

SECTION 61 SANITARY SEWER SYSTEM

61.1 GENERAL

The construction of all sanitary sewer mains and related sewerage structures shall be in accordance with these specifications and all other relevant specifications.

Sewer mains shall refer to the supply and installation of pipe, manholes, bedding, including, but not limited to the cleaning and testing of sewer pipe in accordance with these specifications.

Sewer force mains shall refer to the supply and installation of pipe, manholes, bedding, valves, air releases, pigg ports, including, but not limited to the cleaning and testing of force main pipe in accordance with these specifications.

61.2 MATERIALS

61.2.1 PIPE

a) Poly vinyl Chloride (PVC) pipe

- Conforming to CSA B182.2-M1983 and ASTM D 3034.
- Standard Dimension Ratio (SDR) shall be 35. For sanitary mains in larger than 1050 mm SDR 41 may be used, subject to the written approval of Aquatera. Approvals for SDR 41 shall be based on considerations such as depth, soil conditions and groundwater elevations.
- Jointing shall be bell and spigot type with rubber gaskets conforming to ASTM D 3212 or fused as per the manufacturer's specifications and conforming to ASTM D 2152.

b) Concrete

- Non-reinforced concrete pipe conforming to the Standard Specification ASTM C-14 Class III.
- Reinforced concrete pipe in accordance with ASTM C-76, or Reinforced Concrete D-load pipe conforming to ASTM C-655.
- All concrete pipe to be manufactured with sulphate resistant (SR) cement Type V.
- Gasketed joints or confined O-rings as per ASTM C-443 requirements.

c) Force Main

- Poly Vinyl Chloride (PVC) pipe
 - Conforming to CSA B137.3 (series 160)
 - Dimension Ratio (DR) shall be 26.
 - Jointing shall be Bell and Spigot type with rubber gaskets conforming to the above standards or fused as per the manufacturer's specifications conforming to ASTM D 2152.
 - To facilitate location of force mains a tracing wire or approved equivalent shall be placed along all forcemains at the time of installation.

- High Density Polyethylene pipe (HDPE)
 - Conforming to AWWA C901 or AWWA C906
 - SDR 17
 - Heat fusion or insert or compression fittings conforming to CSA B137.1 for fittings less than 100 mm and conforming to AWWA C906 for fittings larger than 100 mm.
 - Jointing of polyethylene pressure pipe greater than 100 mm shall be by thermal butt fusion process. Procedures recommended by the pipe manufacturer shall be followed.
 - Jointing of polyethylene pressure pipe smaller than 100 mm shall be joined with heat fusion or insert or compression fittings recommended by the manufacture and conforming to Aquatera standards, and that prevent pull out and resist creep deformation at full test pressure.
 - To facilitate location of force mains a tracing wire or approved equivalent shall be placed along all forcemains at the time of installation.

Any proposed alternate materials must be approved in writing by Aquatera.

61.2.2 INSULATION FOR SANITARY SEWERS

Insulation used shall be a minimum of 50 mm thick and be composed of rigid polyurethane foam which is formed onto the pipe. The insulation shall have a thermal conductivity of 0.161 @ 0.174 kcal/cm/h/m²/°C and have a minimum service temperature of -45°C. As an alternative a frost box can be installed using 50 mm foam panels as per the Typical Detail Drawing.

61.2.3 MANHOLES**a) Body**

Pre-cast reinforced sulphate resistant concrete barrel(s) and conical/slab top with minimum 1200 mm inside diameter unless otherwise specified, conforming to ASTM C478

b) Bases

Bases shall be manufactured as per the Concrete Specifications with ASTM type V (Sulphate Resistant) concrete with a minimum 28 day compressive strength of 25 MPA.

Booted connections between the manholes and pipes are not allowed within Aquatera's service area.

Manhole connections shall be either cast in place PVC stubs or cast in place A Lok gaskets.

c) Frame and Cover

Manhole frame and cover shall be cast iron conforming to ASTM A48 Class 61. The cover shall contain the logo "Aquatera Utilities Inc. - Sanitary Sewer" and contain only one vent hole. The vent hole shall be 25 mm, +/- 2 mm, in diameter.

Floating F-80 manhole covers may be used as an alternative to the F-39, where manholes are located in paved areas.

Floating F-90 with gasket sealed manhole covers shall be used on sanitary manholes located in sag/ponding areas in asphalt concrete pavement. F-90 manhole covers shall have no vent holes.

d) Grade Rings

Grade rings shall be either concrete or rubber. Bricks, shims, concrete blocks and steel riser rings and excessive amounts of rubberneck shall not be used to adjust manhole frames and covers.

Concrete grade rings shall be manufactured as per the Concrete Specifications with ASTM type V (Sulphate Resistant) concrete with a minimum 28 day compressive strength of 25 MPA.

e) Rungs

Manhole safety rungs shall be 20mm Ø ribbed, extruded aluminum or hot dipped galvanized.

f) Concrete

All cement to be ASTM TYPE V (Sulphate resistant) 28 day strength of 25 MPa.

g) O-Ring Confined Gaskets conforming to ASTM C - 443

h) Bituminous Gasket-Type Sealant conforming to ASTM C - 990

61.2.4 BEDDING

a) Specified

Granular Bedding (B1)

Granular bedding shall have an even gradation falling within the following limits:

Screen Size (microns)	Allowable Passing (percent)
20,000	95 to 100
12,500	75 to 95
5,000	40 to 60
2,000	25 to 45
400	10 to 25
80	2 to 10

b) Optional Granular

i) Sand

Sand bedding shall have an even gradation falling within the following limits:

Sieve Size (microns) (CGSB Spec)	Allowable Passing (percent)
5,000	100
2,000	70 to 95
400	30 to 65
160	10 to 25
80	2 to 10

ii) Select Native Material

Shall be well graded soil selected by the Contractor from the excavated trench material. It shall contain no particles larger than 32 mm in its largest dimension. It shall contain no frozen soil, roots or other objectionable material in quantities that might cause pipe damage, excessive settlement or inadequate compaction. The moisture content shall be such as to allow proper placing and compaction.

iii) Concrete

Shall be **sulphate resistant** 25 MPa strength at 28 days, with a slump of 25-75 mm.

61.2.5 CONCRETE, GROUT AND MORTAR

Concrete grout and mortar used for patching, filling and repairing holes, cracks and joints in concrete manholes shall be a pre-mixed, non-shrink, cement-based patching material consisting of **sulphate resistant** hydraulic cement, graded silica aggregates, special plasticising and accelerating agents, which have been formulated for vertical or overhead use. It shall not contain chlorides, gypsum's, plasters, iron particles, aluminium powder, or gas forming agents or promote the corrosion of steel it may come into contact with. Set time shall be less than 30 minutes. One-hour compressive strength shall be a minimum of 200 psi and the ultimate compressive strength shall be a minimum of 5000 psi. Bond strengths shall be a minimum of 1700 psi."

61.2.6 WARNING TAPE

Underground warning tape shall be installed above all sanitary mains, sanitary services and other buried sanitary lines of any type.

Material shall be Brady Detectable Identoline Warning Tape or an approved equivalent consisting of B-721 metal detectable polyester with a 4.5 mils minimum thickness. For sanitary lines the color shall be safety green with black lettering on one side only, repeated continuously with "Caution Buried Sewer Line Below".

61.2.7 AIR RELEASE VALVES

Air release valves shall be installed at locations approved by the engineer.

Air release valves shall be single acting type.

Each air release valve shall be installed in a chamber or manhole and be provided with isolation valves **and both sides of the chamber or manhole.**

61.2.8 TRACE WIRE

All underground non metallic pressure pipe systems shall be installed with a continuous trace wire. Trace wire shall be a minimum 10 gauge, solid wire with plastic coating,

attached to the piping system every 3 m with plastic strapping. The wire shall terminate above ground at every valve box and air release valve. The wire shall be of sufficient length to allow the wire to be uncoiled and extended 0.3 m above ground.

Requirements for trace wire for augured installation may be waived by obtaining written approval from Aquatera.

61.3 INSTALLATION

61.3.1 PIPE

a) Placement

- i) All pipe laying and connecting shall be in strict accordance with the manufacturer's recommended practice unless otherwise specified by the Engineer.

Pipe shall be laid at the depth and location shown in the Detailed Engineering Drawings or as specified by the Engineer.

- ii) The Contractor shall remove all water from the trench or tunnel prior to and during the installation of sewer mains and sewerage structures.

All foreign material shall be kept out of the pipe before, during and after installation. When pipe laying is not in progress the pipe shall be temporarily plugged to prevent entry of water or other foreign material.

- iii) Bell and spigot pipe shall be laid with the spigot end pointing downstream.

- iv) Where the pipe connects to or passes through a manhole the pipe shall have a joint connection within 1.5 metres measured from the outside wall of the manhole. The length of incoming pipe that cannot be bedded and supported by undisturbed soil shall be set in an approved concrete cradle.

- v) All insulated pipes shall be installed as per manufacturer's guidelines unless otherwise directed by the Engineer.

- vi) It is the Contractor's responsibility to locate and protect all other utilities in the vicinity of the work.

b) Open Cut Installation

Refers to pipe installation in an open trench. Designed trench widths must be maintained to reflect appropriate loading on the pipe.

c) Augured Installation

Augured Installation refers to the installation of pipe into an uncased tunnel or hole. Refer to Section 13 – Auguring of Aquatera’s Construction Specifications for detailed requirements.

61.3.2 MANHOLES

Manholes shall be constructed in strict accordance with the manufacturers' recommended practice unless otherwise specified in the Detailed Engineering Drawings or these Specifications.

a) Placement/Body

- i) The Body shall be pre cast sulphate resistant reinforced concrete. All manholes shall be plumb with no leaning permitted.
- ii) For tee-risers or perched manholes a maximum of one precast concrete manhole riser or barrel section shall be placed on a freshly poured concrete bases and no further work shall be done for a minimum of 12 hours allowing time for the concrete base to set sufficiently.
- iii) The inside manhole wall shall be finished to a smooth surface. No voids or jagged edges of binding mortar at the joints will be permitted. Riser rings shall not be finished with mortar unless directed by **Aquatera**.
- iv) The joints for precast concrete manholes are to be of the confined o-ring type conforming to ASTM C443 or current version thereof Conical tops, flat tops and grade rings which come without gasket are to be fully sealed to ensure the manhole will be completely water-tight. The contractor shall use an approved flexible bituminous gasket- type sealant. This shall be placed between all the grade rings and between the frame and the top grade ring. The sealant between the cone and the first grade ring should be 25mm, in other locations 13 mm sealant may be used if it manages to make the seal watertight. The seals shall be installed as per manufacturer's specified guidelines.
- v) Stubs for future extensions shall terminate within 1.5m from the outside wall of the manhole, unless otherwise directed by Aquatera. All stubs shall be plugged to prevent the entry of water or other foreign material. The stub shall have positive grade toward the manhole, matching the grade of the future extension of the line. Stubs that grade toward the plug (future downstream manhole) shall be plugged at both ends of the section of pipe installed. **The incoming and outgoing pipes at a manhole shall be supported by an approved concrete cradle of an appropriate length to properly support the pipe.** The cradle will be constructed in such a manner that will not hinder the future extension of the main.

When tying into existing stubs, the Engineer shall verify that the grade of the existing stub is not back graded. In the event that the stub is back graded, the Developer will be responsible to correct the grade of the stub, before tying into the existing stub. Any costs associated with the re-grading of a stubbed sewer line shall be borne by the Developer.

- vi) Drop manholes shall be installed on all drops where the space available between the inlet and outlet is suitable for the fittings required. If a suitable amount of space is not available, the grade of the incoming pipe is to be increased or the entire profile lowered to eliminate any excessive drops. Where the inlet and outlet pipes are of similar diameter, the desirable drop across manholes is 3 cm and 6 cm where a change of direction occurs. Where the pipes are of dissimilar diameters, the crowns of the pipes are to be the same elevation.

b) Concrete Base

i) Pour in Place

The concrete base shall be poured on level undisturbed soil. The concrete base shall have a minimum thickness of 150mm. A maximum of one barrel section shall be placed on a freshly poured concrete base and no further work shall be done for a minimum of 12 hours allowing time for the concrete base to set sufficiently.

ii) Precast

All bases shall be sulphate resistant reinforced concrete. The precast base shall be set on 150 mm of compacted 20 mm gravel sub-base extending 150 mm beyond the perimeter of the precast base. The sub-base shall be constructed on level and undisturbed soil.

c) Frame and Cover

Frames and covers shall be installed as per the manufacturer's recommendations. The elevation of the frame after installation shall be as per the Detailed Engineering Drawings or as indicated by the Developer's Engineer. Where the frame elevation is not specified, they shall be set level to the existing ground or as directed by the Engineer.

d) Ladder

For manholes the ladder rungs to be installed so that they align with the opening in the conical or flat top. The first rung should be within 750 mm of the manhole cover. All sharp edges on the ladder shall be smoothed to prevent injury. Ladder rungs shall not be installed over the inlet or outlet of the manhole wherever possible. It is preferable

that where manholes are located within roadways that the ladder rungs are positioned such that when entering the manhole they face oncoming traffic where traffic is in one direction on the roadway. Where the roadway has two-way traffic the ladder rungs should be positioned perpendicular to the flow of traffic.

e) Pipe Junction

The edge formed between the intersection of the pipe and the inside of the manhole/catchbasin wall shall be well rounded and mortared to form a water tight seal. Where sewer mains pass through or enter manholes, the invert channel shall be smooth and semi-circular in cross-section. It may be formed directly in the concrete of the manhole base, or may be constructed by laying sewer mains continuously through the manhole, and then removing the top exposed section of pipe after the surrounding concrete has hardened, and neatly trimming the edges.

f) Change of Flow Direction

Changes of direction of flow within manholes shall be made with a smooth curve with as long a radius as possible. The floor of the manhole outside the channel shall be smooth and slope toward the channel with not less than 16% grade.

g) Elevation Adjustment

A minimum of 100 mm and a maximum of 450 mm of precast various thickness grade rings shall be used to support the manhole frame unless otherwise specified by Aquatera. Manhole covers are to be set accurately to grade as given in the Detailed Engineering Drawings. Where the cover elevation is not specified, they shall be set level to the existing ground. The minimum thickness of concrete grade ring used in the construction of manholes is 50mm.

h) Backfill

The excavated cavity surrounding the completed manhole shall be backfilled as per the Trenching and Backfill specifications applicable to the pipe entering and/or exiting the manhole, whichever is more stringent.

61.3.3 BEDDING

a) Placement

i) Bedding shall refer to and include all Material placed from the bottom of the trench to 300mm above the pipe. Unless otherwise specified, bedding shall be placed by hand up to 300 mm above the crown of the pipe. This material shall be well tamped, in uniform 150 mm lifts, with hand tools along both sides of the pipe and compacted to 97% Standard Proctor Density unless otherwise specified.

- ii) No bedding shall be laid in water or frozen ground or in any condition considered unsuitable by the Engineer.
- iii) The bedding shall be shaped so as to provide a uniform and continuous support for the pipe and fittings. Proper allowance shall be made for bells and couplings such that the coupling does not bear directly on the bedding or support the weight of the pipe.
- iv) Where granular bedding is specified (B1), a sand approved by Aquatera may be used as a substitute provided the pipe diameter is less than or equal to 375 mm and the pipe has water tight joints.
- v) Concrete bedding shall be placed only to the spring line of the pipe. When using concrete bedding the contractor shall wait 24 hours prior to backfilling.
- vi) Specifications for the various classes of bedding are illustrated in the Typical Detail Drawings at the end of this Section.

61.3.4 CONNECTIONS TO EXISTING SEWER SYSTEMS

a) Construction Bulkheads

Prior to extending a sanitary sewer, the Contractor shall install a watertight bulkhead or seal, in the existing sewer immediately downstream of the point of connection, or the most practical location as determined by Aquatera. This location is to be identified on the approved for construction drawings. This bulkhead or seal shall remain in place until the sanitary sewer has been cleaned of all accumulated water and debris and has been accepted by Aquatera. For pipes up to or equal to 375 mm in diameter the contractor shall contact Aquatera at least 48 hours in advance at (780) 538-0348 to install a plug or seal. For sanitary lines greater than 375 mm the contractor shall install a brick and mortar bulkhead. These shall remain in place until issuance of a construction completion certificate and/or the roadworks or other grading work has been completed. After issuance of a CCC Aquatera will remove the plug or seal, or the contractor will be notified to remove the bulkhead.

During all work stoppages in construction of the sanitary sewer, the open face of the last pipe installed shall be plugged with a watertight seal to prevent sand, water, earth, or other materials from entering the pipe.

b) Tie-In To Existing System

The work under this item shall consist of removing existing plugs and making the connection as required to existing pipes or manhole stubs and shall include all trenching, bedding, laying and jointing of pipe, fittings, adapters, backfilling and clean-up, and other items necessary to complete the work as specified.

c) Break-In To Existing Sewer Main Or Manhole

The work under this item shall consist of breaking into existing manholes or sewer mains and connecting the new sewerage structure to the existing manhole or main. Break-in shall include all trenching, bedding, laying and jointing of pipe, fittings, adapters, backfilling and clean-up, and other items necessary to complete the work as specified.

61.3.5 CROSSING OTHER PIPELINES OR UTILITIES

Where the sewer main being installed crosses another pipeline or utility, the minimum clearance shall be 500 mm. The void between the two lines shall be completely filled with a minimum of 500 mm of granular or sand material compacted to 97% Standard Proctor unless otherwise approved by Aquatera. When crossing under an existing AC water main, a section of that water main (minimum 4m) shall be removed and replaced with PVC.

When crossing water mains, water services, sanitary sewer mains and sanitary sewer service lines by Auguring refer to Section 13 of Aquatera's Construction Manual.

61.3.6 CLEANING

The Contractor shall clean all sewerage structures of sand, dirt, gravel, asphalt and other debris, and shall flush them clean before the maintenance period begins.

61.4 TESTING REQUIREMENTS OF THE CONTRACTOR

61.4.1 PRE-INSTALLATION

a) Materials

If pipe loading is within 10% of recommended pipe strength capacity and/or the soil conditions are highly variable in terms of moisture content, making design trench width difficult to maintain; Aquatera may require additional pipe loading calculations which take into consideration the trench width.

The contractor shall be responsible to inspect all materials delivered to site for condition, damage, roundness of pipes and conformance with these standards.

b) System

The Contractor shall undertake whatever testing is necessary to safeguard and protect existing utilities and structures.

61.4.2 INSTALLATION

a) Materials

The Contractor shall, upon request by Aquatera, provide documentation that material being delivered to or constructed at the site is consistent with the material specified.

b) System

No testing required.

61.4.3 POST INSTALLATION

a) Material

No testing required.

b) Deflection Testing

Deflection testing may be required by Aquatera either during construction and/or following construction. This may be done on any section of installed sewer main prior to final acceptance. The allowable deflection in PVC pipe is 7.5% of the base diameter as measured not less than 30 days following completion of construction. The base diameter is to be calculated in accordance with ASTM D3034.

c) Closed Circuit Television Inspection

Prior to initial and final acceptance of the project, all sewer mains shall be tested as follows:

All sections of sanitary sewers shall be inspected with closed circuit television camera equipment. A written report and a colour video in DVD format shall be submitted to Aquatera for their approval and records prior to the issuance of the Construction Completion Certificate. Details of the inspection and the report are contained in Section 25 of Aquatera's Construction Manual, Closed Circuit Television Inspection of Sewer Lines.

d) Leakage Test

Where deemed necessary by Aquatera, an exfiltration and/or infiltration test shall be conducted. These tests shall not be required if video inspections are done immediately after sewer construction and no deficiencies are observed. Any deficiencies shall be corrected by the Contractor and those portions of sewer affected shall be subject to an additional video inspection.

Infiltration or exfiltration shall not exceed following limits in litres per hour per 100m of pipe, including service connections.

Nominal Pipe Diameter in mm	Allowable Leakage PVC Pipe
100	3.88
125	4.62
150	5.51
200	7.45
250	9.39
300	11.33
350	13.27
400	14.91
450	16.84
500	18.78
550	20.72
600	22.80

e) Pressure Testing

Pressure testing of HDPE forcemains shall be in accordance with ASTM F2164-02. The test pressure shall be 1.5 times the rating of the pipe, but not to exceed the pressure rating of the lowest rated component in the test section, unless these components can be isolated. An Aquatera representative shall be present for the test. When testing to a pressure lower than 1.5 times the pipe rating, the specifications for the lowest rated component shall be provided with the test results.

Pressure testing of PVC forcemains shall be in accordance with Section 91.4.3 b) of the Aquatera Construction Manual.

The contractor shall supply all necessary labour, materials, equipment, tools and incidentals to complete the tests in accordance with these specifications.

f) Trace Wire

Trace wire installation shall be considered complete and acceptable when Aquatera can locate the forcemain using locating equipment.

61.5 PAYMENT**61.5.1 PIPE**

Payment for sanitary sewer mains shall be at the unit prices per lineal metre (L.M.) of pipe, including couplers, shown in the Tender for the various pipe sizes and bedding classes. Measurement shall be made along a straight line between centre line of the upstream manhole and centre line of the downstream manhole.

61.5.2 MANHOLES (Including drop-manholes)

Payment for manholes shall be at the unit price per vertical meter (V.M.) shown in the Tender Form measured to the nearest centimetre. The measurement for payment will be from the lowest invert to the top of the manhole frame. The items included shall be the supply of all materials, the construction of the complete manholes, including base, stubs and plugs, steps, frame and cover, excavation, backfill and clean-up, and **all** incidentals necessary to complete the work in accordance with these specifications.

61.5.3 BEDDING

Bedding is considered incidental to pipe installation, and unless specified otherwise, shall be included in the pipe unit price.

61.5.4 CONNECTIONS TO EXISTING SEWER SYSTEMS

Payment for tying into an existing system will be at the unit price per tie shown in the Tender Form. Such payment will be full compensation for all materials, fittings, adapters, labour, equipment, supervision and all work incidentals necessary to complete the work in accordance with these specifications.

61.5.5 CROSSING OTHER PIPELINES OR UTILITIES

Payment for crossing other pipelines or utilities will be at the unit price shown in the Tender Form. Such payment will be full compensation for all materials, fittings, adapters, labour, equipment, supervision and all work incidentals necessary to complete the work in accordance with these specifications.

61.5.6 CLEANING

Cleaning is considered incidental to the Work. There shall be no separate payment for cleaning.

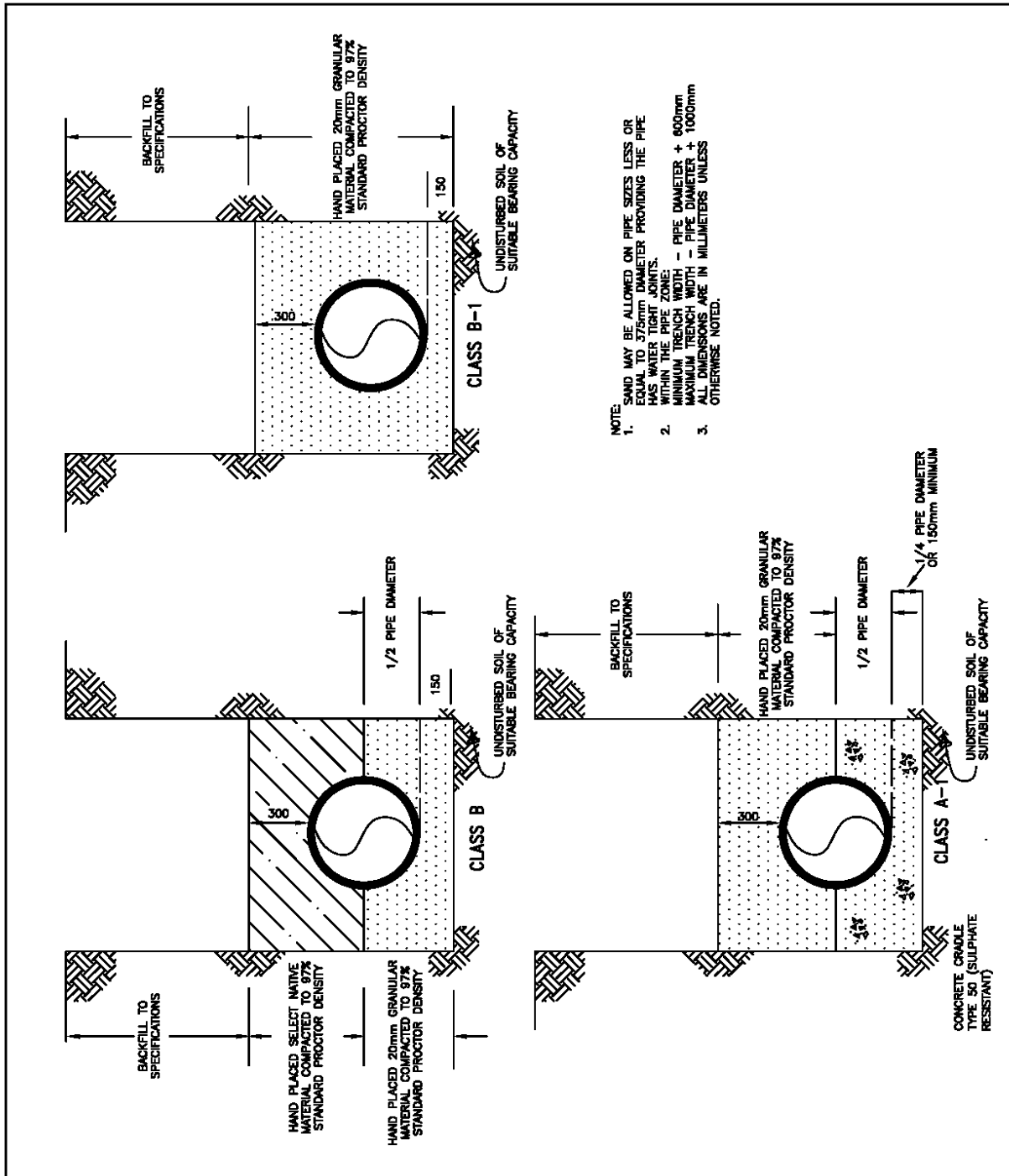
61.5.7 TESTING REQUIREMENTS OF THE CONTRACTOR

a) Television Inspection

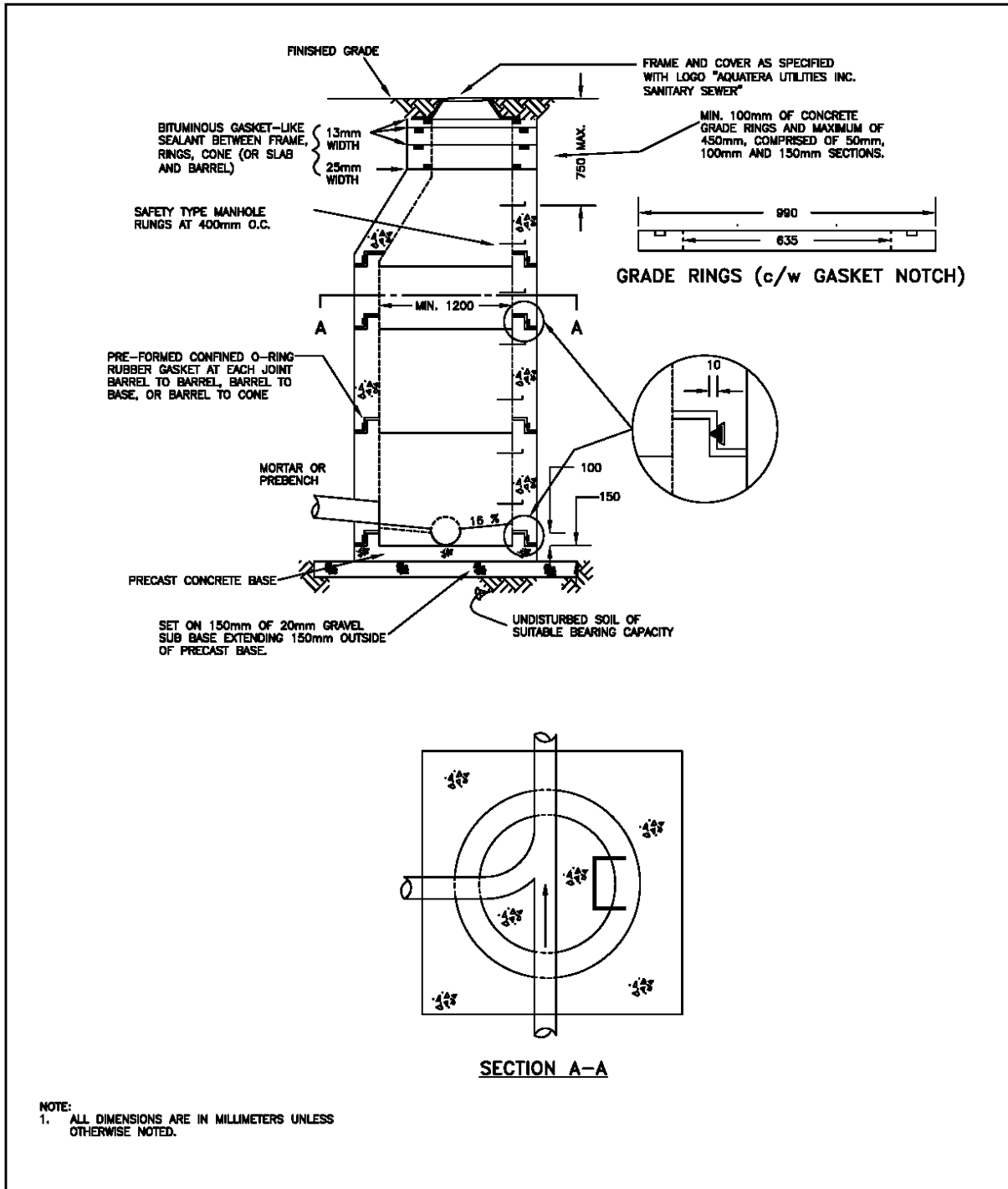
Television inspection of sewers shall be measured in lineal metres (L.M.) from the centre of the upstream manhole to centre of the downstream manhole. Payment for television inspection of sewers shall be at the tender price. Only one payment will be made and any subsequent inspections required by Aquatera will be at the Contractor's cost.

b) Other Testing



There shall be no payment for any other testing required to be undertaken by the Contractor.

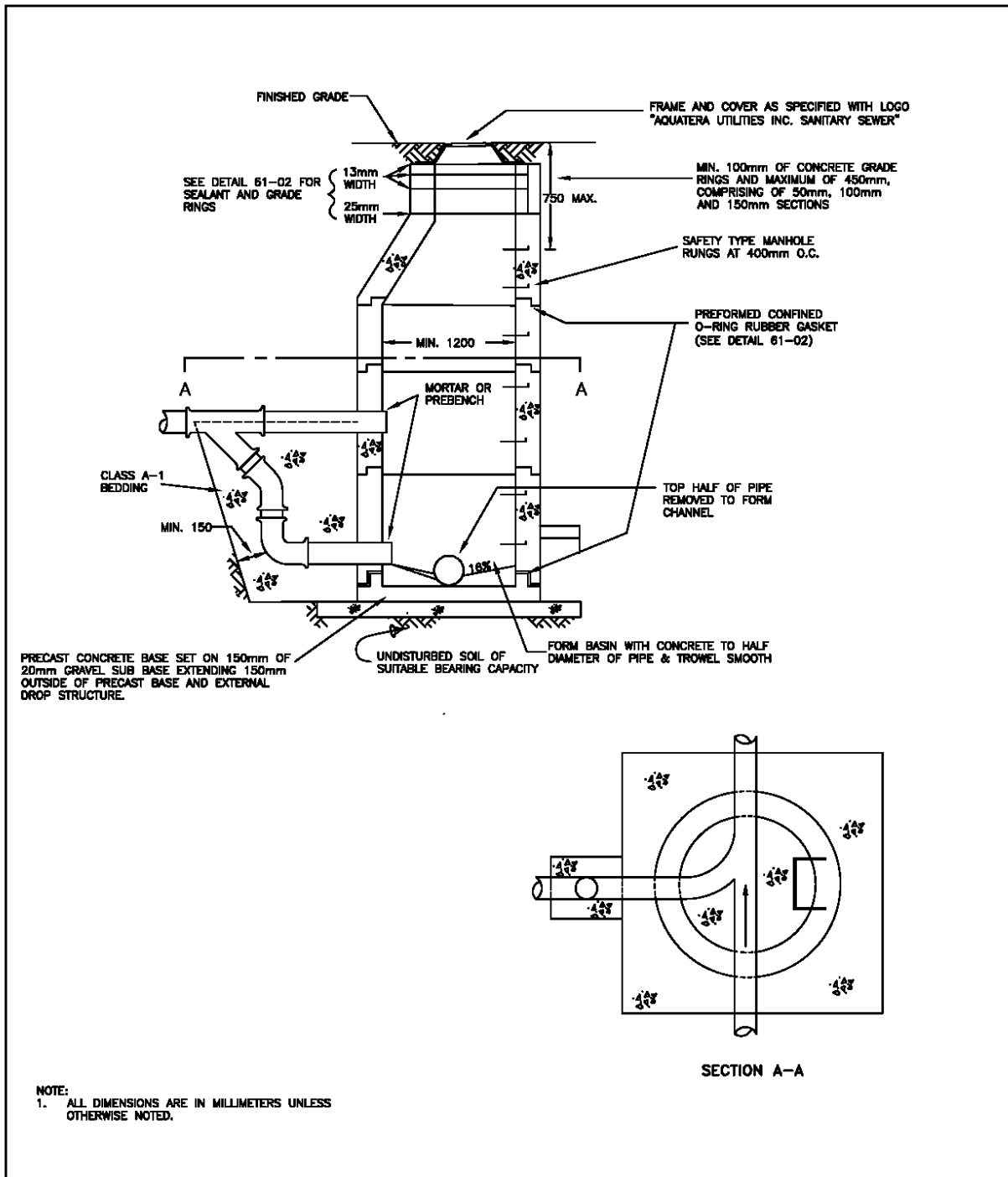


Revisions				BEDDING DETAILS		Standard Detail 61-01
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
			Permit Number P08242	Checked by Norman Kyle, P.L.(Eng.)	Scale N.T.S.	File Number C10056
				Drawn by B. Shervey		

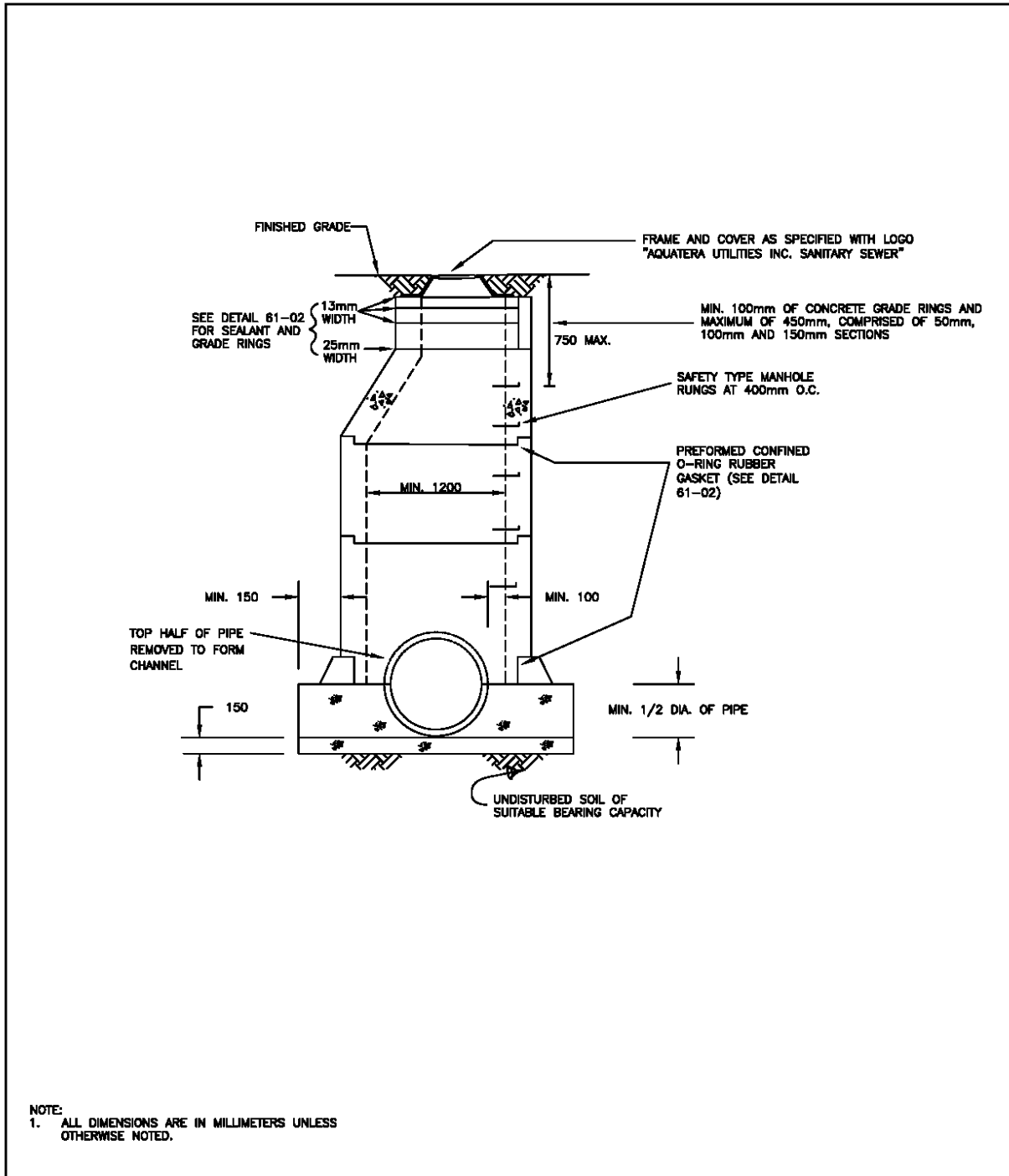



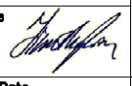
NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

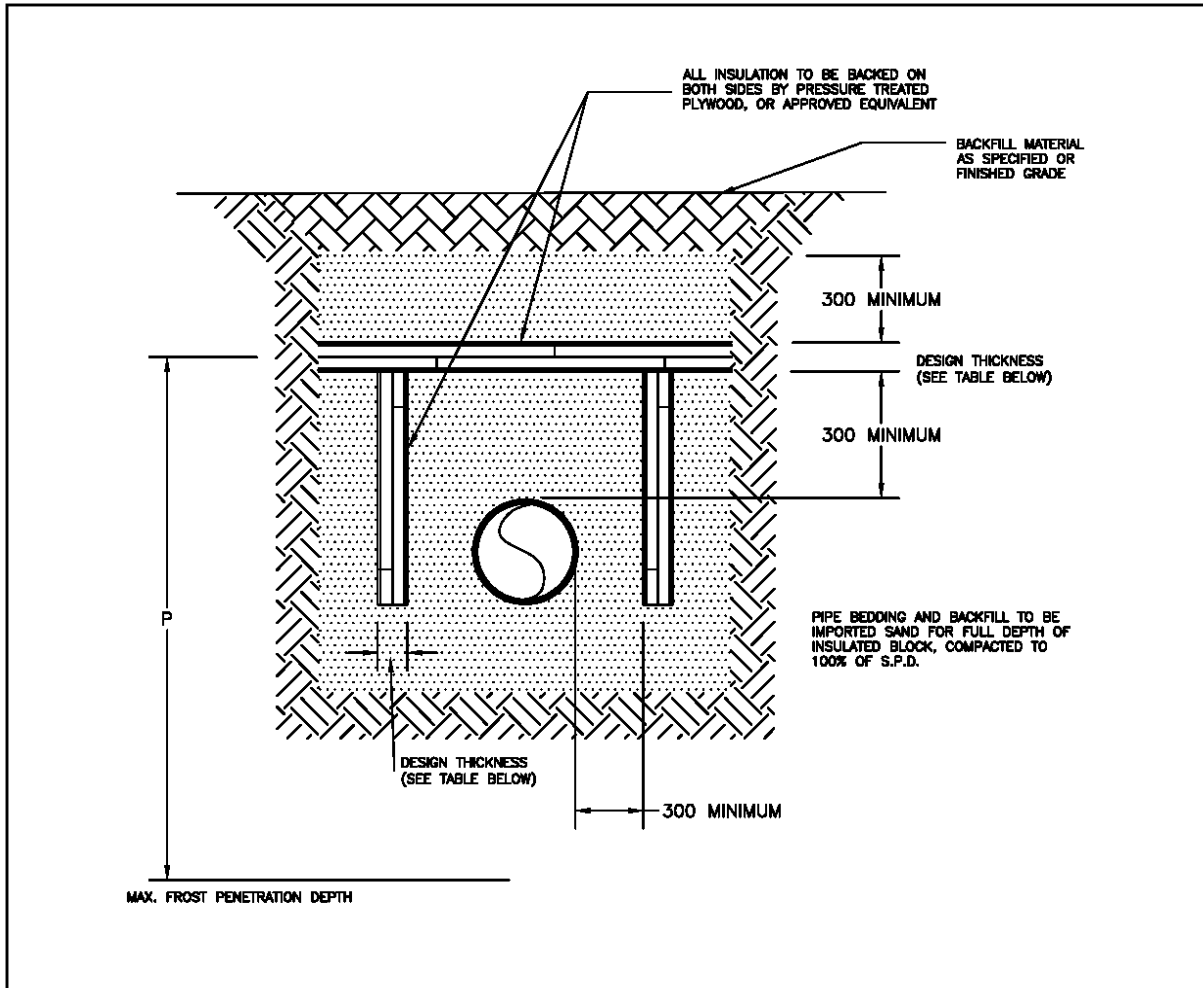
Revisions				PRECAST CONCRETE MANHOLE		Standard Detail 61-02
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
			Permit Number P09242	Checked by Norman Kyle, P.L.(Eng.)	Scale N.T.S.	File Number C10057
				Drawn by B. Shervey	Date 11/02/02	



Revisions				PRECAST EXTERNAL DROP MANHOLE		Standard Detail 61-03
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
				Checked by Norman Kyle, P.L.(Eng.)		File Number C10058
				Permit Number P09242		




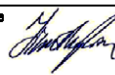
Revisions				MANHOLE CONCRETE BASE FOR EXISTING MAIN		Standard Detail 61-04
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
			Checked by Norman Kyle, P.L.(Eng.)	Scale N.T.S.	Date 11/02/02	File Number C10058
			Permit Number P08242			

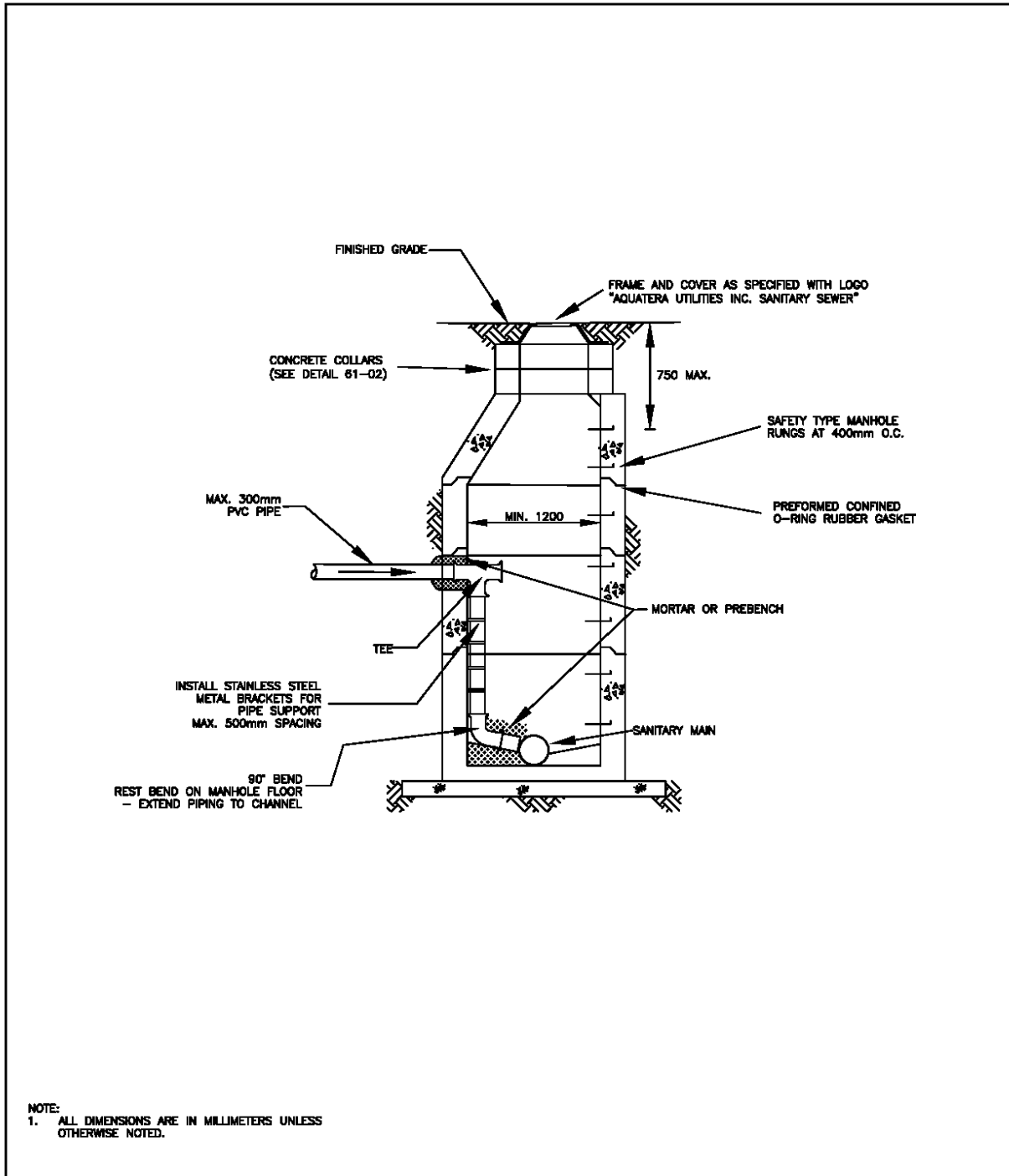


MINIMUM THICKNESS GUIDE			
SANDY SOIL		CLAY SOIL	
P	THICKNESS	P	THICKNESS
1600	100		
2100	150	1500	175
2400	200	2400	225


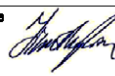

"R" VALUE IS 5 PER 25mm

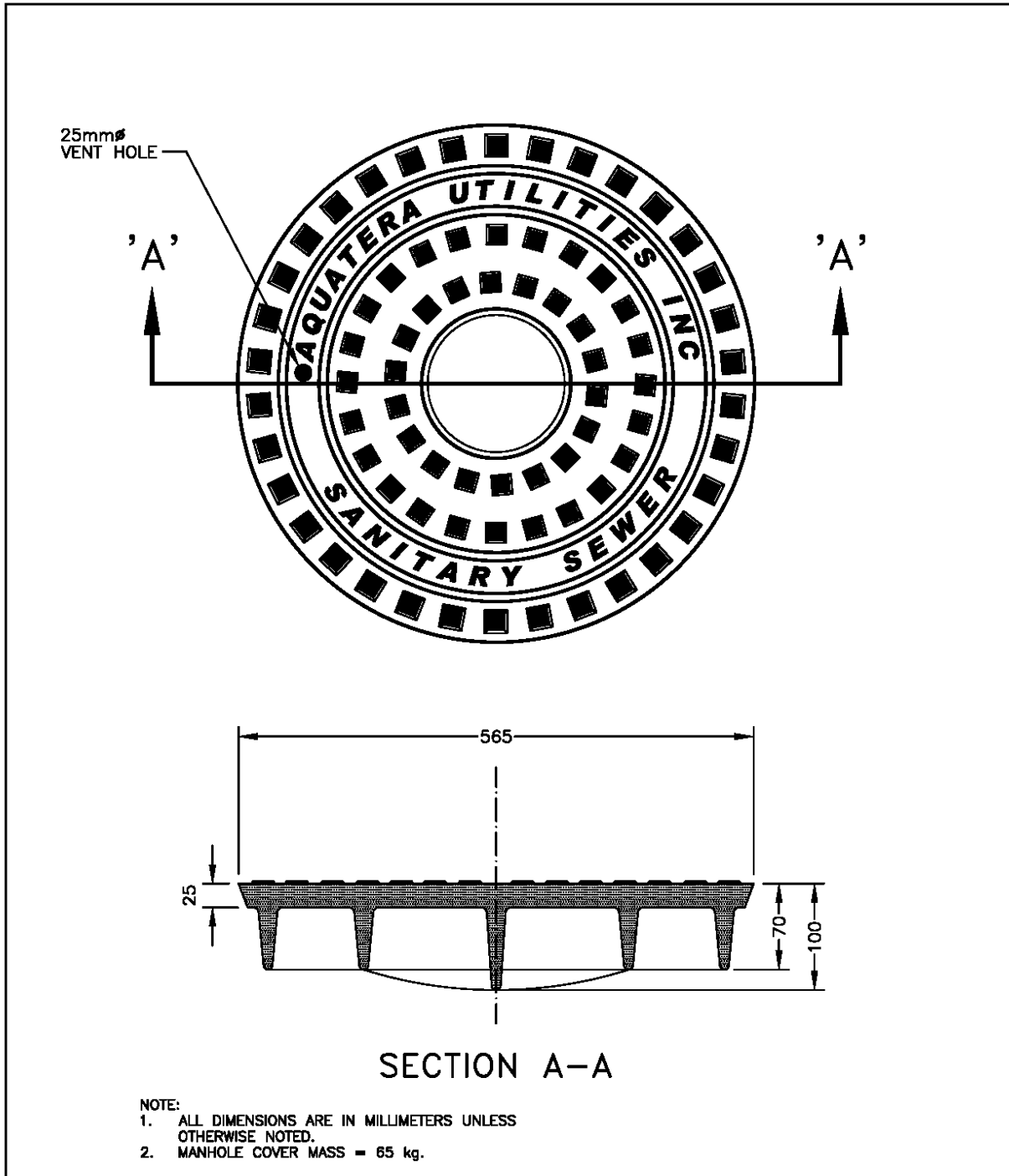
- NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
 2. INSULATION TO BE MINIMUM 100mm THICKNESS.
 3. BACKFILLING TO BE DONE CAREFULLY TO PREVENT BREAKING OR CRUSHING THE INSULATION. CRUSHED SHEETS SHALL BE REMOVED AND REPLACED.


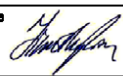

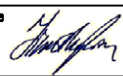
Revisions				PIPE INSULATION DETAIL			Standard Detail 61-05
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 		
			Permit Number P09242	Checked by Norman Kyle, P.L.(Eng.)	Scale N.T.S.	Date 11/02/02	File Number C10080
				Drawn by B. Sharvey			

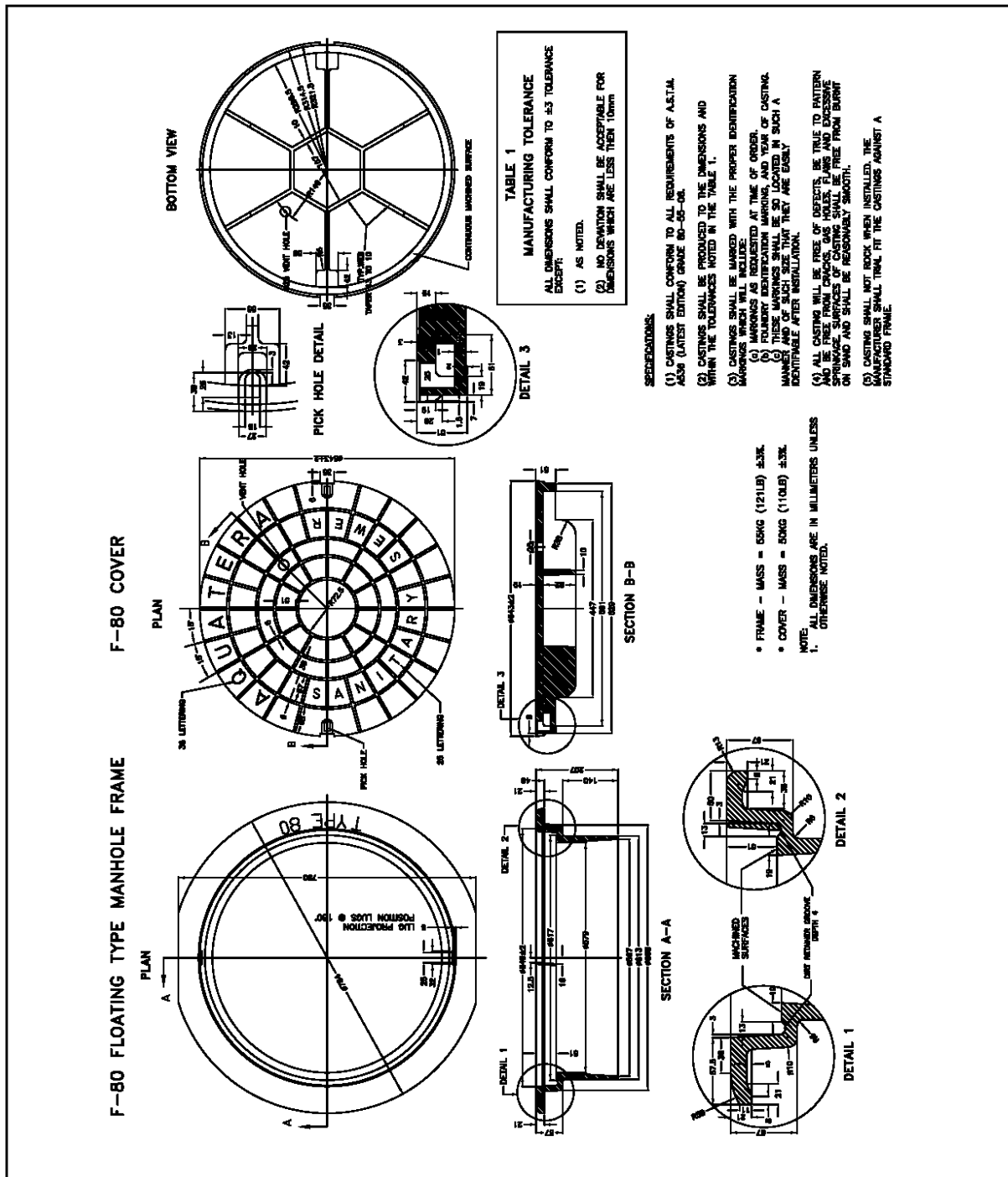


NOTE:
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

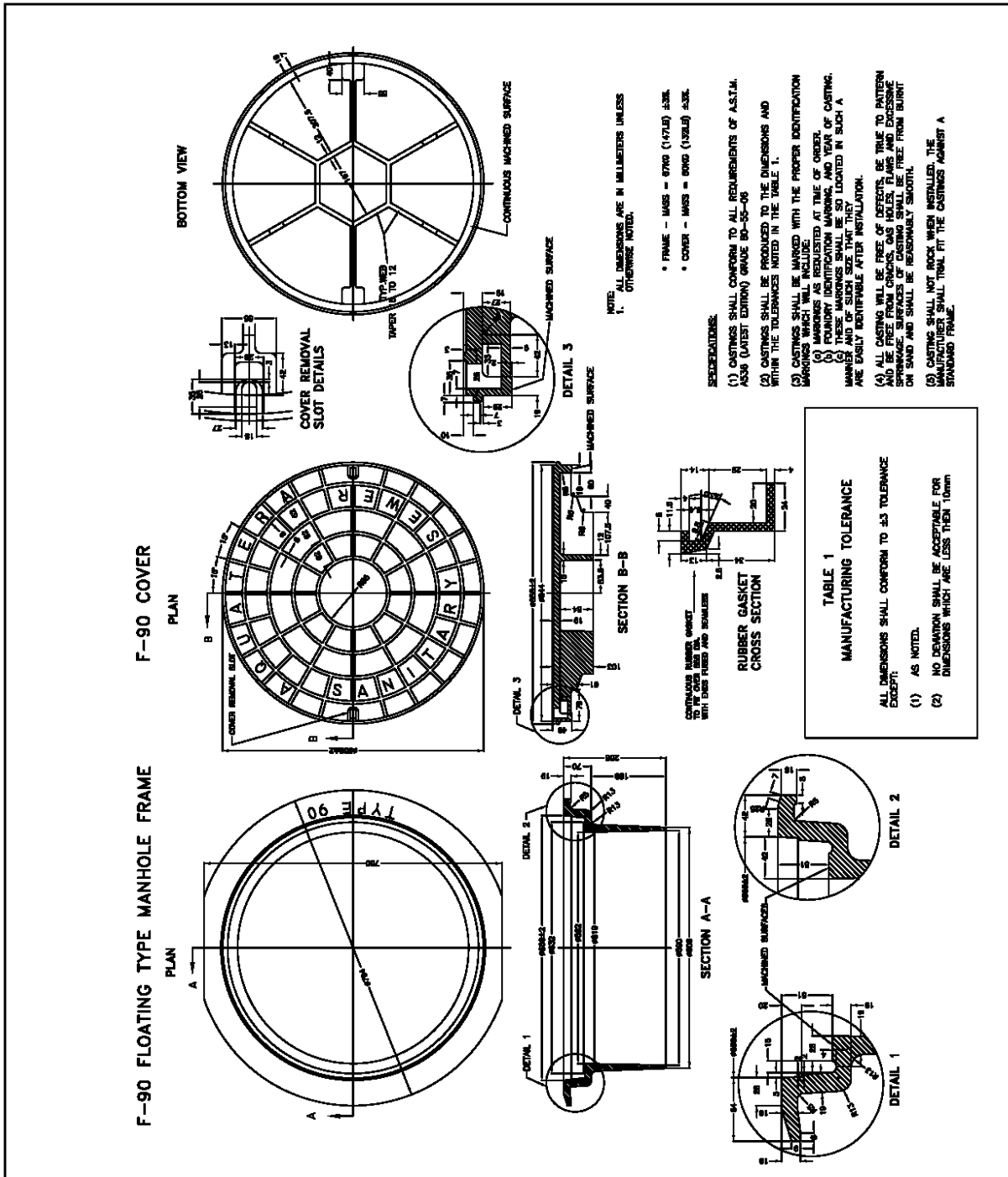
Revisions				PRECAST INTERNAL DROP MANHOLE		Standard Detail 61-06
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
				Checked by Brad Vall, CET	Scale N.T.S.	Date 11/01/31
				Permit Number POB242		



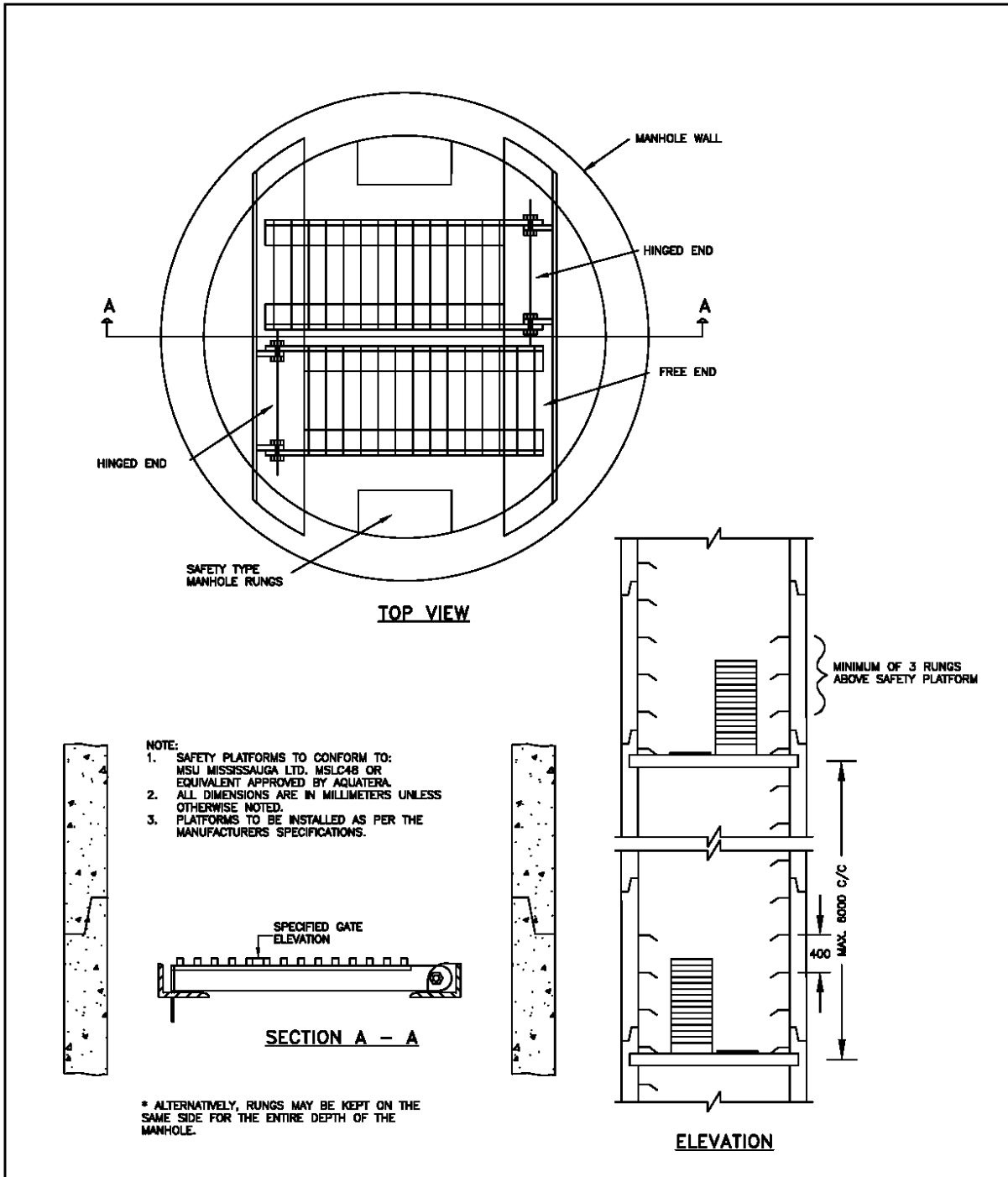
Revisions				F39 MANHOLE COVER – SANITARY SEWER		Standard Detail 61-07
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
				Checked by Norman Kyle, P.L.(Eng.)		File Number C10082
				Permit Number P09242		



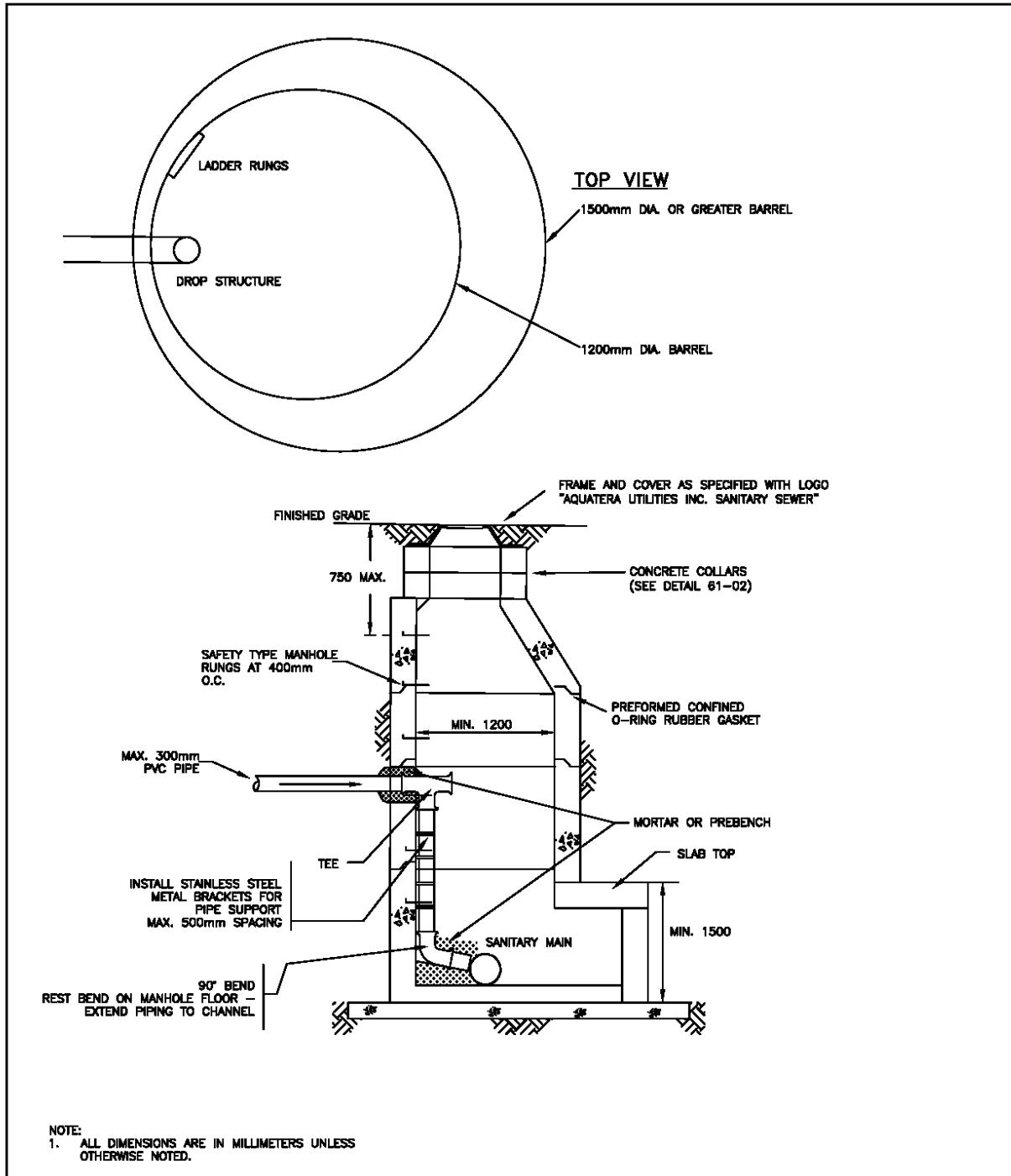
Revisions				F-80 FLOATING TYPE MANHOLE FRAME AND COVER		Standard Detail	
Date	Details	Drawn				61-08	
				Approved by Timothy Lau, P.Eng.	Authorized Signature 		File Number C10083
				Checked by Norman Kyle, P.L.(Eng.)			
			Permit Number POS242	Drawn by B. Sharvey	Scale N.T.S.	Date 11/02/03	





Revisions				F-90 FLOATING TYPE MANHOLE FRAME AND COVER		Standard Detail 61-09
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
			Checked by Norman Kyle, P.L.(Eng.)	Drawn by B. Sharvey	Scale N.T.S.	Date 11/02/03



Revisions				MANHOLE SAFETY PLATFORM		Standard Detail 61-10
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
				Checked by Norman Kyle, P.L.(Eng.)		File Number C10083
				Permit Number P08242		



Revisions				PRECAST VARYING DIAMETER INTERNAL DROP MANHOLE		Standard Detail 61-11
Date	Details	Drawn		Approved by Timothy Lau, P.Eng.	Authorized Signature 	
			Permit Number P08242	Checked by Norman Kyle, P.L.(Eng.)	Scale N.T.S.	File Number C10082
				Drawn by B. Sharvey	Date 11/01/31	

Adopted: March, 2005