed equipment and methodology for dechlorination, and the proposed point of discharge and the receiving body (i.e. storm sewer, open environment, ditch, drain, water course).

- ii) The process proposed and how it will ensure adequate dosing and mixing of the dechlorination compound prior to discharge.
- iii) Ensuring that there are appropriate measures in place to avoid erosion at the point of discharge and downstream.
- iv) There is a location for monitoring (and a method of monitoring) to ensure no chlorine residual remains downstream of the point of discharge.

The Contractor shall also be responsible for documenting the dechlorination and monitoring process. These records will be made available to the City of London Water Operations Representative as required.

Use of Chemicals for Dechlorination of Water

There are several chemicals which can be used to dechlorinate effectively. The following comments are offered with respect to potential impacts of each on the receiving body:

Chemical	Comments/Impacts
Hydrogen Peroxide	This is the best chemical when discharging to an environmentally sensitive watercourse. An overdose will only add more oxygen.
Sulphur Dioxide	This will slightly lower the pH in the receiving water.
Sodium Thiosulphate	Will cause some sulphur turbidity, but an excess is harmless.
Sodium Sulphite	Excess will lower dissolved oxygen.
Sodium Pyrosulphite (sodium Metabisulphite)	Excess will lower dissolved oxygen.

Adequate mixing and dosage of the chemical with chlorinated water must be ensured.

441.09 Measurement for Payment

Section 441.09 has been amended to include the following subsection:

441.09.01 Actual Measurement

441.09.01.01 Watermain (includes bends, 'T's and fittings)

Measurement of watermain shall be by length in metres along the horizontal centreline of the pipe from the point of connection to a chamber, water treatment plant, or existing watermain to a point vertically above the end of the new watermain.

441.09.01.02 Valves

For measurement purposes, a count shall be made of the number of valves installed, regardless of the type and size.

441.09.01.03 Hydrant Sets

For measurement purposes, a count shall be made of the number of hydrant sets installed, regardless of the type.

441.09.01.04 Service Connection Pipe

Measurement of service connection pipe shall be by length in metres along the horizontal centreline of the pipe from the point of connection at the watermain to a point vertically above the end of the service connection.

441.09.01.05 Service Connection Appurtenance Sets

For measurement purposes, a count shall be made of the number of service connection appurtenance sets installed.

441.09.01.06 Connections to Existing Watermain (includes bends, 'T's and fittings)

For measurement purposes, a count shall be made of the number of connections made to existing watermain.

441.09.01.07 Watermain Offsets

Measurement will be the number of offsets installed. The unit of measurement will be each.

441.09.01.08 Cut and Cap Watermain

Measurement will be by the number of watermain cut-offs.

441.09.01.10 Testing, Flushing, Swabbing and Disinfection

For the lump sum payment of this item, the contractor shall supply all labour, equipment and materials required to undertake all testing, flushing, swabbing and disinfection of all watermain and services all in accordance with this document. The testing, flushing, swabbing and disinfection may have to be undertaken in stages to in order to accommodate the proposed construction staging plan.

441.10 Basis of Payment

441.10.01 Watermain (Includes bends, 'T's and fittings) – Item

Clause 441.10.01 is deleted in its entirety and replaced by the following:

Valves (Includes boxes and rods) – Item

Hydrant Sets (Includes valves and leads) – Item

Service Connection Pipes – Item

Service Connection Appurtenances – Item

Watermain Offsets – Item

Watermain Connections (includes bends, 'T's and fittings) – Item

Cut and Cap Watermain – Item

Flushing and Disinfecting Watermain - Item

Payment at the contract price for the above tender item(s) shall be full compensation for all labour, equipment and material to do the work, all thrust restraints, including excavation, bedding, backfilling and compaction to subgrade. Including all thrust restraint and corrosion protection.

No change in Contract Price (credit or increase) will be considered unless as-constructed location of watermain changes by more than 500 mm higher or 500 mm lower than as shown on the Contract Drawings.

Include in the prices bid in the Form of Tender: water used for all testing, hydrostatic testing, cleaning, swabbing, flushing, disinfecting, including, if required, water meter; closures; all temporary connections and piping; temporary bulkheads and thrust restraints required for testing purposes.

When imported Granular 'C' trench backfill is specified in a Special Provision, and the Contract Administrator directs that native, selected native material, and/or selected native site material be used as trench backfill, the credit to the Corporation shall be based on the current market price of Granular 'C' materials delivered to the job site, and the volume in tonnes of native materials that is substituted.

442 Construction Specification for Corrosion Protection of New and Existing Watermains

442.05.05 Test Stations

Subsection 442.05.05 paragraph b) is deleted in its entirety and replaced with the following:

Approved test flush mount test stations:

Pro-mark Model PM-T55

491 Construction Specification for Preservation, Protection and Reconstruction of Existing Facilities

491.07 Construction

491.07.03 Existing Services and Structures

Subsection 491.07.03 is amended by the addition of the following:

On projects where the existing sanitary or storm sewer is preserved, and where new or replacement PDC's are required to be connected to the existing sewer, the Contractor is required to provide the Contract Administrator with a preconstruction video inspection of the existing sewer and a post PDC installation sewer video prior to the placement of the base asphalt as a condition of authorization to place base asphalt.

Amend OPSS 491 by the addition of subsection 491.08

491.08 Measurement for Payment

Sewer Video Inspection

Measurement for the tender items Sewer Video Inspection Pre Construction and Sewer Video Inspection Post PDC Installation shall be by the unit meter of sewer pipe inspected.

491.10 Basis of Payment

Section 491.10 Basis of Payment is extended by the following:

Payment at the Contract price for the above item shall be full compensation for all labour, equipment and material to do the work.

493 Construction Specifications for Temporary Potable Water Supply Services

493.05 Materials

493.05.01 General

All temporary watermain pipe delivered to the City of London or to any Contractor working in the City of London (Including on private property) shall be delivered with the inside of the pipe clean, free of any debris and with end covers.

Any pipe delivered to the site will be evaluated by the Contract Administrator and City of London Water Operations representative to determine its suitability for use.

If some of the end covers have been damaged and there is any dirt or debris in the pipe, the Contractor, if they choose to accept the shipment, at their expense, will take whatever measures are

necessary to clean the pipe and ensure it is the same condition as it was when it left the manufacturer or it will be rejected by the Contract Administrator and City of London Water Operations representative. Once on site, the watermain must be stored in a location to prevent damage to the end covers. The inside of the watermain must be free of dirt and debris before it is installed, to the satisfaction of the Contract Administrator and City of London Water Operations representative.

It should be noted that the condition of materials used for delivery of temporary potable water is of great concern to the customer and the City of London. Contractors shall take care to ensure that the state of the temporary water supply pipes and handling protocols conveys an image which is desirable for the City of London, the Contractor and the water supply industry.

493.07 Construction

493.07.01 General

Notification cards will be supplied by the City of London Water Operations site representative and distributed by the Contractor to all properties/businesses/residential units which will be affected with a minimum 24 hour notice in advance of a water shutoff.

Operation of any existing valves, fire hydrants or service boxes will be by the City of London Water Operations Representative or under the direct supervision of the Water Operations Site Representative.

Amend the 4th paragraph to read:

It shall be the responsibility of the Contractor to ensure an adequate water supply at all times. During the construction process, the Contractor will be responsible to restore a customer's water supply within two (2) hours upon notification.

493.07.08 Flushing and Disinfecting Temporary Watermain and Services

Remove subsection 493.07.08 in its entirety and replace with the following:

This work is to be done where specified on the Contract Drawings and shall include the supply, labour, material and equipment required for the following operations.

The temporary by-pass watermain must be pressure tested (to the static pressure of the area), swabbed, flushed, disinfected including bacteriological testing to the satisfaction of the City of London Water Operations Representative and with the Contract Administrator and in accordance with the current City of London Standards. The existing watermain shall not be removed from service until the installed by-pass line and services have been approved by the City of London Water Operations Representative and the Contract Administrator.

The temporary by-pass watermain is to be installed and operational prior to any undergrounds works which affect water supply.

1010 Material Specification for Aggregates – Base, Sub-Base, Select Subgrade and Backfill Material

1010.05 Materials

1010.05.03 Granular B

Subsection 1010.05.03 is amended by the addition of the following:

"Granular 'B' - Select" physical requirements shall conform with "Table 1 Physical Requirements" Granular 'B' type 1 and the following gradation chart.

Granular 'B' - Select

Sieve Size	% Passing
100.0 mm	100
37.5 mm	65-100
22.4 mm	57-90
4.75 mm	25-75
1.18 mm	10-65
0.300 mm	5-35
0.075 mm	0-8

1010.05.05 Select Subgrade Material

Subsection 1010.05.05 is amended by the addition of the following:

The following gradation charts are specified for select subgrade material.

Coarse Sand

Sieve Size	% Passing
20.0 mm	100
9.5 mm	80-100
4.75 mm	55-100
2.36 mm	35-100
1.18 mm	25-85
0.600 mm	15-55
0.300 mm	7-35
0.150 mm	2-20
0.075 mm	0-8

Granular 'C'

Sieve Size	% Passing
150.0 mm	100
26.5 mm	50-100
4.75 mm	22-100
1.18 mm	10-100
0.300 mm	5-90
0.150 mm	4-30
0.075 mm	0-10