SECTION F STORMWATER MANAGEMENT SYSTEM

F.1 GENERAL

F.1.1 The Developer and the Developer's Engineer are responsible to ensure that the storm sewer system is designed and constructed according to accepted engineering practice. These guidelines are intended as a guide only and shall not be considered as a substitute for a detailed material and construction specification to be prepared by the Developer's Engineer.

F.1.2 The stormwater management system should be designed with major and minor drainage systems. In general, a minor system consists of piping, manholes, catch basins and outfall structures that have been designed in order to avoid property damage and flooding due to runoff generated by a 1 in 5 year rainfall event. A major system consists of the roads, gutters, lot drainage and detention facilities designed to avoid significant property damage and control flooding caused by a 1 in 100 year rainfall event. When the capacity of the minor system is exceeded, the major system must provide a continuous overland flow route allowing the excess runoff to reach the designated ponding areas or water body.

F.1.3 Post development runoff rates shall not exceed the pre-developed runoff rate for a given contributing area. The allowable discharge rate must be calculated by the Developer's Engineer and detailed in the Stormwater Management Plan. The proposed method of stormwater control must reduce the allowable discharge rate to a level that is acceptable to both the Municipality and Alberta Environment and Water.

F.1.4 The design of both the major and minor systems must meet the requirements outlined in the Alberta Environment "Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems". Drainage diversions (pipes, ditches, berms, ditch checks, storm ponds, culverts, rip-rap) and other means of erosion control shall be approved by Alberta Environment and Water as applicable.

F.1.5 Properly graded and surfaced roads and lanes, landscaping and sediment control structures at storage facility inlets and outlets shall be used to minimize sediment discharge into the stormwater collection system and receiving water body.

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F.1.6 Legislation, standards and guidelines that may affect the design and construction of stormwater management systems include:

Federal Fisheries Act

Federal Navigable Waters Protect Act

Alberta Water Act

Alberta Environmental Protection and Enhancement Act

Municipal Government Act

Alberta Environment "Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems"

Alberta Environment, Stormwater Management Guidelines

County of Vermillion River Land Use Bylaw

Development Agreement

ASTM – American Society for Testing and Materials

CSA – Canadian Standards Association

F.2 MINOR SYSTEM

F.2.1 Flow Rates

F.2.1.1 The storm sewers shall be designed as a separate sewer system. Effluent from sanitary sewers or any potentially contaminated drainage shall not be discharged in the storm sewers.

F.2.1.2 The Minor System shall be designed to accommodate the runoff generated from a 1:5 year or more frequent rainfall event without surcharge of sewer pipes or ponding at catch basins. An allowance should be made for sump pump discharge or individual service lines from weeping tiles where required.

F.2.1.3 Roof leaders should be discharged to the ground and drain away from the building, water supply well and septic bed. Provisions shall be

made to prevent soil erosion. The Municipal Engineer may approve discharge of roof leaders to the storm sewer when conditions warrant in order to prevent erosion and/or property damage.

F.2.1.4 Dry wells shall be permitted only where the groundwater table is below the bottom of the dry well. Dry wells shall be not less than five metres from the building foundation and located to ensure that drainage flows away from the building.

F.2.1.5 The Rational Method shall be used in estimating flows for the design of storm sewers for areas less than 65 hectares.

$$Q = \frac{CIA}{360}$$

where Q = the design peak flow rate in cubic metres per second
I = the intensity of rainfall is millimetres per hour
A = the contributing area in hectares
C = the runoff coefficient

F.2.1.6 The five-year rainfall intensity shall be taken from climatic design values obtained by writing to Atmospheric Environment Services, Environment Canada, 4905 Dufferin Street, Downsview, Ontario M3H 5T4.

F.2.1.7 Minimum runoff coefficients shall be according to the following table:

Land Use / Surface Characteristics	Runoff Coefficient, C
Country Residential	0.3
Urban	0.4
Grassed Areas (Parks, Playgrounds)	0.15
Undeveloped Land (Farmland)	0.1
Industrial	0.6
Commercial	0.7

F.2.1.8 Due to the large variation in lot sizes for rural residential developments and in impervious areas for commercial and industrial areas, a

weighted runoff coefficient for these types of developments can be calculated using the following formula:

$$C = \frac{(0.9 \times \text{Impervious Area}) + (0.15 \times \text{Pervious Area})}{\text{Total Area}}$$

F.2.1.9 The intensity for the rational formula is to be sought from Atmospheric Environment Services, Environment Canada. T_c is the sum of the inlet time and travel time. The inlet time is the time for the overland flow to reach the curb. The maximum inlet time for residential areas shall be 10 minutes. Inlet times for commercial or industrial areas shall be calculated on a site-specific basis. The travel time, being the time it takes for the runoff to reach the design point from the moment it reaches the curb, is calculated based on gutter and pipe velocity.

F.2.1.10 For areas larger than 65 hectares, the Developer must submit acceptable computer modelling of the area for review.

F.2.1.11 Weeping tile flows must be presented in a detailed Geotechnical Hydrogeological Investigation prepared by a qualified geotechnical engineer or hydrogeologist. The report should outline expected weeping tile flows and any design and construction procedures required for foundation installation.

F.2.2 Pipe Sizing

The following design factors shall be used in determining the storm sewer pipe sizes:

F.2.2.1	Minimum pipe size for storm sewer main	-	300 mm
F.2.2.2	Minimum pipe size for foundation drains main accommodating flow from weeping tiles ONLY	-	150 mm
F.2.2.3	Minimum pipe size for catch basin leads	-	250 mm
F.2.2.4	Manning's Formula "n"	-	0.013
F.2.2.5	Minimum flow velocity when flowing full	-	0.6 m/sec
F.2.2.6	Maximum flow velocity	-	3.0 m/sec

F.2.2.7 Minimum design slopes

Sewer Diameter (mm)	Minimum Design Slope
300	0.194 %
375	0.145 %
450	0.114 %
525	0.092 %
600	0.077 %
675	0.065 %
750	0.057 %
900	0.045 %
1050	0.036 %
1200	0.031 %
1350	0.027 %
1500	0.023 %
1650	0.020 %
1800	0.018 %
1950	0.016 %
2100	0.015 %
2250	0.013 %
2400	0.012 %
2550	0.011 %
2820	0.010 %

F.2.2.8 Minimum slope on curved sections

Sewer Diameter (mm)	Minimum Design Slope
300	0.25 %
375	0.18 %
450	0.15 %
525	0.13 %
600 and greater	0.10 %

F.2.2.9 Minimum grade for catch basin leads - 1.0%

F.2.2.10 The minimum grade of the first upstream leg shall not be less than 0.5%

F.2.3 Storm Sewer Alignment and Location

F.2.3.1 Sewer mains shall be located within the road right-of-way and outside the carriageway in accordance with the typical roadway cross section.

F.2.3.2 Storm sewers shall be located a minimum of 3.0 m o/c from any watermain and 1.8 m o/c from any gas line or as required by the utility company.

F.2.3.3 Storm sewers shall be spaced at a minimum of 0.2 5m between pipe walls from any adjacent sanitary sewer.

F.2.3.4 Public Utility Lot (PUL) widths shall be at least 4.0 m for a single utility and 6.0 m for two utilities.

F.2.3.5 Curved sewers shall run parallel to the curb or road centreline.

F.2.4 Required Depth for Storm Sewers and Catch Basin Leads

Storm sewers shall be installed at a sufficient depth to meet the following requirements:

F.2.4.1 The main shall have a minimum depth of cover of 2.2 m measured from finished grade to the invert.

F.2.4.2 The storm sewer shall have sufficient depth of cover to provide complete frost protection.

F.2.4.3 The main shall have sufficient depth to allow all required building foundations to drain by gravity to the sewer. Special consideration should be taken when building floor elevations are lower than the roadway. Service lines shall have a minimum cover of 2.0 m from the finished lot surface to the top of pipe at the property line.

F.2.4.4 The catch basin leads shall have a minimum of 1.5 metres of cover measured to the top of pipe.

F.2.4.5 Under normal conditions, storm sewer mains shall cross below water mains with sufficient clearance to allow for proper bedding and structural support of the pipes. Pipe clearance when passing under any

watermain shall be a minimum of 300 mm separation between the top of the sewer pipe and the bottom of the watermain.

F.2.4.6 Pipe clearance when passing over any watermain shall be a minimum of 500 mm separation between the bottom of the sewer pipe and the top of the watermain. Efforts shall be made to pass under the watermain when possible.

F.2.5 Manhole Design and Location

F.2.5.1 Manholes shall be located at the end of each line, at all changes in pipe size, grade and alignment.

F.2.5.2 The maximum distance between manholes shall not exceed 150 m.

F.2.5.3 All manholes shall be a minimum 1200 mm minimum inside diameter.

F.2.5.4 Manholes shall be located at the extension of property lines whenever possible in order to avoid conflicts with driveways.

F.2.5.5 The drop across manholes should be of sufficient magnitude to account for any energy losses in the manhole.

F.2.5.5.1 pipe deflections of less than 45° require a drop of at least 30 mm

F.2.5.5.2 pipe deflections of 45° to 90° require a drop of at least 50 mm

F.2.5.6 Invert drops for pipes larger than 600 mm or for high flow situations shall be assessed on an individual basis.

F.2.5.7 The obvert elevation of a sewer entering a manhole shall not be lower than the obvert elevation of the outlet pipe.

F.2.5.8 Pipe deflections in manholes shall not be greater than 90°.

F.2.6 Storm Services and Foundation Drains

F.2.6.1 Foundation drain service connections will be required for weeping tile flow in areas where the water table is higher than the basement foundations. Sizing of foundation drain service lines shall be based on expected flows as determined by the geotechnical investigation. Sump

pump discharge collection systems with surface discharge shall not be permitted in areas with urban road cross sections.

F.2.6.2 Storm sewer connections for the connection of roof drains will only be required where geotechnical conditions dictate such as areas where slope stability is an issue

F.2.6.3 When required, separate storm sewer or foundation drain service connections shall be provided for each separately titled lot.

F.2.6.4 The minimum size of a residential storm sewer or foundation drain service shall be 100 mm. Non-residential service connections shall be sized according to anticipated flow.

F.2.6.5 Connections for all proposed residential lots requiring storm sewer or foundation drain services shall be installed at the time of initial subdivision development.

F.2.6.6 The minimum grade for a storm sewer or foundation drain service line shall be 2.0%.

F.2.6.7 Services shall be located such that they do not conflict with driveway locations.

F.2.6.8 The storm sewer or foundation drain services shall be installed to the property line. In areas where natural gas distribution facilities require an easement along the front of the property, the service connections shall be extended to the edge of the easement furthest from the roadway.

F.2.7 Catch Basins and Leads

F.2.7.1 The maximum surface/gutter flow distance shall be 150 m.

F.2.7.2 The catch basin grates, leads and spacing shall be designed such that there will be no ponding during a 1:5 year rainfall event.

F.2.7.3 At sag locations, the determination of the required capacity must account for flow that may bypass inlets at upstream gutter locations.

F.2.7.4 The minimum inside diameter for a pre-cast catch basin shall be 610 mm.

F.2.7.5 The minimum sump depth in catch basins shall be 600 mm.

F.2.7.6 Gutter flow shall be intercepted by a catch basin prior to crossing a walkway wherever possible.

F.2.7.7 The depth of flow in gutters should not exceed the top of curb at any point.

F.2.7.8 Catch basins shall be located at the BC or EC of any curb return.

F.2.7.9 The maximum length of a catch basin lead shall be 30 metres. If the length must exceed 30 metres, a catch basin manhole must be installed on the upstream end.

F.2.7.10 All leads shall be connected to a manhole or catch basin manhole at the downstream end.

F.2.7.11 Catch basins and leads shall not be placed beyond the public right-of-way. Lots must be filled and graded to ensure that all runoff drains to a public right-of-way.

F.2.7.12 The minimum grade on a catch basin lead shall be 1.00%.

F.2.7.13 Minimum depth of cover shall be 1.5 metres to top of pipe.

F.2.8 Storm Sewer Materials

F.2.8.1 The Developer shall supply only new materials. All materials found to be defective or damaged shall be replaced at the cost of the Developer.

F.2.8.2 Where specific products are specified, it is intended that approved equals are also acceptable. Approval must be obtained by the Municipal Engineer prior to installation.

F.2.8.3 PVC pipe and fittings shall conform to the following:

F.2.8.3.1 CSA B182.2, ASTM D3034, ASTM F679, NQ 3624-130 and NQ 3624-135 standards with minimum stiffness of 320 kPa. Service lines shall a minimum stiffness of 625 kPa.

F.2.8.3.2 Ultra Rib PVC or approved equal is acceptable from 250 to 600 mm. Pipe shall conform to CSA B182.2 and ASTM F794 with a minimum stiffness of 320 kPa.

F.2.8.3.3 Standard Dimension Ratio (SDR) 35 unless otherwise indicated on the drawing.

F.2.8.3.4 Sealing gaskets shall meet requirements of CSA B182.2 and ASTM F477.

F.2.8.3.5 Injection moulded gasketed fittings for service connections shall conform to CSA B182.1 or CSA B182.2 and fabricated fittings shall conform to CSA B182.2 and ASTM F679.

F.2.8.3.6 Pipe shall be tested by the manufacturer and marked in accordance with CSA B182.2. Test results shall be recorded on a certification form signed by a qualified representative of the manufacturer.

F.2.8.3.7 Pipe and fittings shall be installed within two years form the production date indicated on the certification.

F.2.8.4 Concrete pipe and fittings shall conform to the following:

F.2.8.4.1 All concrete pipe shall be manufactured using Type V sulphate resistant cement CSA A3000.

F.2.8.4.2 Non reinforced concrete pipe shall conform to CSA A257.1, minimum Class 3 and ASTM C14.

F.2.8.4.3 Reinforced concrete pipe shall conform to CSA A257.2 and ASTM C76.

F.2.8.4.4 Flexible rubber gasket joints shall conform to CSA 257.3 and ASTM C443.

F.2.8.4.5 The manufacturer of the concrete pipe shall perform quality testing and control in accordance with CSA 257.0, 257.1, 257.2 and 257.3.

F.2.8.4.6 Each concrete pipe shall be marked with the manufacturer's name, date of casting and quality testing passing stamp.

F.2.9 Manhole Materials

F.2.9.1 Manholes shall be manufactured using sulphate resistant Type V cement.

F.2.9.2 Manhole sections shall be pre-cast reinforced concrete conforming to ASTM C478 and CSA A257.4.

F.2.9.3 All manholes shall have an inside diameter of 1200 mm for pipe 900 mm and less. For pipe exceeding 900 mm or manhole having multiple inlets, manhole sizing shall be subject to review by the Municipal Engineer.

F.2.9.4 Manhole steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminium forged from 6061-T6, 6351-T6.

F.2.9.5 All joints shall be sealed with rubber gaskets conforming to ASTM C443 and grouted with non-shrink grout.

F.2.9.6 Manhole frames and covers shall be cast iron conforming to Class 20 ASTM A48 and ASTM A536. Type NF80 covers shall be used for all streets and driveways, type NF90 covers with rubber gasket shall be used for manholes located in sags and low areas and type F39 covers shall be used for all other areas. Castings shall be marked with series designation, foundry identification and date of casting. Manhole covers with Lamont County identification will be encouraged. Manhole covers with names of other municipality names are not permitted.

F.2.9.7 Pre-benched manhole bases shall be use wherever possible with pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.

F.2.9.8 Tee Riser manholes shall conform to CSA 257.2, ASTM C76 and CSA A257.4, ASTM C76.

F.2.9.9 Safety platforms are required for all manholes greater than 7.0 m in depth.

F.2.9.10 All pre-cast units shall be market with manufacturer's identification, date of casting, type of cement and CSA standard.

F.2.10 Catch Basin Materials

F.2.10.1 Catch basin barrels shall be manufactured using sulphate resistant Type V cement.

F.2.10.2 Catch basin frames and grates shall be cast iron conforming to Class 20 ASTM A48 and ASTM A536. Type F38 or F39 grates shall be used for all round top inlet catch basins, type F51 or F36A grates shall be used for straight face curbs and type F33, K7 or DK7 shall be used for rolled face curb. Any other types must obtain approval by the Municipal Engineer. Castings shall be marked with series designation, foundry identification and date of casting.

F.2.10.3 If required, catch basin steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminium forged from 6061-T6, 6351-T6.

F.2.10.4 All pre-cast units shall be market with manufacturer's identification, date of casting, type of cement and CSA standard.

F.2.11 Trenching, Bedding and Backfilling

F.2.11.1 All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.

F.2.11.2 If unsuitable soil conditions are encountered, proper measures for dealing with the conditions shall be identified either on the design drawings or as a brief report to the Municipal Engineer prior to construction.

F.2.11.3 Class "B" pipe bedding shall be utilized in suitable soil conditions. Washed rock shall be used if water table is above the pipe zone. Bedding sand shall have minimum depth of 100 mm below the pipe, shall extend up both sides to the trench wall and provide a minimum cover of 300 mm above the pipe. The Developer's Engineer shall identify special pipe foundation measures for areas where unsuitable pipe foundation conditions exist.

F.2.11.4 The minimum trench width measured at the pipe springline shall be the pipe outside diameter plus 450 mm. The maximum trench measured at the pipe springline shall be the pipe outside diameter plus 600 mm. The Municipal Engineer must be notified if the trench must be excavated deeper or wider than specified.

F.2.11.5 Excavated material shall be stockpiled at a safe distance from the edge of the trench.

F.2.11.6 The Developer's Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing in order to protect workers, property or adjacent structures.

F.2.11.7 Trench excavations shall be kept free of water.

F.2.11.8 It shall be the Developer's responsibility to ensure that the utility trenches are adequately compacted.

F.2.11.8.1 Native backfill under existing or proposed roads or laneways shall be compacted throughout the entire right-of-way width to:

F.2.11.8.1.1 98% standard proctor density from subgrade to 1.5 m below subgrade or original ground, whichever is lower;

F.2.11.8.1.2 95% standard proctor density greater than 1.5 m from the subgrade or original ground, whichever is lower;

F.2.11.8.2 Granular backfill under existing or proposed roads or laneways shall be compacted to 95% of standard proctor density

throughout the entire trench depth below subgrade and the entire right-of-way width.

F.2.11.8.3 Backfill in all other areas shall be compacted to 95% standard proctor density.

F.2.11.8.4 Subgrade and base course compaction for roadway construction shall be as specified in Section G.

F.2.11.8.5 If the above standards cannot be achieved due to a large variation in soil types throughout the development, the Municipal Engineer, at his or her sole discretion, may establish a more appropriate standard on an individual case basis. One-mould proctor density testing may be permitted if the Developer submits an acceptable proposal prepared by the Developer's Engineer, justifying the required changes to the compaction standards.

F.2.11.9 If the minimum compaction standards cannot be met due to abnormal weather or wet ground conditions, the Municipal Engineer may establish a more suitable standard on a site specific basis provided adequate justification is presented by the Developer. One-mould proctor density testing will not be permitted as an alternate testing procedure due to wet soil conditions. The Developer's engineer will be required to suggest appropriate measures such as drying in-situ material or importing suitable material in order to meet the required Standard Proctor Densities.

F.2.11.10 All landscaping, pavement structures, sidewalks, curb and gutter damaged or removed during trenching shall be restored or replaced unless otherwise directed by the Municipal Engineer.

F.2.11.11 All debris, surplus fill and unused materials must be removed from the site.

F.2.12 Storm Sewer Installation

F.2.12.1 The pipe and gasket installation shall be conducted in compliance with the pipe manufacturer's specifications. Installation of PVC pipe and fittings shall conform to CSA-B182.11.

F.2.12.2 Pipe installation shall start at the outlet and work upstream.

F.2.12.3 Align pipes carefully when jointing. Keep joints free of mud, gravel and foreign material and apply sufficient pressure to ensure that the joint is complete as outlined in the manufacturer's specifications. Complete each joint before laying the next length of pipe. Deflections shall not exceed those permitted by the manufacturer.

F.2.12.4 The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete.

F.2.12.5 The alignment of pipes less than 900 mm in diameter shall not be more than 150 mm off the designated alignment. The alignment for pipes larger than 900 mm shall not deviate by more than 50 mm per 300 mm of diameter.

F.2.12.6 The invert of the pipe shall not deviate from the design grade by more than 6 mm plus 20 mm per metre of diameter of sewer pipe.

F.2.13 Manhole Installation

F.2.13.1 Manholes shall be installed as depicted on the detail drawings and in accordance with manufacturer's recommendations.

F.2.13.2 Backfill around manholes shall be compacted to a minimum of 98% Standard Proctor Density.

F.2.13.3 Tee Riser manholes shall require Class A bedding to the elevation of the springline.

F.2.13.4 Pre-cast manhole bases shall be installed on a base of 100 mm to 300 mm washed gravel.

F.2.13.5 Cast in place manhole bases approved by the Engineer shall be places directly on undisturbed ground.

F.2.13.6 Safety steps shall be aligned on centreline perpendicular to the main flow channel. Wherever possible the steps shall be aligned so that a person exiting the manhole would face oncoming traffic if not conflicting with the previous requirement. The distance from the top of the rim to the first step shall not be greater than 300 mm. Steps shall be evenly spaced at a maximum of 410 mm to within 600 mm of the base of the manhole. Refer to Drawing E-08 for details.

F.2.13.7 The frame and cover shall be installed following manufacturer's recommendations.

F.2.14 Inspection and Testing

F.2.14.1 All sewer installations shall be subject to inspections by the Municipal Engineer prior to issuance of the Construction Completion Certificate (C.C.C.) and Final Acceptance Certificate (F.A.C.).

F.2.14.2 Video inspections by qualified personnel are required prior to C.C.C. for all sewers less than 1200 mm in diameter. A walk through inspection is permitted for any sewer 1200 mm and larger. A written report including still photographs and/or a video tape recording of the entire inspection shall be submitted to the Municipal Engineer for review. The report shall indicate the location and severity of all leaks, cracks, breaks, collapses, deflections, sags, obstructions and any other defects affecting the performance of the line. Sections requiring repair will be subject to re-inspection when complete.

F.2.14.3 Re-inspection by camera may be required on suspect areas prior to F.A.C. at the discretion of the Municipal Engineer. All video inspection costs shall be borne by the Developer.

F.2.14.4 All material testing (backfill densities) shall be performed by an accredited agency. All test results shall be submitted to the Municipal Engineer with a report indicating any deficiencies and remediation.

F.2.14.5 An infiltration and/or exfiltration test may be required at the Municipal Engineer's sole discretion for any section showing deficiencies during the camera test.

F.2.14.5.1 The test section shall be filled with water allowing displacement of air in the line and will be allowed to stand for 24 hours to ensure absorption in the pipe wall. Prior to the test, add enough water to ensure a head of 1 m to 3 m over the pipe crown in the upstream manhole. The test duration shall be 2 hours. The water level should be measured at the beginning and end of the test in order to calculate the infiltration/exfiltration.

F.2.14.5.2 The allowable leakages are as follows:

F.2.14.5.2.1 Infiltration Test: Performed when the groundwater is above the pipe crown for the entire test length. Allowable infiltration is 5.0 L/day/mm dia./km for PVC pipe and 20.0 L/day/mm dia./km for concrete pipe.

F.2.14.5.2.2 Exfiltration Test: Performed when the groundwater is below the pipe invert for the entire test length. Allowable exfiltration is 5.0 L/day/mm dia/km and 20.0 L/day/mm dia./km for concrete pipe.

F.3 MAJOR SYSTEM

F.3.1 General

F.3.1.1 The overall major drainage system must be designed to provide continuous overland flow routes with minimum depths of ponding in roadway sags and to provide overflow routes at all storm water management facilities. The development of the major drainage system framework shall be a key component of the Master Drainage Plan to be developed by the Developer's Engineering Consultant for new drainage basins (watersheds).

F.3.1.2 The major system shall accommodate a 1:100 year storm condition with maximum surcharging in the roadway gutter of 180 mm. If downstream constraints require a gutter flow in excess of 180 mm, special modelling and design calculations shall be submitted to the County Engineer for review. The County Engineer shall determine

the extent, if any, of a relaxation of the maximum 180 mm gutter flow standard on an individual basis. The major drainage system shall be fully contained within the boundary of Public Property.

F.3.1.3 Arterial roads shall not be apart of the major overland flow system. Where the slope of the terrain makes it particularly difficult to prevent the major drainage from accessing an arterial right-of-way the County Engineer may grant the Developer permission to discharge primary drainage flow on to the arterial right-of-way subject to:

F.3.1.3.1 no adverse impact on the drainage on the arterial road, or

F.3.1.3.2 the opportunity for the provision of a depressed swale or pathway with sufficient flow and/or storage capacity to accommodate a 1:100 year storm event and carry the flow to the point of discharge into an off arterial overland flow route, and

F.3.1.3.3 the Developer's agreement to pay for the cost of such additional works or charges needed to accommodate the increased discharge.

F.3.1.4 Provisions must be taken to employ control/abatement measures to that construction material and debris does not enter any storm water management facility at any point during subdivision construction.

F.3.1.5 Grading

Carefully designed and controlled lot grading is an important component of the Major System. Lots shall be designed to drain from back to front, except under extreme cases where the Developer can satisfy the County Engineer that back to front drainage is not technically feasible. If an alternate system is required it must be designed so that surface water crosses the fewest lots possible in its path to the street. No more that 2 lots shall be crossed. In extreme cases the County Engineer may permit more than 2 lots to be crossed provide a concrete drainage swale and easements are established. The potential problem areas shall be identified in the Design Brief.

F.3.2 Lot Grading

F.3.2.1 Proper lot grading is the first step towards a well planned major drainage system. The goal of the lot grading shall be to ensure that water flows away from the building, water supply well, and septic bed, and in no case shall ponding levels come within 150 mm from the finished ground elevation at the building during a 1:100 year rainfall event. Flow from lots shall always have an escape route to a public right-of-way. The lot-grading plan shall develop a proper balance between the road and gutter elevations, proposed building elevations, surrounding development and existing topography.

F.3.2.2 Generally, the lots shall be designed to drain from back to front. Drainage towards the back of lot will be permitted where laneways or public right-of-ways are in place to accommodate drainage directly from the lot without crossing adjacent lots. An overall drainage plan will be required for all subdivisions.

F.3.2.3 An initial grade of 10% sloping away from the building for a distance of 3m shall be required on all sides. The slope shall continue at a minimum grade of 2.0% to the property boundary. Larger slopes are desirable if topography allows to a maximum of 10%.

F.3.2.4 Reserves, and public lands shall be graded to drain towards developed streets, lanes, and/or the storm drainage system.

F.3.3 Swales

F.3.3.1 Drainage swales on municipal or private property shall be constructed prior to any development of subdivision lots. Complete swale construction shall be a prerequisite to the issuance of the Construction Completion Certificate.

F.3.3.2 Drainage swales located on private property shall be covered by an easement in favour of the County. A minimum clearance of 200 mm should be provided between the edge of the swale and the property line. Major rainfall event flows shall be contained within the easement.

F.3.3.3 Drainage swales crossing several properties for the collection of runoff shall not be permitted unless special circumstances warrant.

F.3.3.4 Concrete swales shall be required when accommodating flow from more than three adjacent lots.

F.3.3.5 Earthen swales shall be protected from erosion by grass cover, appropriate ground cover or geotextile fabric.

F.3.3.6 The minimum design slope for concrete swales on private property is 0.75%.

F.3.3.7 The minimum design slope for concrete swales on public property is 0.5% or as required to provide adequate hydraulic capacity.

F.3.3.8 The minimum design slope for swales without a concrete gutter is 1.5%.

F.3.4 Roadways

Grading of streets comprising the major drainage system shall follow the guidelines listed below:

F.3.4.1 Continuity of overland flow routes between adjacent developments shall be maintained.

F.3.4.2 Collectors shall have at least one lane that is not inundated.

F.3.4.3 Local roads should not have a depth of water more than 50 mm above the crown of the road.

F.3.4.4 The depth of water at the curb shall be less than 500 mm for all roadways.

F.3.5 Stormwater Storage Facilities

F.3.5.1 General

F.3.5.1.1 This section identifies the general design parameters for the planning and design of stormwater storage facilities.

F.3.5.1.2 A drainage master plan must be prepared by the Developer providing a detailed description of the development area

including overland flow, catchment areas, natural storage and planned storage.

F.3.5.1.3 Several different storage methods may be employed for a stormwater storage facility such as:

F.3.5.1.3.1 Retention Storage (wet ponds) – collects and stores runoff for a period of time and releases it after the inflow has ceased. Retention storage also includes constructed wetlands.

F.3.5.1.3.2 Detention storage (dry ponds) – provides a control outlet to the area restricting flow. When the inflow exceeds the allowed outflow, water is detained in the designated storage area until flows diminish. Low flows are not usually detained.

F.3.5.1.3.3 Channel Storage – channels constructed with wide bottoms and small grades will provide a type of storage as the channel fills with water. The Municipality will not permit roadside ditches to be used as channel storage.

F.3.5.1.4 The design of the storage facility shall be based on a 1:100 year rainfall event. The Developer's Engineer shall include detailed calculations for a range of storm durations to determine the critical volume as well as an analysis of the capacity and characteristics of the downstream receiving drainage course. Measures shall be taken in order to avoid flooding, erosion or sedimentation in the downstream receiving drainage course.

F.3.5.1.5 These minimum standards are not intended to restrict Developers from formulating innovative stormwater management processes intended to protect the environment and improve the stormwater quality prior to release. All stormwater management plans must be submitted to the County for review and approval.

F.3.5.1.6 The developer and his Engineering consultant must address the guidelines presented in the latest edition of the publication

"Stormwater Management Guidelines for the Province of Alberta" prepared by Alberta Environment Protection.

F.3.5.1.7 Storm water quality best management practices shall be an objective in the design of storm water management facilities.

F.3.5.2 Design Standards for Lakes and Wet Ponds

F.3.5.2.1 Lands covered by the facility including areas covered by water at the normal water level (NWL), inlets, outlets, control structures and access routes shall be designated as Public Utility Lot (P.U.L.).

F.3.5.2.2 Private property subject to potential flooding shall be covered by an easement in the favour of the County.

F.3.5.2.3 A restrictive covenant shall be placed on the lots abutting the facility as required to control development that will restrict the capacity.

F.3.5.2.4 The design shall incorporate a semi-annual turnover at average annual precipitation.

F.3.5.2.5 The high water level shall be at least 300 mm below the lowest building opening on adjacent lots.

F.3.5.2.6 The minimum surface area at normal water level shall be 2 ha in order to discourage a large number of small facilities.

F.3.5.2.7 The lake shall have maximum side slopes of 3H : 1V from the lake bottom to 1 m below the NWL. Slopes above this level shall have a maximum slope of 7H : 1V. These slopes may be revised in confined spaces or areas with extreme topography at the discretion of the Municipal Engineer.

F.3.5.2.8 The minimum depth from the NWL to the lake bottom shall be 2.5 m in order to discourage growth of vegetation.

F.3.5.2.9 Where the ground water level is below the NWL, the lake bottom shall be of impervious material. Where the ground water level is near or above the NWL, the lake bottom may be

made of a pervious material based on geotechnical investigation.

F.3.5.2.10 Inlets and outlets are to be placed in order to maximize detention time and water circulation thereby avoiding dead storage areas.

F.3.5.2.11 Inlet and outlet pipes are to be fully submerged and at least 200 mm above the lake bottom and 1.0 m below the NWL.

F.3.5.2.12 The inlet manhole invert shall be at or above the NWL in order to avoid sedimentation.

F.3.5.2.13 Provision shall be made in order to drain the lake completely by gravity or portable pump system.

F.3.5.2.14 An overflow channel and overland drainage route must be provided the high water level.

F.3.5.2.15 Edge treatment is required for erosion protection due to wave action from 0.3 m below the NWL to 0.3 m above the NWL.

F.3.5.2.16 All weather vehicle access must be provided to all control works. Access to the lake for launching boats shall also be available.

F.3.5.2.17 Approved fencing and signage shall be installed where necessary for safety purposes.

F.3.5.2.18 The shoreline treatment between the high water level and the normal water level shall be chosen to ensure that erosion does not occur and natural wetland vegetation develops.

F.3.5.3 Design Standards for Dry Ponds

F.3.5.3.1 Lands covered by the facility including areas covered by water at the 1:5 year level, inlets, outlets, control structures and access routes shall be designated as Public Utility Lot (P.U.L.).

F.3.5.3.2 Private property subject to potential flooding shall be covered by an easement in the favour of the County.

F.3.5.3.3 A restrictive covenant shall be placed on the lots abutting the facility as required to control development that will restrict the capacity.

F.3.5.3.4 All dry ponds shall be designated as off-line storage areas designed to temporarily detain excess flow and control downstream flow to acceptable limits. Low flow conditions shall not be diverted to the dry pond.

F.3.5.3.5 The maximum storage depth shall be 1.5 m measured from the invert of the outlet pipe.

F.3.5.3.6 The pond shall be designed to drain completely after excess flow has dissipated. The pond bottom shall have a minimum slope of 1.0% towards the outlet.

F.3.5.3.7 Side slopes shall have a maximum slope of 7H : 1V within private property and 5H : 1V within public property.

F.3.5.3.8 Grass cover shall be established after completion of construction.

F.3.5.3.9 All inlets and outlets shall have grates with a maximum bar spacing of 150 mm over their openings in order to prevent access. The possibility of plugging shall be considered in the sizing of the outlet pipe. Maximum flow through the grating shall be 1.0 m/sec.

F.3.5.4 Inlets, Outlets and Outfall Structures

F.3.5.4.1 Obverts of outfall pipes shall be above the 1:5 year flood level of the receiving drainage course.

F.3.5.4.2 Inverts shall be above the winter ice or completely submerged with obverts 1.0 m below NWL.

F.3.5.4.3 Drop structures, energy dissipaters, riprap and filter fabric shall be used where necessary to prevent erosion.

F.3.5.4.4 Removable grates shall be installed on openings to discourage unauthorized access.

F.3.5.4.5 All piped inlets and outlets for stormwater storage facilities shall be capped with compacted clay or other impervious material at the pond inverts in order to prevent water from washing out the granular bedding material.

F.3.5.4.5 A slit trap shall be provided at the inlets of each pond. A defined path via publicly owned land or established drainage courses shall be identified and designed to carry flows when the design storage is exceeded.

F.3.5.4.6 The lake and perimeter area design must allow for vehicle access to inlets, outlets, and other facilities requiring maintenance.

F.3.6 Erosion and Sediment Control (ESC) Plan

F.3.6.1 For any land disturbing construction project, the proponent shall prepare a project specific Erosion and Sediment Control (ESC) Plan outlining appropriate preventive measures against potential erosion and sedimentation. An ESC plan shall comprise of a report and a detailed drawing illustrating structural and vegetative erosion and sediment control measures for the specific project.

F.3.6.2 Latest versions of Alberta Transportation Design Guidelines for Erosion and Sediment Control for Highways, City of Lloydminister Erosion and Sedimentation Control Guidelines and/or other industry standard guidelines may be utilized in preparing the ESC plan.

F.3.6.3 The ESC plan report should include as a minimum the following:

- ✓ Project description including proposed construction activities and the area to be disturbed.
- ✓ Existing site conditions including soil, topography, vegetation and drainage.
- ✓ Adjacent features such as stream, lakes, residential areas, road, environmental reserves, etc., which may be affected by the land disturbance.
- ✓ An assessment of potential erosion and sedimentation.

- ✓ Any temporary and permanent structural and/or non-structural erosion and sediment control practices including specifications.
- ✓ Inspection and maintenance schedule of ESC structures.

F.3.6.4 The ESC plan drawing should include as a minimum the following:

- ✓ Site plan with contours.
- ✓ Limits of clearing and grading.
- ✓ Drainage patterns
- ✓ Existing vegetation - Show the existing tree lines, grassed areas, or unique vegetation.
- ✓ Critical erosion areas with potentially serious erosion problems.
- ✓ Location of temporary and permanent ESC structures and vegetations
- ✓ Appropriate details, notes and specifications of the ESC practices for proper installation, maintenance and inspection.

F.3.6.5 The ESC plan shall be certified by a Professional Engineer or a Certified Professional in Erosion and Sediment Control (CPESC) and to be submitted as a separate package along with other design drawings/documents. The ESC plan drawing and report should bind into one document.

F.3.6.6 The proponent shall notify the County and submit an updated ESC plan should the original plan changes.

F.4 SUMMARY OF SANITARY SEWER SYSTEM STANDARDS

The following is a summary of the standards applicable to the sanitary sewer systems materials and construction. In all cases, it is intended that the latest apply.

ASTM

A48	Grey Iron Castings
C14	Concrete Sewer, Storm and Drain, and Culvert Pipe
C76	Reinforced Concrete Culver, Storm Drain, and Sewer Pipe
C443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C478	Precast Reinforced Concrete Manhole Sections
D698	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures
D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

CSA

A5	Portland Cements
A23.1	Concrete Materials and Methods of Concrete Construction
A257 Series	Standards for Concrete Pipe
B182.1	Sewer Pipe Fittings
B182.2	PVC Sewer Pipe and Fittings (PSM Type)
B182.4	Profile PVC Sewer Pipe and Fittings
B182.11	Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings
G30.12	Billet Steel Bars for Concrete Reinforcement

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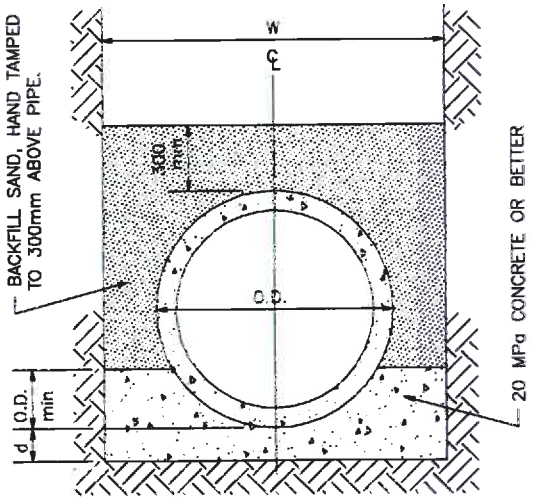

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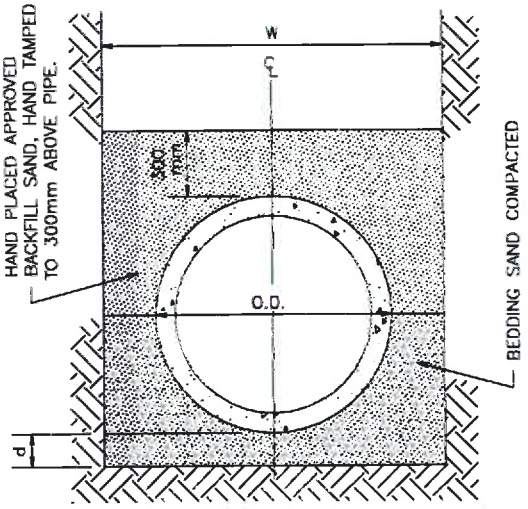

CLASS C BEDDING

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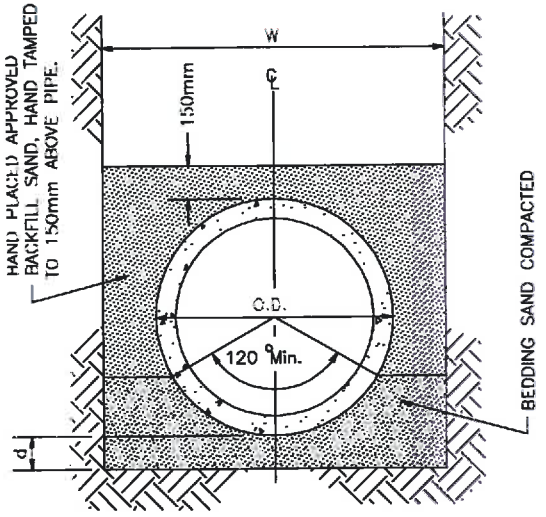

CLASS B BEDDING

ALTERNATE – 375mm I.D. & UNDER

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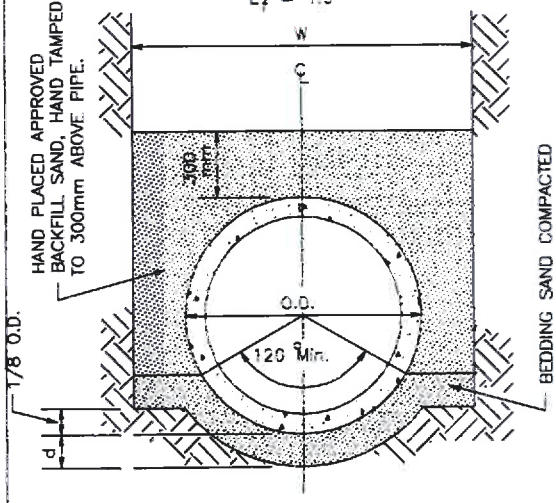


NOTES:

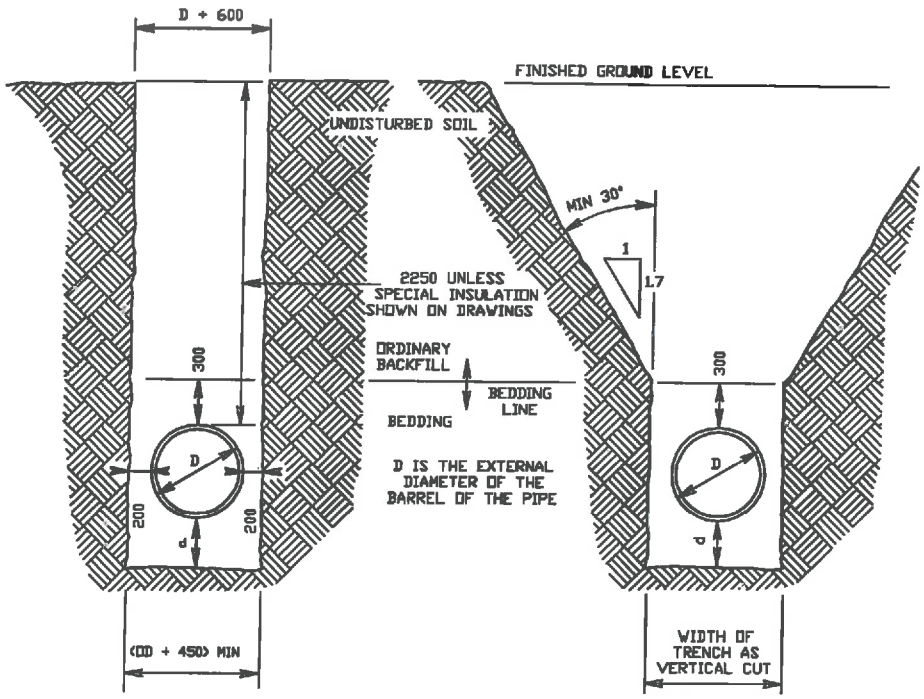
W = TRENCH WIDTH – O.D. + 450mm (MINIMUM)
– 1000mm max. FOR PIPES UP TO AND INCLUDING 400mm DIAMETER
– O.D. + 400mm max. (ON EITHER SIDE (800mm TOTAL)) FOR PIPE DIAMETERS 450mm AND ABOVE

O.D.= OUTSIDE PIPE DIAMETER
I.D. = INSIDE PIPE DIAMETER
L_f = LOAD FACTOR
d = DEPTH OF BEDDING BELOW PIPE
I.D.= 675mm OR SMALLER – d min = 150mm
I.D.= 750mm TO 1500mm – d min = 150mm
I.D.= 1650mm AND LARGER – d min = 150mm

Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		STANDARD TRENCH BEDDING FOR CIRCULAR PIPES	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–01
Date: APRIL 2013	Drawn: JIM	Scale NTS		



STANDARD TRENCH VERTICAL CUT

(TO BE SHORED AS PER OCCUPATIONAL HEALTH AND SAFETY STANDARDS)

STANDARD TRENCH SLOPING CUT

(TO BE SLOPED AS PER OCCUPATIONAL HEALTH AND SAFETY STANDARDS)

MAXIMUM TRENCH WIDTHS FOR SINGLE PIPES

- –UP TO AND INCLUDING 400mm DIAMETER – 1000mm
- –450mm DIAMETER AND ABOVE – OD + 600mm

DEPTH OF BEDDING BELOW PIPE BARREL (d)

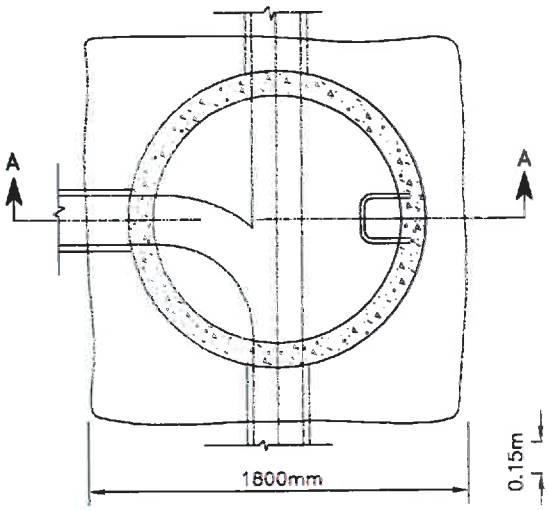
- –EXTERNAL DIAMETER OF 700mm AND BELOW :75
- –EXTERNAL DIAMETER GREATER THAN 700mm :100

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

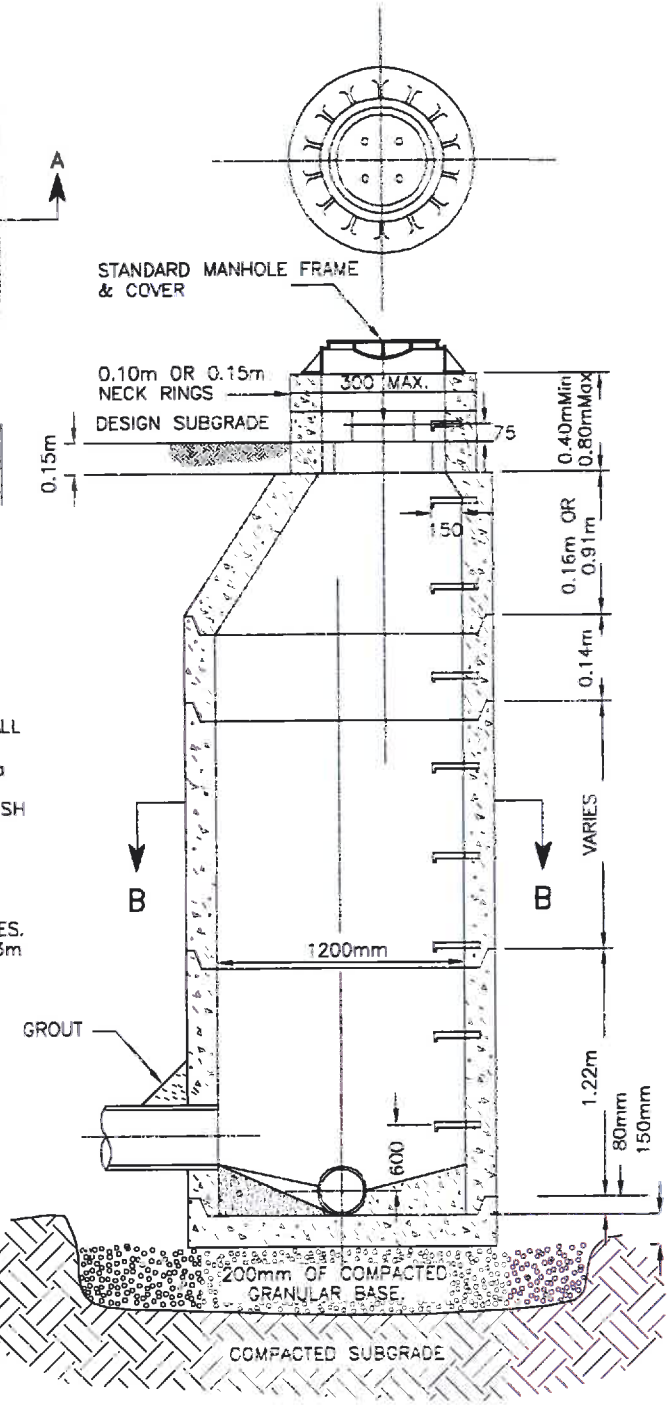
Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		STANDARD TRENCH DIMENSIONS FOR CIRCULAR PIPE	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–02
Date: APRIL 2013	Drawn: JIM	Scale NTS		



SECTION B – B



SECTION A – A

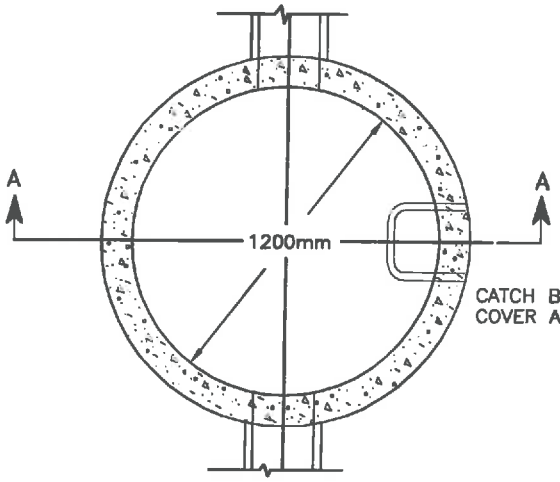
NOTES

1. STANDARD M.H. FRAME & COVER.
2. MANHOLE BARRELS TO MEET A.S.T.M. C478
3. FORMANHOLES OVER 5.00m IN DEPTH, PRECAST OR POURED IN PLACE BASES SHALL BE REINFORCED WITH BARS.
4. POURED IN PLACE CONCRETE TO BE 30MPa AT 28 DAYS.
5. INLET & OUTLET PIPE TO BE GROUTED FLUSH WITH WALL.
6. GALVANIZED STEEL SAFETY STEPS AT 0.41m MAXIMUM TO FULL HEIGHT OF M.H.
7. RUBBER GASKET JOINT.
8. SAFETY GRATING TO BE USED WHEN THE DEPTH OF THE MANHOLE EXCEEDS 5 METRES. THE SAFETY GRATING WILL BE PLACED AT 3m BELOW THE MANHOLE TOP.

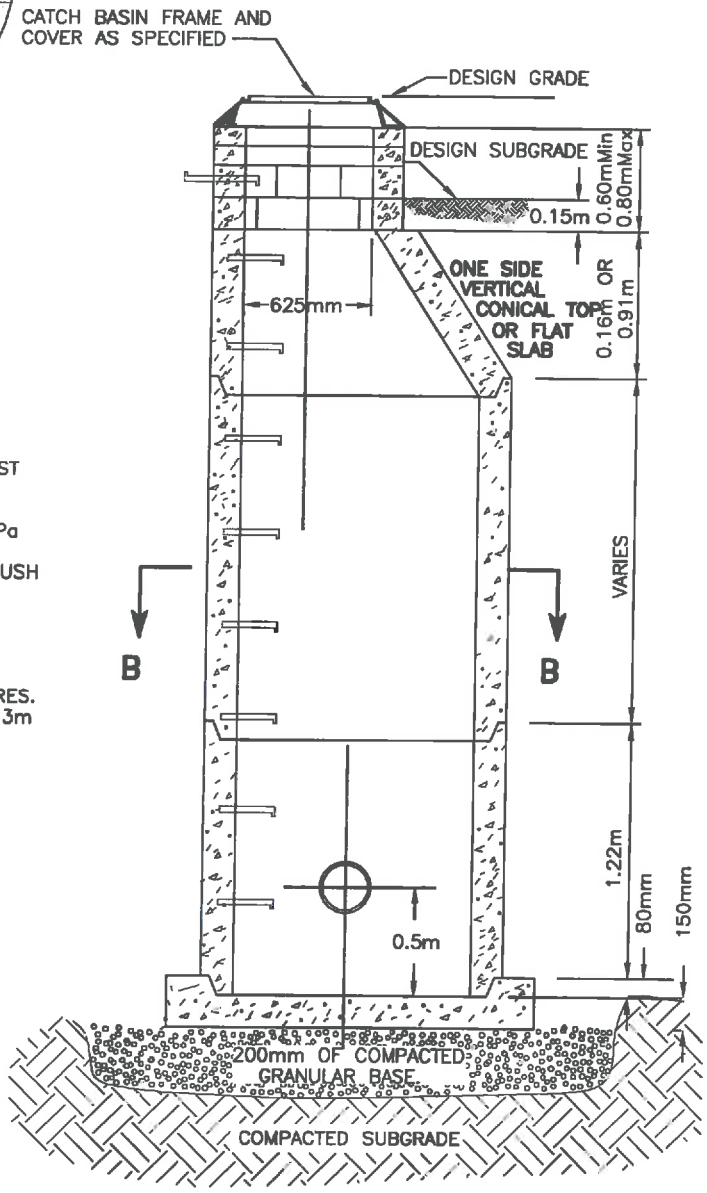
Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		STANDARD 1200mm MANHOLE	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–03
Date: APRIL 2013	Drawn: JIM	Scale NTS		



SECTION B – B



SECTION A – A

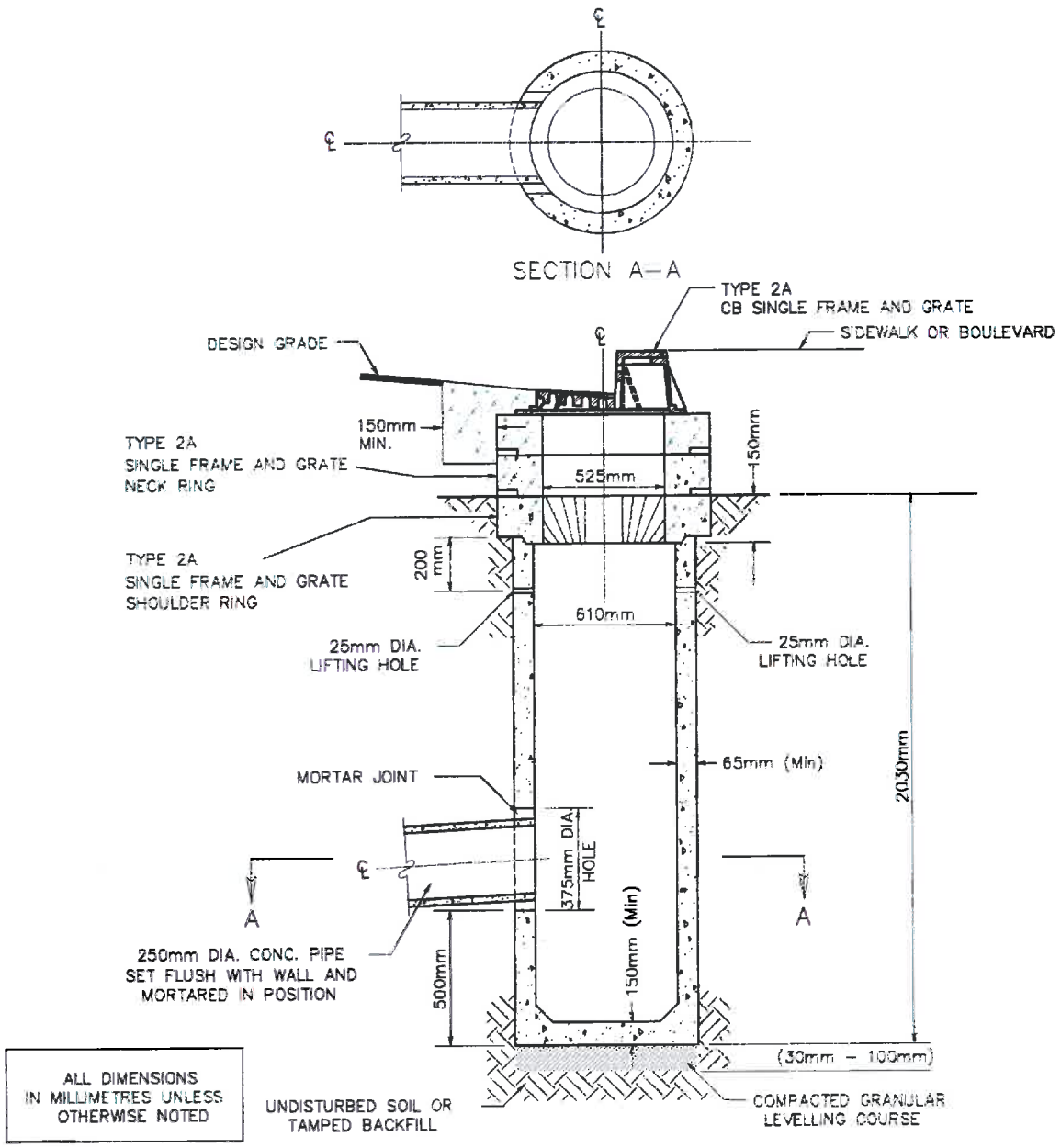
NOTES

1. MANHOLE BARRELS TO MEET ASTM. C478.
2. POURED IN PLACE CONCRETE BASES MAY BE USED.
3. FOR CBMH. OVER 5.0m IN DEPTH, PRECAST OR POURED IN PLACE BASES SHALL BE REINFORCED WITH BARS.
4. POURED IN PLACE CONCRETE TO BE 20MPa AT 28 DAYS.
5. INLET & OUTLET PIPE TO BE GROUTED FLUSH WITH WALL.
6. GALVANIZED STEEL SAFETY STEPS AT 0.41m MAXIMUM TO FULL HEIGHT OF M.H.
7. RUBBER GASKET JOINTS.
8. SAFETY GRATING TO BE USED WHEN THE DEPTH OF THE MANHOLE EXCEEDS 5 METRES. THE SAFETY GRATING WILL BE PLACED AT 3m BELOW THE MANHOLE TOP.

Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		STANDARD 1200mm C.B. MANHOLE	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–04
Date: APRIL 2013	Drawn: JIM	Scale NTS		



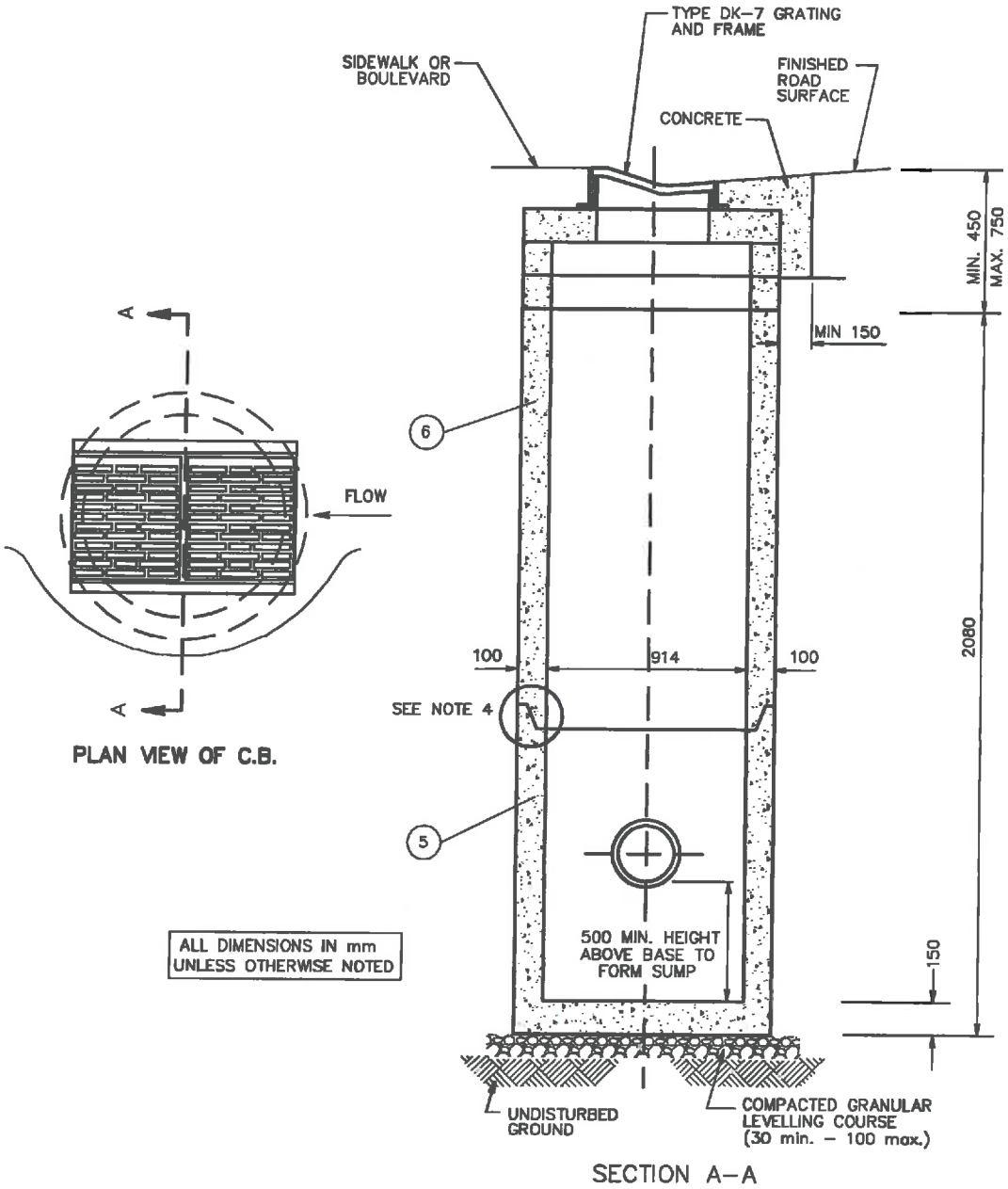
NOTES:

1. RUBBER GASKET, KENT SEAL OR EQUIVALENT TO BE INSTALLED BETWEEN BARREL, ALL SHOULDER AND NECK RINGS AND CATCH BASIN FRAME.
2. ALL ROUGH JOINTS SHALL BE POINTED WITH MORTAR TO ENSURE SMOOTHNESS.
3. ALL CATCH BASIN COMPONENTS TO BE IN ACCORDANCE WITH ASTM C478.

Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		PRECAST 610 CATCH BASIN	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–05
Date: APRIL 2013	Drawn: JIM	Scale NTS		



PLAN VIEW OF C.B.

SECTION A-A

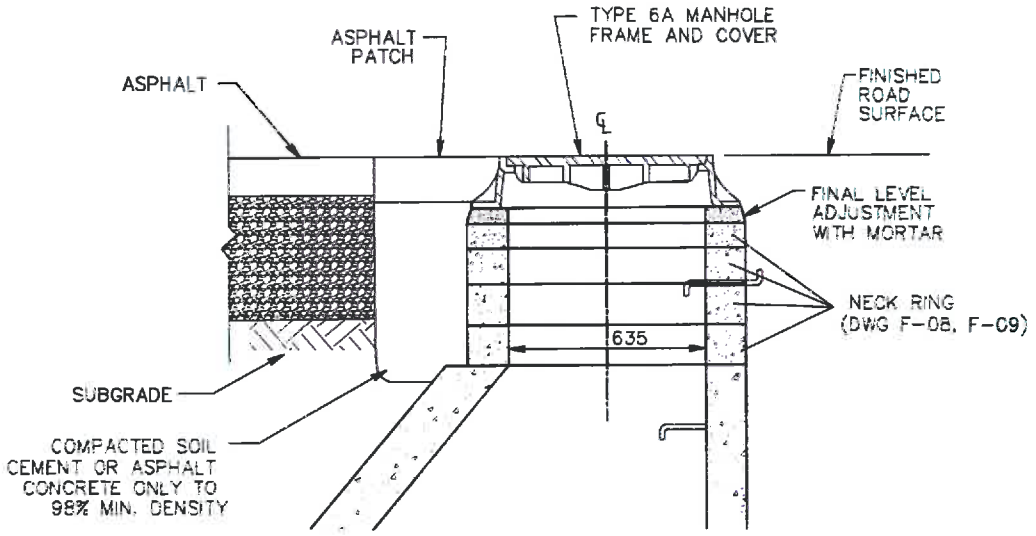
NOTES:

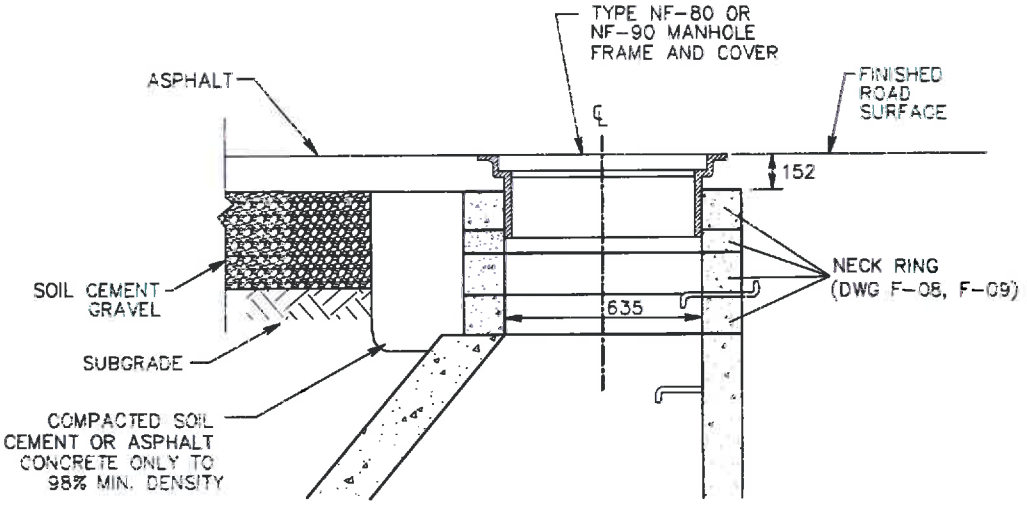
1. ITEM 5 COULD BE MADE UP FROM TWO ITEMS (BASE AND BARREL).
2. ITEM 6 COULD BE MADE UP FROM TWO ITEMS (SHOULDER RING SLAB TOP AND BARREL).
3. ITEMS 5 AND 6 COULD BE MADE AS ONE UNIT.
4. OPPOSITE ORIENTATION OF JOINS IS ACCEPTABLE.

Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		STANDARD 900 CATCH BASIN WITH TYPE DK-7 GRATING AND FRAME	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F-06
Date: APRIL 2013	Drawn: JIM	Scale NTS		



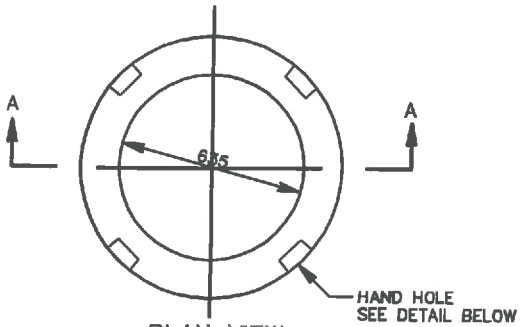


ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED

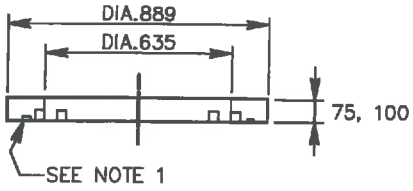
Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		NECK SECTION DETAILS FOR STANDARD 1200 MANHOLE	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F-07
Date: APRIL 2013	Drawn: JIM	Scale NTS		



PLAN VIEW

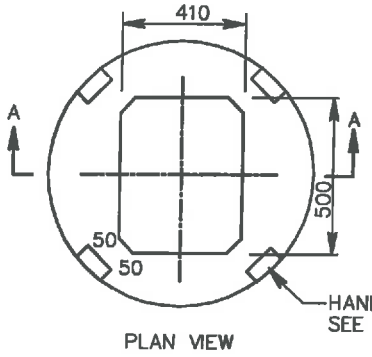


SECTION A–A

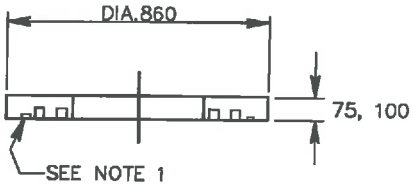
635 RING

(NECK RING FOR USE WITH TYPES 4A,6,6A,8,NF–80,NF–90 FRAMES AMD COVERS/GRATINGS)

ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED



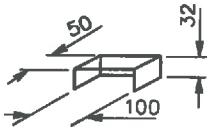
PLAN VIEW



SECTION A–A

K–7 RING

(NECK RING FOR USE WITH TYPE K–7 OR F–5I WITHOUT SIDE INLET FRAMES AND GRATINGS)



HAND HOLE DETAIL

NOTES:

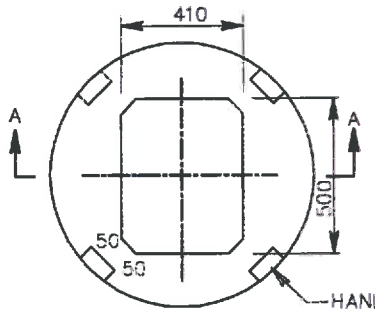
1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.

Lamont County

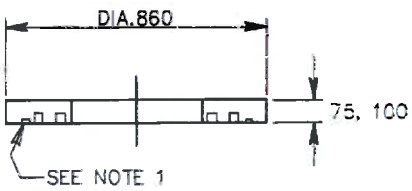
General Municipal Servicing Standards

Rev.	Stewart Weir		NECK RINGS	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–08
Date: APRIL 2013	Drawn: JIM	Scale NTS		

ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED



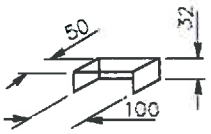
PLAN VIEW



SECTION A–A

K–7 RING

(NECK RING FOR USE WITH TYPE K–7 OR F–5I WITHOUT SIDE INLET FRAMES AND GRATINGS)



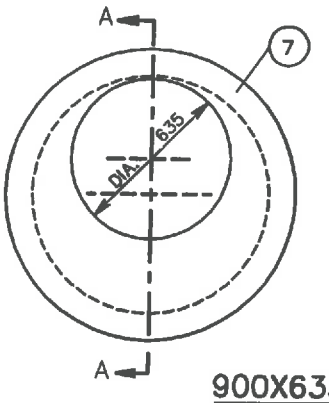
HAND HOLE DETAIL

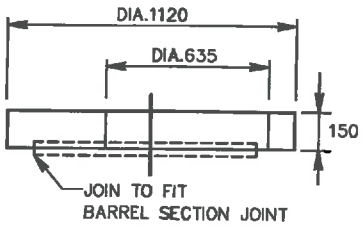
NOTES:

1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.

Lamont County — General Municipal Servicing Standards

Rev.	Stewart Weir		K–7 NECK RING	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–09
Date: APRIL 2013	Drawn: JIM	Scale NTS		

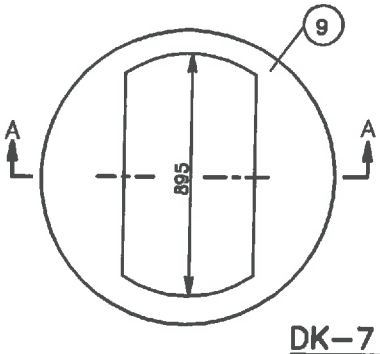


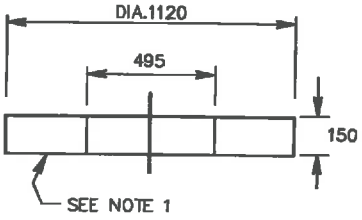


SECTION A–A

900X635 SLAB TOP

(TOP BELOW NECK FOR USE WITH 4A, 6, 8 FRAME AND GRATING)

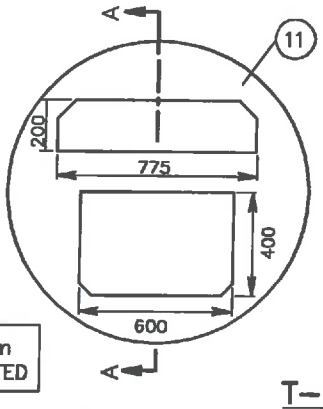


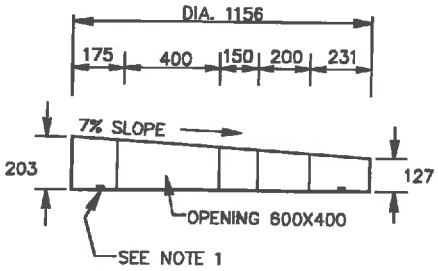


SECTION A–A

DK–7 TOP

(SLAB TOP FOR USE WITH DK–7 FRAME AND GRATING)





SECTION A–A

ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED

T–TOP

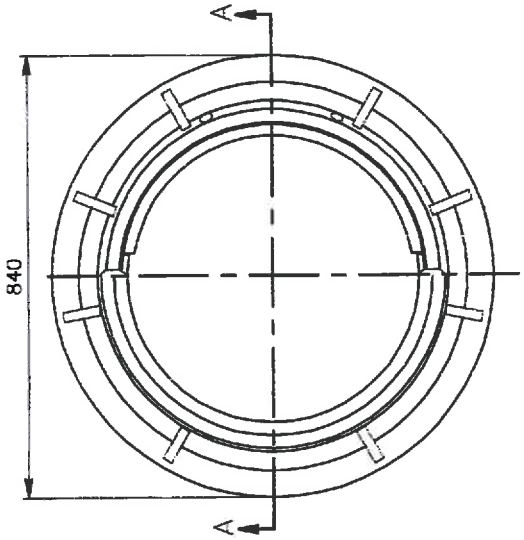
(TEE TOP FOR USE WITH F–5I WITH SIDE INLET)

NOTES:

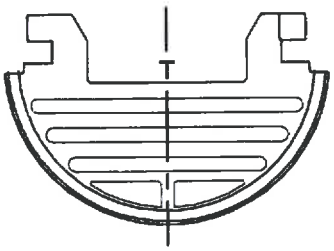
1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.

Lamont County — General Municipal Servicing Standards

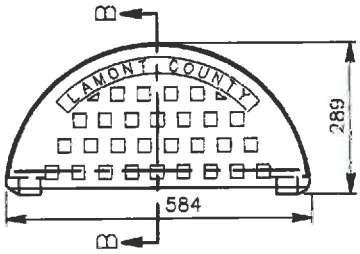
Rev.	Stewart Weir		SLAB TOPS FOR STANDARD 900 CATCH BASIN	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–10
Date: APRIL 2013	Drawn: JIM	Scale NTS		



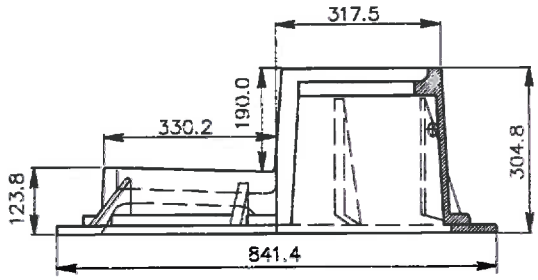
TOP VIEW (FRAME)



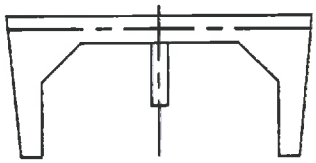
TOP VIEW – COVER (PART A)



TOP VIEW – COVER (PART B)

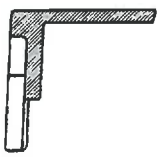


SECTION A–A



FRONT VIEW – COVER (PART B)

ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED



SECTION B–B

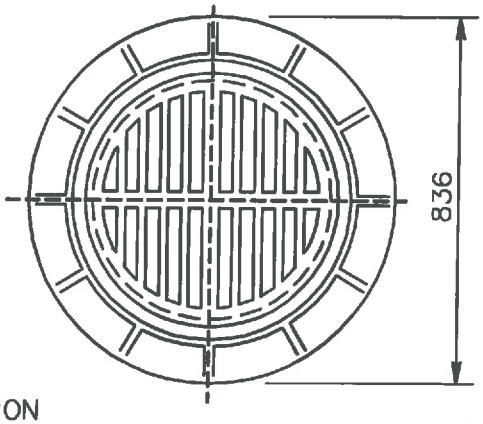
MATERIAL:

FRAME: GRAY IRON CLASS 20B
COVER: PART A IRON CLASS 20B
PART B DUCTILE IRON GRADE 65–45–12

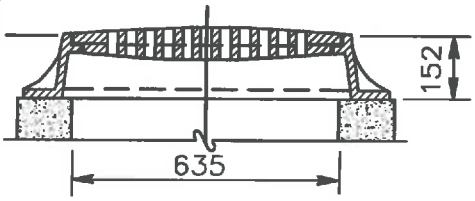
Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		TWO PIECE TYPE 4A GRATING AND FRAME	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–11
Date: APRIL 2013	Drawn: JM	Scale NTS		

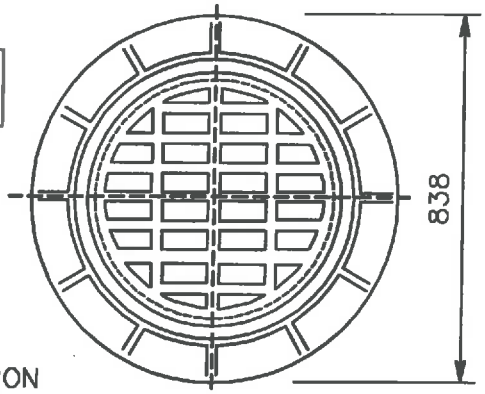


MATERIAL: GRAY IRON
FRAME: CLASS 20B
COVER: CLASS 20B

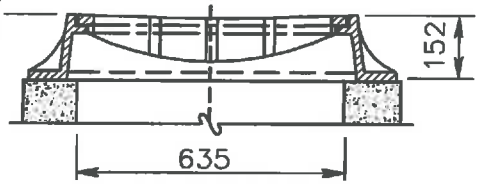


NO.6 ROUND TOP CATCHBASIN
OR MH FRAME & COVER

ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED



MATERIAL: GRAY IRON
FRAME: CLASS 20B
COVER: CLASS 20B

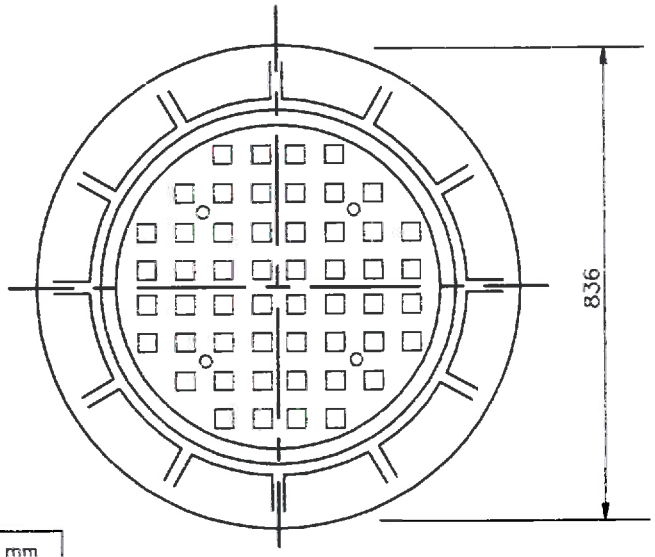


NO.8 LARGE PAVING AND CURB RAMP
CATCHBASIN OR MH FRAME & COVER

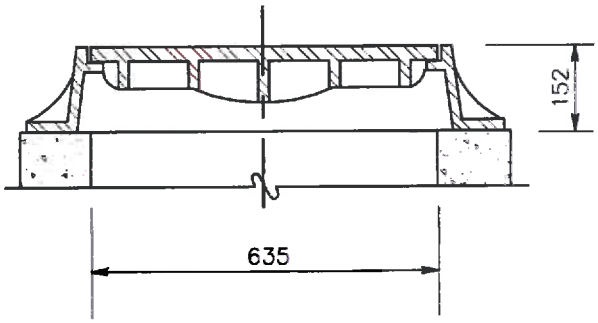
Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		FRAME AND GRATING TYPE 6 AND 8	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F-12
Date: APRIL 2013	Drawn: JIM	Scale NTS		



ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED



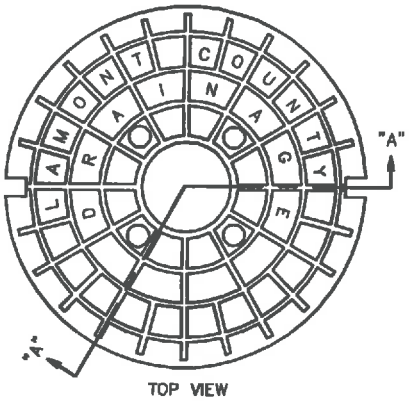
MATERIAL:

FRAME: GRAY IRON CLASS 20B
COVER: GRAY IRON CLASS 20B

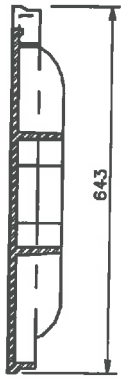
Lamont County

General Municipal Servicing Standards

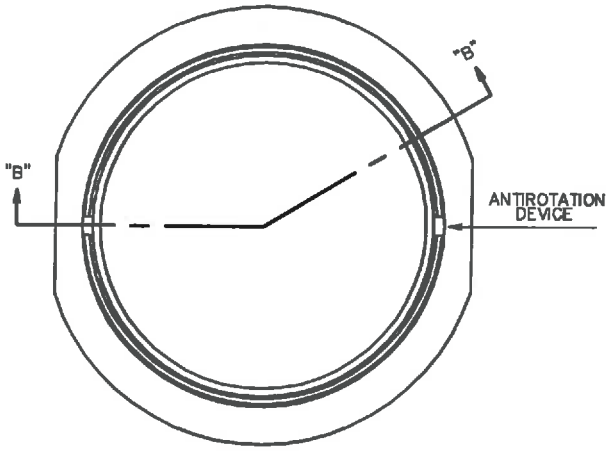
Rev.	Stewart Weir		TYPE 6A COVER AND FRAME	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F-13
Date: APRIL 2013	Drawn: JIM	Scale NTS		



TOP VIEW
MANHOLE COVER
WITH 4 VENTHOLES

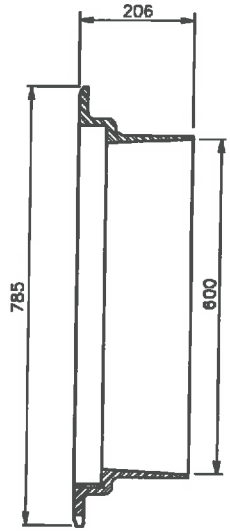


SECTION "A-A"



PLAN

ALL DIMENSIONS IN mm
UNLESS OTHERWISE NOTED



SECTION "B-B"

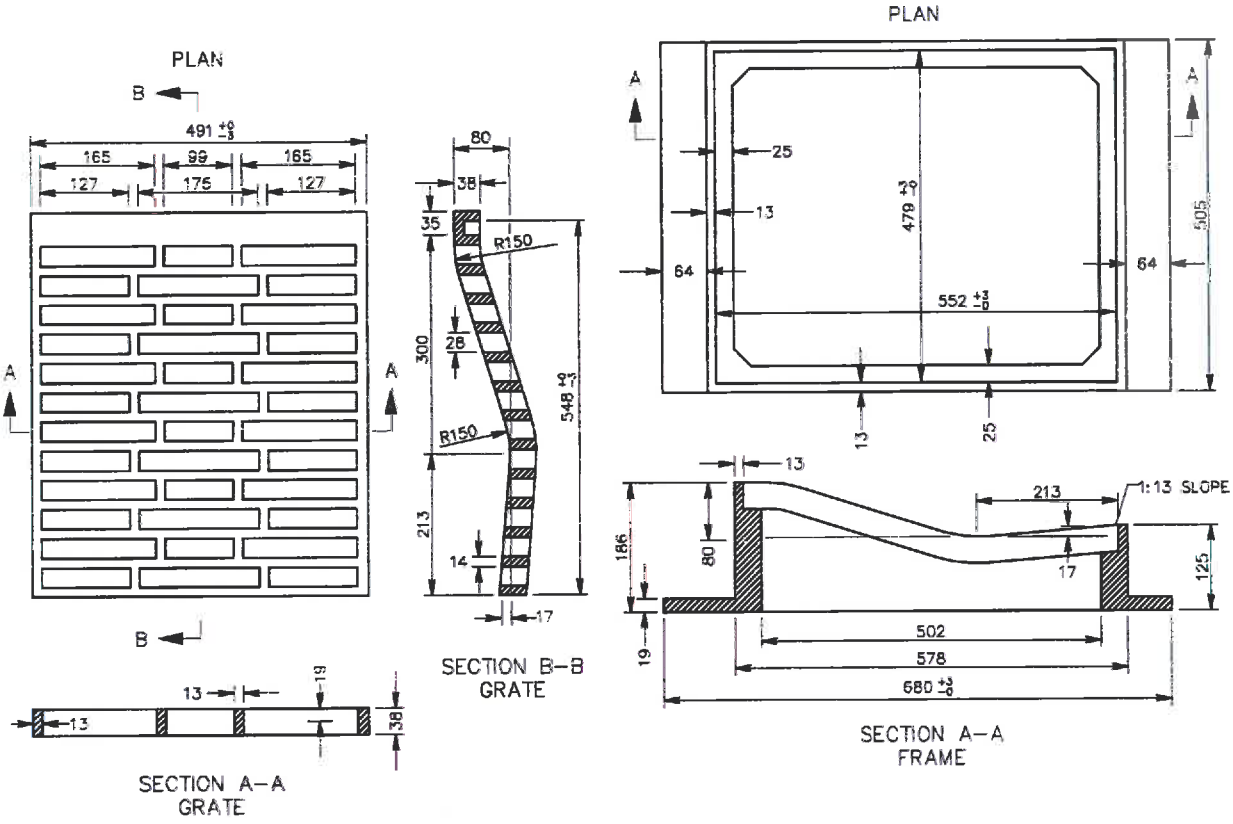
TYPE NF-80 FLOATING MANHOLE FRAME

NOTES:

1. MATERIAL SPECIFICATION:
   DUCTILE IRON TO CONFORM TO A.S.T.M. A536 (LATEST EDITION) GRADE 80-60-03
2. NF-90 FRAME AND COVER IS WATERTIGHT VARIATION OF NF-80.
   THERE ARE NO VENTING HOLES IN NF-90 COVER AND A GASKET IS
   PLACED BETWEEN THE FRAME AND COVER

Lamont County — General Municipal Servicing Standards

Rev.	Stewart Weir		TYPE NF-80 AND NF-90	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F-14
Date: APRIL 2013	Drawn: JIM	Scale NTS		



NOTES: GRATE

1. GREY CAST IRON TO CONFORM TO CLASS 25B A.S.T.M. A48 (LATEST EDITION)
2. MASS =

FRAME

1. DUCTILE IRON TO CONFORM TO A.S.T.M. A536 (LATEST EDITION) GRADE 80–55–06
2. MASS =

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

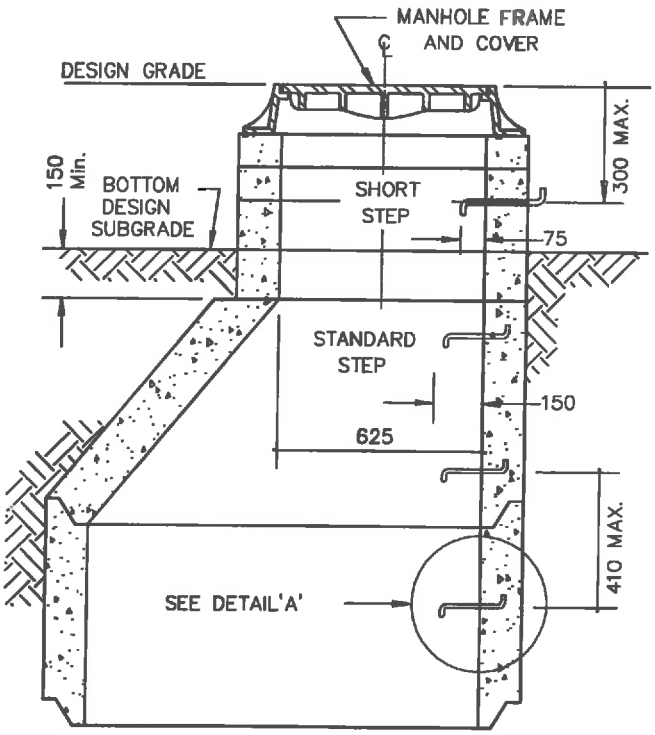
Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		FRAME & GRATING TYPE K–7	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F–15
Date: APRIL 2013	Drawn: JIM	Scale NTS		

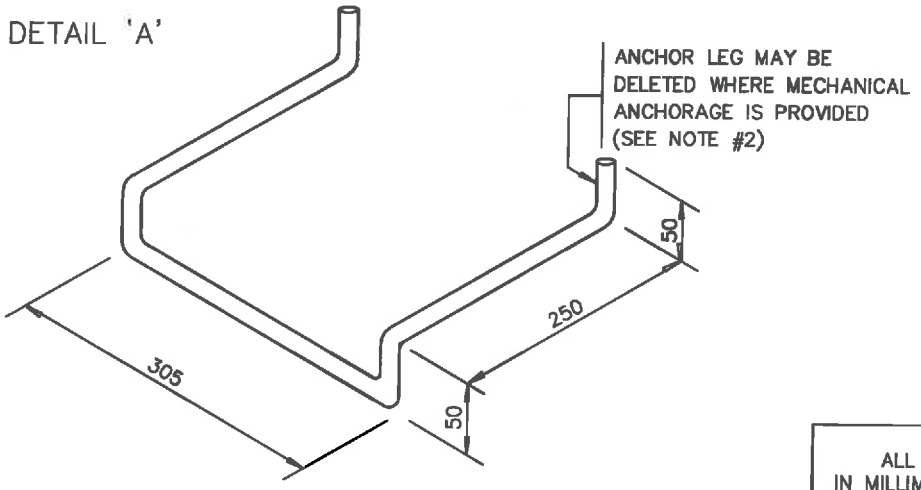
PLACEMENT:

1. EXCEPT WHERE SPECIFIED OTHERWISE, SAFETY STEPS SHALL BE INSTALLED IN ALL PRECAST MANHOLE SECTIONS & CONES, IN THE GRADE ADJUSTMENT SECTIONS AND IN CAST IN PLACE SECTIONS SO THAT WHEN THE VARIOUS SECTIONS ARE ASSEMBLED IN ANY COMBINATION THEY WILL FORM A CONTINUOUS VERTICAL LADDER WITH RUNGS EQUALLY SPACED AT A MAXIMUM OF 410mm TO WITHIN 300mm BELOW THE COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING.
2. STEPS SHALL BE CAST FIRMLY IN PLACE OR SECURED WITH A SUITABLE MECHANICAL ANCHORAGE TO PREVENT PULLOUT, AND MAINTAIN WATER TIGHTNESS.
3. "STANDARD STEPS" SHALL PROJECT A DISTANCE OF 150mm MEASURED AT THE POINT OF EMBEDMENT.
4. A "SHORT STEP" WITH A PROJECTION OF 75mm SHALL BE INSTALLED WITHIN THE GRADE ADJUSTMENT SECTION, CAST INTO THE NECK OR FIRMLY MORTARED IN PLACE BETWEEN THE NECK RINGS, WITH THE ANCHOR LEGS OUTSIDE OF THE NECK RING.
5. EXCEPT AS SPECIFIED ABOVE, DESIGN AND INSTALLATION OF SAFETY STEPS SHALL CONFORM TO A.S.T.M. C478.



TYPICAL MANHOLE SECTION

DETAIL 'A'

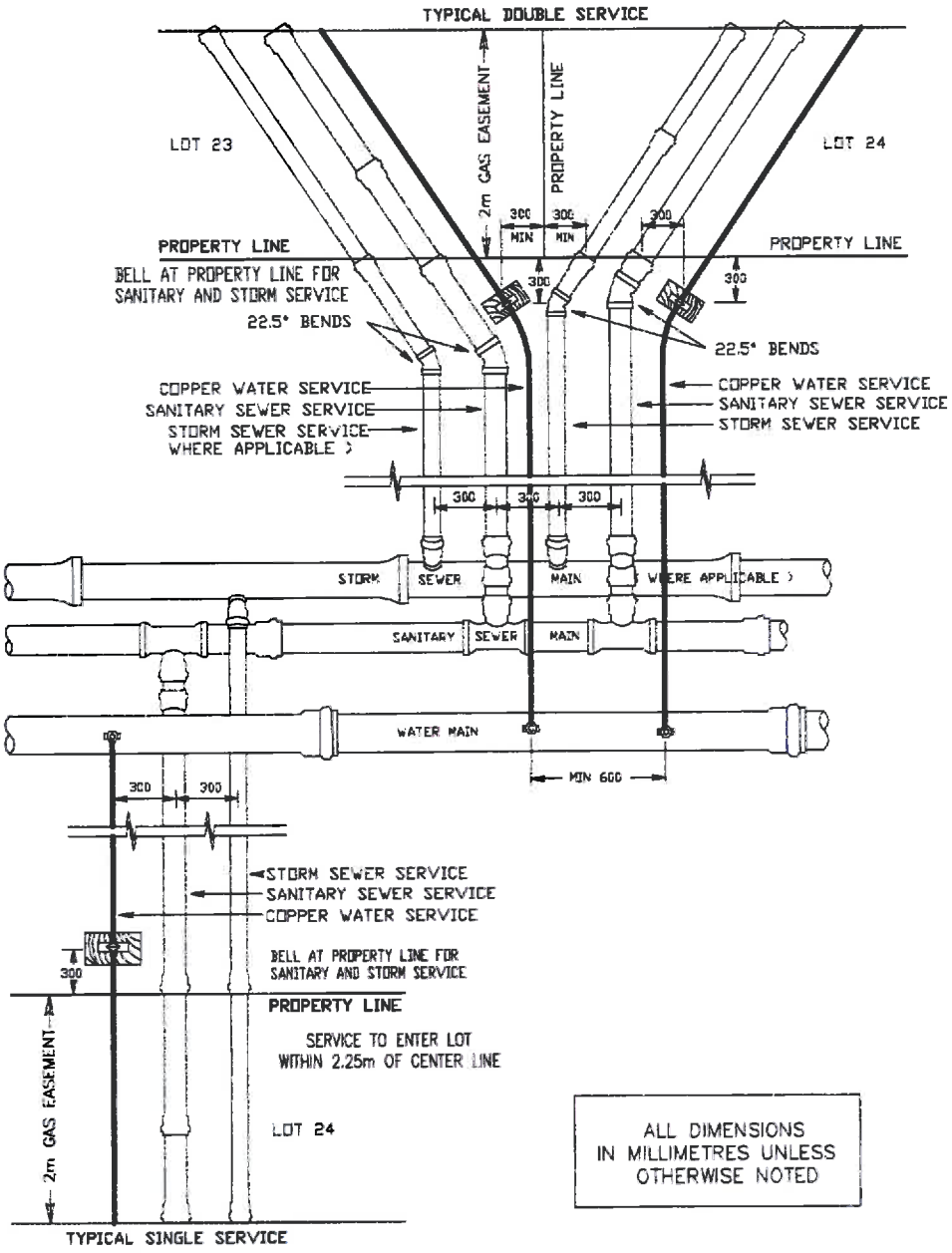


ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED

Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		SAFETY STEPS FOR MANHOLES	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F-16
Date: APRIL 2013	Drawn: JIM	Scale NTS		



NOTES:

1. WATER AND SEWER SERVICES MAY BE EXTENDED TO EDGE OF 2.0m GAS EASEMENT.
2. THE CITY ACCEPTS NO RESPONSIBILITY FOR THE CONSTRUCTION OR MAINTENANCE OF SERVICES INSTALLED WITHIN THE EASEMENT.
3. MARK ENDS OF SERVICES AT EDGE OF GAS EASEMENT WITH A 50mm X 100mm X 750mm STAKE PROTRUDING 450mm ABOVE GROUND AND PAINTED BLUE. MARK THE CURB CONTROL VALVE WITH A SIMILAR STAKE PAINTED RED.
4. THE END OF COPPER WATER SERVICE PIPING SHOULD NOT BE CRIMPED CLOSED, PERMEABLE FILTER CLOTH MAY BE USED TO PREVENT INTRUSION OF DEBRIS AND TO ALLOW TESTING FLOW OF CURBSTOP.

Lamont County

General Municipal Servicing Standards

Rev.	Stewart Weir		TYPICAL SERVICES (SINGLE & DUAL)	
Rev.				
Rev.				
Rev.	File No.: ED60.36498	Design:	Approved:	Drawing F-17
Date: APRIL 2013	Drawn: JIM	Scale NTS		