

SEWERS

PART 1 GENERAL

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| 1.01 OTHER CONTRACT DOCUMENTS | The General Conditions of the Contract, General Requirements, and Supplemental Conditions attached hereto shall apply to and be part of this Section. |
| 1.02 DESCRIPTION OF WORK | The Work described herein shall be for the construction of sanitary sewer or land drainage sewer mains, manholes, catch basins, appurtenances and associated works. |
| 1.03 RELATED WORK | Section 02210 Excavation Bedding & Backfill Section 02665 Building Connections |
| 1.04 CLASSIFICATION OF THE WORK | <p>Sewers shall be classified as either a Sanitary Sewer or a Land Drainage Sewer with each class described on the basis of the conduit size expressed as the nominal inside diameter of the pipe and fittings, on the basis of the type of pipe material, on the basis of the installation depth, and on the basis of the class of trench backfill required. Only one type of pipe shall be used between manholes.</p> <p>Manholes shall be classified as either Type A or Type B with each class described on the basis of the nominal inside diameter of the manhole measured at the invert or base. Unless specified otherwise in Section 01001 Supplemental Conditions or shown on the Drawings, Type A Manholes shall be installed on Sewers 600 millimetres in diameter and smaller and shall have precast floors wherever practicable. Type B manholes shall be installed on sewers 750 millimetres in diameter and larger.</p> <p>Catch basins shall be classified on the basis of the nominal inside diameter of the catch basin measured at the invert of the catch basin, on the basis of the inside depth, and on the basis of the type of inlet casting required.</p> <p>Connections shall be classified on the basis of type of connection being made to a point of discharge.</p> |

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PART 2 PRODUCTS

**2.01 PVC PIPE &
FITTINGS**

PVC pipe and fittings shall be Polyvinyl Chloride (PVC) having a cell classification of 12454B and a minimum pipe stiffness of 320 kPa. All pipe and fittings shall be manufactured in accordance with ASTM Standard D 3034 'Type PSM Poly (Vinyl Chloride)(PVC) Sewer Pipe and Fittings' and CAN/CSA-B182.2 'PVC Sewer Pipe and Fittings (PSM Type)' or CAN/CSA-B182.4 'Profile PVC Sewer Pipe and Fittings'. With the exception of profile walled pipe, all PVC solid wall pipe shall be DR 35.

Each length of sewer pipe shall have a bell end complete with a factory installed push on elastomeric ring gasket. Lubricant for joining pipes shall be approved by the gasket manufacturer. Pipe shall be coloured green and supplied in lengths not in excess of 6.1 metres.

PVC fittings, (tees, wyes, bends, reducers and plugs) shall be injection moulded PVC or fabricated from sections of PVC pipe of the same, class, type, size and manufacturer as the pipe to which it joins. Fittings shall be coloured white or green.

Pipe and/or fittings which have been manufactured in excess of thirty (30) months prior to installation will not be accepted for incorporation into the Work.

**2.02 CONCRETE PIPE
& FITTINGS**

Concrete pipe and fittings shall be manufactured in accordance with ASTM C 76M 'Reinforced Concrete, Storm Drain and Sewer Pipe', class III, wall B minimum. Acceptance shall be on the basis of Subsection 5.1.1 of ASTM C 76M. Unless otherwise specified, pipe joints shall be tongue-and-groove with each length of pipe supplied complete with a preformed flexible butyl rubber gasket such as 'Kent Seal No 2', 'Rub'r Nek' or approved equal conforming to ASTM C 443M. Lubricant for joining shall be approved by the gasket manufacturer. Each length of pipe shall not exceed 3.0 metres in length and be free of broken pieces of any size, surface defects of any kind, exposed reinforcing, excessive cracking, or any crack extending through the entire wall of the pipe.

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**2.03 MANHOLES AND
CATCH BASINS**

Manholes and Catch Basins sections shall be precast concrete sections manufactured in accordance with ASTM C 478 'Precast Reinforced Concrete Manhole Sections'. Precast sections shall be steam cured and shall not be shipped from the point of manufacture for at least five days after having been cast.

Each precast section shall be supplied with a preformed bituminous sealant such as 'RamNek' or flexible butyl rubber joint sealant such as 'Kent Seal No 2' or approved equal. Each manhole section shall be supplied complete with 19 millimetre diameter galvanized steel ladder rungs accurately cast into each manhole section to form a continuous ladder with rungs evenly spaced at no more than 325 millimetres on center.

The manufacturer shall provide circular or horseshoe shaped openings complete with grooved or roughened surfaces for sewers entering and leaving the manhole. Additional openings required on the Site shall be made in a manner approved by the Engineer.

If specified in Section 01001 Supplemental Conditions, the exterior surface of each manhole section shall be thoroughly covered with a 12 mil coating of coal tar epoxy type sealant.

**2:04 MANHOLE FRAME,
COVER &
ADJUSTING RING
CATCH BASIN
INLET**

Manhole frame, cover, adjusting rings and Catch Basin inlets shall be cast of close grained gray iron true to the required pattern as shown on the Standard Drawings STD 1111A,B,C,D attached to this Section, and shall be smooth, clean, free of cracks, gas holes, runners, blisters, blow holes, shrinkage, cold shuts, risers, fins, burnt on sand and other cast on pieces or flaws. Bearing surfaces shall be clean and shall provide uniform contact.

Unless stated otherwise in Section 01001 Supplemental Conditions or shown on the Drawings, Manhole frame and covers shall be the solid type. Catch Basin inlets shall be as shown on the Drawings.

2.05 CONCRETE

Concrete used for pipe, manhole bases, manhole stacks, catch basins, grouting, benching or flow channels shall be manufactured using Type 50 sulphate resistant Portland cement as described in Section 02512, Ready Mixed Concrete.

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| 2.06 CEMENT MORTAR | Cement mortar shall consist of equal parts of sulphate resistant Portland cement and clean sharp mortar sand mixed dry with only enough water added to make the mixture workable, all in accordance with Section 02512, Ready Mixed Concrete. Mortar which has begun to set shall not be used. |
| 2.07 REINFORCING STEEL | Reinforcing steel shall be new deformed bars of intermediate grade billet steel conforming to the most recent edition of CAN/CSA-G30.18M 'Billet-Steel Bars for Concrete Reinforcement'. |
| 2.08 SEWER CONNECTION COUPLER | Sewer Connection Coupler used to connect two pipes of similar or dissimilar material shall have rubber gasket joints. The manufacturer of the coupler must specifically state the coupler will provide a sound and watertight connection between the two pipes being connected. A rubber gasket slip-on coupler will be allowed for PVC to PVC connections only, all other types of connections shall use a flexible rubber coupling such as a 'Fernco Tridon Coupling Adaptor' or approved equal. A coupler requiring a solvent sealed joint will not be permitted. |
| 2.09 SEWER CONNECTION SADDLE | Sewer Connection Saddle shall be a PVC plastic strap on saddle complete with rubber gasket and two all stainless steel worm drive clamps or straps. The Sewer Connection Saddle shall be of a type and size to suit the Sewer Connection pipe material to which it is being installed. |

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PART 3 EXECUTION

3.01 LINE AND GRADE At each proposed manhole/outfall location, the Engineer will establish offset hubs for horizontal control and provide a grade on a minimum of one hub for vertical control. Prior to commencing any Work the Contractor shall satisfy himself as to the meaning and correctness of all hubs, no claims shall be made for any alleged inaccuracies because of his failure to read same correctly. The Contractor shall maintain all hubs in good order and transfer the correct horizontal and vertical control to the sewer invert(s) in the manhole.

The use of a laser is required to maintain line and grade. The laser shall be set within a manhole and emit its light beam through the interior of the pipe. If bending of the beam due to air temperature variations or dust in the air is apparent within the pipe, a fan shall be provided to circulate the air. Air velocity shall not be so excessive as to cause pulsating or vibrating of the beam. Pipe laying shall not commence until the laser setup has been approved by the Engineer. The Contractor shall follow the manufacture's instructions for the laser's use and ensure that a qualified operator handle the equipment during the course of construction. If, in the opinion of the Engineer, the Contractor's method of setting grade is inaccurate or insufficient, the Engineer may direct that a more suitable method be used to ensure that accurate grade and /or alignment is maintained.

3.02 TOLERANCES Sewer pipe, fittings, appurtenances, manholes and catch basins shall be installed accurately to the required line and grade shown on the Drawings or as set on the Site the Engineer. Vertical and horizontal variance from line shall not exceed 12 millimetres. There shall be no dips which will allow ponding of water to a depth of more than 25 millimetres. Sharp bends will not be permitted even though the pipe remains within these tolerances.

3:03 SEWAGE HANDLING The Contractor shall supply, operate and maintain all necessary equipment to ensure the continuous operation of the existing sewage collection system. Under NO circumstances shall raw sewage be discharged onto land, streets or into ditches,

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streams, lakes, or water courses during the performance and execution of the Work. Where existing sewers carrying sanitary sewage are encountered, the Contractor shall supply, install and maintain temporary connection and pumping facilities as required by the Engineer in order to prevent any nuisance.

3.04 EXCAVATION

Excavation shall be in accordance with Section 02210, Excavation Bedding & Backfill.

**3.05 INSTALLATION
OF PIPE**

Each section of pipe shall be accurately placed on a dry, firm but slightly yielding foundation of bedding material to the line and grade stated in Parts 3.01 and 3.02 and backfilled as described in Section 02210 Excavation Bedding & Backfill. Pipe laying shall proceed upgrade beginning at the lowest elevation of the length being laid with the spigot end of each pipe pointing in the direction of the flow.

All sewer pipe and fittings shall be joined using elastomeric gaskets and in strict accordance with the pipe manufacturer's printed assembly instructions to form a watertight connection with the adjoining pipe. Prior to joining pipes, the Contractor shall obtain the approval of the Engineer for the method to be used and, if requested, shall demonstrate, his ability to carry out the method proposed. Extreme care should be taken during joining to insure that all interior and joining surfaces are clean and free of any foreign materials. Displaced or contaminated gaskets shall be removed, cleaned and lubricated or replaced prior to joining. Pipes shall be carefully aligned and inserted by hand, bar and wooden block, lever type or friction pullers. The use of hydraulic excavation equipment as the means of pushing or moving the pipe to grade will not be permitted. Each joint shall be satisfactorily completed prior to installation of the next length of pipe.

The Contractor shall cut pipe with a fine toothed hand saw, power saw, hack saw, or disk cutter, but not with a chain saw. The spigot end of solid wall PVC pipe shall be bevelled.

At the end of each workday, or when sewer pipe is not being installed, the open end of the pipe shall be protected by a close

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fitting stopper to keep the pipe clean, with adequate precautions taken to overcome possible uplift.

All lift holes in concrete pipe shall be plugged with concrete mortar and, on pipes 750 millimetres in diameter and larger, they shall be trowelled smooth and flush with the inside face of the pipe.

3.06 BEND AND CURVES ON SEWER MAINS The Contractor will not be permitted to deflect straight pipe sections to create curves or correct alignment errors. Curves and bends on pipes shall be made with either radius pipe or approved fittings.

3.07 MANHOLES Manholes shall be installed at the locations shown on the Drawings, as directed by the Engineer, or as specified in Section 01001 Supplemental Conditions all in accordance with the Standard Drawings STD 1111Q,R,S attached to this Section, or as detailed on the Drawings.

Each manhole base shall rest on 150 millimetres of foundation stone. As an alternative to a precast manhole base, the Contractor may use an open base to straddle an existing sewer(s) with the base floor cast in place after the reinforcing has been placed as required for a precast manhole.

Each precast concrete manhole section including adjustment ring(s) shall be joined using a preformed bituminous sealant installed on the tongue end of each manhole to form a continuous watertight joint. Sections shall be lowered with care and properly aligned to ensure ladder rungs line up vertically. All joints and lifting holes shall be sealed on the inside and outside with grout to form a watertight installation.

All PVC pipe entering a manhole shall have a manhole water stop gasket installed firmly clamped around the pipe at the manhole. If a flexible entry is used the, water stop gasket is not required and the PVC sewer pipe shall be installed completely through the manhole with a continuous slope from the inlet to the outlet side(s). The Contractor shall ensure a suitable bond is obtained between the PVC pipe and the concrete by coating the PVC pipe with an epoxy and applying a select granular material (sand) to the epoxy which shall be allowed to harden

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prior to grouting the pipe into the manhole. As an alternative, the Contractor shall install a manhole adaptor grouted into place to ensure a flexible water tight connection.

Concrete benching and flow channels shall be constructed provided as shown on the Drawings and as directed by the Engineer. After benching of the manhole is complete the top portion of the pipe shall be removed at the spring line by neatly cutting the pipe lengthwise such that a semi circular pipe is created. With concrete pipe, channels shall be formed and cast in concrete to the spring line of the connecting pipe. The finished invert shall be a semi circular shaped smooth channel directing the flow to the downstream sewer.

Drop inlets shall be constructed as shown on the Drawings and the Standard Drawing STD 1111 R attached to this Section.

Unless otherwise specified in the Section 01001 Supplemental Conditions, the completed manhole shall be backfilled with Granular Backfill as described in Section 02210, Excavation, Bedding & Backfill, a minimum distance of 1 metre from the side of the manhole.

The cast iron cover frame shall be supported on at least one (1) 150 millimetre deep precast concrete adjusting ring and sealed to the adjusting ring by a preformed bituminous sealant placed between the cover frame and the concrete. The frame and cover shall be set level with the finished grade elevation as shown on the Drawings, or as directed by the Engineer, and if required shall be temporarily ramped with earth or gravel.

**3.08 CONNECTION TO
EXISTING SEWER**

Prior to connecting to an existing sewer the Contractor shall provide adequate means, such as a dam in a downstream manhole, to prevent soil, silt, gravel or debris from entering the existing sewer system.

The plug shall be removed from the existing sewer. Any debris which collects in a new or existing main as a result of the Contractor's operations shall be removed and all pipes left clean and unobstructed. A new gasket shall be installed in the

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bell or grove of the existing pipe and the new pipe installed as stated in Part 3.05 of this Section. If the new pipe is of a different material than the existing pipe, an approved sewer connection coupler shall be installed in strict accordance with the coupler manufacturer's printed assembly instructions. Any damage to the existing sewer shall be promptly repaired at the Contractor's sole expense.

**3.09 CONNECTION TO
EXISTING
MANHOLE**

Prior to connecting to an existing manhole the Contractor shall provide adequate means, such as a dam in the downstream invert, to prevent soil, silt, gravel or debris from entering the existing sewer system. The wall of the existing manhole shall be exposed by excavation and a jackhammer or sledge hammer used to carefully break an opening in the manhole wall where the new pipe invert is located. Any damage to the existing manhole shall be promptly repaired at the Contractor's sole expense. The reinforcing mesh shall be cut and removed along with the rubble and disposed of as directed by the Engineer. If a semi circular channel does not already exist in the bottom of the manhole, one shall be installed by removing the existing concrete benching and installing a new PVC or concrete flow channel as described in Part 3:07 of this Section. Any debris which collects in the manhole as a result of the Contractor's operations shall be removed and all flow channels and inverts left clean and unobstructed.

3.10 CATCH BASIN

The catch basin shall be installed and connected at the locations shown on the Drawings, as directed by the Engineer, or as specified in Section 01001 Supplemental Conditions all in accordance with the Standard Drawings STD 1111P attached to this Section and as detailed on the Drawings. Catch basin leads between single and multiple catch basins and a land drainage sewer shall be 300 millimetre Class III reinforced concrete pipe with rubber gasket joints unless shown otherwise on the Drawings or specified in Section 01001 Supplemental Conditions.

Catch basin leads shall be installed as described in Part 2.05 of this Section. The outlet pipe shall be trimmed such that it opens flush with the inside wall of the catch basin. Where an existing catch basin lead is moved from a sanitary to a land

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drainage sewer, the Contractor shall, if possible, reuse the existing catch basin outlet when installing the new storm water leads. Abandoned lead outlets in catch basins, manholes and the disconnected pipe ends shall be plugged and made watertight. Where an existing catch basin reconnected to a land drainage sewer has leads smaller than 300 millimetres in diameter, the Contractor shall enlarge the pipe openings in both the existing catch basin and manhole and install the size of lead specified or shown on the Drawings. The Engineer may permit an existing 250 millimetre lead to remain in place.

The casting frame shall be sealed to the reducer by a preformed bituminous sealant placed between the inlet frame and the concrete to provide a watertight joint. The cast inlet frame shall be set level with the finished grade elevation as shown on the Drawings, or as directed by the Engineer, and if required shall be temporarily ramped with earth or gravel.

**3.11 ABANDONED
WORKS**

The Contractor shall seal all abandoned sewers not removed during the course of construction by placing a minimum length of 500 millimetres of 10.5 MPa concrete into the end of each abandoned sewer(s), including any unused inverts in manholes and catch basins, forming a complete seal.

Abandoned manholes shall have the upper rings or rows of bricks removed to a depth of 1.2 metres below the finished grade. The remainder of the manhole shall be filled with compacted select granular material and buried. Catch basins shall be completely removed with the open excavation filled with compacted select granular material and buried. All salvaged manhole and inlet frames and covers removed by the Contractor shall be stockpiled and delivered to the City.

3.12 SEWER CLEANING

The sewer pipe and manhole(s) shall be thoroughly cleaned upon completion of the Work and prior to deflection testing or television inspection. The sewer and manhole(s) shall be cleaned with high velocity sewer cleaning equipment which shall remove all foreign materials from the sewer and related structures. Precautions shall be taken by the Contractor to ensure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. All dirt, sand, rocks, grease and other solid or

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semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned and disposed of as directed by the Engineer. Passing material from manhole section to manhole section will not be permitted.

Acceptance of the sewer cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Engineer. If the television inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to again and televise the sewer until the cleaning is shown to be satisfactory.

3.13 SEWER TESTING

All tests and television inspection shall be carried out from manhole to manhole as directed by the Engineer. Testing shall not be carried out until a period of at least two (2) weeks has expired after well-point de-watering has ceased. Deflection testing may be conducted in conjunction with the television inspection however the sewer jet shall not be in operation during the television inspection.

**3.14 DEFLECTION
TESTING**

All PVC sewers shall be tested for deflection using a rigid mandrel sized to pass a maximum deflection (deformation of the pipe diameter) of 5%. No allowance shall be made for pipe wall thickness tolerances or out of round due to heat, shipping, or other external cause. The inspection shall be conducted no earlier than thirty (30) calendar days after the backfill has been placed to final grade, and provided in the opinion of the Engineer that sufficient water densification or rainfall has occurred to thoroughly settle the soil throughout the entire trench depth. If densification cannot be achieved in the time after installation of the pipe and backfill prior to the project completion date, then the mandrel size shall be increased to pass a maximum deflection of 4%.

The mandrel shall be carefully pulled through the sewer by the Contractor. Any sections of sewer that does not allow the mandrel to pass shall be considered to have failed the deflection test and shall be uncovered, repaired or replaced at the Contractor's sole expense and the section tested again.

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**3.15 TELEVISION
INSPECTION**

Television inspection shall be between manholes or other appropriate locations as directed by the Engineer. The Engineer shall be present at all times during the television inspection of the sewer and will indicate to the Contractor what data shall be logged and retained for his records. The television inspection shall be performed by persons skilled and qualified in the use of CCTV inspection equipment. The Contractor shall provide an air conditioned viewing room large enough to accommodate a minimum of three people for the purpose of viewing the monitor (minimum size 17 inch diagonal) while the inspection is in progress. The image shall be clear and sharp enough to enable those viewing the monitor to easily see the interior condition of the sewer being inspected. The Contractor shall deliver to the Engineer a complete typed television inspection report and one VHS format videotape recording of the inspected sewer.

Any sections of sewer that contain defects or deficiencies shall be considered to have failed the inspection and shall be uncovered, repaired or replaced at the Contractor's sole expense and the section televised again.

3.16 INFILTRATION TEST

Prior to testing the sewer shall be cleaned as described in Part 3:14 of this Section and all accumulated water removed from the sewer. Over a continuous 24 hour period, the Engineer shall observe the amount of accumulated infiltration. The maximum allowable rate of infiltration of ground water shall be 4.0 litres/millimetre of inside diameter of pipe/100 metres of pipe (including length through manholes)/24 hours.

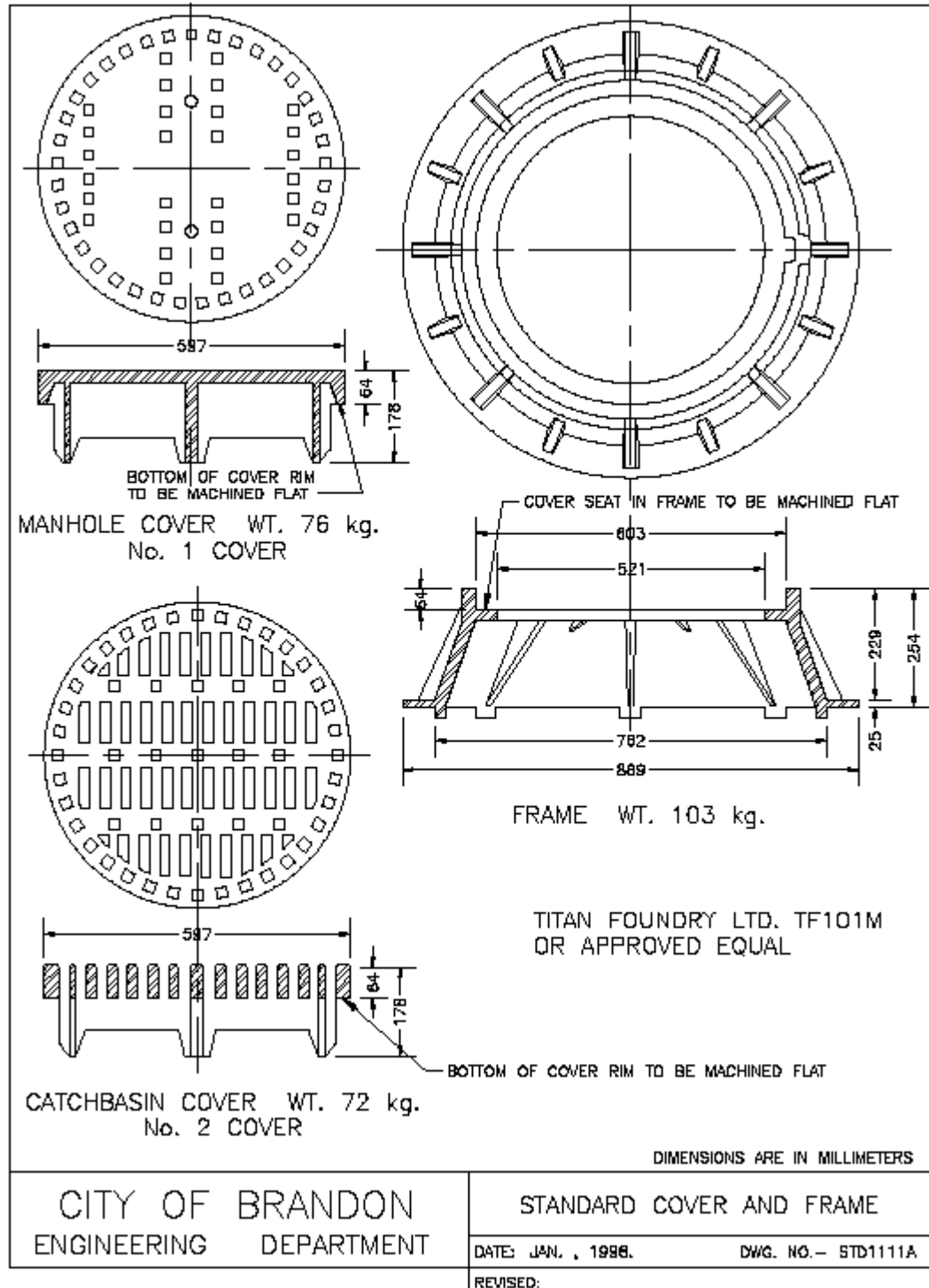
**3.17 EXFILTRATION
TEST**

The Contractor shall install water tight bulkheads in a suitable manner to isolate the section of sewer being tested from the remainder of the sewer system. The test section shall be filled with water and left to stand for 24 hours prior to commencing the test, in order to allow for absorption into the pipe walls. Following the absorption period, the lines shall be filled until there is a head of 1 metre over the interior crown of the pipe measured at the highest point of the test section or water in the manhole is 1.0 metre above static ground water level whichever is greater, or to the level determined by the Engineer. The Engineer shall observe the drop in water level

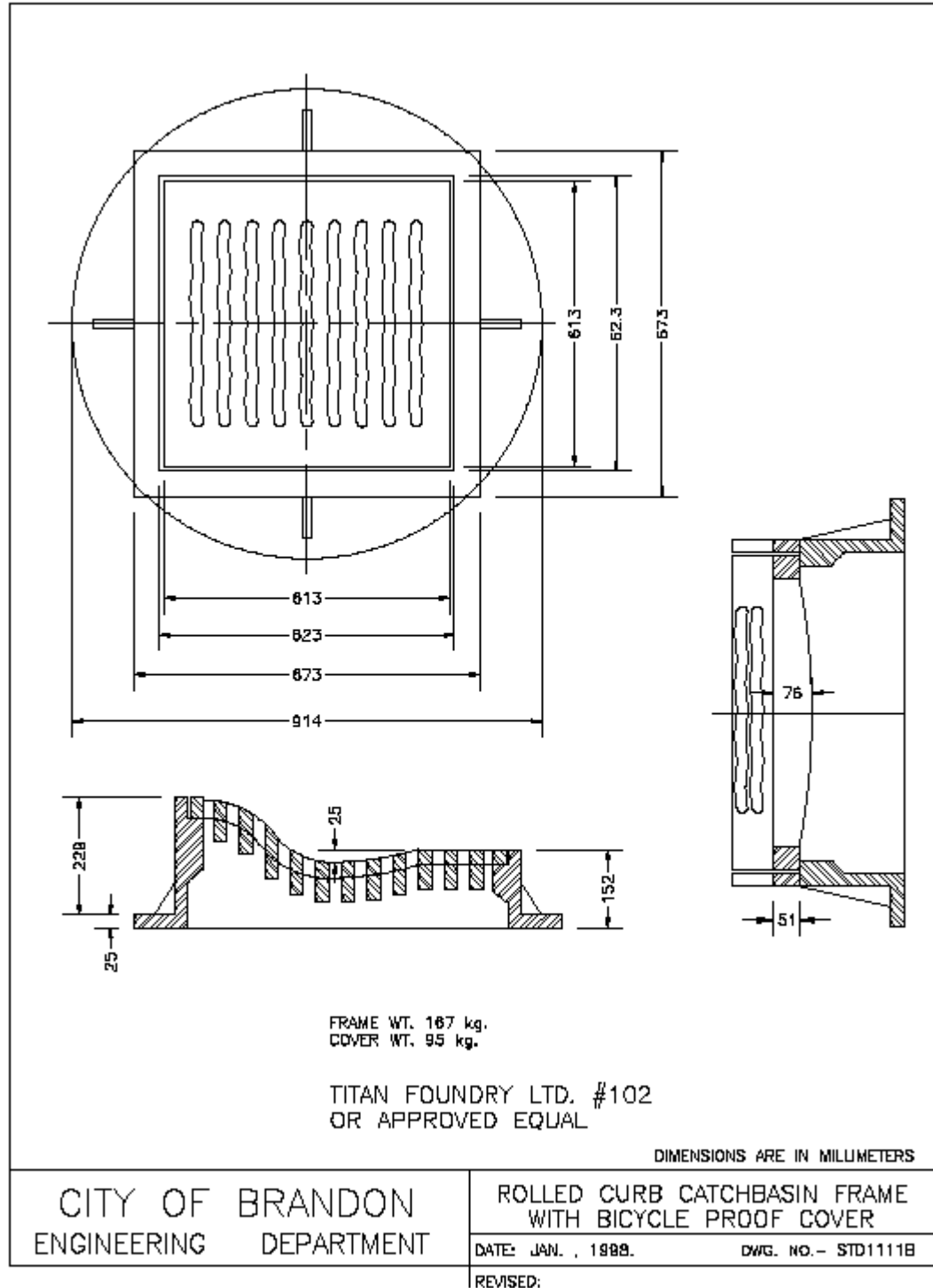
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over a 2 hour period. The maximum rate of leakage shall be 0.20 litres/ millimetre of inside diameter of pipe/100 metres of pipe/ hour. An additional 3.0 litres/hour/vertical metre of manhole riser above the invert shall be allowed for leakage through manholes. If hydrostatic testing reveals excessive leakage, the Contractor shall repair the defective lines and the test shall be repeated until leakage falls within the allowable limit.

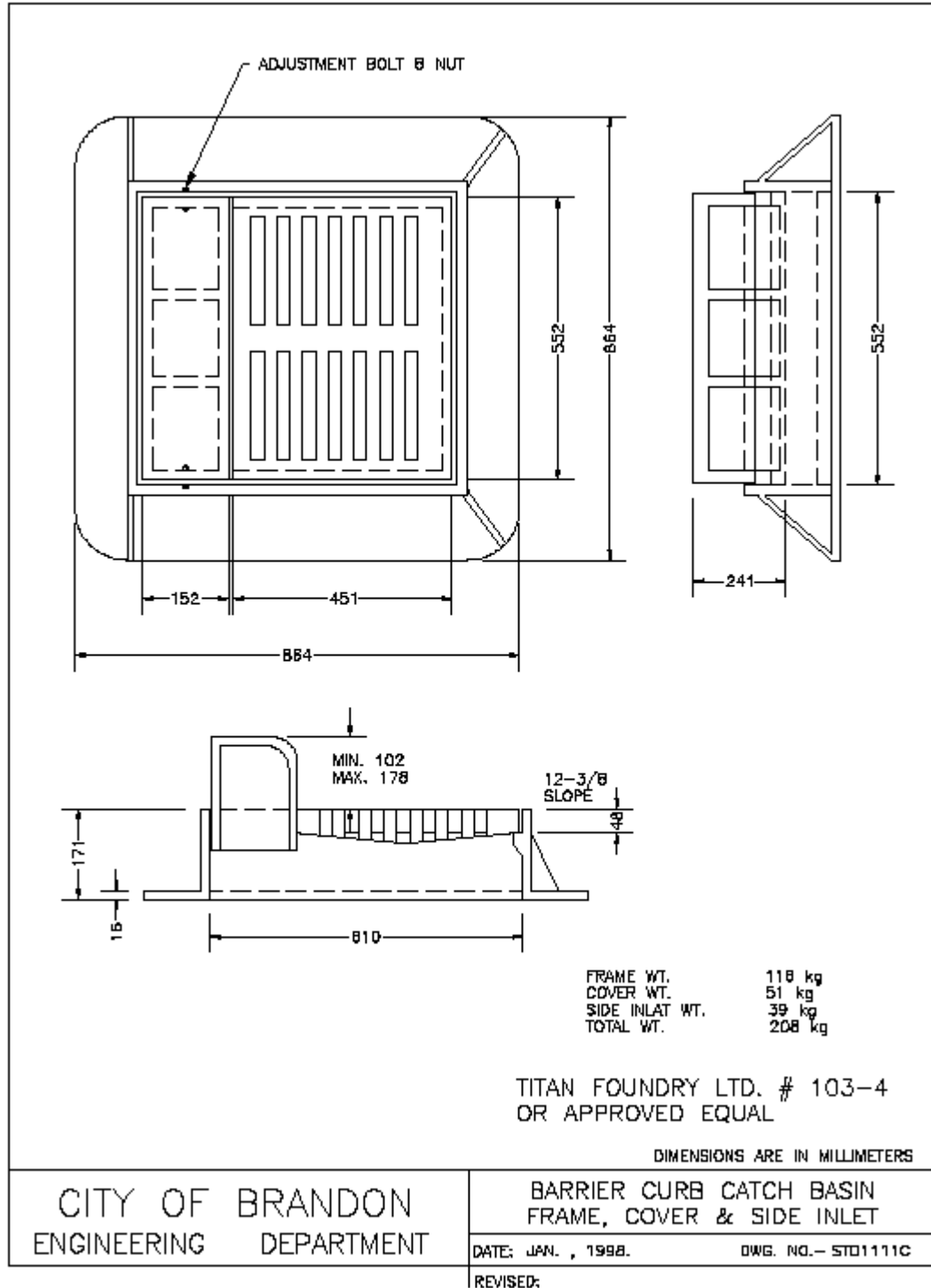
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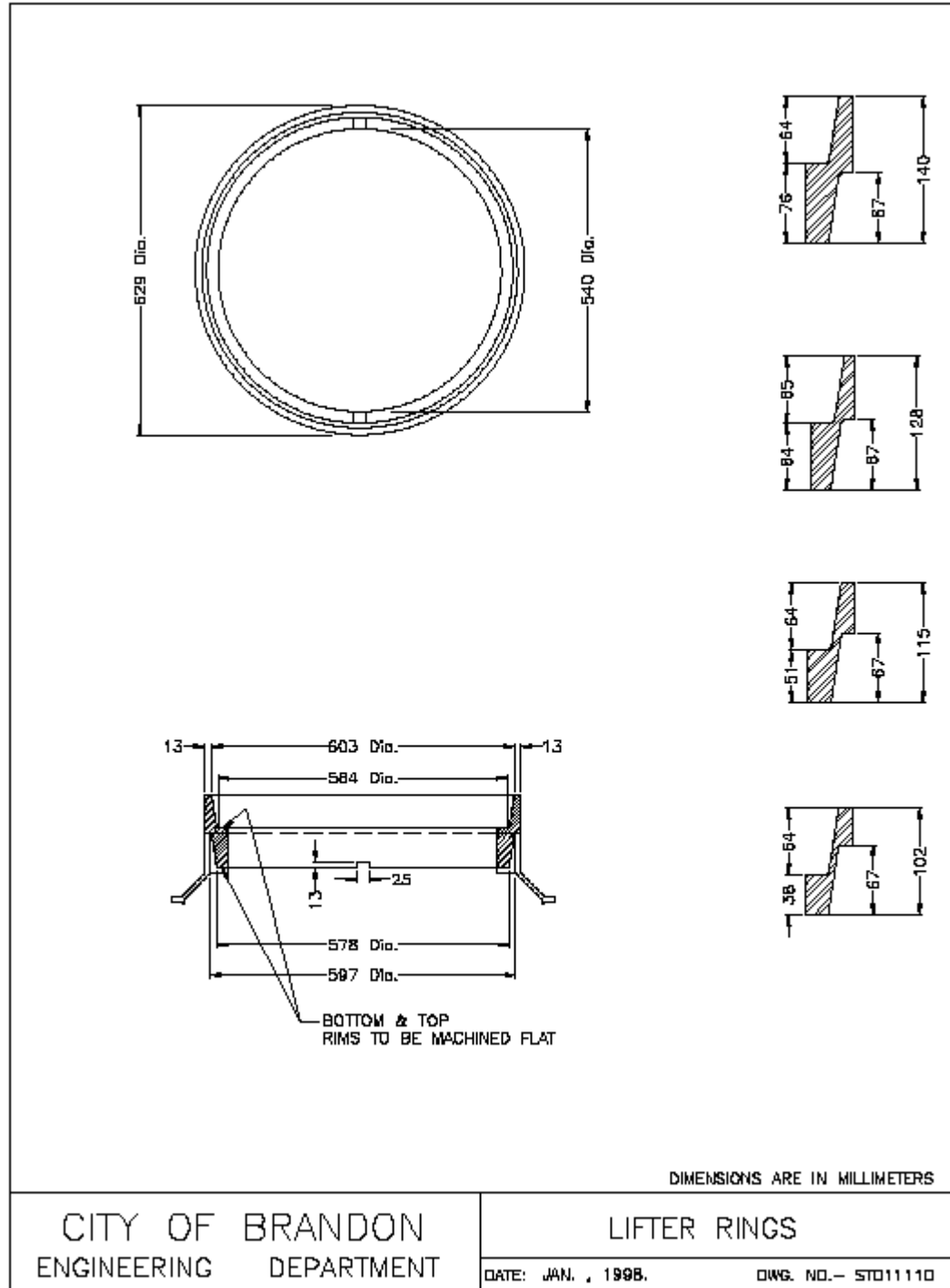
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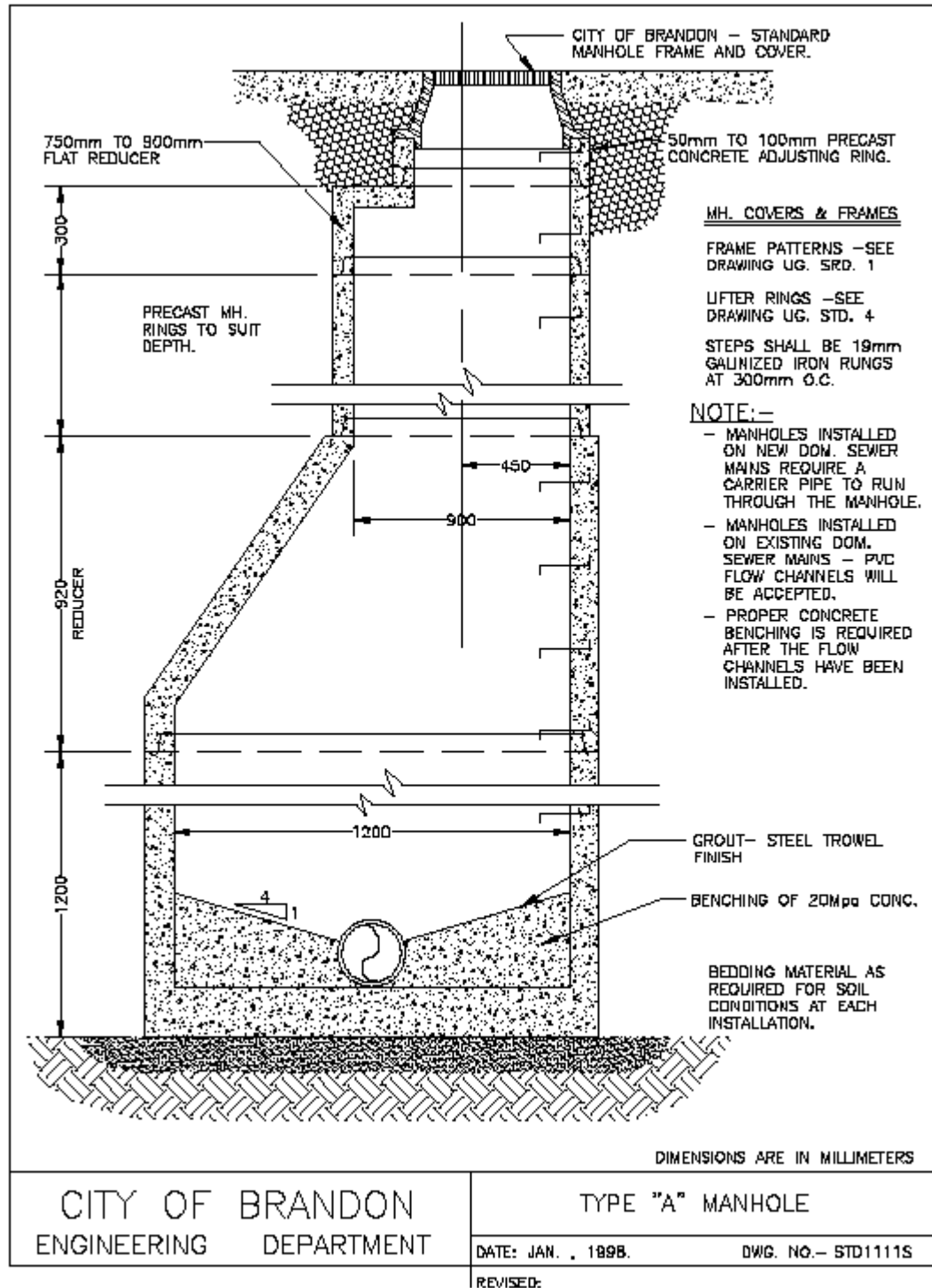
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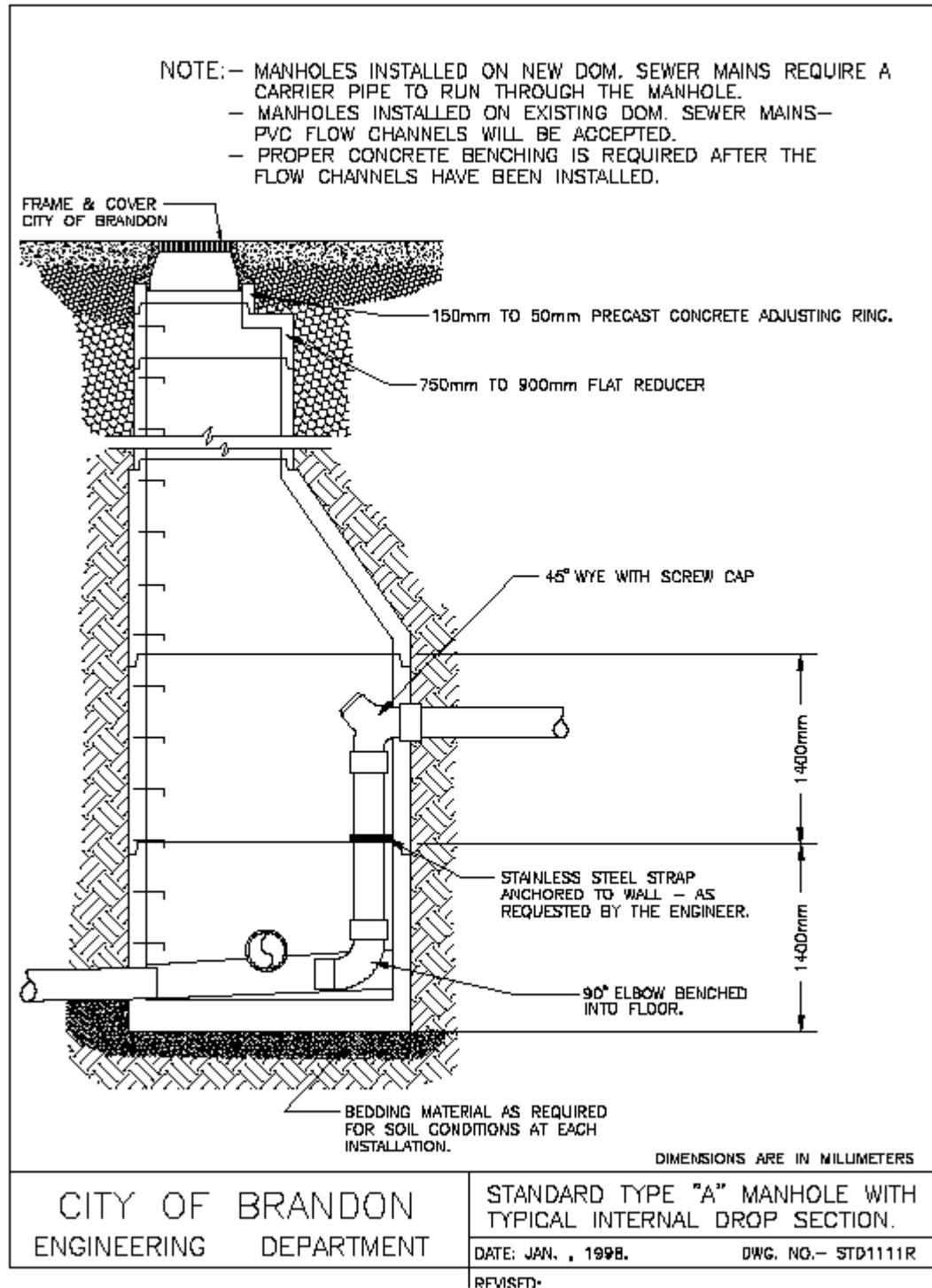
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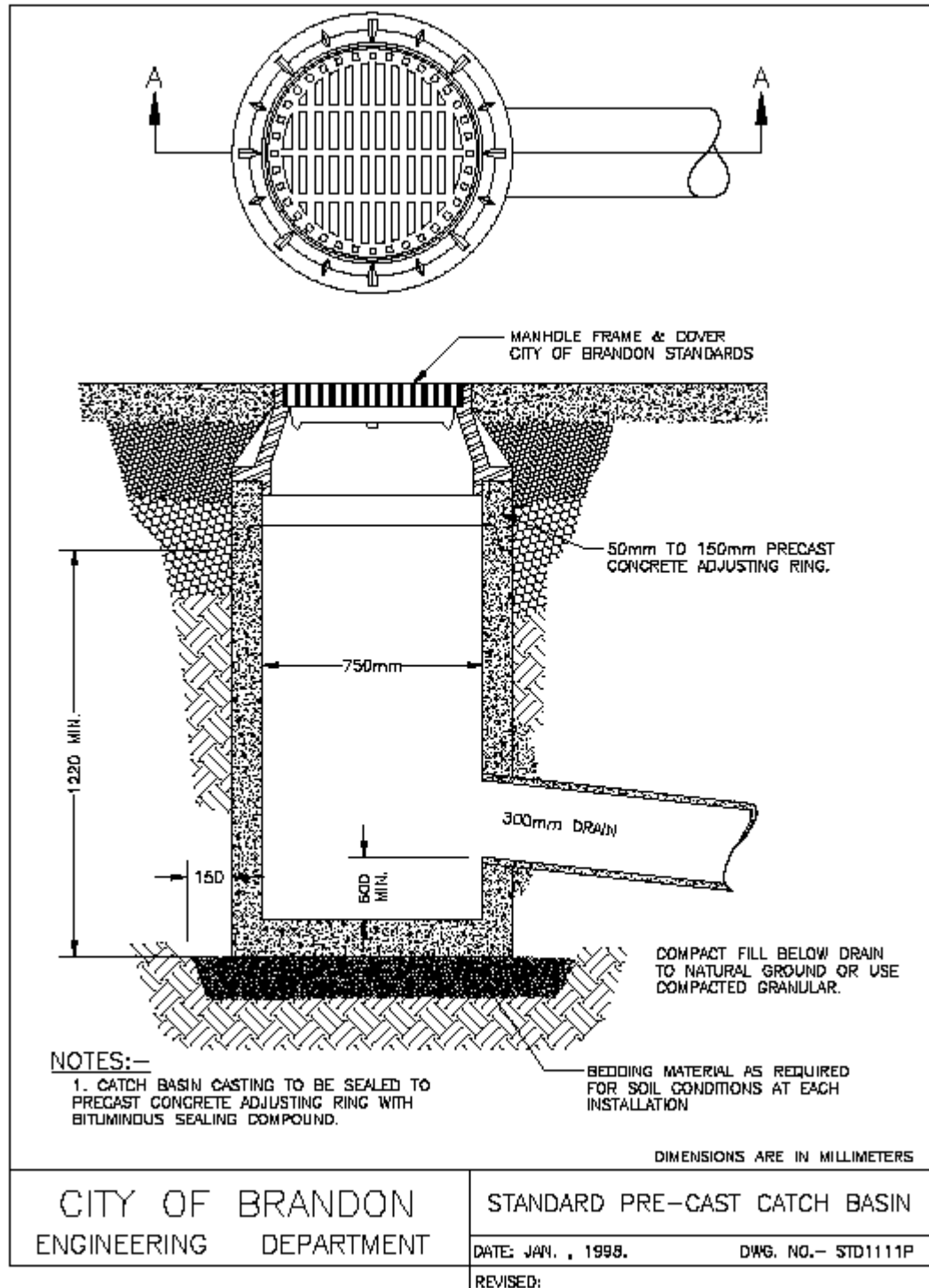
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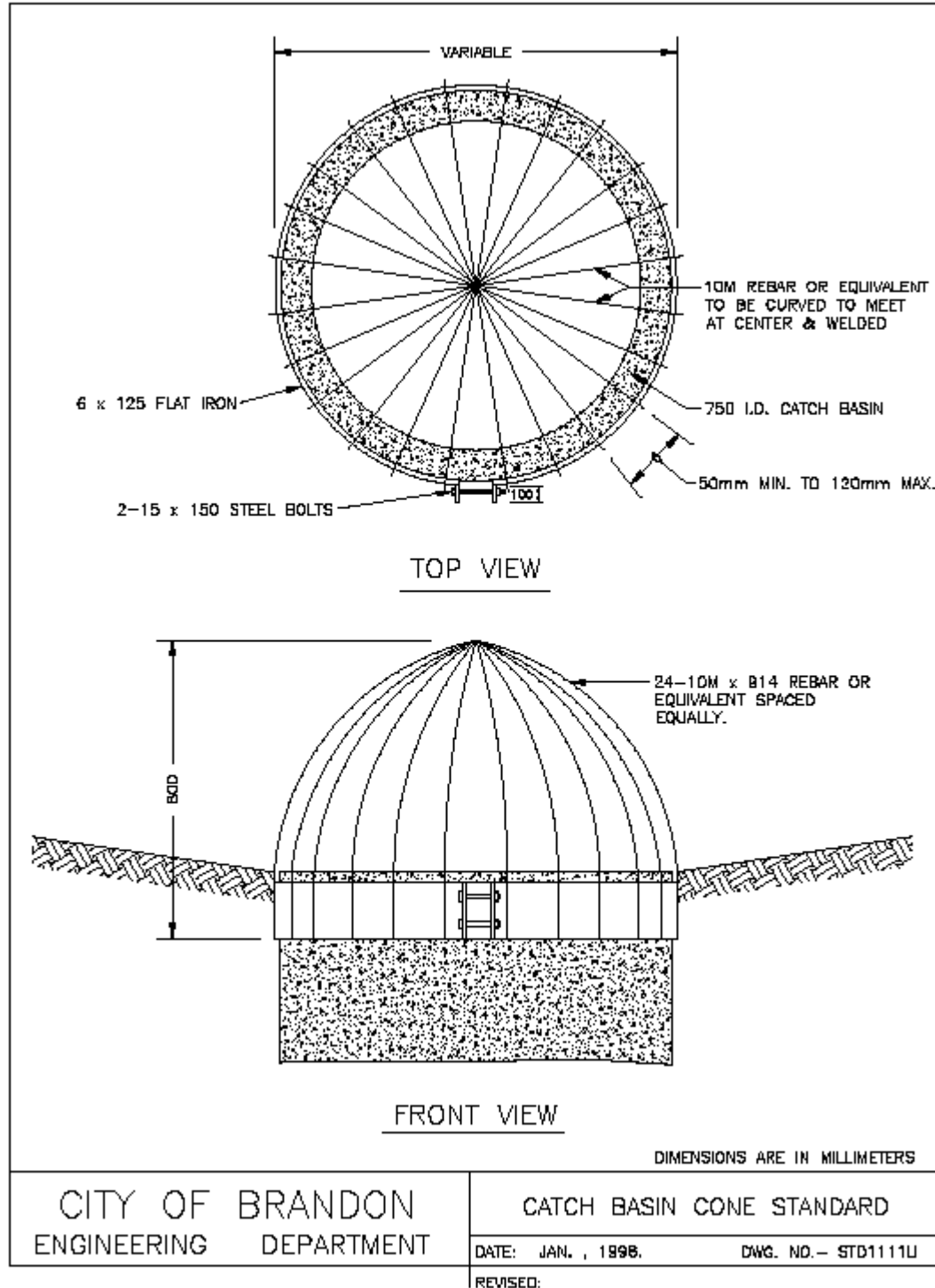
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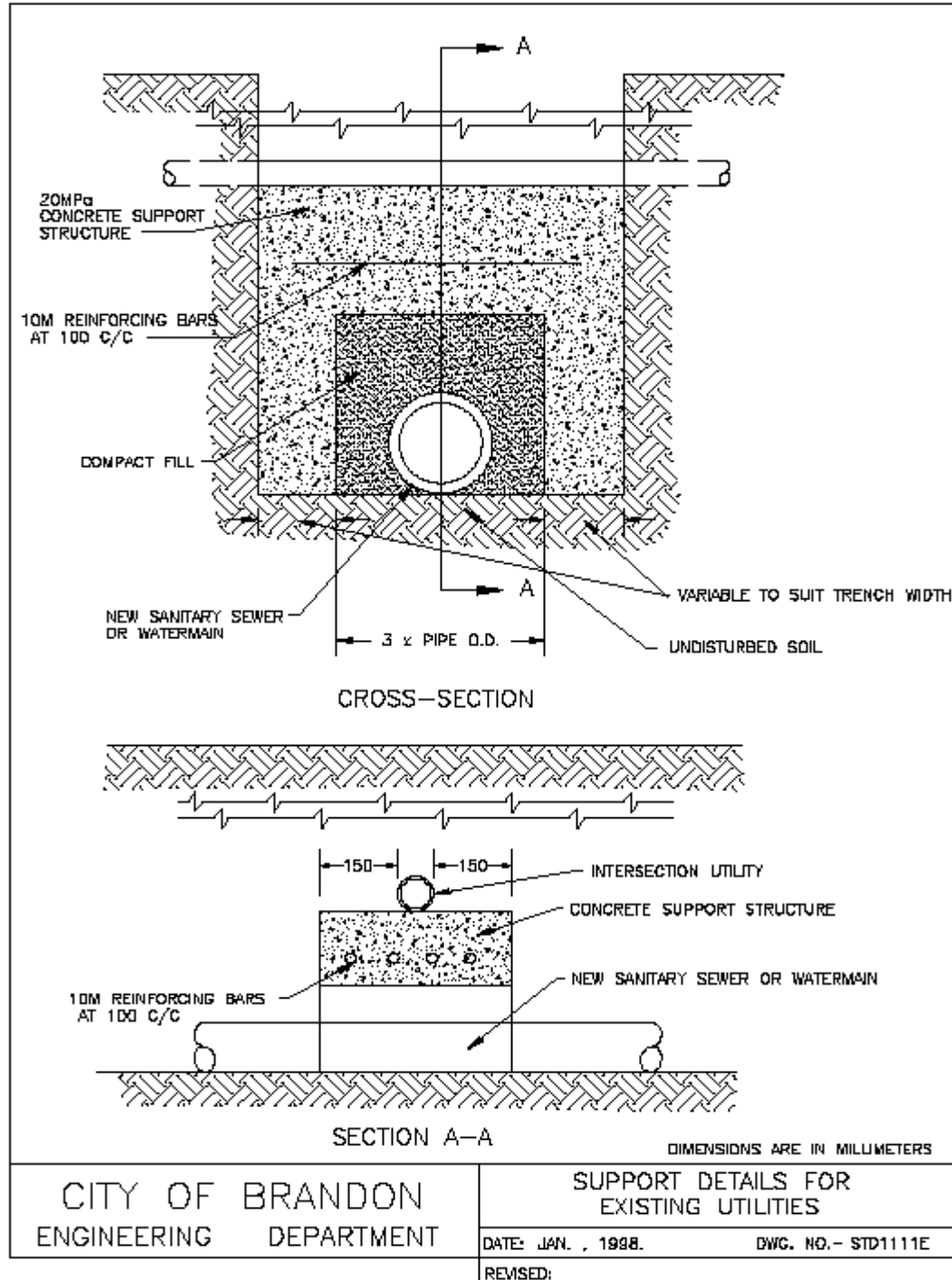
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