

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM A48/A48M, Standard Specification for Gray Iron Castings.
 - .2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM C117, Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Maintenance holes.
 - .6 ASTM C478M, Standard Specification for Precast Reinforced Concrete Maintenance Hole Sections (Metric).
 - .7 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m³)).
- .2 CSA Group
 - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A165 Series, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
 - .3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .4 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.
- .3 City of Winnipeg
 - .1 City of Winnipeg Standard Construction Specification CW2030, Excavation Bedding and Backfill [February 2005]
 - .2 City of Winnipeg Standard Construction Specification CW2130, Gravity Sewers [August 2010]
 - .3 City of Winnipeg Standard Construction Specifications CW2145, Sewer and Manhole Inspection [May 2016]
 - .4 City of Winnipeg Standard Construction Specification CW2160, Concrete Underground Structures and Works [March 2006]
- .4 City of Winnipeg Standard Details (<http://www.winnipeg.ca/matmgt/Spec/Default.stm>)
 - .1 SD-001, Standard Pipe Bedding Classes
 - .2 SD-009, Sewer or Sewer Service Connection to Existing 1050 Diameter or Larger Sewer
 - .3 SD-010, Standard Precast Concrete Manhole (for up to 525 Diameter Pipe)

- .4 SD-10D, SD-010, Standard Precast Concrete Manhole (for up to 525 Diameter Pipe) with internal drop pipe
- .5 SD-011, Standard Precast Concrete Manhole (for 600 to 1500 Diameter Pipe)
- .6 SD-023, Curb and Gutter Inlet with Catch Pit
- .7 SD-024, Catch Basin with Curb and Guter Inlet
- .8 SD-025, Standard Catch Basin

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for maintenance holes and catch basin structures and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

1.3 QUALITY ASSURANCE

- .1 Certifications:
 - .1 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations.
 - .2 Store and protect maintenance holes and catch basin structures from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 APPROVED PRODUCTS

- .1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg found on the City of Winnipeg, Materials Management web site at:
<http://www.winnipeg.ca/matmgt/spec/>

2.2 MAINTENANCE HOLES, CATCH BASINS AND CATCH PITS

- .1 Pre-cast concrete sections as indicated on SD-010, SD-011, SD-023, SD-024 and SD-025: to CSA A257.4 and ASTM Standard C 76 Class II and C 478 (circular sections)
- .2 Cast iron frames and covers to be in accordance with AP-004, AP-005, AP-006, AP-007, AP-008, AP-009, AP-010 and AP-011 in accordance with AT 4.2.1.73, AT 4.2.1.75, AT 4.2.1.83B, and AT 4.2.1.83M of the Approved Products for Underground Use in the City of Winnipeg.
- .3 Ladder rungs to be in accordance with AT 4.2.1.72 of the Approved Products for Underground Use in the City of Winnipeg.
- .4 Pre-cast concrete adjusting rings in accordance with CAN/CSA A257.4 and ASTM C478.
- .5 Concrete brick in accordance with CAN3-A165 Series.
- .6 Catch basin hood to be in accordance with AP-012 and AT 4.2.1.84 of the Approved Products for Underground Use in the City of Winnipeg.
- .7 Maintenance hole and catchbasin joint gaskets to be in accordance with AT 4.2.1.71 of the Approved Products for Underground Use in the City of Winnipeg.
- .8 Core and seat boot type flexible rubber connection for PVC pipe in accordance with material requirements of ASTM C923.

2.3 FASTENERS

- .1 Fasteners, tie rods, clamps, straps, bands, nuts and bolts to be stainless steel in accordance with ASTM A320, ANSI Type 316 marked as such with raised or indented numerals.

2.4 CEMENT PATCHING COMPOUND

- .1 Cement patching compound to be fast hardening, high strength non-shrink mixture suitable for use on vertical surfaces.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for maintenance holes and catch basin structures installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 EXCAVATION AND BACKFILL

- .1 Excavate and prepare trench a sufficient distance in ahead to not to interfere with installation of the pipe.

3.3 FOUNDATION AND BEDDING

- .1 Place and compact foundation material, where required and bedding material in bottom of trench or excavation to grade and elevation shown. Level across full width of trench or excavation and leave ready for pipe installation.

3.4 INSTALLATION IN A TRENCH

- .1 Install same material, class and type of pipe between adjacent Maintenance Holes.
- .2 Assemble pipe in accordance with manufacturer's instructions so when complete sewer will have a smooth and uniform invert. Lay pipe with bell upgrade. Use longest pipe size manufactured where practicable to reduce total number of joints on sewer.
- .3 Place pipe on compacted bedding ensuring uniform support under bell and pipe body throughout its full length. Work and compact bedding material under sides of pipe to provide proper haunching.
- .4 Protect exposed pipe ends with an approved stopper to prevent excess amounts of water, earth and debris from entering pipe as work proceeds.
- .5 Install pipe to the line and grade shown.
- .6 Pipe joint deflections to be within the manufacturer's recommendations.
- .7 Remove construction debris and materials from sewers before performing video inspection.

3.5 FITTING INSTALLATION

- .1 Install fittings of same material, type and class as sewer, sewer service or catch pit pipe.
- .2 Install watertight plug in the end of sewers where shown on the Drawings to allow for a future connection.
- .3 Excavate, bed and install fittings as specified for sewers and sewer services.

3.6 LINE AND GRADE

- .1 Allowable variance from specified line to be +/- 100 millimetres. Allowable variance from specified grade to be 25 millimetres above grade and 50 millimetres below grade at any one location. Allowable ponding in pipe due to combined variance above and below grade not to exceed 50 millimetres.
- .2 Correct alignment and grade exceeding the allowable variance in a manner acceptable to the Departmental Representative.

3.7 MAINTENANCE HOLE AND CATCH BASIN INSTALLATION

- .1 Level bedding to ensure maintenance hole base, catch basin and catch pit is uniformly supported and the floor is level.
- .2 Construct maintenance holes, catch basins and catch pits as shown on the Drawings. Install maintenance hole, drop pipe, catch basin and catch pit sections plumb and level. Variance from line and grade to be in accordance with Section 3.6 of this specification.
- .3 Install approved gasket or joint sealer between pre-cast concrete sections including 750 millimetre diameter riser adjusting rings and between frame and pre-cast concrete riser as

construction progresses. Alternately install grout between frame and pre-cast concrete risers if approved by the Departmental Representative. Ensure grout completely fills space between frame and riser to make joint watertight and finish flush with inside surface of risers.

- .4 Connect sewers to maintenance hole bases, catch basins and catch pits at invert elevations shown on the Drawings and grout in place to make a watertight connection. Coat outside of PVC pipe end for a length equal to the maintenance hole, catch basin and catch pit wall thickness plus 150 millimetres with an approved cementing agent to which sand has been added and allow mixture to harden before grouting in place. Alternatively PVC pipe may be connected using an approved pre-treated, gasketed PVC insert or an approved interference fit flexible rubber boot or gasket inserted into a hole cored in the maintenance hole base, catch basin or catch pit wall.
- .5 Bench and channel maintenance hole floor with mortar or concrete in accordance with SD-010 and SD-011 and as shown on the Drawings. Curve flow channels smoothly and provide smooth transition between inlet and outlet pipes.
- .6 Grout and plug lifting holes, joints and frame with mortar to make watertight. Remove excess mortar from inside surface of maintenance hole.
- .7 Compact backfill between maintenance holes, catch basins or catch pits and the sides of the trench or excavation.

3.8 NEW MAINTENANCE HOLE ON EXISTING SEWER

- .1 Where a new maintenance hole is to be installed by removing a length of the existing sewer pipe install the maintenance hole in accordance with the following requirements.
 - .1 Cut fully through the existing sewer pipe leaving neat, square ends and remove the required length or remove existing sewer pipe at a joint within the excavation.
 - .2 Excavate the required depth below the existing sewer for granular foundation and bedding.
 - .3 Install required length of new sewer, connect to existing sewer with approved coupling, adapter or bushing and connect to new maintenance hole.
 - .4 Remove construction debris and materials from maintenance holes and sewers when the Work is complete.
- .2 Where a new maintenance hole is to be installed overtop the existing sewer without removing a length of pipe install the maintenance hole in accordance with the following requirements.
 - .1 Excavate the required depth below the existing sewer for the cast-in-place concrete maintenance hole floor. Fully support the existing sewer during excavation.
 - .2 Set the saddle or arch type open maintenance hole base over the existing sewer in a manner to not damage the existing sewer.
 - .3 Place concrete in the bottom of the excavation and embed the maintenance hole base to required elevation. Plumb and level the maintenance hole base as required.
 - .4 Cut out and remove top portion of existing sewer as required in a manner that will not damage the remaining sewer pipe.

- .5 Grout around the sewer pipe and maintenance hole wall opening with mortar to make a watertight joint.
- .6 Place mortar or concrete between the existing sewer pipe and the inside of new maintenance hole wall and form smooth flow channel and benching.
- .7 Remove construction debris and materials from maintenance holes and sewers when the Work is complete.

3.9 REMOVAL AND REPLACEMENT OF EXISTING MAINTENANCE HOLES AND CATCH BASINS

- .1 Remove and replace existing maintenance holes, catch basins and catch pits where indicated on the Drawings and Specifications as excavation progresses. Install replacement maintenance holes, catch basins and catch pits in accordance with SD-010, SD-010D, SD-011, SD-023, SD-024 and SD-025, Section 3.8 of this specification and the following requirements
 - .1 Cut fully through existing sewer pipe or catch basin lead pipe leaving neat, square ends before removing the existing catch basin, catch pit or maintenance hole base. Alternately, remove existing sewer pipe or catch basin lead pipe at a joint location within the excavation.
 - .2 Install new sewer pipe or catch basin lead pipe of specified size and type from new maintenance hole or catch basin to existing sewer pipe or catch basin lead pipe.
 - .3 Connect to existing sewer pipe or catch basin lead pipe with approved coupling, adapter or bushing to make a watertight connection.
- .2 Remove construction debris and materials from maintenance holes, catch basins, catch pits and sewers when the Work is complete.

3.10 CONNECTING NEW SEWERS AND CATCH BASINS TO EXISTING MAINTENANCE HOLES AND CATCH BASINS.

- .1 Connect new sewers and catch basin leads to existing maintenance holes, catch basins and catch pits at locations and elevations shown on the Drawings
- .2 Excavate required depth and make neat hole in maintenance hole, catch basin or catch pit wall a maximum of 25 millimetres larger than outside diameter of the sewer or catch basin lead pipe.
- .3 Connect sewers, catch basin leads and drainage connection pipes in accordance with Section 3.7 of this specification.
- .4 Connect catch basin leads to existing maintenance holes at a depth of 2.4 to 4.0 metres below finished grade and from 600 millimetres to 900 millimetres above the maintenance hole floor where the maintenance hole floor is between 3.0 and 4.0 metres below finished grade
- .5 Install approved catch basin hood in accordance with AP-012, SD-024 and SD-025. Reuse existing catch basin hood if not damaged.
- .6 Cut existing catch basin lead pipe flush with catch basin or catch pit wall and plug opening with mortar or concrete to make watertight.

- .7 Re- bench and re-channel maintenance hole floor as required with mortar or concrete in accordance with SD-010 and SD-011. Curve flow channels for perpendicular connections smoothly into main flow channel.
- .8 Remove construction debris and materials from existing maintenance holes, catch basins, catch pits and sewers.

3.11 CONNECTING NEW SEWER OR SEWER SERVICE TO EXISTING SEWER

- .1 Connect to existing sewer fittings where provided with approved coupling, adapter or bushing to make a watertight connection.
- .2 Connect to existing vitrified clay pipe sewers where no fitting is provided by removing the required length of sewer pipe and installing an approved tee, required lengths of new sewer pipe and flexible couplings, bushing or adapters.
 - .1 Where approved by the Departmental Representative a connection can be made to 300 millimetre and larger vitrified clay sewers with an approved PVC saddle.
- .3 Connect to other types of existing sewers where no fitting is provided using one of the following methods.
 - .1 Remove a section of existing sewer pipe and install an approved tee. or
 - .2 Make a neat circular hole in the existing sewer the same size as the sewer or sewer service to be connected and install an approved PVC saddle in accordance with the manufacturer's instructions using stainless steel straps or 6 millimetre diameter stainless steel bolts.
 - .1 .1 Maximum connection to an existing sewer using a PVC saddle to be two sizes smaller than the sewer pipe.
 - .2 Install fastening bolts with head on the inside of the sewer pipe. Use washers if hole has chipped during drilling. Do not over tighten bolts to cause stress or damage to existing sewer pipe.
 - .3 Limit excavation beneath existing sewer to only what is required to install saddle straps. Fill excavation beneath existing sewer with grout or cement stabilized fill.
 - .3 Make a neat circular hole in the existing sewer a maximum of 25 millimetres larger than sewer or sewer service pipe to be connected. Insert a short piece of sewer or service pipe into the hole with the bell end resting on the outside of the existing sewer pipe. Grout around and between the sewer or service pipe bell and the existing sewer pipe wall with mortar in accordance with SD-009 or construct a concrete collar to make a watertight connection.
- .4 Make holes in existing sewer pipes using the following methods.
 - .1 Non-reinforced monolithic concrete sewer and pre-cast reinforced concrete pipe 900 millimetres in diameter and larger: by concrete coring.
 - .2 Pipes less than 900 millimetres in diameter: by concrete coring or drilling a series of 12 millimetre diameter holes with a masonry drill bit around the circumference of the hole and carefully tapping out the coupon.
 - .1 Drill holes at 15 millimetres on centre for sewer pipes 375 millimetre diameter and smaller and at 25 millimetres on centre for sewer pipes up to and including 900 millimetre diameter.

- .3 PVC pipe: by coring or cutting with hole saw or other tool capable of cutting a circular opening.
- .5 Ensure the new sewer or service pipe does not protrude more than 19 millimetres into the existing sewer.
- .6 Remove all construction debris and materials from the existing sewer when the Work is complete.
- .7 Perform a video inspection of the existing sewer after completion of backfilling and compaction using the video equipment indicated in CW 2145 from the nearest maintenance hole to a minimum of 2 metres past the new connection. Provide the DVD of the inspection to the Departmental Representative for review. The video inspection is to clearly show the distance from the maintenance hole to the connection and the connection. Coding of the video inspection will not be required.

3.12 FIELD QUALITY CONTROL

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

- .1 American Water Works Association (AWWA)
 - .1 AWWA C217, Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipeline
 - .2 AWWA C502, Standard for Dry-Barrel Fire Hydrants
 - .3 AWWA C800, Underground Service Line Valves and Fittings
 - .4 AWWA Manual of Water Supply Practices M23, PVC Pipe – Design and Installation
- .2 ASTM International
 - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
 - .3 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings
 - .4 ASTM F1674, Standard Test Method for Joint Restraint Products for Use with PVC Pipe
- .3 City of Winnipeg
 - .1 City of Winnipeg Standard Construction Specification CW2030 – Excavation Bedding and Backfill [February 2005]
 - .2 City of Winnipeg Standard Construction Specification CW2110 – Watermains [August 2010]

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for valves, couplings and mechanical joints and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect piping materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 APPROVED PRODUCTS

- .1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg found on the City of Winnipeg, Materials Management web site at:
<http://www.winnipeg.ca/matmgt/spec/>

2.2 PIPE

- .1 150 to 300 millimetre watermain pipe in accordance with AT 4.1.1.10 of the Approved Products for Underground Use in the City of Winnipeg.
- .2 350 to 500 millimetre water services in accordance with AT 4.1.1.11 of the Approved Products for Underground Use in the City of Winnipeg.
- .3 19 to 50 millimetre water services in accordance with AT 4.1.2.10 of the Approved Products for Underground Use in the City of Winnipeg.

2.3 SMALL DIAMETER WATER SERVICE FITTINGS

- .1 19 to 50 millimetre ASTM B62 composition bronze high-pressure with flared ends for copper water.
- .2 19 to 50 millimetre water service plugs to ASTM B62 composition bronze high-pressure with AWWA taper thread in accordance with AWWA C800.

2.4 HYDRANTS

- .1 Post type, dry barrel with compression shutoff in accordance with CAN/ULC-S250 and AWWA C502.
- .2 Designed for working pressure of 1.0 MPa
- .3 Provided with two 65 millimetre threaded hose outlets, one 100 millimetre threaded pumper connection, 150 millimetre riser barrel with break away flange, 125 millimetre bottom valve and 150 millimetre bottom inlet with push-on joint with harnessing lugs for watermain lead pipe connection.
- .4 Drain to be omitted or plugged.
- .5 Hydrants to open counter clockwise.
- .6 Components used for hydrant adjustment purposes including barrel extensions, stem extensions, stem couplings, breakaway flanges or kits, rubber seals, flange gaskets and fasteners to be original equipment manufacture (OEM) for the style of hydrant being adjusted.

2.5 VALVES AND VALVE BOXES

- .1 150 to 400 millimetre, direct bury, non-rising stem, resilient seated wedge gate valve rated at 1 MPa in accordance with AT 4.1.1.80 of the Approved Products for Underground Use in the City of Winnipeg.
- .2 Valve body to be epoxy coated in accordance with AT 4.1.1.80 of the Approved Products for Underground Use in the City of Winnipeg.

- .3 Valve ends to be push-on type with full depth insertion in accordance with AT 4.1.1.80 of the Approved Products for Underground Use in the City of Winnipeg.
- .4 Valve boxes to be in accordance with AP-001 and AT 4.1.1.81 of the Approved Products for Underground Use in the City of Winnipeg.

2.6 CORPORATION STOPS

- .1 .1 19 to 50 millimetre curb stops to be in accordance with AT 4.1.2.40 of the Approved Products for Underground Use in the City of Winnipeg.
- .2 .2 Curb stop boxes to be in accordance with AP-013 and AP-014 and in accordance with AT 4.1.2.41 of the Approved Products for Underground Use in the City of Winnipeg.

2.7 WATERMAIN APPURTENANCES

- .1 Repair clamps to be in accordance with AT 4.1.1.69 of the Approved Products for Underground Use in the City of Winnipeg.
- .2 Mainline and wide range couplings to be in accordance with AT 4.1.1.63 and AT 4.1.1.65 of the Approved Products for Underground Use in the City of Winnipeg.
- .3 Tapping sleeves to be in accordance with AT 4.1.1.70 of the Approved Products for Underground Use in the City of Winnipeg.
- .4 Connection saddles to be in accordance with AT 4.1.1.30 of the Approved Products for Underground Use in the City of Winnipeg.
- .5 Fasteners, tie rods, clamps, nuts and bolts to be stainless steel in accordance with ASTM Specification A320. ANSI Type 316 marked with raised or indented numerals.
- .6 Joint harness for PVC fittings in accordance with ASTM F1674.
- .7 Corrosion protection wrapping in accordance with AWWA C217. Acceptable product, Denso LT Petroleum Tape.
- .8 Rigid extruded polystyrene foam insulation in accordance with CSGB Specification 51-GP20M (Type 4).
- .9 Zinc anodes to be in accordance with AT 4.1.3.20 of the Approved Products for Underground Use in the City of Winnipeg.
- .10 Continuity bonding wire to be #6 AWG 7 strand copper wire with TWU minus 40 degree C insulation (colour: green).
- .11 Polyethylene wrap in accordance with CAN/CGSH-51.34M. Thickness to be 0.15 millimetres (6 mil).

2.8 BEDDING AND BACKFILL

- .1 Bedding and backfill material in accordance with CW 2030.

2.9 TEMPORARY PRESSURIZED WATER SUPPLY PIPE

- .1 Temporary pressurized water supply pipe and fittings to be in accordance with CAN-B137 and be suitable for outdoor exposure, pressure rated service and meet National Sanitation Foundation Standard #14 & #61 for plastic piping system components and related materials.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 EXCAVATION

- .1 Excavate in accordance with CW 2030. Excavate and prepare trench a sufficient distance in ahead to not to interfere with installation of the pipe.

3.3 INSTALLATION IN A TRENCH

- .1 Assemble and install pipe in accordance with the manufacturer's instructions and AWWA Manual of Water Supply Practices M23, PVC Pipe – Design and Installation. When complete the watermain is to have a smooth and uniform invert.
- .2 Place pipe on compacted bedding ensuring uniform support under bell and pipe body throughout its full length. Work and compact bedding material under sides of pipe to provide proper haunching.
- .3 Protect exposed pipe ends with an approved stopper to prevent excess amounts of water, earth and debris from entering pipe as work proceeds.
- .4 Install pipe to the line and grade shown on the Drawings or as determined by the Departmental Representative in the field within a horizontal and vertical variance of +/- 100 millimetres.
- .5 Pipe joint deflections to be within the manufacturer's recommendations.

3.4 BACKFILL

3.5 HYDRANT ASSEMBLY INSTALLATION

- .1 Install hydrant assembly in accordance with the Drawings.
- .2 Install hydrant plumb with pumper nozzle perpendicular to and facing the street.
- .3 Construct concrete thrust block at base of hydrant to not interfere with base flange barrel bolts.
- .4 Install hydrant assembly to the line and grade shown on the Drawings or as determined by the Departmental Representative in the field within a horizontal and vertical variance of +/- 100 millimetres.
- .5 Locate hydrant flange 50 to 150 millimetres above finished grade elevation.
- .6 Install new hydrant assembly on an existing watermain as follows.
 - .1 Excavate and expose the existing watermain at location shown on the Drawings.

- .2 Cut existing pipe square to axis and remove the required length of pipe.
- .3 Install required fittings, new pipe, thrust blocks, couplings and other material necessary to make the connections. Install new gaskets in bell ends of existing pipe or fittings.
- .4 Provide a 1000 millimetre length of PVC pipe on each side of a new hydrant tee installed on an existing Asbestos-Cement watermain.
- .5 Install a continuity bonding wire between ends of cast and ductile iron watermains that have been replaced with a length of PVC pipe. Prepare an area 50 millimetres square on the top of the pipe surface by grinding or filing to bare metal and attach the continuity bonding wire using the Thermitic Welding process (Cadwelding).

3.6 VALVE INSTALLATION

- .1 Install valves on watermains and large diameter water services in accordance with manufacturer's instructions. Valves are to be the same size as the watermain and water service unless shown otherwise on the Drawings.
- .2 Install valve box plumb, centred on valve with top of box at finished grade. Provide valve stem extension in valve box.
- .3 Install new valves on existing watermains in accordance with methods in Section 3.5.6 of this specification.
- .4 Orient valve box lids to close with the direction of traffic where installed in pavement.
- .5 Install valves at locations and grades shown on the Drawings or as determined by the Departmental Representative in the field within a horizontal and vertical variance of +/- 100 millimetres.

3.7 WATER SERVICE INSTALLATION

- .1 Install water services as specified for watermains in Section 3.3 of this specification.
- .2 Install the curb stop so the operating key is inline with the water service when the curb stop is in the open position.
- .3 Depth of water service from watermain to property line to be above combined sewers, wastewater sewers and sewer services where possible and be 2.3 to 2.75 metres deep.
- .4 Locate curb stops for 19 to 50 millimetre diameter water services in street right-of-way 300 millimetres from property line. Locate control valves for 150 millimetre and larger water services as follows.
 - .1 Regular water service: in street right-of-way 300 millimetres from property line.
 - .2 Fire protection service: within 1.0 metre of watermain.
 - .3 Combined regular water and fire protection service: within 1.0 metre of watermain.
- .5 Couplings will not be permitted on new 19 to 38 millimetre diameter water service installations under 20 metres in length.
- .6 Locate required water service pipe couplings outside of existing and future pavement limits unless approved otherwise by the Departmental Representative.

- .7 Install approved curb stops and curb stop boxes on all new water services or where an existing curb stop is to be replaced.
- .8 Install cast iron replacement curb stop boxes for existing 19 and 25 millimetre curb stops and cast iron valve box for existing 38 and 50 millimetre curb stops. Cut suitable slots in lower casing of valve box to allow box to be centred over curb stop and to not allow weight of curb box to be transferred to curb stop and water service pipe. Provide minimum 38 millimetre x 285 millimetre x 300 millimetre long pressure treated lumber base beneath curb stop to attach curb stop to and support curb stop box.
- .9 Direct tap corporation stops into watermains except where connection clamps or tapping sleeves are indicated in Table 1. Obtain the Departmental Representative's approval to use connection clamps as an alternate to direct tapping.
- .10 Install 19 and 25 millimetre diameter corporation stops in top quadrant of watermain at an angle between 0o and 30o to horizontal. Install 38 and 50 millimetre corporation stops horizontally into watermain. Install corporation stops requiring connection clamps horizontally into watermain.
- .11 Locate tap holes for corporation stops no closer than 600 millimetres from the end of an individual pipe length. Stagger multiple taps and separate by a minimum of 450 millimetres along pipe.
- .12 Wrap threads of corporation stops with 3 to 4 layers of "Teflon" type pipe thread tape and tighten into watermains as follows leaving 1 to 3 threads showing.
 - .1 Asbestos-Cement, ductile and cast iron pipe: 70 to 80 Newton metres of torque.
 - .2 PVC pipe: 35 to 40 Newton metres of torque
- .13 Cut copper water service pipe with a suitable tube cutter, flare end with appropriate flaring tool and connect to corporation stop and curb stop. Ensure ends of pipe are cut square and true with burrs removed before flaring. Tighten flare nut using suitable wrench. Pipe wrenches or other serrated jaw type wrenches will not be permitted. The following torque values are provided as a guide, check with manufacturer to confirm recommended tightening torque.

Water Service Size	Maximum Torque
19 mm	100 Newton meters
25 mm	100 Newton meters
38 mm	135 Newton meters
50 mm	170 Newton meters

- .14 Form a combination vertical and horizontal gooseneck on 19 and 25 millimetre water service pipe adjacent to the corporation stop without kinking and exceeding manufacturer's maximum degree of curvature. Ensure top of gooseneck is a minimum 2.1 metres below finished grade above the gooseneck.

WATERMAIN MATERIAL AND SIZE	WATER SERVICE SIZE			
	19 mm	25 mm	38 mm	50 mm
Asbestos-Cement				
100 mm	CS	CS	NA	NA
150 mm Class 150	CS	CS	CS	CS

150 mm Class 150	CS	CS	CS	CS
200 to 400mm	CS	CS	CS	CS
Ductile and Cast Iron				
100 mm	DT	DT	TS	TS
150 mm	DT	DT	CS	CS
200 to 500 mm	DT	DT	DT or CS	DT or CS
PVC (CI OD)				
150 to 300 mm	DT	DT	CS	CS
350 to 450 mm	CS	CS	CS	CS
PVC (IPS)				
150 to 300 mm	CS	CS	CS	CS
	DT – Direct Tap CS – Connection Saddle NA – Not Allowed TS – Tapping Sleeve CI OD – Cast Iron Outside Diameter IPS – Iron Pipe Size			

TABLE 1 – WATERMAIN TAPPING METHOD

3.8 FITTING AND THRUST BLOCK INSTALLATIONS

- .1 Install fittings at locations and elevations shown on the Drawings, where required to connect to existing watermains and where directed by the Departmental Representative.
- .2 Construct cast-in-place concrete thrust blocks for fittings as follows:
 - .1 Thrust block to bear against undisturbed soil.
 - .2 Cut soil to have a smooth vertical face and be at the proper angle to the fitting.
 - .3 Ensure horizontal struts or braces required for shoring are not located within limits of concrete thrust blocks.
 - .4 Install a minimum 0.15 millimetre (6 mil) thick polyethylene sheet bond breaker between cast iron fittings and concrete.
- .3 Provide 24 hours notice to the Departmental Representative before concrete is placed to allow inspection and approval of thrust block formwork.

3.9 WATERMAIN AND WATER SERVICE INSULATION

- .1 Insulate watermains and water services where cover to final grade will be less than 2.1 metres, at locations shown on the Drawings and where directed by the Departmental Representative.

3.10 CONNECTING TO EXISTING WATERMAINS

- .1 Where connecting to an existing watermain or large diameter water services requires removal of a plug in a fitting or end of pipe, connection will be considered an in-line connection – plug existing.

- .2 Where connecting to an existing watermain or large diameter water service requires removal of a fitting or valve, connection will be considered an in-line connection – no plug existing.
- .3 Where connecting to an existing watermain or large diameter water service requires installation of a tee, connection will be considered a perpendicular connection.
- .4 Excavate and expose existing watermain or large diameter water service at locations shown on the Drawings and remove existing fitting, valve, plug, concrete thrust block and required length of pipe to make the connection.
- .5 Install a new gasket in the bell of the existing pipe or fitting.
- .6 Cut the end of the existing pipe square to the axis of the pipe.
- .7 Install required fittings, valves, new pipe, thrust blocks, couplings and other material necessary to make in-line or perpendicular connection.
- .8 Use 150 x 150 x 150 millimetre tee with a 150 to 100 millimetre reducer when making perpendicular connection to an existing 100 millimetre watermain. Install reducer immediately adjacent to tee.
- .9 Repair clamps will not be permitted for use as couplings when connecting to existing watermains.
- .10 Repair existing watermains and large diameter water services that were damaged by carelessness during construction.

3.11 EXPOSING EXISTING WATERMAINS AND SEWER SERVICES

- .1 Expose existing watermains at proposed connection locations and other locations far enough in advance of watermain installation to allow existing watermain inverts to be determined. The Departmental Representative will modify design grades as required.
- .2 Locate and expose existing sewer services far enough in advance of watermain installation to allow the Departmental Representative to determine if there is a conflict with the watermain grade. The Departmental Representative will modify watermain design grade or direct the sewer service to be re-graded if there is a conflict.
- .3 Replace sewer services removed to facilitate installation of watermain or that are damaged during excavation for the watermain installation.

3.12 HYDROSTATIC LEAKAGE TESTING AND DISINFECTION

- .1 Perform hydrostatic leakage testing and disinfection of watermains and water services in accordance with CW 2125.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Specification 31 23 33.01, Excavating, Trenching and Backfill

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C14M, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
 - .4 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .5 ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- .2 City of Winnipeg
 - .1 City of Winnipeg Standard Construction Specification CW 2130, Gravity Sewers [August 2010]
 - .2 City of Winnipeg Standard Construction Specification CW 2145, Sewer and Manhole Inspection [May 2016]
 - .3 City of Winnipeg Standard Details, Specifications, and Approved Product Lists (<http://www.winnipeg.ca/matmgt/spec/>)
- .3 CSA International
 - .1 CAN/CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings
 - .2 CSA A257 Series, Standards for Concrete Pipe.
- .4 Canadian General Standards Board (CSBG)
 - .1 CSGB Specification 51-GP20M (Type 4)

1.3 DEFINITIONS

- .1 Fittings include tees, wyes, bends, reducers, couplings and plugs.
- .2 Appurtenances include, flexible rubber compression joint sealers, bushings, catch basin hoods, hooks and pins, fasteners and miscellaneous components.
- .3 Trenchless installation methods are methods of installing pipe inside a hole that has been made between shafts by coring, boring, horizontal directional drilling, jacking, tunnelling and extraction of an existing pipe or similar methods with minimal excavation and surface disruption.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 APPROVED PRODUCTS

- .1 Use only those products listed as Approved Products for Underground Use in the City of Winnipeg found on the City of Winnipeg, Materials Management web site at:
<http://www.winnipeg.ca/matmgt/spec/>

2.2 SEWER AND SEWER SERVICE PIPE

- .1 Mainline and sewer connection pipe to be in accordance with AT 4.2.1.10 and AT 4.2.2.10 of the Approved Products for Underground Use in the City of Winnipeg.
- .2 Mainline cul-de-sac sewer pipe to be in accordance with AT 4.2.1.11 of the Approved Products for Underground Use in the City of Winnipeg.
- .3 Open profile ribbed storm sewer pipe in accordance with AT 4.2.1.16 of the Approved Products for Underground Use in the City of Winnipeg.
- .4 250 to 600 millimetre non-reinforced concrete bell and spigot pipe in accordance with CAN/CSA A257.1 and ASTM C14, Class 3.
- .5 300 millimetre and larger reinforced concrete bell and spigot pipe in accordance with CAN/CSA A257.2 and ASTM C76.
- .6 Reinforced concrete bell and spigot straight wall pipe used for jacking in accordance with CAN/CSA A257.2 and ASTM C76. Outside of bell ends to be fitted with a 14 gauge steel band with a width of 1.5 times the length of the bell end groove.

2.3 DRAINAGE INLET CONNECTION PIPE

- .1 250 millimetre diameter gasketed bell and spigot PVC pipe in accordance with CAN/CSA B182.2 and ASTM D 3034, SDR 35.
- .2 250 millimetre non-reinforced concrete bell and spigot pipe in accordance with CAN/CSA A257.1 and ASTM C14, Class 3.

2.4 SEWER AND SEWER SERVICE FITTINGS AND CONNECTION SADDLES

- .1 150 millimetre and larger gasketed push-on style PVC injection moulded fittings in accordance with AT 4.2.1.60 of the Approved Products for Underground Use in the City of Winnipeg.
- .2 450 millimetre and larger gasketed push-on style PVC fabricated fittings in accordance with AT 4.2.1.61 of the Approved Products for Underground Use in the City of Winnipeg.
- .3 250 millimetre and larger gasketed bell and spigot concrete pipe fittings in accordance with CAN/CSA A257 Series and ASTM C 14 and C 76.

2.5 SEWER PIPE GASKETS

- .1 PVC pipe gaskets, flexible rubber in accordance with ASTM F477.
- .2 Concrete pipe gaskets, flexible rubber in accordance with ASTM C443.
- .3 Where required, elastomeric compounds for oil and gas resistant gaskets to be rated as "excellent".

2.6 FLEXIBLE PIPE TRANSITION PIPE COUPLINGS

- .1 Flexible transition sewer couplings to be in accordance with AT 4.2.1.66 of the Approved Products for Underground Use in the City of Winnipeg.

2.7 FASTENERS

- .1 Fasteners, tie rods, clamps, straps, bands, nuts and bolts to be stainless steel in accordance with ASTM A320, ANSI Type 316 marked as such with raised or indented numerals.

2.8 CAST-IN-PLACE CONCRETE, GROUT, MORTAR AND CEMENT-STABILIZED FILL

- .1 Cast-in-place concrete, grout, mortar and cement stabilized fill in accordance with CW 2160.

2.9 CEMENT PATCHING COMPOUND

- .1 Cement patching compound to be fast hardening, high strength non-shrink mixture suitable for use on vertical surfaces.

2.10 BACKFILL MATERIAL

- .1 Type 3 in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.11 INSULATION

- .1 Insulation for pipes shall be rigid polystyrene foam insulation in accordance with CSGB Specification 51-GP20M (Type 4) and shall be installed in accordance with the Drawings and manufacturer recommendations.

Part 3 Execution

3.1 EXCAVATION

- .1 Remove existing concrete pavement slabs, miscellaneous concrete slabs, curbs and asphalt pavement.
- .2 Excavate and prepare trench a sufficient distance in ahead to not to interfere with installation of the pipe.

3.2 FOUNDATION AND BEDDING

- .1 Place and compact foundation material, where required and bedding material in bottom of trench or excavation to grade and elevation shown. Level across full width of trench or excavation and leave ready for pipe installation.

3.3 INSTALLATION IN A TRENCH

- .1 Install same material, class and type of pipe between adjacent manholes.
- .2 Assemble pipe in accordance with manufacturer's instructions so when complete sewer will have a smooth and uniform invert. Lay pipe with bell upgrade. Use longest pipe size manufactured where practicable to reduce total number of joints on sewer.
- .3 Place pipe on compacted bedding ensuring uniform support under bell and pipe body throughout its full length. Work and compact bedding material under sides of pipe to provide proper haunching.
- .4 Protect exposed pipe ends with an approved stopper to prevent excess amounts of water, earth and debris from entering pipe as work proceeds.
- .5 Install pipe to the line and grade shown in accordance with the limits in Section 3.6 of this specification.
- .6 Pipe joint deflections to be within the manufacturer's recommendations.
- .7 Remove construction debris and materials from sewers before performing video inspection.

3.4 INSTALLATION USING TRENCHLESS METHODS

- .1 Install sewers using trenchless methods where alignment is under or crosses existing and proposed pavements, existing boulevards, trees, utility poles, structures and at other locations.
- .2 Install same material, class and type of pipe between adjacent manholes.
- .3 Excavate shafts and provide shoring.
- .4 Provide the locations and sizes of shafts to the Departmental Representative for review before excavating.
- .5 Completely remove existing pipe for on-line sewer renewals.
- .6 Join pipe sections together in shafts before inserting into installation hole. Pull or push entire length of pipe into installation hole from end of last pipe with bells facing away from pulling or pushing direction. Installation methods where tension is applied to a pipe section will not be permitted.

- .7 Ensure the force applied to the section of pipe being pulled or pushed into the installation hole does not result in spigots being inserted into the bell beyond the manufacturer's recommended insertion depth.
- .8 Pull back the entire length of pipe already in the installation hole if a length of pipe is to be withdrawn from the installation hole.
- .9 Install pipe to the line and grade shown in accordance with the limits in Section 3.6 of this specification.
- .10 Keep pipe joint deflections within the manufacturer's recommendations.
- .11 Remove construction debris and materials from sewers before performing video inspection.
- .12 Repair damage to underground and surface structures due to surface subsidence and soil heaving caused by trenchless installation methods.
- .13 Where field conditions are such that sewers cannot be installed using trenchless methods install sewers in a trench using the type of backfill specified for the installation location.

3.5 FITTING INSTALLATION

- .1 Install fittings of same material, type and class as sewer, sewer service or catch pit pipe.
- .2 Install watertight plug in the end of sewers to allow for a future connection.
- .3 Excavate, bed and install fittings as specified for sewers and sewer services.

3.6 LINE AND GRADE

- .1 Allowable variance from specified line to be +/- 100 millimetres. Allowable variance from specified grade to be 25 millimetres above grade and 50 millimetres below grade at any one location. Allowable ponding in pipe due to combined variance above and below grade not to exceed 50 millimetres.
- .2 Correct alignment and grade exceeding the allowable variance in a manner acceptable to the Departmental Representative.

3.7 BACKFILL

- .1 .1 Place and compact initial backfill above the pipe in accordance with Specification 31 23 33.01 and SD-001.
- .2 .2 Backfill the remainder of the trench or excavation in accordance with Specification 31 23 33.01 and SD-002.

3.8 SEWER SERVICE INSTALLATION

- .1 Install sewer services as specified for sewers in accordance with Section 3.3 and 3.4 of this specification.
- .2 Variance from specified line not to exceed +/- 100 millimetres. Variance from specified grade not to exceed +/- 25 millimetres. Connect sewer services to sewers at locations where preformed fittings have been provided. Use an approved adapter, coupling or bushing if required to make a watertight connection.

- .3 Install a sewer service riser pipe in accordance with SD-014 and SD-015 where the connection to the sewer is deeper than 4.25 metres. Terminate sewer service riser 3.35 to 4.25 metres below finished grade.
- .4 Use 45 degree or less bends only on sewer services.
- .5 Install a watertight removable plug in the end of the sewer service to allow for a future connection.

3.9 DRAINAGE PIPE INSTALLATION

- .1 Install drainage connection pipe between inlet box or catch pit and catch basin in accordance with Section 3.3 and 3.4 of this specification at locations as shown.
- .2 Variance from specified line not to exceed +/- 100 millimetres. Variance from specified grade not to exceed +/- 25 millimetres.
- .3 Connect drainage connecting pipe to existing catch basins in accordance with Section 3.8 of this specification.

3.10 CONNECT NEW SEWERS AND CATCH BASIN LEADS TO EXISTING MANHOLES, CATCH BASINS AND CATCH PITS

- .1 Connect new sewers and catch basin leads to existing manholes, catch basins and catch pits at locations and elevations shown.
- .2 Excavate required depth and make neat hole in manhole, catch basin or catch pit wall a maximum of 25 millimetres larger than outside diameter of the sewer or catch basin lead pipe.
- .3 Connect sewers, catch basin leads and drainage connection pipes in accordance with Section 3.8 of this specification.
- .4 Connect catch basin leads to existing manholes at a depth of 2.4 to 4.0 metres below finished grade and from 600 millimetres to 900 millimetres above the manhole floor where the manhole floor is between 3.0 and 4.0 metres below finished grade
- .5 Install approved catch basin hood in accordance with AP-012, SD-024 and SD-025. Reuse existing catch basin hood if not damaged.
- .6 Cut existing catch basin lead pipe flush with catch basin or catch pit wall and plug opening with mortar or concrete to make watertight.
- .7 Re-bench and re-channel manhole floor as required with mortar or concrete in accordance with SD-010 and SD-011. Curve flow channels for perpendicular connections smoothly into main flow channel.
- .8 Remove construction debris and materials from existing manholes, catch basins, catch pits and sewers.

3.11 CONNECTING NEW SEWER OR SEWER SERVICE TO EXISTING SEWER

- .1 Connect to existing sewer fittings where provided with approved coupling, adapter or bushing to make a watertight connection.
- .2 Connect to other types of existing sewers where no fitting is provided using one of the following methods.

- .1 Remove a section of existing sewer pipe and install an approved tee.
- .2 Make a neat circular hole in the existing sewer the same size as the sewer or sewer service to be connected and install an approved PVC saddle in accordance with the manufacturer's instructions using stainless steel straps or 6 millimetre diameter stainless steel bolts.
 - .1 Maximum connection to an existing sewer using a PVC saddle to be two sizes smaller than the sewer pipe.
 - .2 Install fastening bolts with head on the inside of the sewer pipe. Use washers if hole has chipped during drilling. Do not over tighten bolts to cause stress or damage to existing sewer pipe.
 - .3 Limit excavation beneath existing sewer to only what is required to install saddle straps. Fill excavation beneath existing sewer with grout or cement stabilized fill.
- .3 Make a neat circular hole in the existing sewer a maximum of 25 millimetres larger than sewer or sewer service pipe to be connected. Insert a short piece of sewer or service pipe into the hole with the bell end resting on the outside of the existing sewer pipe. Grout around and between the sewer or service pipe bell and the existing sewer pipe wall with mortar in accordance with SD-009 or construct a concrete collar in accordance with the Drawings to make a watertight connection.
- .3 Make holes in existing sewer pipes using the following methods.
 - .1 Non-reinforced monolithic concrete sewer and pre-cast reinforced concrete pipe 900 millimetres in diameter and larger: by concrete coring.
 - .2 Pipes less than 900 millimetres in diameter: by concrete coring or drilling a series of 12 millimetre diameter holes with a masonry drill bit around the circumference of the hole and carefully tapping out the coupon.
 - .1 Drill holes at 15 millimetres on centre for sewer pipes 375 millimetre diameter and smaller and at 25 millimetres on centre for sewer pipes up to and including 900 millimetre diameter.
 - .3 PVC pipe: by coring or cutting with hole saw or other tool capable of cutting a circular opening.
- .4 Ensure the new sewer or service pipe does not protrude more than 19 millimetres into the existing sewer.
- .5 Remove all construction debris and materials from the existing sewer when the Work is complete.
- .6 Perform a video inspection of the existing sewer after completion of backfilling and compaction using the video equipment indicated in CW 2145 from the nearest manhole to a minimum of 2 metres past the new connection. Provide the DVD of the inspection to the Departmental Representative for review. The video inspection is to clearly show the distance from the manhole to the connection and the connection. Coding of the video inspection will not be required.

3.12 CONNECTING TO EXISTING SEWER AND SEWER SERVICE STUBS

- .1 Remove the existing plug and connect the new sewer or sewer service pipe to the existing sewer pipe with an approved coupling, adapter or bushing to make a watertight connection.

3.13 CONNECTING EXISTING SEWER SERVICE TO NEW SEWER

- .1 Locate existing sewer service by dye tracing, electronic tracing or video inspection.
- .2 Excavate and connect to the existing sewer service pipe at the location shown or within the limits of excavation for on-line sewer renewals.
- .3 Cut fully through the existing sewer service pipe leaving a neat square end or remove existing sewer service pipe at a joint location within the excavation.
- .4 Connect the new sewer service pipe to the existing sewer service pipe or joint using an approved flexible transition coupling, adaptor or bushing to make a watertight connection.
- .5 Install fittings, riser pipe, required length of new sewer service pipe and connect to the tee on the new sewer.

3.14 PLUGGING AND ABANDONING EXISTING SEWERS AND SEWER SERVICES

- .1 Abandon existing sewers and sewer services smaller than 300 millimetres in diameter by completely plugging each end at a manhole or where cut off with mortar or concrete a minimum of 300 millimetres thick.
- .2 Abandon existing sewers and sewer services 300 millimetres in diameter and larger by plugging one end with mortar or concrete and completely filling the sewer or sewer service with cement stabilized flowable fill. Confirm all active sewer services have been disconnected from sewer being abandoned and have been reconnected to new sewer before filling the sewer.
- .3 Abandon sewer services under pavement by installing a plug within 1.0 metre of the sewer and filling with flowable cement-stabilized fill in accordance with SD-021 except where the existing sewer itself will be abandoned with flowable cement-stabilized fill.
- .4 Perform a video inspection of the existing sewer using the equipment indicated in CW 2145 from the nearest manhole to a minimum of 2 metres past the abandoned sewer service and provide the DVD to the Departmental Representative for review. The video inspection is to clearly show the distance from the manhole to the abandoned sewer service. Cleaning of the sewer and coding of the video inspection will not be required.

3.15 MAINTAINING FLOW IN EXISTING SEWERS

- .1 Maintain flow in existing sewers and sewer services during renewal, repair and any other time construction activities may impede or interrupt flow by methods such as diversion through the excavation, redirecting flow or providing by-pass pumping.
- .2 Provide details of methods for maintaining flow in existing sewers to the Departmental Representative for review prior to beginning the Work.

- .3 Provide approved traffic ramps for by-pass pumping discharge hoses where crossing roadways and traffic lanes and locate where directed and approved by the Departmental Representative.

3.16 DEFLECTION TESTING OF SDR 35 PVC SEWERS

- .1 Perform deflection testing of SDR 35 PVC pipe in the presence of the Departmental Representative by pulling a cylindrical shaped mandrel constructed with 9 evenly spaced arms generally conforming to SD-020 through the sewer after installation of sewer services and no sooner than 24 hours after compaction of backfill.
- .2 Position the mandrel a minimum of 4 metres in front of the camera if deflection testing is performed with video inspection.
- .3 Allowable deflection to be no greater than 0.15 times the pipe SDR as indicated in Table 1. Deflection is expressed as a percent of the base inside diameter of the sewer pipe as defined in the ASTM standard to which the pipe is manufactured.
- .4 Mandrel diameter will be checked with a go/no-go proving ring having an inside diameter equal to 2 times the specified Mandrel arm radius. Mandrels passing through the proving ring will not be allowed for deflection testing.
- .5 Sewer pipe that does not allow the mandrel to pass will be considered to have failed deflection testing and is to be replaced or re-bedded as directed by the Departmental Representative.

Nominal Pipe Size (mm)	Mandrel Arm Radius (mm)	Mandrel Contact Length (mm)	Proving Ring Inside Diameter (mm)
250	115.7	200	231.40
300	137.46	250	274.92
375	168.17	300	336.34
450	205.41	350	410.82
525	242.03	450	484.12
600	272.03	500	544.06

TABLE 1

3.17 VIDEO INSPECTION

- .1 Perform video inspection of sewers in accordance with CW 2145 except for Sections 3.18, 3.19, 3.21 and 3.22 and their associated payment clauses which do not apply to sewer repairs and new sewer installations.
- .2 Perform video inspection of catch basin leads longer than 15 metres in length.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Specification 33 41 00 Storm Utility Drainage Piping

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - .2 ASTM D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .3 ASTM D3212-86, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - .4 ASTM F477-90, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - .5 ASTM F913-87, Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - .6 ASTM C579, Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - .7 ASTM C580, Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
 - .8 ASTM C307, Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
 - .9 ASTM C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
 - .10 ASTM C267, Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
 - .11 ASTM C666, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
 - .12 ASTM G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- .2 City of Winnipeg
 - .1 City of Winnipeg Standard Construction Specification CW2030, Excavation Bedding and Backfill [February 2005]
 - .2 City of Winnipeg Standard Construction Specification CW2130, Gravity Sewers [August 2010]
- .3 CSA
 - .1 CAN/CSA B182-M95, Plastic Drain and Sewer Pipe and Pipe Fittings

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop Drawings:
 - .1 Shop drawings to indicate proposed products and method of installation.
 - .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .3 A Certificate of Compliance in conformance with the provisions of these Specifications shall be furnished to the Departmental Representative. Grates shall be independently tested to AASHTO M-306.
- .4 Certification to be marked on pipe.
- .5 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- .6 Manufacturer's Instructions: submit to Departmental Representative, 1 copy of manufacturer's installation instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PLASTIC PIPE

- .1 In accordance with the City of Winnipeg's Approved Products for Underground Works: http://www.winnipeg.ca/finance/findata/matmgmt/std_const_spec/current/Docs/Approved_Products_Underground_Works.pdf
- .2 Pipe Body: homogenous throughout and free from cracks, voids, foreign inclusions or other defects. Pipe to be uniform in colour, density, opacity and other physical properties.
- .3 Elastomeric Gaskets: homogenous and free from porosity, blisters, pitting or other imperfections.

2.2 PRECAST LINEAR TRENCH DRAIN

- .1 The precast trench drain shall be manufactured using polyester polymer concrete with the following material properties when tested:

Property ASTM	Test Method	Value
Compressive Strength	ASTM C579	117,211 kPa (17,000 psi) Minimum
Bending Strength	ASTM C580	27,578 kPa (4,000 psi) Minimum
Tensile Strength	ASTM C307	13,790 kPa (2,000 psi) Minimum
Moisture Absorption	ASTM C140	0.2% Maximum
Chemical Resistance	ASTM C267	Pass
Freeze/Thaw w/o weight loss	ASTM C666	1,600 Number of Cycles Minimum
Resistance to Fungi	ASTM G21	Zero (0) Rating Mold Growth
UL/ULC Listed- Flame Spread	UL-723	Class A

The trench consisting of 1 meter (39.19”) nominal channels with nominal 155 mm (6”) 155mm outside width, 100mm (4”) inside width. Pre-sloped channels shall have a standard slope of 0.6% with radius bottom. Non-sloping channels must have written approval by Departmental Representative prior to installation. Channels shall have tongue and groove joints. Grate lock down slots shall have polyethylene vibration dampening inserts. All channels must have full length anchoring ribs for a positive mechanical lock with the surrounding concrete.

2.3 FRAME AND GRATE

- .1 Epoxy coated ductile iron conforming to ASTM A-536 with a minimum of .064m²/Lm (0.21Ft² /L Ft) open area. Grates shall meet a minimum 4275 kPa (620 psi) proof load per AASHTO M-306 test modified by utilizing a 229 x 76 mm (9” x 3”) load plate. Frames shall be a minimum of 4.77mm (0.188”) thick. The frames shall have 6.35 dia. x 76.2mm (0.25” dia. x 3”) long (minimum) anchors spaced no more than 431.8mm (17”) on center. Frames shall be independent of the channels. Frames and grates shall seat into channels without rocking and shall be locked to the channel using a zinc plated steel 7.9mm (5/16”) – 18 UNC bolt and zinc plated steel toggle bar system with a bolt torque of 1.13 Nm (10in/lb).

2.4 POLYMER PRECAST CATCH BASIN

- .1 Provide precast polymer catch basin as indicated on the Drawings. Catch basin materials to comply with Manufacture’s trench drain products.
- .2 Provide removable galvanized steel trash bucket for polymer catch basin.

2.5 PIPE BEDDING AND BACKFILL MATERIALS

- .1 Perform pipe bedding and backfill in accordance with City of Winnipeg Specification CW2030 – Excavation Bedding and Backfill.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

3.2 TRENCHING

- .1 Excavate to the lines, grade, elevations and dimensions as indicated.
- .2 Ensure the bottom of the excavation is smooth, free from depressions, lumps and protruding objects.
- .3 Maximum trench width from the underside of the pipe bedding and foundation to 600 millimeters above the top of the pipe to be the greater of 1200 millimeters or the outside diameter of the pipe plus 750 millimeters.
- .4 Where the maximum trench width is exceeded due to unstable soil conditions or over-excavation, Departmental Representative will review the external loading condition on the pipe to determine if the bedding and pipe type or strength specified needs upgrading.
- .5 Remove unsuitable soil from bottom of excavation.
- .6 Fill over-excavation to required elevation with bedding material and compact to at least 95% Standard Proctor Density.

3.3 GRANULAR BEDDING

- .1 In accordance with City of Winnipeg Specification CW2030 – Excavation Bedding and Backfill.

3.4 INSTALLATION

- .1 Install product specific materials in accordance with manufacturers recommendations.
- .2 Install general plastic pipe and fittings in accordance with City of Winnipeg Specification CW2130 – Gravity Sewers.

3.5 BACKFILL

- .1 Remove boulders, rocks or concrete larger than 50 millimetres in size, ice, snow, frozen material, organic material, or debris from bottom of excavation before placing backfill material.
- .2 Place backfill material in unfrozen condition, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

- .1 Leave joints and fittings exposed until field testing is completed.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer full width of bed to at least 95% Standard Proctor Density.
- .6 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.6 CONCRETE BEDDING

- .1 Provide concrete bedding around precast trench drain as specified by Manufacturer.
- .2 Use same concrete mix as the mainline paving.
- .3 Isolate concrete from existing and new pavements with approved isolation products.

3.7 FIELD TESTS AND INSPECTIONS

- .1 Repair or replace linear trench drains, grates, pipe, pipe joint or bedding found defective.
- .2 Remove foreign material from sewers and related appurtenances manually or by flushing with water.
- .3 Television and photographic inspections performed in accordance with City of Winnipeg Specification CW 2145 – Sewer and Manhole Inspection.

3.8 CLEANING

- .1 Progress Cleaning: Leave Work area clean at end of each day.
- .2 Protect trench drain from construction debris for full duration of construction.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This specification governs all operations necessary for and pertaining to the removal and disposal of existing culverts and placement of new culverts.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C14M, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C655, Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe.
- .2 CSA International
 - .1 CAN/CSA G401, Corrugated Metal Pipe Products.
 - .2 CSA B182.8, Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings
- .3 Manitoba Infrastructure and Transportation
 - .1 Manitoba Infrastructure and Transportation Construction Specification 400, Specifications for Removing and Placing Culverts [March 2002]

1.3 DEFINITIONS

- .1 Foundation – The natural soil sub-grade or granular material to replace unsuitable soil.
- .2 Bedding – Material placed over the Foundation to the centre elevation of the culvert.
- .3 Backfill – Material placed over the Bedding and culvert to a minimum of 300mm above the top of the culvert.
- .4 CSP – Corrugated Steel Pipe
- .5 HDPE - High Density Polyethylene
- .6 PCP – Precast Concrete Pipe

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Samples:
 - .1 Inform Departmental Representative at least 2 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.

- .3 Certification: to be marked on pipe.
- .4 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .2 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CORRUGATED STEEL (CSP) PIPE CULVERTS,

- .1 Supply CSP Metal pipe, fittings and other accessories: to CAN/CSA-G401.

2.2 PRE-CAST CONCRETE (PCP) PIPE CULVERTS

- .1 Supply PCP pipe, fittings and other accessories: to ASTM C-14, C-76 OR C-655.

2.3 HIGH-DENSITY POLYETHYLENE (HDPE) PIPE CULVERTS

- .1 Supply HDPE culvert fittings and couplers in accordance with CSA B182.8.
- .2 HDPE culvert fittings and couplers and shall be made of virgin high density polyethylene material. The HDPE culvert shall have a full circular cross section, be dual walled with a smooth inner liner and an outer corrugated pipe wall. HDPE culvert shall have a minimum stiffness of 320kPa at 5 percent deflection in accordance with ASTM D2412.
- .3 HDPE culvert lengths shall be coupled with a Type 3 Soil tight external split coupler or better.

2.4 GRANULAR BEDDING

- .1 Culvert gravel shall be well graded and shall consist of sound, durable particles of gravel stone, sand and fines, free from sod, roots and organic material and shall meet the following gradation requirements:

Passing			
37.5 mm		100%	
4.75 mm		25 – 80%	
425 um	a)	15 – 40%	when mechanically compacted
	b)	5 – 40%	when water jetted
75 um	a)	6 – 18%	when mechanically compacted
	b)	0 – 8%	when water jetted

- .2 The shale content shall not exceed 25% by weight of the particles retained on a 4.75 mm sieve.
- .3 Culvert gravel for bedding shall be spread uniformly along the full length of the culvert foundation. For metal culverts the bedding shall be constructed so that after compacting, a depth of at least 150 mm of gravel remains under the full length of the culvert. For concrete culverts, the bedding shall be constructed so that after compacting, a depth of at least 100 mm of gravel remains under the full length of the culvert. For concrete culverts, an additional layer of culvert gravel shall then be spread loosely and uncompacted at a uniform depth of 100 mm along the full length of the culvert foundation. After the culvert has been installed and assembled on the loose bedding, the bedding on both sides of the culvert shall be compacted. Culvert bedding shall be compacted at optimum moisture content to a minimum of 95% AASHTO Standard Dry Density. The supply of water for compaction will be considered as an incidental operation to Culvert Gravel.

Part 3 Execution

3.1 REMOVING CULVERTS AND TIMBER STRUCTURES

- .1 Concrete and Metal Pipe Culverts
 - .1 All culverts removed shall become the property of the Contractor.
- .2 Structural Plate Culverts
 - .1 Prior to dismantling structural plate culverts, the Contractor shall match mark each plate and prepare a plan for the Engineer showing the relative position of each plate.
 - .2 Similar plates shall be securely banded together in convenient quantities and stored neatly at a designated location on the right-of-way. The Contractor shall repair or replace any portion of the culvert damaged during removal.
- .3 Concrete Box Culverts
 - .1 Reinforced concrete box culverts to be removed shall be demolished. Explosives shall not be used for demolition purposes unless permission has been granted by the Engineer. When permission has been granted it will not relieve the Contractor of liability for damage to persons or property resulting from the use of explosives. Broken concrete shall be disposed of in accordance with the requirements for Loose Rock disposal in the Specifications for Grading.
- .4 Timber Structures
 - .1 Material obtained from removing designated timber structures shall become the property of the Contractor. Material salvaged by the Contractor shall be removed from the right-of-way. Debris and unsalvageable material shall be collected and disposed of by burning or burying. Timber or metal piles shall be cut off at ground level unless otherwise specified by the Engineer.
- .5 Excavation
 - .1 Excavation required for the removal of culverts and structures will be considered incidental to the work related to removing culverts or timber structures.

- .6 Filling Depressions
 - .1 Construction methods for ground preparation and backfilling of depressions resulting from the removal of culverts and timber structures shall be in accordance with the Specifications for Grading.

3.2 CULVERT INSTALLATIONS

- .1 The contractor shall have at least two plate type mechanical compactors on the job site before commencing any culvert installations.

3.3 CULVERT FOUNDATION AND BEDDING

- .1 The culvert foundation means the natural soil, underlying the excavation, upon which the culvert bedding or the culvert is to be placed.
- .2 The culvert foundation shall be prepared and compacted to the staked gradeline and for a width sufficient to permit compaction of the bedding under the culvert haunches. Unsuitable material from below the staked gradeline shall be removed to an approved depth and replaced with suitable bedding and suitable geotextile if required, to provide uniform continuous support.
- .3 The culvert bedding means a layer of selected material, generally culvert gravel, constructed on the culvert foundation so as to uniformly support the culvert. In general, culvert gravel shall be used at through grade installations and under concrete culverts installed at any location.

3.4 BEDDING

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% AASHTO Standard Dry Density.
- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated.
- .4 Place bedding in unfrozen condition.

3.5 BACKFILLING

- .1 Backfill around and over culverts as indicated.
- .2 Placement and compaction of fill material in the haunch area may be carried out by mechanical methods or by water jetting.
 - .1 Mechanical Method
 - .1 Fill material under haunches shall be placed alternately in 150 mm layers on both sides of the pipe to permit thorough compaction. The material under the haunches must be in firm contact with the entire bottom surface of the structure. (Backfill and compaction under haunches is a manual job, consisting of shovel placement, timber rammer or hand held packers.
 - .2 Water Jetting Method

- .1 Water jetting, when approved by the Engineer, may be used as an alternative method for backfilling haunches. Free draining backfill material shall be water jetted.
 - .2 The water jet pipe shall be 25 mm in diameter, pinched at the outlet end, have a shut off valve and in general be at least one metre long. The operational pressure shall be sufficient so as to produce a horizontal throw of six metres.
 - .3 Gravel shall be placed uniformly on each side of the culvert at the same time so as to construct and compact at least two uniform lifts of gravel between the bedding and the springline of the culvert.
 - .4 Each lift shall be water jetted at not more than one-half metre intervals to consolidate the aggregate under the haunches and parallel to the pipe. Water shall be forced into the aggregate until the voids are filled and water is rejected.
- .3 Compaction to Springline
- .1 After the haunch area has been backfilled and compacted, additional bedding material shall be placed adjacent to the pipe haunches in lifts not exceeding 150 mm. Each lift shall be compacted with a plate type mechanical compactor. Bedding material shall be placed in this manner up to the level of the springline. Material placed above the springline shall be placed as described in Backfill.
- .3 Compact each layer to 95% AASHTO Standard Dry Density taking special care to obtain required density under haunches.
- .4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.
- .1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.
- .5 Place backfill in unfrozen condition.
- .6 Final backfill to achieve design grade shall be excavated material or material similar to the roadway embankment. Do not place large rocks or clumps within 600 mm of pipe.

3.6 PLACING CORRUGATED METAL CULVERTS

- .1 Culverts shall be placed at the location, grade and alignment.
- .2 Begin pipe placing at downstream end.
- .3 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .4 Riveted culverts shall be placed so that horizontal seams are located in the upper half of the culvert with inside circumferential laps pointing in the direction of the flow.
- .5 Culvert sections shall be placed so that the coupler corrugations shall properly engage pipe corrugations with the minimum gap between section ends. Coupler bolts shall be fully tightened.

- .6 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.
- .7 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.
- .8 Corrugated Metal Culvert Joints:
 - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
 - .3 Insert and tighten bolts.

3.7 PLACING CONCRETE CULVERTS

- .1 Begin at downstream end of culvert.
- .2 Concrete culverts shall be placed with the bell or groove on the upstream end of the culvert the foundation or bed shall be contoured to receive the bells
- .3 Ensure barrel of each pipe is in contact with shaped bed throughout its length.
- .4 Rubber gaskets shall be lubricated and installed on cleaned and lubricated joints in accordance with the specifications of the Manufacturer. Culvert sections shall be joined to form a watertight joint, with an opening not to exceed 20 mm.
- .5 Culvert sections shall be secured tightly together until sufficient fill material is tamped in place to prevent the joints from opening.
- .6 Culvert sections with lift holes shall be laid so that the lift holes are at the top. The lift holes shall be filled with non-shrink mortar before the culvert is covered.
- .7 Allow water to flow through pipes during construction only as permitted by Departmental Representative.
- .8 Concrete Culvert Joints
 - .1 Rubber gasket joints:
 - .1 Install in accordance with manufacturer's written recommendations.
 - .2 Ensure that tapered ends are fully entered into flanged ends.
 - .2 Bituminous filled joint:
 - .1 Make joint with excess of filler to form continuous bead around outside of pipe and finish smooth on inside.
 - .3 Mortar joints:
 - .1 Prepare mortar as specified herein.
 - .2 Clean pipe ends and wet with water before joint is made.
 - .3 Place mortar in lower half of flanged end of pipe section in place.
 - .4 Apply mortar to upper half of tapered end of pipe section being installed.
 - .5 Join pipe ends and force joint up tight, taking care to ensure inner surfaces of abutting pipe sections are flush and even.
 - .6 Clean inside of pipe and annular space between ends of pipes after each joint is made.

- .7 Fill joint with mortar and finish smooth and even.
- .8 For pipes 800 mm or less diameter, fill joints before mortar in joints has set.
- .9 For pipes over 800 mm diameter, postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

3.8 TIE STRAPS ON CONCRETE PIPE

- .1 The Contractor shall use galvanized steel tie straps to secure the outer two joints at each end of the culvert installation. The straps shall be anchored at the ten and two o'clock positions on culverts up to 1 050 mm in diameter, and ten, twelve and two o'clock positions on larger culverts. Holes for wedge anchors shall be drilled to appropriate depth and diameter.
- .2 Wedge anchor fasteners will be supplied as followed:

Culvert Diameter (mm)	Wedge Anchor Fasteners				
	Dia (mm)	Length (mm)	Minimum Drill Hole Depth (mm)	Size of Drill Hole (mm)	No. Required Per Installation
300 – 600	9.5	69	38	9.5	16
750 – 1050	13	95	57	13	16
1200 – 1800	13	95	57	13	24

- .3 Tie straps and wedge anchors will be supplied by the Contractor.
- .4 No direct payment will be made for the additional securing of culverts as it will be considered as an incidental operation to Placing Culverts.

3.9 LAYING POLYETHYLENE PIPE CULVERTS

- .1 Begin laying at downstream end of culvert.
- .2 Install pipe in trench by lowering.
- .3 Ensure bottom of pipe is in contact with shaped bedding throughout pipe length.
- .4 Allow water to flow through pipes during construction only as permitted by Departmental Representative.

3.10 JOINTS FOR POLYETHYLENE CULVERTS

- .1 Install couplings in accordance with manufacturer's instructions.

3.11 EXTENDING EXISTING CULVERTS

- .1 Damaged ends of existing metal culverts to be extended shall be straightened or cut off. Damaged sections of existing concrete culverts shall be removed. At least 600 mm existing culvert shall be exposed prior to installation of the extension.

3.12 THROUGH EXISTING EMBANKMENTS

- .1 When placing culverts through an existing embankment, and the roadway is open to traffic, the Contractor shall construct a shoo-fly detour at each location. At the completion of the installation, the detour shall be removed and the material used in the construction of the embankment.
- .2 When the Contract requires a shoo-fly detour it shall be constructed in accordance with the Drawings. The Contractor shall maintain it. Traffic control devices shall be supplied, installed and maintained by the Contractor. The removal of the detour will be required upon completion.

3.13 TRENCHING

- .1 Trenches, when required, shall be excavated wide enough to allow for compaction on both sides of the culvert. If conditions and safety requirements permit, trench walls shall be vertical to at least the top of the culvert. Excavated material shall be stockpiled not closer than one metre from the edge of the trench.
- .2 The minimum trench width shall be three times of the normal pipe diameter, 3D width.
- .3 Spacing for Parallel Pipes: For two or more parallel pipes in a common trench, properly compacted backfill is required between pipes. Minimum spacing between pipes shall be 450mm.

END OF SECTION