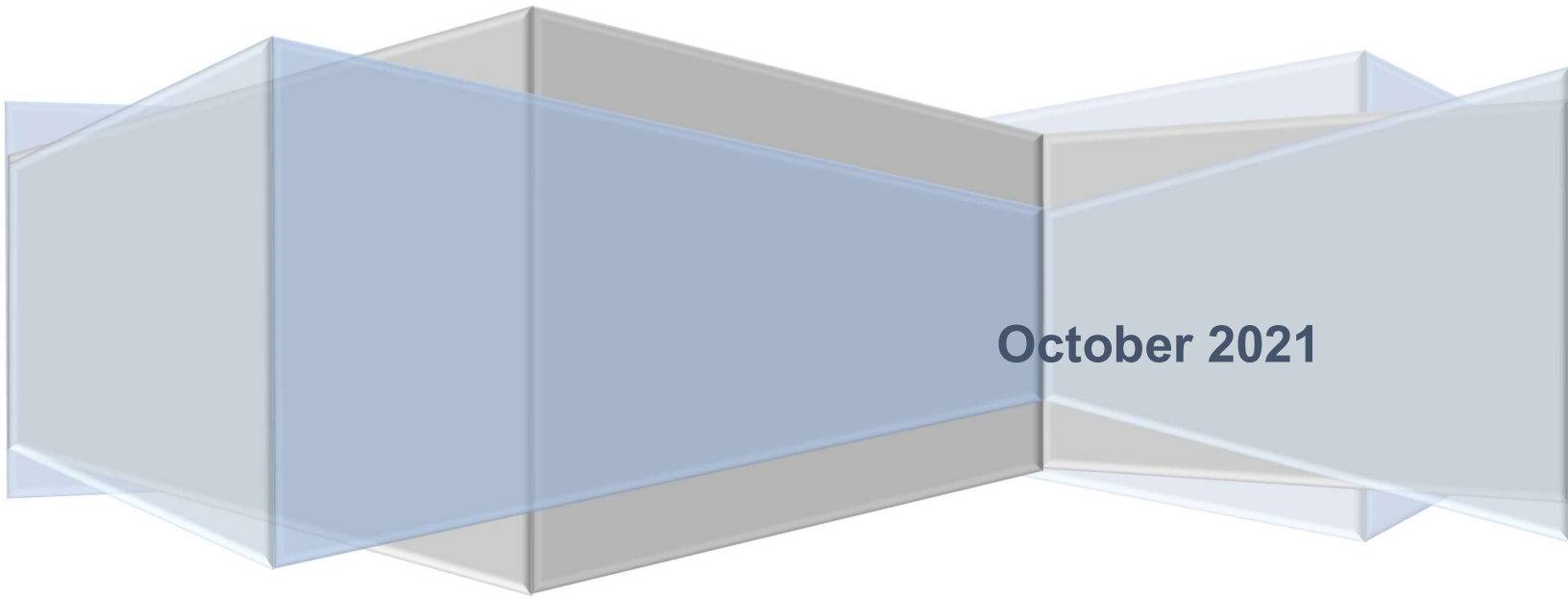
Servicing Standards



October 2021

INDEX

SECTION 1 – ROADS

SECTION 2 – SANITARY SEWERS

SECTION 4 – WATERMAINS

SECTION 10 – STORMWATER MANAGEMENT

GENERAL REQUIREMENTS

These Servicing Standards provide for the standardization of the design, layout and construction of roads, sanitary sewers, storm sewers, watermains, lot grading, tree protection and planting of trees in the Municipality. These standards shall be used in the design and construction of the above-mentioned services. Deviations from these standards will be acceptable only under unusual circumstances and shall be approved in writing by the Municipality.

Construction of the proposed work: shall not commence until the following conditions have been met:

a) the Plans and Specifications have been approved, in writing, by the Municipality;

b) the Plan of Subdivision has been registered;

c) approval has been granted by the Ministry of the Environment for sewage, drainage and waterworks by a Form 1;

d) the Development Agreement has been executed; and

e) the signed copies of the Contract Documents between the Contractor and the Developer have been submitted.

The Developer shall retain a Professional Consulting Engineer licensed in the Province of Ontario for the design and preparation of the Contract Drawings and Specifications.

The Developer's Consulting Engineer shall be available for consultation as required during the construction period. The Developer's Consulting Engineer shall also provide full time resident inspection of the installation of the works.

The Developer shall also provide details of: the existing soil conditions; material testing; compaction and exfiltration tests; and pressure testing as required by the Municipality.

All costs associated to obtaining third-party peer review of submitted development applications incurred by the Municipality are to be reimbursed by the Developer. Costs related to time, third party inspections, equipment, material or water provided by the Municipality for the purpose of infrastructure (sanitary, storm, watermain, stormwater management, roads, etc.) review, testing, commissioning, acceptance, or inspection is to be reimbursed by the Developer.

The Developer shall provide the Municipality with written certification from the Developer's Consulting Engineer to confirm all infrastructure (sanitary, storm, water, stormwater management, roads, etc.) has been installed in accordance with specifications and all infrastructure, including appurtenances prior to assumption.

SECTION 1 - ROADS

1.1 GENERAL

All roads and roadway lighting (see Section 5) shall be generally designed and constructed in accordance with the current edition of the "Manual of Geometric Design Standards for Canadian Roads" and the current edition of the "Guide for the Design of Roadway Lighting" as published by the Roads and Transportation Association of Canada.

1.2 STREET CLASSIFICATION

The Municipality of Strathroy-Caradoc Official Plan governs over the Street Classification and Road Allowance information below. However, where the Official Plan lacks information, the Servicing Standards shall govern.

Street Classification for residential roadways (rural or urban) shall be based on the traffic volume and number of houses with access onto the street as follows:

Street Auto-Oriented Classification	Estimated * No. of Houses	Estimated Traffic Volume
Local	up to 100	0 – 4000
Collector	100 – up	4000 – 8000
Arterial	--	8000 – up

* Traffic volumes are based on trips per household as follows:

Single Family	8-10 per day
Multi-Family	7-9 per day
Apartment	6-8 per day

1.3 ROAD ALLOWANCE, PAVEMENT WIDTHS, LOCATION, AND LAYOUT

a) The minimum width of road allowances and pavement width is shown below:

Street Classification	Minimum Road Allowance	Minimum Pavement Width
Local	20.10 m	8.0 m
Primary Collector	26.10 m	10.0 m
Secondary Collector	20.10 m	8.0 m
Arterial	30.48 m	9.2 m
Industrial	26.10 m	9.7 m

b) Intersections of more than two streets shall not be permitted.

c) Streets should intersect at right angles with each other.

d) Jogged intersections will not be permitted.

e) Street intersections shall not be closer than 60 m.

f) SCSD-1, SCSD-2 and SCSD-3 show the standard utility locations for residential and industrial roads.

g) The maximum length of a cul-de-sac to the turning circle shall be 150 m. This distance may be increased to 230 m should a 3.0 m wide right-of-way be provided at the turning circle for emergency access and a pedestrian walkway. SCSD-4 and SCSD-5 show typical residential and industrial cul-de-sacs respectively.

h) Half bulbs will not be permitted.

i) Local street patterns should be planned to minimize through traffic and also minimizing dead ends.

j) Centerline horizontal curves for arterial roadways shall be derived from Table C3-3 of the Geometric Design Standards for Ontario Highways.

k) Centerline horizontal curves for collector roadways and local streets shall be designed to the Municipality's satisfaction. Sharp 'S' bends will not be accepted.

l) Bends of 90 degrees are only acceptable on local streets. Local streets with bends of approximately 90 degrees are to have a minimum inside street-line radius in accordance with the following:

Road Allowance	Street Line Radius	Road Width
20.0 m	9.0 m	8.0 m

m) Bend "elbows" will not be permitted.

1.4 GRADES

a) The maximum and minimum vertical road grades are 5% and 0.5% respectively, for new developing subdivisions.

b) Vertical curves are required if the algebraic difference in grades is greater than 1%. The minimum length of the vertical curve shall not be less than 45m.

c) Road grades at intersections shall not exceed 2% across the intersection.

d) All roadways shall be crowned on a 2% slope.

e) Boulevards are to be sloped from the property line to the edge of the roadway at 2% to 6% (10% maximum on approval).

f) Road shoulders shall be sloped from edge of the roadway at a 6% slope.

g) Sawtooth roadway design will not be permitted in developments where a consistent longitudinal roadway slope along a significant length of roadway can be achieved.

h) Maximum allowable depth of ponding within roadway sags is 150mm prior to overland flow runoff.

1.5 DESIGN

Typical cross-sections of residential subdivision streets shall conform to the details shown on SCSD-6 and SCSD-7. Typical cross-sections of industrial subdivision streets shall conform to the details shown on SCSD-8.

1.5.1 Pavement

a) An engineered design for all proposed roadways based on Geotechnical design and report must be submitted to the Municipality for review.

b) The gradation requirements, placing, and compaction of granular materials are to conform to the current O.P.S. Specifications, O.P.S.S. 314. Hot-mix, hot laid asphalt shall conform to the current O.P.S. Specifications, O.P.S.S. 310.

c) For residential roads the following minimum compacted depths of granular and asphaltic pavement courses shall be provided:

Material	Minimum Thickness	Compaction Requirements
HL3 Asphaltic Concrete	40 mm	97% Marshall Density
HL8 Asphaltic Concrete	50 mm	97% Marshall Density
Granular 'A' Base	150 mm	100% S.P.M.D.D
Granular 'B' Sub-Base	300 mm	100% S.P.M.D.D.

And shall be designed in accordance with the recommendations of a Geotechnical Engineer.

d) Subdrains will be required where storm sewers are installed below the groundwater elevation in accordance with recommendations of a Geotechnical Engineer. Refer to Section 3 – Storm Sewers for additional information regarding subdrains.

1.5.2 Engineered Fill

Following the removal of topsoil and any fill material, the subgrade should be thoroughly proof-rolled and inspected by a Geotechnical Engineer. Any loose or soft zones noted in the inspection should be sub-excavated and replaced with approved inorganic fill.

Grades can then be restored with compacted fill material. Any required fill material should be inspected and approved by a Geotechnical Engineer and should be placed in accordance with the Geotechnical Engineer's recommendations.

1.5.3 Curb and Gutter

a) Typical concrete barrier curb with standard gutter will be as per OPSD 600.040.

b) Typical concrete semi-mountable curb with standard gutter will be as per OPSD 600.060.

c) Typical concrete curb will be as per OPSS 353 - Construction Specifications for Concrete Curb and Gutter Systems. All local streets will have concrete semi-mountable curb with standard gutter and all other streets will have concrete barrier curb with standard gutter unless otherwise approved by the Municipality. In new subdivisions, concrete barrier curb with standard gutter will be placed. Where driveways are proposed, concrete semi-mountable curb with standard gutter will be installed.

d) Concrete curb and gutter (all types) to be placed on a minimum of 150mm thick Granular 'A' base.

e) Asphaltic curb will not be permitted.

f) The radii of curvature of the curbs and gutters at the intersections shall be as follows:

i) General

Arterial streets to:	Arterial streets	12.0m R
	Collector streets	12.0m R
	Local streets	12.0m R
Collector streets to:	Arterial streets	10.5m R
	Collector streets	9.0m R
	Local streets	9.0m R
Local streets to:	Arterial streets	7.5m R
	Collector streets	7.5m R
	Local streets	7.5m R

ii) Truck Routes

Collector streets to:	Collector streets	12.0m R

Note: A 3.0m daylighting triangle is required at the intersections itemized in ii) above.

Arterial streets to:	Arterial streets	15.0m R
	Collector streets	15.0m R
	Local streets	15.0m R

Note: a 6.0m daylighting triangle is required at the intersections itemized above.

iii) Cul-de-sac

The minimum required radii of curvature of curb and gutters for a residential and industrial cul-de-sac are as per SCSD-4 and SCSD-5.

1.5.4 Sidewalks

a) Typical sidewalks shall be as per OPSD 310.010.

b) Typical concrete sidewalk will be as per OPSS 351 Construction Specification for Concrete Sidewalk.

c) Sidewalks shall be provided as follows:
   i) Sidewalks are required on one side for local roads.
   ii) Sidewalks are required on both sides for collector and arterial roads.
   iii) Sidewalks may be required on both sides of a local street if the street forms walkway to a park, shopping or schools.
   iv) Sidewalks are required on both sides of cul-de-sacs longer than 107m and one side if shorter than 107m. This will be reviewed on a case-by-case basis.
   v) Sidewalks and fencing are required on all walkways as per SCSD-9.
   vi) Sidewalks shall be minimum of 1.5 m wide and shall be located as shown in and SCSD-6 and SCSD-7.
   vii) Sidewalks and curbs shall be ramped at street intersections to permit easy passage of wheelchairs, etc. ramps shall conform to OPSD 310.030.
   viii) Municipality to provide direction on a case-by-case basis where proposed sidewalks within a new development could link with existing sidewalks.

d) Tactile plates are required on all assumed sidewalks at all intersections and elevation changes (i.e., steps). Tactile plates must conform with OPSD 310.033 and OPSD 310.039 and cover the entire width of the sidewalk. The tactile plates must be red, cast iron, detectable and meet the needs and requirements of Accessibility of Ontarians with Disabilities Act (AODA). The tactile plates must have:
   i) Raised tactile profiles;
   ii) High tonal contrast with adjacent surface;
   iii) Located at the bottom portion of the ramp;
   iv) Set back between 150mm and 200mm from curb edge; and
   v) Minimum 610mm depth.

1.5.5 Driveways

a) All driveways shall meet the requirements shown in SCSD-10.

b) Driveways are to be made perpendicular to the roadway.

c) Only one driveway entrance per lot shall be permitted.

d) No part of the driveway shall encroach upon the property boundaries when extended from the edge of the right-of-way to the roadway.

e) If a concrete driveway is installed, expansion joints are to be installed at the property line, at both sides of the sidewalk and at the curb.

f) Maximum driveway widths shall be in accordance with the current Municipal Zoning By Law.

g) In the event of reconstruction or repairs requiring driveway restoration, the affected portion of the driveway within the right-of-way will be restored with asphalt. The property owner is responsible for any additional costs related to upgrading the driveway restoration material (i.e., upgrading from asphalt to concrete or brick pavers).

1.5.6 Islands

All proposed islands (cul-de-sac, median) are to be designed to the Municipality's satisfaction.

1.6 CONSTRUCTION

1.6.1 Materials

The requirement for materials and the placing of the materials shall be as follows:

a) Road Base - See SCSD-6, SCSD-7 and SCSD-8.
Granular Base Course - OPSS 314
Asphalt - OPSS 310

b) Curb and Gutter – See OPSD 600.040, OPSD 600.060 and OPSS 353
i) Concrete shall be 32 MPa at 28 days with 6% ± 1% entrained air.
ii) Contraction joints shall be provided every 3.0 m.
iii) Expansion joints shall be provided at both sides of catch basins at the beginning and end of circular curves, at any abutting sidewalk, setbacks, gutter inlets, or any structure, at maximum 6m intervals.

c) Sidewalks - See SCSD-1, SCSD-2, SCSD-6, SCSD-7, OPSD 310.010, OPSD 310.020, OPSD 310.030 and OPSS 351
i) Concrete shall be 32 MPa at 28 days with 6% ± 1% entrained air and not less than 355 Kg/m³ of cement. Maximum slump shall be 70 mm.
ii) Sidewalks are to be a minimum thickness of 100 mm.
iii) Concrete sidewalks in walkways, shall be 125 mm thick.
iv) Driveways to industrial, commercial or multi-family properties shall be 150 mm thick.
v) All sidewalks to be constructed on a 150 mm minimum thick Granular 'A' bed.
vi) Expansion joints shall be provided every 6.0 m and where the sidewalk abuts a rigid object construction joints shall be provided every 1.5 m.
vii) Sidewalks shall have a 2% minimum slope towards the road. Gradient in excess of 4% is subject to approval by the Municipality.

1.6.2 Compaction

Compaction of earth fill and native backfill material forming the road subgrade shall be 98% Standard Proctor Maximum Dry Density.

Compaction of granular materials in road base course construction shall be 100% Standard Proctor Maximum Dry Density.

Compaction of asphalt materials shall be 97% Marshall Density.

1.6.3 Road Cuts

The edges of all paved and concrete surfaces to remain in place must be properly saw cut prior to removal.

All asphalt road cuts must have a milled lap joint including tack coat unless otherwise approved by the Municipality.

1.7 ROADWAY SIGNAGE

Refer to Section 8 for roadway signage specifications and requirements.

1.8 NOISE WALLS

A Noise Study is required for all developments, unless otherwise stated by the Municipality upon Developer's inquiry. Noise Study to include complete noise wall design, requirements, specifications and construction details. Upon completion of noise wall construction and prior to assumption, the Developer must submit a letter from a licensed Acoustical Engineer confirming the noise wall was constructed in accordance with requirements outlined in the Noise Study.

In general, noise walls shall be installed:

a) On the road allowance within the 0.3m reserve

b) If no 0.3m reserve, adjacent to property line entirely within the right-of-way

1.9 ROUNDABOUTS

A roundabout is an intersection in which vehicles are to travel through in a counterclockwise direction around a raised island located in the center of the intersection.

1.9.1 Design Considerations

The designer must evaluate and consider a roundabout as the primary configuration for higher volume intersections such as collector to collector intersections.

Incorporation of a roundabout intersection must first receive approval from the Municipality on a site-specific basis.

Driveways are not permitted to have their access directly into a roundabout.

Tactile plates are required at all road entrances.

For streets that intersect at approximately 90 degrees, the property line must be setback 31.0m from the intersection of the center line of the right-of-way or 8.5m from the nose of the splitter island for a 6.0m driveway width. Alternatively, the property line must be setback 28.0m from the intersection of the center line of the roundabout or 5.5m from the nose of the splitter island for a 3.0m driveway width.

For arterial roads or if the roadways do not intersection at 90 degrees, the property line must be set back 8.5m from the nose of the splitter island for a 6.0m driveway width or 5.5m from the nose of the splitter island for a 3.0m driveway width.

Minimum Splitter Island Lengths:

Road Classification	Minimum Length of Splitter Island
Local and Collector	5.5m
Arterial	15.0m

Splitter islands are to be constructed at the same time as the center island.

Crossfall shall be away from the center island.

Sidewalks are required on all sides of the roundabout.

1.9.2 Required Signage

All approaches to the circle shall be protected by a Yield sign to ensure vehicles already travelling on the roundabout have right-of-way over the entering vehicles.

A One-Way Sign (Rb-21A) shall be installed on the center island opposite each approach indicating the counterclockwise direction of travel.

1.9.3 Maintenance Holes and Water Valves

Sanitary maintenance holes are to be installed within the apron of the island and are not permitted to be located within the raised center island.

Storm maintenance holes may be located within the center island of the roundabout provided that the proposed landscaping does not hinder access to the maintenance hole.

Water valves may be placed within the raised roundabout island. However, if valve placement creates potential conflict with the curb and gutter of the island, then valves are to be placed in the boulevard clear of the curb and gutter of the approaching streets.

1.9.4 Curb and Gutter

Curb and gutter shall be OPSD 600.040 within roundabouts.

1.9.5 Plantings

Island plantings and typical cross sections are to be designed to the Municipality's satisfaction.

1.9.6 Roundabout Lighting

Street lighting within roundabouts is to be designed to the Municipality's satisfaction.

See Section 5 for street lighting requirements.

SECTION 2 - SANITARY SEWERS

2.1 GENERAL

All subdivisions shall be serviced with sanitary sewers connected to the municipal sanitary sewer system. Consideration will be provided on an individual case by case basis for small residential developments (typically less than 5 lots by severance) where no municipal sanitary sewer system exists. All plans of such works shall be approved by the Municipality.

The basic design factors requiring evaluation are water consumption, land use and population trends for the area served. Well-designed and well-constructed sewers may reasonably be expected to have a useful life in excess of 50 years. Accordingly, sanitary sewers are to be designed for a period not less than 50 years.

In general, sanitary sewer pipes shall be circular. The use of elliptical pipe in site specific situations shall be subject to approval of the Municipality.

2.2 DESIGN

Sanitary sewers shall be located in accordance with the Standard Utility Location Drawing SCSD-1, SCSD-2 and SCSD-3.

Sanitary sewers shall be designed in accordance with the design principles recommended in the most current edition of the Ministry of the Environment, Conservation and Parks (or the applicable environmental agency) Guidelines for the Design of Sanitary Sewers. Design computation sheets are to be submitted to the Municipality for approval and shall be in accordance with the design criteria as outlined in Section 2.3 - Sanitary Sewage Flows.

a) The minimum size of sanitary sewers shall be 200 mm in diameter.

b) Sewer Gradients shall be such that the minimum velocity is 0.6 m/s and the maximum velocity is 4.5 m/s. Within upstream sections of a 200 mm diameter sanitary sewer, the slope shall be governed by the number of dwelling units connected:

1 to 5 units	S = 0.70%
6 to 8 units	S = 0.60%
9 to 12 units	S = 0.50%
13 or more units	S = 0.35%

The minimum slope for a 200 mm diameter sanitary sewer shall be 0.35%. The minimum slope for a 250 mm diameter sanitary sewer shall be 0.25%.

c) The minimum depth of cover over the crown of the pipe in residential areas shall be:
Basement Drainage required: 2.75 m
Basement Drainage not required: 1.80 m

d) Hydraulics - Gravity Sewers

The Manning's Formula shall be used to design gravity sanitary sewers for peak sanitary sewage flows.

The Manning Equation is expressed as:

$$V = \frac{1}{n} r^{0.67} S^{0.5}$$

Where,

V is the velocity in meters per second

r is the hydraulic radius in meters

S is the slope of conduit

n is the roughness coefficient; n values for pipes flowing full shall be as follows:

- 0.013 - polyvinyl chloride (PVC) pipe
- 0.013 - concrete pipe

Minimum allowances for hydraulic losses in manholes shall be as follows:

straight through flow – grade of sewer
45^0 + change in direction of flow - 0.03 m
90^0 change in direction of flow - 0.06 m

The allowances listed above are reasonable for practical design purposes and shall be used unless a detailed hydraulic analysis indicates otherwise.

The invert drops noted above are adequate for sewers flowing at velocities at the low end of the acceptable range. Required drops are to be calculated for high velocity and trunk sewers.

e) Hydraulics - Forcemains

The Hazen-Williams Formula shall be used to design forcemains for peak sanitary sewage flows and is expressed as:

$$V = 0.85\ C\ r^{0.63}s^{0.54}$$

Where,

V is the velocity in meters per second
C is the roughness coefficient = 120
r is the hydraulic radius in meters
s is the slope of the conduit

Head losses in forcemains shall be computed and submitted to the Municipality for approval. Allowances shall be included for hydraulic losses due to valves, bends and other miscellaneous fittings.

A pressure test for forcemains shall be 700 kPa and may be measured at any point on the forcemains by applying an appropriate connection. The test pressure shall be maintained for at least two hours with no pressure loss.

f) Inspection

All new sewers shall be inspected by means of a closed-circuit television inspection just prior to assumption in accordance with OPSS 409 and one digital (USB) copy of the video and report book detailing the condition shall be provided to the Municipality. Refer to Section 2.9 Installation for additional information regarding the inspection of new sewers.

g) Minimum Easement Widths

Easement widths are determined by the diameter of the pipe being installed and the depth of cover from the centerline of the road/ground over the pipe to the invert of the sewer. SCSD-19 shows how an easement width is to be determined. The minimum width of a sewer easement shall be 3.0 m for storm sewers with diameter 450mm and smaller and 5.0m for storm sewers with diameters 525mm and larger, and shall be determined in accordance with SCSD – 19.

h) The maximum allowable depth to invert permitted on sanitary sewer pipe (all materials) is 5.0m. Deeper sewers may be considered by the Municipality on a case-by-case basis should the Consulting Engineer provide reasonable justification and a sound engineering design.

i) All sanitary sewer maintenance hole riser section joints located from 1m above the established groundwater level to bottom of manhole must be waterproofed using Mel-Rol self-adhering waterproofing membrane, or an approved equivalent.

j) Odour Control and Design Considerations for Sanitary Sewers/Systems to Reduce Sewer Gas and H2S Creation

The MECP (or applicable environmental agency) Design Guidelines for Sewage Works provides information and guidelines with respect to odours and corrosion in sewers.
In general, problems have been experienced with the development of sewer gases which cause odours and corrosion of concrete sewer infrastructure due to:

i) hydraulic design which induces turbulence in flow and encourage the release of sewer gases (i.e. sewer forcemains which jet into manholes or chambers, poor benching or transitions where sewers outlet into an existing sewer, high sewer slopes which induce hydraulic jumps, elevation changes with poor transitions)

ii) long residence time of sewage in sewer systems (ie: sewer systems, pumping stations and forcemains which service new developments and have low initial flows, pumping stations and forcemains with long forcemains)

Every effort should be made to minimize conditions or designs which may lead to the creation of sewer gases (odours and corrosion). Where it is not possible to avoid these types of situations, it will be a requirement to mitigate the impacts through use of means acceptable to the Municipality.

2.3 SANITARY SEWAGE FLOWS

Sanitary sewage flows shall be based on the following:

a) When designing residential parcels of land, the following criteria will apply:
Low Density (Zone Category R1) = 30 units/hectare @ 2.4 people/unit
Medium Density (Zone Category R2) = 75 units/hectare @ 2.4 people/unit
High Density (Zone Category R3) = 150 – 300 units/hectare @ 1.6 people/unit
Refer to the Municipality's most current zoning by-law for zone descriptions.

b) Tributary population densities to be in accordance with the recommendations of the Official Plan and Zoning Bylaw. The following population densities shall be adhered to when only the type of development is known:

Residential and Commercial: population density shall be taken as 50 persons per gross hectare or 70 persons per net hectare.

Industrial: population density shall not be less than 11 persons per net hectare.

Results and findings in the secondary plan take precedence over the above population densities where available.

c) Daily per capita sewage flows of 300 liters (excluding infiltration allowance) shall be used to compute sewage flows for residential.

d) Land Use:

The Municipality's official land use plan is to be used to forecast ultimate probable land use in any particular area.

The net area shall be taken as the gross hectares less the area occupied by roads, parks, rights-of-way, etc.

The net area for residential and commercial land shall be taken as 73 percent of the gross hectares. The net industrial area shall be taken as 80 percent of the gross industrial hectares.

e) Capacity Factor:

Residential and Commercial – The capacity factor for residential and commercial areas ranges from 1.55 for 4.0 hectares of net residential or commercial lands to 1.00 for 3,000 net hectares.

Industrial – The capacity factor for industrial areas ranges from 1.55 for 4.0 hectares of net industrial land to 1.00 for 1,600 hectares of net industrial land.

f) Sewage flow allowances for industrial and commercial development shall not be less than 22,500 liters per gross hectare per day. Proponent shall provide the Municipality with their estimated average and peak daily flow rates.

Peak residential sewage flows shall be based on the "Harmon Formula".

$$M = \left(\frac{14}{4 + P^{0.5}} + 1\right) * 1.1$$

Where,

P is the tributary population in thousands

M is the peaking factor

1.1 is the Uncertain Development Factor

Peak industrial/commercial sewage flows shall be "Harmon" x 0.8

g) Infiltration allowance for all types of development shall be as follows:
   i) 6740 litres per hectare per day or 0.08 litres per hectare per second.

2.4 DESIGN SHEET

The sanitary sewer design sheet incorporating the factors described herein is to be used for the design of sanitary sewers. A copy of the design sheet together with the sanitary sewer area plan and structure invert table(s) shall be submitted to the Municipality. A Functional Servicing Report along with all other necessary information shall be provided to the Municipality. The Municipality will hire a third party to complete modeling to confirm adequate capacity within the downstream sanitary sewer system. This modeling will be paid for by the Developer.

2.5 PIPE MATERIALS

Pipe material shall be concrete or polyvinyl chloride (PVC).

a) Concrete Pipe

   Shall conform to CSA and ASTM Standards manufactured in accordance with the following specifications:

   i) Non-Reinforced to CAN/CSA A257.1 (200mm - 600mm dia.)
   ii) Reinforced to CAN/CSA 257.2 (675mm and larger)

b) Polyvinyl Chloride Pipe (PVC)

Smooth wall from 100 mm to 600 mm inclusive; shall be certified, to CSA B182.1 and CSA B182.2 and conform to ASTM D3034, Pipe sizes 200 mm diameter and larger shall be SDR 35, and less than 200 mm diameter shall be SDR 28 for private drain connections (PDC).

c) Ribbed Polyvinyl Chloride Pipe

From 200 mm to 600 mm inclusive; shall be certified, to CSA B182.4 and meet the requirements of ASTM F794.

d) Pipe material for all proposed sanitary sewer forcemains shall be specified based on site-specific hydraulic design.

2.6 PIPE JOINTS

a) Concrete Pipe

All joints shall be rubber gasket conforming to CSA A257.3 and ASTM C443M-94.

b) PVC Pipe

Sealing gaskets shall meet the requirements of CSA. B182.2 and ASTM F477.
All PVC fabricated and molded fittings shall be CSA certified.

2.7 PRECAST MAINTENANCE HOLE

a) Maintenance Holes shall be located at the junctions of sewers and at changes in grade, diameter or alignment. The maximum spacing between manholes is 120 m. Maintenance Holes and components shall be precast concrete conforming to OPSD 701.010 to 701.080.

b) Manhole frames and grates to be in accordance with OPSD 401.010 (Type A).

c) The precast concrete adjustment units used to extend maintenance holes shall be in accordance with OPSD 704.010 and OPSS 408. Three courses, maximum, of approved adjustment units are required on precast maintenance holes. The outside and interior faces of all concrete rings should be plastered and troweled smooth with mortar 6mm thick, consisting of one part masonry cement and 3 parts sand.

d) Maintenance hole steps shall be circular or rectangular aluminum and shall be in accordance with OPSD 405.010 or OPSD 405.020. Steps to be at 300 mm centered vertically with 450 mm maximum distance from top of maintenance hole to the first step.

e) Aluminum safety landings shall be provided in maintenance holes deeper than 5.0m from the top of maintenance hole cover to the lowest invert. Details shall be in accordance with OPSD 404.020 to 404.022.

f) All precast maintenance hole section joints shall contain an approved rubber gasket or approved equal. Joints, lifting holes and pipe connections are to be filled with a non-shrink mortar mix.

g) Drop structures are required at maintenance holes where the difference in invert elevations is greater than 600 mm for sanitary sewers. Cast-in-place external drop structures shall be in accordance with OPSD 1003.010 or OPSD 1003.020. External precast drop structures are an acceptable alternative. Internal drop structures for existing maintenance holes in accordance with OPSD 1003.030 may be considered on a case-by-case basis.

h) Benching of manholes is to be performed in accordance with OPSD 701.021. Benching height should be increased to obvert to increase hydraulic benefit as required.

i) A flexible joint shall be provided on all concrete pipes within 0.5 m of the outside wall of the maintenance hole. Concrete bedding 20 MPa to solid ground and extending to the first pipe joint may be used as an alternate approach.

j) All sewer connections to maintenance holes must be a "boot type" KOR-N-SEAL style, or an approved equal.

2.8 SANITARY PRIVATE DRAIN CONNECTIONS

a) Each property will be provided with a private drain connection of a minimum diameter of 125 mm having a minimum slope of 2%.

b) Private drain connections to industrial, commercial, or high-density residential properties shall not be less than 150 mm diameter with an inspection manhole placed at the property line just onto private property.

c) Drawing SCSD-13 shows the orientation of the private drain connections.

d) Roof water leaders shall not be connected to the sanitary sewers. Connection of foundation weeping tiles to the sanitary sewer is prohibited.

e) The installation of the private drain connections shall be in accordance with the standards set out in Section 2.8 and materials shall conform to Section 2.5.

f) Each private drain connection shall include a clean-out installed 0.3 m on the municipal side of property line as detailed on drawing SCSD-16.

2.9 INSTALLATION

All installations shall be subject to the inspection, approval and acceptance of the Municipality.

a) Sewer pipe bedding shall be in accordance with OPSD.

b) In general, trench backfill shall consist of Granular 'B' material conforming to OPSS 1010 and compacted to 95 percent Standard Proctor Density. The use of on-site or other materials for trench backfill within existing and/or future roadways will only be permitted if approved by the Proponent’s Geotechnical Engineer and Municipality. The use of on-site or other approved materials for trench backfill outside the limits of the travelled portion of the existing and/or future roadways may be permitted if approved by the Proponent’s Geotechnical Engineer and Municipality.

c) Compaction of bedding material shall be carried out in accordance with the recommendations of the Geotechnical Engineer.

d) Sewer service connections for rigid main pipe sewer shall be in accordance with OPSD 1006.010 and for flexible main pipe sewer shall be in accordance with OPSD 1006.020. A 50mm x 100mm timber marker stake shall be installed at the end of the private service connection from the invert to 300mm above finished ground. The stake shall be painted brown.

e) Infiltration and exfiltration tests shall be carried out by the Developer/Contractor. Certified results must be provided to the Municipality. The rate of infiltration shall not be greater than 0.075 liters per millimeter diameter per 100 meters of pipe per hour. In testing for exfiltration, the maximum permissible leakage shall not exceed 0.075 liters per millimeter diameter per 100 meters of pipe per hour.

f) The test pressure for forcemains shall be 700 kPa and may be measured at any point on the forcemains by applying an appropriate connection. The test pressure shall be maintained for at least two hours. The test will not be considered to pass unless there is zero pressure loss.

g) If any utilities or services are encountered during construction, they are to be supported in accordance with the requirements of the various utility companies as applicable.

h) Road surfaces shall be restored to their original condition where existing roads are disturbed, all to the satisfaction of the Municipality.

i) All new sewers shall be inspected by means of a closed-circuit television inspection within fifteen (15) days of servicing completion and within 30 days prior to assumption in accordance with OPSS 409 and one copy of the video and report provided to the Municipality on a USB for its records. Videos and reports must clearly identify the date each video was performed, length of sewer run, name of starting and ending structures and defect codes (if applicable) in accordance with industry standards. The video must stop, pause and be directed into every lead connected to the sewer.

All sewers must be flushed prior to video inspection. This work shall be performed by an independent inspection company with the Municipality given the opportunity to attend and paid for by the Contractor or Developer.

j) Ring deflection testing shall be performed on all new pipe sewers constructed using plastic pipe in accordance with OPSS 410.07.16.05. Testing is to take place within 15 days after the completion of service connections and backfilling and again within 30 days prior to assumption with the Municipality in attendance. Written certification confirming successful ring deflection testing, along with a detailed written report, shall be provided to the Municipality by the Contractor or Developer.

2.10 PRESSURE SEWERS

Losses due to bends, valves and miscellaneous fittings must be taken into account when designing pressure sewers and forcemains.

2.11 SEWAGE PUMP STATIONS

Sewage pump stations must be a Duplex System designed in accordance with the Ministry of the Environment, Conservation and Parks (or the applicable environmental agency) guidelines and require standby power. Proposed sewage pump stations must be submitted with complete detailed design calculations and modelling (Design Brief) to the Municipality for review and approval.

2.12 SANITARY INFRASTRUCTURE REMOVAL OR ABANDONMENTS

Any existing sanitary infrastructure, or services, fronting a development within the right-of-way proposed to be removed or abandoned is to be performed by methods approved by the Municipality, on a case-by-case basis.

SECTION 3 - STORM SEWERS

3.1 GENERAL

The basic design factors requiring evaluation are land use, storm design frequency, precipitation and runoff coefficient. The storm sewers shall be designed for a period of not less than 50 years and shall be designed to convey the 2-year minor storm event to a sufficient outlet or to a storm water management facility.

The Municipality will not accept developments which solely rely on infiltration to control storm water. A storm sewer system providing a viable outlet for the storm water must also be utilized to ensure effectiveness of the system in all conditions (including frozen or blocked conditions). Refer to Section 10 for stormwater management design standards.

In addition to implementing Low Impact Development Systems (LIDS), both the internal drainage system and stormwater management outflows shall be provided through a pipe system and outlet configuration capable of handling a minimum of 20% of the post-development inlet flow for a 5-year storm.

In addition, runoff from major storm events (i.e. 100-year and Regional Storms) shall be accommodated by an overland flow route that has been designed assuming that all of the source controls and storm water conveyance controls have failed. All overland flow routes must be clearly identified within the Lot Grading Drawing(s).

Storm sewer systems shall include storm water management facilities and/or measures for both water quality and quantity in accordance with accepted practices as outlined in the most current edition of the publication entitled "Storm Water Management Planning and Design Manual" prepared by the Ontario Ministry of the Environment (MECP).

Storm water storage requirements for quality control shall be in accordance with Table 3.1 of the above noted Manual with the "Level of Protection" being determined in consultation with the St. Clair Region Conservation Authority, the Department of Fisheries (DFO) and the Municipality.

If the storm sewer outlet for a development is into an existing Municipal Drain, the current Drainage Report must be reviewed to confirm its capacity. Impacts of development on the Municipal Drain must be noted on the design drawings. Similarly, if an existing Municipal Drain flows through a proposed development, incorporation of the Municipal Drain flows must be incorporated and included in the Storm Sewer Design.

3.2 QUANTITY OF STORM WATER

3.2.1 Land Use

The Municipality's five (5) year official land use plan shall be used to forecast the ultimate probable land use in any particular area. Consideration should be given to the effect of increased urbanization. Planning and development on a watershed or a sub-watershed basis is essential.

3.2.2 General

Refer to Section 10 (Stormwater Management) for information and principles related to determining water quantity criteria in the absence of watershed/sub-watershed planning.

Although noted principles must be considered, site-specific characteristics will dictate the appropriate quantity control measures.

The use of computer software programs to determine and evaluate the storm water management facilities, runoff generated, etc. is acceptable provided the program is approved by the Municipality. All design parameters and output are to be provided to the Municipality by electronic copy (USB) in a format acceptable to the Municipality. In addition, an Environmental Compliance Approval (ECA) is required from the Ministry of the Environment prior to construction being undertaken.

Runoff from major storm events shall be accommodated by an overland flow route that has been designed assuming that all of the source controls and storm water conveyance controls have failed.

3.2.3 Estimated Quantity of Storm Runoff

The Rational Formula is to be used to determine the quantity of storm water runoff. The use of other empirical runoff formulae must be approved by the Municipality. The Rational Formula is:

$$Q = 2.78\ C\ i\ A$$

Where,

Q is the storm water runoff in liters per second (l/s)
C is the runoff coefficient
i is the average rainfall intensity (mm/hour)
A is the drainage area tributary to the point under design (hectares).
The initial time of concentration for all types of development is ten minutes

The drainage area used in the storm sewer design must include all external areas which naturally or reasonably drain to the development area.

The following runoff coefficients are to be used with the Rational Formula:

Single Family Residential (Lots smaller than 375 m^2)	0.60
Single Family Residential (Lots 375m^2 to 550m^2)	0.50
Single Family Residential (Lots larger than 550m^2)	0.45
Multi-Family Residential	0.65 – 0.80
Undeveloped Residential	0.50
Commercial	0.70 – 0.85
Industrial	0.70 – 0.90
Parks, Cemetery, Playgrounds & Farmlands	0.20

The runoff coefficients indicated above are adequate as a baseline value. Justification, including supporting calculations, must be provided to verify the runoff coefficient(s) utilized within the storm design for each individual development area based on the amount of impervious area and proposed lot coverage.

3.2.4 Rainfall Frequency and Intensity

Storm sewer design is to be based on the 2-year Rainfall-Intensity Duration curve on Drawing No. SCSD-14.

3.2.5 Infiltration

In general, infiltration of ground water can be ignored in storm sewer design computations.

3.2.6 Location

Storm sewers shall be located in accordance with the Standard Utility Drawing SDSC-1, SDSC-2, and SDSC-3.

3.3 DESIGN

a) Storm sewers shall be designed in accordance with the design principles as outlined in the most current edition of the Ministry of the Environment (or the applicable environmental agency) Guidelines for the Design of Storm Sewers. Design computation sheets shall be submitted to the Municipality for approval. In general, sewer pipes shall be circular. The use of elliptical pipe shall be subject to the Municipality's approval on a case-by-case basis.

b) The minimum size of storm sewer shall be 300mm diameter. The sewer gradient shall be such that a minimum velocity of 0.9 m/s is attained with the maximum velocity being 4.6 m/s (pipes 300mm – 825mm dia.) and 6.0 m/s (pipe 900mm dia. and larger). Velocities of sewers deviating from those described herein will require Municipal approval.

   i) Minimum depth of cover on storm sewers to be 1.5m.

   ii) The Manning Formula shall be used in the design of gravity storm sewers.

Pipe Size Diameter mm	Minimum Grade %	Pipe Size Diameter mm	Minimum Grade %
300	0.44	600	0.18
375	0.35	675	0.15
450	0.25	750	0.13
525	0.21		

3.3.1 Hydraulic Calculations

Hydraulics – Gravity Sewers

Sewers are to be considered as open channels in the selection of hydraulic formulae for design purposes with the exception of pressure systems.

The Mannings Formula shall be used to design gravity storm sewers.

The Manning Equation is expressed as:

$$V = \frac{1}{n} r^{0.67} S^{0.5}$$

Where,

V is the velocity in meters per second

r is the hydraulic radius in meters

S is the slope of conduit

n is the roughness coefficient (n values for pipes flowing full shall be 0.013 for all pipes.)

Hydraulics – Pressure Sewers

The Hazen-Williams Formula shall be used in the design of pressure sewers and is expressed as:

$$V = 0.85\ C\ r^{0.63} s^{0.54}$$

Where,

V is the velocity in meters per second

C is the roughness coefficient = 120

r is the hydraulic radius in meters

s is the slope of the conduit

3.4 OPEN CHANNEL DRAINAGE

a) The use of open channels shall not be permitted in residential or urbanized areas. However, open channels may be permitted, if approved by the Municipality, in industrial or rural areas.

b) Thorough soils investigations and interpretations shall be a prerequisite to the detailed design of the open channel.

The Manning Formula shall be used in the design of open channels:

i) For grass-lined channels, ‘n' values shall be based on the product of the velocity (V) and the hydraulic radius (r):

V x r	n
<0.5	0.150
0.5 to 1.0	0.120
1.0 to 2.0	0.070
2.0 to 5.0	0.050
5.0 to 10.0	0.035
>10.0	0.030

ii) Side slopes for grass-lined channels shall not be steeper than 3H:1V.

iii) Flow velocities shall be in the following ranges:

sand, sandy loam, or silty loam: 0.75 m/s to 0.90 m/s

gravel or clay material: 0.75 m/s to 1.50 m/s

c) Full details of open channel design including energy dissipation structures shall be submitted to the Municipality for review and approval.

d) To carry open channel drainage under driveways and across intersections, a 300 mm dia. (minimum) culvert shall be used. It may be necessary to increase the culvert size to accommodate higher flows from upstream tributary areas, with design calculations provided to support the proposed design.

e) Culverts shall be 2.8 mm thick (minimum) aluminized corrugated steel pipe (C.S.P) or H.D.P.E. 320kPa bell and spigot pipe. This C.S.P. material shall conform to the requirements of CSA Standard CAN3- G401-M81- Corrugated Steel Pipe Products.

f) The maximum allowable depth to invert permitted on storm sewer pipe (all materials) is 5.0m. Deeper sewers may be considered by the Municipality on a case-by-case basis should the Consulting Engineer provide reasonable justification and a sound engineering design.

g) All storm sewer maintenance hole riser section joints located from 1m above the established groundwater level to bottom of manhole must be waterproofed using Mel-Rol self-adhering waterproofing membrane, or an approved equivalent.

3.5 PIPE MATERIALS

Pipe material shall be concrete, polyvinyl chloride (PVC) or high-density polyethylene (HDPE). Pipe sub-drains to be corrugated steel pipe or polyvinyl chloride (PVC) pipe.

a) Concrete Pipe

Shall conform to CSA and ASTM Standards manufactured in accordance with the following specifications:

i) Non-Reinforced to CAN/CSA A257.1 (100mm - 250mm dia.)

ii) Reinforced to CAN/CSA 257.2 (300mm and larger)

b) PVC Pipe (100 mm - 600 mm only)

Shall be in compliance with CSA B182.1 and CSA B182.2 and conform to ASTM D3034. Pipe sizes 200mm diameter to 600mm diameter shall be SDR 35, and less than 200 mm diameter shall be SDR 28 for private drain connections (PDC's).

c) Profile (Ribbed) Pipe (200mm - 600mm only)

Ribbed pipe and fittings shall be certified to CSA B182.4 and meet the requirements of ASTM F794.

All PVC Fittings shall be in compliance with CSA B-182.1, CSA B-182-2 and CSA B-182A, ASTM.

d) High Density Polyethylene (HDPE) Pipe (200mm – 600mm only)
For use on storm sewers only, with integral bell and spigot, shall be certified to CSA B182.6

3.6 PIPE JOINTS

a) Concrete Pipe
All joints shall be rubber gasket conforming to CSA A257.3 and ASTM C443M94.

b) PVC Pipe
Sealing gaskets shall meet the requirements of CSA B182.2 and ASTM F477. All PVC fabricated and molded fittings shall be CSA certified.

c) HDPE Pipe
All HDPE fabricated pipe and molded fittings shall be CSA certified.

3.7 MAINTENANCE HOLES

a) Maintenance holes shall conform to the specifications outlined in Section 2.7 except for the maintenance hole spacing as follows:

Pipe Size	Maximum Maintenance Hole Spacing
Up to 450 mm	120 m
525 mm to 750 mm	150 m
Over 750 mm	180 m

b) Precast Concrete Maintenance Hole Manufactured Tees may be used in storm sewers 1200 mm in diameter and over and shall be in accordance with OPSD 707.010. The precast riser sections shall be at least 1200 mm in diameter. Maintenance hole tees shall be bedded on 28 MPa concrete. Full details shall be submitted to the Municipality.

c) Drop structures are required at maintenance holes where the difference in invert elevation is greater than 900mm. See OPSD 1003.010 and OPSD 1003.020.

d) Allowances for hydraulic losses in maintenance holes shall be as follows:

i) straight through flow – grade of sewer

ii) 45^0 + change in direction of flow – 0.03 m

iii) 90^0 change in direction of flow – 0.06 m

The allowances indicated above are reasonable for practical design and purposes and shall be used unless the detailed hydraulic analysis indicates otherwise.

Although the above invert drops will be adequate for sewers flowing at velocities at the low end of the acceptable range, the required drops should be calculated for high velocity sewers.

3.8 CATCH BASINS

a) Catch basins shall conform to OPSD 705.010, 705.020, 705.030 and 705.040 and ditch inlet catch basins shall conform to OPSD 705.030 and 705.040.

b) Catch basin leads shall not be less than 250 mm in diameter and shall connect to the storm sewer as shown in OPSD 708.010 or OPSD 708.030. Support for pipe at catch basin to be in accordance with OPSD 708.020.

c) Catch basins are to be installed with 150 mm diameter subdrains with sock, 1.5 m long and parallel to curb and gutter each side of catch basin. Subdrains shall be installed such that the invert matches the invert of the downstream catchbasin outlet pipe.

d) Catch basin frames and grates shall conform to the details in OPSD 400.020 and must meet ASTM Designation A-48. Catch basin frames with curb inlet, OPSD 400.090, shall be used for arterial roads and at all low points in the road. Ditch inlet catch basin grate shall conform to OPSD 403.010.

Twin inlet or curb inlet catch basins shall be provided at all low points in the road with single inlet catch basins at intersections. Additional catch basins shall also be provided as follows:

Road Gradient (%)	Maximum Spacing
0.5 to 3.0	90m
3.1 to 4.5	75m
Greater than 4.6	60m

e) The precast concrete adjustments units used to extend maintenance holes and catch basins shall meet the OPSD 704.010 and OPSS 407. Three courses, minimum, of approved adjustment units are required on precast maintenance holes. The outside and interior faces of all concrete rings shall be plastered and troweled smooth with mortar 6mm thick, consisting of 1 part masonry cement and 3 parts sand.

f) All joints, lifting holes, and pipe connections are to be filled with a non-shrink mortar mix. Rear yard catchbasins will only be considered where deemed necessary by the Municipality on a case-by-case basis. Where rear yard catchbasins are permitted by the Municipality, at their sole discretion, all structures must be protected from flooding if the inlet is blocked or surcharged during a major storm event.

3.9 INSTALLATION

The installation of storm sewers shall be carried out in accordance with the requirements of Section 2.9 (Sanitary Sewers – Installation).

3.10 STORM PRIVATE DRAIN CONNECTIONS

a) Roof water leaders and foundation weeping tiles shall not be connected to the Storm Sewers unless the storm sewers have been designed to accept these stormwater discharges upon Municipality approval. All foundation weeping tiles are to be discharged onto the ground surface on private property.

b) Pipe materials shall conform to Section 2.5.

c) Stormwater private drain connections to industrial, commercial or high-density residential properties shall not be less than 150mm diameter with an inspection manhole placed at the property line just onto private property.

d) SCSD-13 shows the orientation of the private drain connections.

e) The installation of stormwater private drain connections shall be in accordance with the standards set out in Section 2.9.

3.11 SUB DRAINS (INSTALLATION OF STORM SEWER BELOW WATERTABLE)

a) In areas where storm sewers will be installed below the elevation of the ground water table as identified in geotechnical report and the area has been identified as a concern to neighbouring properties due to elevated water table, the installation of subdrains will be required.

b) This installation shall include 150 mm dia. (minimum) Perforated pipe subdrain as per OPSD 809.010, including filter wrap (non-woven type) Class I with a Filter Opening Size (FOS) of 130-100 um (subject to geotechnical report) and subdrain end cap, for each storm manhole.

3.12 LATERAL INFLOW IN MAINTENANCE HOLES

If the lateral inflow is a significant portion of the total flow through the manhole, then provision must be made for increased head loss. In such instances, a detailed hydraulic analysis of the head losses shall be submitted to the Municipality.

3.13 PRESSURE SEWERS

Head losses in pressure sewers such as forcemains, shall be analyzed and submitted to the Municipality. Losses due to bends, valves and miscellaneous fittings must be taken into account when designing pressure sewers and forcemains.

3.14 DESIGN COMPUTATION SHEET

The design computation sheet incorporating the factors described herein, is to be used for the design of storm sewers. A copy of the computation sheet together with the related plan of the sewer area, including all detailed sewer shed limits, shall be submitted to the Municipality.

3.15 STORM SEWER EASEMENTS

Easements are required for all storm sewers and appurtenances, to be assumed by the Municipality located outside of the right-of-way. An easement is required to ensure municipal services crossing the site can be properly installed and maintained by the appropriate personnel.

Where rear yard catchbasins are permitted by the Municipality, at their sole discretion, easements are not required for rear yard catchbasins within new subdivisions as rear yard catchbasins shall be the property and responsibility of the private property owner. Easements for rear yard catchbasins are only required where rear yard catchbasins are designed to receive water from Municipal lands, such as parklands.

3.15.1 Types of Easements

Multi-Purpose Easement for Municipal Service

Required for storm sewers, catchbasins, infiltration pots, drains, stormwater management ponds and channels that cross a site and are maintained by the Municipality.

Temporary and Working Easements

Temporary easements are required for storm sewers, catchbasins, infiltration pots, drains, stormwater management ponds and channels, that temporarily cross a site. Infrastructure within the easement is to be maintained by the owner of the services. Working easements are required as necessary during construction, to allow for safe construction and restoration of the disturbed area. The temporary working easement is released upon construction completion.

3.15.2 Easement Widths

Easement widths shall be determined by the diameter of storm pipe being installed and the depth of cover from the centerline of the ground above the pipe to the invert. The minimum width of a sewer easement shall be 3.0 m for storm sewers with diameter 450mm and smaller and 5.0m for storm sewers with diameters 525mm and larger, and shall be determined in accordance with SCSD – 19.

3.16 STORM INFRASTRUCTURE REMOVAL OR ABANDONMENTS

Any existing storm infrastructure, or services, fronting a development within the right-of-way proposed to be removed or abandoned is to be performed by methods approved by the Municipality, on a case-by-case basis.

SECTION 4 - WATERMAINS

4.1 INTRODUCTION

4.1.1 General Requirements

This section presents requirements for the design and construction of water distribution systems. All water distribution systems including watermains, services, private watermains and appurtenances shall be designed and installed to the following:

a) Municipality of Strathroy-Caradoc Standards;

b) Reg. 435/93, 170/03 and any other regulations under the Safe Drinking Water Act and the Ontario Water Resources Act.

These specifications shall apply to all services and private watermains and to all watermains up to 450 mm diameter including appurtenances. For watermains larger than 450 mm diameter and for any other water system installation, special specifications must be prepared for and approved by the Municipality.

4.2 APPROVAL OF PLANS

4.2.1 Watermains

a) Preliminary Approval
Approval of plans by the Municipality will be required prior to installation of watermains. All plans shall be prepared in metric. Submission for preliminary approval shall consist of:

i) One (1) digital copy of the proposed layout plan. Preferred scale is 1:1000. The layout plan shall show the location of the proposed watermains and the existing watermains to be connected, dimensioned to street lines, the location of valves and hydrants and the size and type of pipe.

ii) One (1) digital copy of the detail plan and profile drawings. Preferred scale is 1:250 horizontal and 1:50 vertical.

The detail drawings for new subdivisions shall show in plan the proposed watermain, sewers, other existing and proposed utilities and all surface detail within the street allowance. In profile they shall show the existing and proposed ground surface, proposed watermain and details of other existing and proposed utilities where they pass over or under the watermains.

Both plan and profile shall show all details of watermain installation including valves, hydrants, fittings, offsets, deflection angles, joint thrust restraints, concrete thrust blocks and other pertinent details. Watermain profiles shall be shown as straight line grades with centerline of pipe elevation shown at each grade change and percent grade of each section shown. Hydrants to have flange elevation shown. Detail drawings for watermains or watermain extensions on existing streets shall show, in addition to the above requirements, all other existing utilities in plan and profile relative to proposed watermains.

iii) One (1) digital copy of the design data and calculations for the watermain or watermain system. This information shall include domestic and fire design flows used, location of fire demand flows and resulting head loss in each section of watermain.

iv) In addition to submission of copies of drawings, a digital version of the drawings on USB in AutoCad release 14 (or latest version) must be submitted.

A computer analysis shall be carried out on the proposed system, the results of which should be noted on a general plan of the system together with an indication of the conditions imposed in the program.

A Functional Servicing Report along with all other necessary information shall be provided to the Municipality. The Municipality will hire a third party to complete modeling to confirm adequate capacity within the water system. This modeling will be paid for by the Developer.

b) Final Approval

A final digital submission shall then be made consisting of the layout plan and detailed drawings, revised as requested, as well as the completed and signed Ministry of Environment, Conservation and Parks (or the applicable environmental agency) (FORM 1) application for the approval of proposed Waterworks.

The Ministry application documents will be signed by the Municipality as the operating authority of the Strathroy Water System.

For installation of watermains, the Developer must have final approval from the Municipality and all required agreements executed with the Municipality prior to construction.

c) Revisions

Any changes required by the Developer to plans which have final Municipality approval must be resubmitted to the Municipality for approval before such changes can be made in the field.

d) As Recorded Drawings

Prior to and as a condition of assumption, the Developer shall ensure that one complete digital set of “as recorded” drawings is supplied to the Municipality. Drawings shall be layout plan and detail drawings, as specified in Section 4.2.1.1(a) and (b), revised to show all changes made during installation. The Developer or their agent shall provide the drawings in digital form on a USB in AutoCad and PDF format, including a list of layers and pen settings used. Refer to Section 9.4 for additional details regarding “As-Recorded” drawing requirements.

4.2.2 Services and Private Watermains

When services are larger than 50 mm (2”) diameter, when fire protection may be required, when more than one building is serviced off one private watermain or when any other problem may exist, the Developer must submit plans to the Municipality for approval. When a final submission drawing has been approved and returned to the Developer and the Developer has paid all applicable charges, the Municipality will authorize installation or inspection of the service.

For installation of private watermains, the Developer must have written approval and must comply with the Municipality General Conditions, Specifications, and Standard Drawings for the Water Distribution System (latest revision), Ontario Watermain Disinfection Procedures (latest revision) and the Ontario Plumbing Code (latest revision).

a) Preliminary Approval

A digital copy of the site plan(s) must be submitted. Preferred scales are 1:250 or 1:500. Drawings shall show: location and size of watermain to be connected to; location of service and private watermain dimensioned from property line or structure; offsets from sanitary sewer and storm sewer; type and size of pipe, fittings, valves, and hydrants; size and location of meters; type of fire protection system with maximum volume of water required in L/min. and location of siamese connections; all site structures, poles, hydrants, roads, driveways, parking areas, sidewalks and sewers; municipal number, assessed frontage, lot dimensions, acreage, floor area, number of storeys and number of dwelling units. One preliminary drawing will be marked with required revisions and returned to the Developer or his agent.

b) Final Approval

A digital copy of the site plan(s) showing all requested revisions must be submitted for final approval.

c) Revisions

Any changes required by the Developer to plans which have final approval must be resubmitted to the Municipality for approval before such changes can be made in the field.

4.3 DESIGN AND LAYOUT OF WATERMAINS

4.3.1 Watermain Location

Water Distribution Systems shall be laid out in the gridiron system or so that they can be later incorporated in a gridiron system. Dead end watermains will not be allowed, unless unavoidable. Watermains located on a cul-de-sac shall be looped with a 50mm watermain as per Drawing SCSD-37.

Watermains shall be located in accordance with Drawings SCSD-1, SCSD-2 and SCSD-3. Deviation from the standard location must be approved by the Municipality.

The standard location must be used on straight streets. On bends, the Watermain may deviate from the standard up to 1.0 m closer to the street line but not closer to the curb and gutter. Maximum use shall be made of pipe joint deflections so that a minimum number of bends are used on any curved laying line. Refer to AWWA C600 and suppliers' specification for allowable joint deflection and pipe bending.

Watermains shall be terminated opposite street lines or property lines.

Watermains shall have no less than 1.7 m (5'6") from final surface grade. Variations from this cover may be made only if approved on plans or in writing by the Municipality.

4.3.2 Watermain Design

a) Pressure and Flow Requirements

Watermains shall be sized to maintain the greater of:

i) All watermains, including those not designed to provide fire protection, should be sized after a hydraulic analysis based on flow demands and pressure requirements.

The system should be designed to maintain a minimum pressure of 140 kPa (20 psi) at ground level at all points in the distribution system under maximum day demand plus fire flow conditions. The normal operating pressure in the distribution system should be approximately 350 to 480 kPa (50 to 70 psi) and not less than 275 kPa (40 psi). Pressures outside of this range may be dictated by distribution system size and/or topography. The designer should also consider pressure losses within serviced buildings due to the installation of equipment or appurtenances (water meters, backflow preventers, etc.) relative to the minimum operating pressure in the system.

The maximum pressures in the distribution system should not exceed 700 kPa (100 psi) to avoid damage to household plumbing and unnecessary water and energy consumption. When static pressures exceed 700 kPa (100psi), pressure reducing devices should be provided on mains or service connections in the distribution system

ii) The pipes shall be designed so that the velocity for normal rates will be between 0.9 and 1.5 m/s (3 to 5 ft/sec.). The maximum velocity for fire demand shall not exceed 3.0 m/s (10 ft/sec.).

b) Domestic Water Demands

Average day domestic demand for design shall be 250 L/D (55 IGPD) per capita.

Maximum peaking factors of 3.5 for maximum day and 7.8 for maximum hour shall be used for design.

Use	Population per unit
Low Density Residential	2.4 people per unit
Medium Density Residential	2.4 people per unit
High Density Residential	1.6 people per unit

c) Commercial, Institutional and Industrial Water Demands

These demands vary greatly with the type of water using facilities or process present in the development. If the Developer (designer) does not know the required demand he should refer to Ontario Ministry of the Environment, Conservation and Parks (or the applicable environmental agency) "Guidelines for the Design of Water Distribution Systems". For industrial demands the Developer (designer) should discuss water requirements with the Municipality.

d) Fire Demands

To estimate the fire flow requirements for a particular structure or area of a Municipality, the designer should refer to the guide "Water Supply for Public Fire Protection - A Guide to Recommended Practice", (latest revision) prepared by Fire Underwriters Survey, Insurers' Advisory Organization. For further fire related requirements refer to the Ontario Building Code, the Ontario Fire Code, and NFPA 13 Standards.

e) Friction Factors

The following Hazen-Williams "C" values shall be used for design, regardless of material:

Diameter	“C” Factor
100 and 150mm	100
200 and 250mm	110
300 to 600mm	120
Over 600mm	130

f) Minimum Pipe Sizes

The minimum size for watermains shall be 150 mm (6”) diameter, except beyond the last hydrant on cul-de-sacs where smaller diameter pipe shall be used and designed for domestic and maximum hour demands only. Smaller diameter watermain may be used in a looped system at the discretion of the Municipality. However, consideration for future expansion and growth must be made in determining appropriate watermain sizes, as directed by the Municipality.

4.3.3 Watermain Valves

In developments of single family and semi-detached units, valves shall be distributed so that any section of watermain serving up to sixty (60) units can be isolated by operating not more than four (4) valves.

In these residential areas, valves shall be spaced no more than 250 m (820') apart and in high density residential, industrial, and commercial areas, no more than 150 m (500') apart. Feeder watermains should have valves spaced no more than 400 m (1300') intervals.

At intersections where smaller watermains connect to larger feeder watermains, each smaller watermain shall be valved whereas the larger watermain shall be valved as required above.

Watermains crossing rivers, railways and controlled access highways shall be valved on each side of the crossing.

Valves shall be located on the extension of street lines or according to Drawing SCSD-28. Valves shall be located on all hydrant laterals according to Drawing SCSD-26. All valves shall be provided with valve boxes. All valves shall be located to avoid installation in driveways and sidewalks.

Air release valves shall be placed at all significant high points of the system. These valves shall be located in approved chambers. Prior to design, the designer should discuss site specific requirements with the Municipality.

4.3.4 Blow-offs and Dead Ends

All watermain layout shall be looped to avoid dead ends. If a dead end is unavoidable a hydrant and valve shall be installed on the end and an automatic flushing device with water usage paid by the Developer which may be required at the discretion of the Municipality. The Municipality may require the Developer to submit cash for the future extension of the system so that it can be looped.

For a street to be extended in the future a hydrant and valve shall be installed on the end. In certain cases, a blow-off may be allowed on the end of a short section of watermain upon approval by the Municipality.

All dead ends, both temporary and permanent shall be equipped with an automatic flushing device.

Where an automatic flushing device is used to maintain water quality, a water meter (in a meter pit) shall be installed to measure the volume of water discharged. Refer to SCSD-38 and SCSD-39 for details. The Developer will be charged for all water used. Designers must provide calculations which indicate the volume of water to be discharged by the automatic flushing device, including the device sizing and timing settings. This information must also be shown on all related drawings. The Developer's Contractor is responsible to set up the automatic flushing device to the specified setting.

Designers must consider the following when proposing an automatic flushing device:

a) Automatic flushing devices may not discharge directly to a ditch or natural environment due to chlorine content.

b) Any water discharged from an automatic flushing device must have a total chlorine residual less than 1.0 mg/L.

c) Under normal conditions an automatic flushing device is to discharge to a storm sewer, which ultimately discharges to a stormwater management pond where the remaining chlorine can dissipate prior to being released or discharged to the natural environment. In any situation where there are large volumes of water potentially being discharged from an automatic flushing device, or where the receiving storm system is a sensitive system, further consultation is required with the Municipality.

d) Where an automatic flushing device is not required to maintain water quality, a standard 50mm blow-off will be required to allow flushing to take place.

e) On cul-de-sac or similar streets, blow-offs, when required, shall terminate in the boulevard. Blow-offs must be operable without the necessity of excavating.

4.3.5 Watermain and Other Utilities Separation

Designers should refer to Ontario Ministry of Environment Conservation and Parks (or the applicable environmental agency) Guidelines regarding the location of watermains relative to sewers and to the Public Utilities Act of Ontario regarding the location of watermains relative to other utilities.

a) Parallel Installations

Sewers and watermains located parallel to each other should be constructed in separate trenches maintaining the maximum practical horizontal and vertical separation as noted in the Ontario Ministry of the Environment Conservation and Parks Guidelines.

Under normal conditions, watermains shall be laid with at least 2.5 m (8') horizontal separation from any sewer or sewer manhole. The horizontal distance shall be measured from the nearest edges.

In cases where it is not practical to maintain separate trenches, deviation from the above may be permitted provided that there is no less than 1.5 m (5') clear horizontal separation and the crown of the sewer at least 0.50 m (1'8") below the invert of the watermain. Where this vertical separation cannot be achieved, the sewer shall be constructed of materials and joints that are equivalent to watermain standards of construction and shall be pressure tested at a pressure of 350 kPa (50 psi) with no leakage. Any deviation is subject to approval by the Municipality in conjunction with other remedial measures.

b) Crossings

i) Under normal conditions, watermains shall cross above sewers and (Private Drain Connection) PDC's with a vertical separation of 0.15 m (6") to allow for proper bedding and structural support of the watermain and sewer or PDC. Where crossing above sewers requires the pipe to be laid with less than 1.5m (5') of cover, insulation shall be placed to prevent freezing as per Drawing SCSD-23.

Type and configuration (box, channel, flat top, etc.) of insulation shall be reviewed and accepted on a case-by-case basis.

ii) Where it is not possible for the watermain to cross above the sewer or PDC, the watermain passing under a sewer or PDC shall be protected by providing a vertical separation of at least 0.15 m (6") between the invert of the sewer or PDC and the crown of the watermain.

4.4 DESIGN AND LAYOUT OF SERVICES AND PRIVATE WATERMAINS

4.4.1 Domestic Service

a) Size Required

The Developer will be responsible for private watermain and service sizing.

The Municipality should be consulted for available pressures and flows at the watermain under design conditions given in Section 4.3.2.1. If the results of hydrant flow tests are to be used, the Municipality should be consulted for necessary adjustments since flow tests are not usually performed at design conditions. Minimum size for services is 25 mm (1") diameter.

b) General Requirements

i) All structures, including duplexes, apartments, commercial, industrial, and institutional properties shall have one meter and one service connected to a watermain or private watermain. For private developments, a meter pit shall be installed at Property Line. Similarly, where the distance from property line to the building is greater than 30m, an approved meter pit is required at property line, or as specified in the most current version of the Municipality's Water Supply Control By-Law. Meter pit is to be Ford Model PDBHC-444-20-60-nl, including insulating cover, or an approved equivalent.

ii) Swimming pool facilities and lawn sprinkler systems must be serviced by connecting to the metered side of a service that is in use yearlong and that is in a heated structure.

iii) When there are two (2) watermains on a road allowance, the water service shall be laid from the structure to the watermain that, in the opinion of the Municipality, provides adequate flow and/or pressure.

iv) Services to semi-detached housing must front the unit they serve.

v) All new development shall include grounding of electrical system other than to the water system. Refer to Ontario Hydro Electrical Safety Code (Section 10) for grounding requirements.

vi) Each property shall have a single service and single meter.

c) Looped Private Watermain

Looping private watermains to municipal watermains is not permitted.

d) Location

The service pipe must be installed at right angles to the watermain and in a straight line from the watermain to the meter. The standard single unit residential or subdivision service stub is typically located to pass through the midpoint of the lot frontage provided that the meter can be located per Section 4.4.6.

A private watermain to a complex of structures shall be located to serve all structures in the complex with the least number of bends possible. Services off a private watermain are subject to the same requirements as services off a watermain.

Any private watermain ending in a dead end must have a hydrant and valve installed at the end.

4.4.2 Fire Service

a) Fire Service Design

The determination of fire service requirements and the sizing of supply piping shall be the responsibility of the Developer. If a domestic service is combined with a fire supply service, the Developer is responsible to ensure that the supply pipe is large enough to carry the combined demand. Design and installation of sprinkler and standpipe systems and their supply services shall conform to the requirements of the Ontario Building Code, Section 4.3.2, the Fire Code, NFPA 13 Standards, and the Fire Underwriters Survey and must be approved by the Chief Official (Fire Prevention Office) of the Municipality of Strathroy-Caradoc.

The designer should obtain information from the Municipality regarding flows and pressures available for fire systems. If the flows and pressures required are in excess of the minimum design standards given in Section 4.3.2 and in excess of the actual capacity of the system, the Developer shall install booster pumps and/or storage to satisfy the required demand.

b) Fire Service Layout

Layout and installation of fire services to the structure including required valves and hydrants must be approved by the Municipality and the Fire Department. This requires a submission of plans as specified in Section 4.2.1.

For fire service layout and details, refer to Drawing SCSD-29 and SCSD-31.

Sprinkler and standpipe services may be combined or a domestic service may be combined with either or both but the Developer is advised to obtain the approval of his Insurance Underwriter before combining them.

All fire protection systems must have a reduced pressure backflow preventer device conforming to CSA Standards.

4.4.3 Services to Blocks in Subdivisions

Where service stub size and/or location for any block cannot be determined prior to street construction, the Municipality will not approve installation of the service stub. The following policy administered by the Municipality will apply and the cost will be paid by the Developer of the block serviced. “Where any water service connection is required to be made following the construction of curb, gutter, concrete sidewalk and/or wearing surface coat of asphalt on any street in a new subdivision, such water service connection shall not be made using "open cut" methods but shall be made using drilling or boring techniques and in such a manner as to eliminate the possibility of settlement of such curb, gutter, concrete sidewalk or wearing surface coat of asphalt. This policy shall apply except where, in the opinion of the Municipality, ground conditions are such that the use of drilling and boring methods become unreasonable or uneconomical.”

4.4.4 Services and Backflow Prevention

All industrial, commercial, institutional and multi residential buildings must be equipped with a cross connection control device, or as specified within the most current version of the Water Supply Control By-law.

Backflow preventers shall be per AWWA Standard C506 and shall conform to the requirements of the Ontario Water Resources Act, Plumbing Code, O.R. 401/91 or latest revision.

4.4.5 Service and Private Watermain Valves

On services of 50 mm (2”) diameter and smaller, a main or corporation stop shall be installed at the watermain and a curb stop shall be installed on the property line. It is the Municipality’s preference that services are to be located such that curb stops are not located in driveways, where possible.

On services of 100 mm (4”) diameter and larger where the watermain cannot be closed off for the service connection, a tapping sleeve and valve will be required at the watermain. Where the watermain can be closed off and a tee cut into it, or where a new watermain is being installed, a valve shall be installed on the property line.

Services to structures in a complex that are to be connected to a private watermain shall have the curb stop or valve placed at the service main.

Valves shall be installed on private watermains to isolate buildings or groups of building so that no more than sixty (60) individual services are on any one valved section. The Developer shall install a valve on the street watermain between connections to a looped private watermain if there is no existing valve.

All service valves and curb stops shall be installed with valve boxes and operating rods.

The Developer shall ensure that service control valves on his property are not covered by "mound" or "berm" type landscaping.

4.4.6 Meters

All services must be metered. If the meter location is greater than 30 m from the property line, a meter pit will be required at the property line. Condominium complexes must have a meter pit at property line. Private properties with multiple services or servicing multiple units must have a meter pit installed at the property line. Fire services may not be metered at the Discretion of the Director except sprinkler systems in individually metered dwelling units. The meter shall be installed immediately inside the point of entry of the building. Any variation from this location must be approved in writing by the Municipality. The Developer shall provide sufficient space for installation and maintenance of the meter. The Municipality will supply and install the meter. The meter must be accessible for reading and maintenance and must be protected from freezing and other damage. All meters and backflow preventers shall be located in a heated room for services up to and including 25mm (1”) in size if they are not installed in a meter pit.

Accessible for reading and maintenance means that the meter must be installed in a location where an adult person can access the meter with room to perform the required work. At no time shall the meter be enclosed by any type of permanent construction within the building.

If the meter is not readily accessible and it is necessary to remove parts of walls or other fixtures to gain access, all costs for this work shall be the customers responsibility.

The meter or piping shall be no closer than 1 m (39”) to any electrical panel or above or below any electrical panel nor installed in an electric meter room.

Meter Valving

All new or upgrade installations shall require a valve on each side of the meter.

The Owner is responsible and must maintain all valves for all meter sizes.

Property line meters shall be installed in an approved chamber/pit when the distance between the property line and meter location is greater that 30 meters or if there are multiple units.

4.5 LAYOUT OF HYDRANTS AND FIRE DEPARTMENT CONNECTIONS

4.5.1 Hydrants on Public Streets

Hydrant spacing shall be no greater than 140 m (450’) in residential areas, and 105 m (350’) in commercial and industrial areas, measured along the centerline of the watermain. Hydrants shall be placed at every second intersection. Hydrants shall be placed 0.60m (2’) from the property line at lot lines whenever possible, conforming to Drawing SCSD-26.

If a non-standard location is required, details must be submitted to the Municipality. Hydrant valves shall not be located in sidewalks. All hydrants shall be valved with counterclockwise opening valves.

For a more detailed discussion of hydrant spacing requirements, refer to "Water Supply for Public Fire Protection" - A Guide to Recommended Practice.

4.5.2 Hydrants on Private Property

Hydrants will be located on private property where required by the Fire Department. Fire hydrants must be installed at grades such that they are readily accessible to the fire department and a minimum of 3.0 m (10') from a building foundation. The Developer must supply, install and maintain these hydrants. The Owner must also maintain and test the hydrants annually.

a) Hydrants for Fire Department Connections
Refer to requirements within Section 3.2 of the Ontario Building Code.

b) Protection of Hydrants
Bollards are to be installed in sufficient number to protect a hydrant from damage where placement of the hydrant increases the possibility of damage from vehicular traffic. The minimum distance from any bollard to a hydrant is 0.65m, measured centre to centre.

Bollards shall be 1.0m in height above ground. Bollard material is steel with concrete fill, painted hydrant yellow.

4.6 MATERIAL

The Municipality has sole discretion in choosing the type of pipe material to be used in any given situation. In general, the most current version of OPSS 701.05 Construction Specification for watermain installation in open cut, materials are to be followed with the following amendments.

Transition from one pipe material to another must be made at a valve or joint (tee or cross).

The Municipality may approve the use of jack and bore, and directional boring as alternative construction techniques. The Municipality has sole discretion in their use on a per project basis. Design calculations submitted shall conform to the current standards accepted by the industry. Design and construction methods including materials shall be submitted to the Municipality for review and approval.

Protective shipping and storage end caps are required for all watermain pipe material.

4.6.1 Pipe Material

Replace OPSS 701.05.02 – 701.05.09 for pipe material and fittings with:

a) Concrete Pressure Pipe

The use of concrete pressure pipe may be accepted in special circumstances (i.e. trunk lines) at the discretion of the Municipality. Concrete pressure pipe is to be designed in accordance with current standards and to the Municipality's satisfaction.

b) Ductile Iron Pipe

The use of ductile iron pipe is not acceptable to the Municipality.

c) Polyvinyl Chloride Pipe (PVC) – Flexible Pipe

The Polyvinyl Chloride (PVC) plastic pipe shall be constructed of rigid polyvinyl chloride compound and shall conform to the current AWWA C-900 (CSA B-137.3). Polyvinyl chloride plastic pipe shall be Class 150 (SDR 18) for sizes up to and including 300mm diameter.

All watermain pipe delivered to site shall be "Factory Capped". For watermains larger than 300mm diameter the type of watermain shall be determined in consultation with the Municipality.

Pipes shall be supplied in standard lengths of not less than 6 meters nor more than 11.6 meters except that short lengths and special adaptor shall be provided as required for completing connections or where ground conditions are such that shorter lengths are necessary. Pipes shall be joined by means of a "Tyton" type rubber ring bell joint which shall be an integral and homogeneous part of the pipe barrel. Rubber rings shall conform to ASTM Specifications D1869.

The class and type of pipe shall be stenciled on each length of pipe.

Joints shall be bell and spigot with rubber gaskets. The spigot shall be lubricated. A solid 12-gauge TWN copper wire must be supplied along the full length of the pipe to provide electrical continuity for location purposes.

Fittings:

Fittings shall be cast iron with mechanical joint or push-on ends adapted for use in making connection with PVC pipe and in accordance with AWWA C110 and C111. All fittings shall be cement lined in accordance with AWAA C104.

PVC Injection Molded Fittings with push-on joints (for use with PVC and PVCO Pressure Pipe conforming to AWWA C900, CSA 137.3, and AWWA [C909], CSA B137.3.1 having cast iron OD) shall conform to AWWA C907, shall be UL listed and FM approved and shall be certified by the Canadian Standards Association to CSA Standard B137.2.

Joint Thrust Restraints:

All fittings shall be installed with mechanical restraints. Restraint devices to meet or exceed the minimum requirements of ASTM F 1674-96, be UL listed and FM approved.

Restraining glands (100 to 300mm) to be manufactured of high strength ductile iron conforming to the requirements of ASTM A536, Grade 65 45 12 m (min) (400 to 600mm) shall be manufactured of structural steel conforming to the requirements of ASTM A36. Pipe joint restraints shall be designed for the same design, test and surge pressure ratings as the pipeline in accordance with AWWA-M23 PVC pipe design and installation.
All restraints are to be installed as per the manufacturer's specifications and torqued using a calibrated torque wrench. If the contractor uses power equipment during installation, it shall be set so as not to over torque the bolts. Final torquing of bolt shall be done using a torque wrench set to the proper torque.

All fittings and joints must be restrained as determined by the manufacturer and approved by the Municipality and noted on the drawings. At minimum, no less than three (3) joints (minimum 18.0 m length) in each direction from each fitting, valve and dead end must be restrained. Refer to Standard Drawing SCSD-21.

d) Pipe – Directional Drilling

When directional drilling is accepted by the Municipality, the following materials shall be used:

For watermains installed by directional drilling, pipe material shall be fusible polyvinyl chloride (PVC) DR18. Use of fusible PVC will require the pipe supplier to provide written confirmation of a suitable wall thickness, but in no case shall the wall thickness be thinner than DR18.

Thermal Insulation:

Material used to thermally insulate watermains shall have a minimum compressive strength of 690 Kpa (100 psi). Approved material is STYROFOAM HI 100 BRAND by Dow Chemical or Approved equal.

4.6.2 Cathodic Protection

All Cast Iron (CI) fittings shall be protected with 14.5 kg (32 lb.) high purity magnesium anode. The anode shall be attached to the fitting used a Cadwell and coated with mastic (Handy Cap IP).

All curb stops and main stops shall be protected with a 5.5 kg (12 lb.) high purity zinc anode. Anode shall be attached to the curb stop using the electrical thaw nut. Fire hydrants shall be protected using 14.5 kg magnesium anode attached using Cadwell.

Epoxy coated gate valves do not require cathodic protection unless, in the opinion of the Municipality, the epoxy coating is compromised.

All exposed nuts and bolts shall be protected using Denso Paste, Mastic and Tape. All pipe and/or fitting restraints and rods shall be protected using Denso paste, mastic and tape.

4.6.3 Tracer Wire

For purposes of locating plastic pipe, a solid 12-gauge TWN copper wire must be installed along the top of the pipe, strapped to it at 6.0 m (20') intervals. The wire must be installed between each valve and/or the end of the watermain.

Joints in the wire between valves will not be allowed. At each valve, a loop of wire must be brought up outside the valve box (Drawing SCSD-32).

The tracer wire must not be wrapped around the valve-operating nut. The inspector must test the tracing wire for conductivity. If it is not continuous from valve to valve, the Developer shall, at their expense, replace the wire.

At all hydrants a continuous loop of wire must be brought up the backside of the barrel. A 40 mm (1 ½") PVC pipe shall be used to protect the wire as shown on Drawing SCSD-26 .A Copperhead Industries cobra access point with a 40mm (1 ½") PVC pipe and Cobra Hydrant Flange Package or approved equivalent must be installed on hydrants to allow for testing.

In cases of installing plastic watermain pipe by directional drilling, double (2) tracer wires must be installed with the pipe.

4.6.4 Valves

All watermain valves shall be gate valves. All valves must be epoxy coated inside and out (minimum of 3mm thickness) and conform to AWWA C550. All valves up to 200mm diameter may be M.J. or push-on joint. Valves 250mm to 400mm diameter must be mechanical joint to allow adequate mechanical thrust restraints.

Gate valves shall be iron body, bronze-mounted, non-rising stem. Gates must be resilient seat. Valves shall be manufactured in accordance with AWWA Standard C500/C509 or other approved specification.

Minimum design working water pressure shall be 1.21 MPa (175 psi). "O" rings shall be used for valve stem stuffing box packing.

Valves to open to the Left i.e., counterclockwise and stems fitted with 50mm square operating nut with arrow showing opening direction and have S.S. nuts and bolts.

A 10.9kg zinc anode shall be connected to all watermain valves. Epoxy coated gate valves do not require anodes unless coating is damaged in the opinion of the Municipality.

a) Valve Chambers:
A cast iron valve chamber or valve box shall be supplied and installed on every watermain valve and hydrant shut-off valve. Box shall have a minimum internal diameter of 125mm and be adjustable for total length. Box to have attachable base of sufficient size to prevent box bearing on the valve. Cover to be marked WATER. Valve boxes may be the No. 5 Screw Type W\No. 6 base as manufactured by EMCO or approved equal.

b) Air Valves:
Design requirements and specifications for air release valves shall be submitted to the Municipality for approval on a case-by-case basis.

4.6.5 Hydrants

OPSS 701.05.10 has been amended with the following:

Hydrants shall conform to AWWA C502 for dry barrel hydrants. All hydrants shall open left (counterclockwise) and shall be Canada Valve Century, Clow-Brigadier M-67 with break flange, or AVK model 2780, with two 63 mm (2 ½") hose connections, and one 100mm (4") Storz (black) pumper connection.

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

All hydrants shall have tees with restraining glands as indicated on Drawing SCSD-26. All tie rods and bolts shall be wrapped with Denso paste, mastic and tape, all to the satisfaction of the Municipality.

Fire hydrants shall have a chrome yellow high gloss exterior paint over quick dry red oxide primer. Damage to the fire hydrant paint coating shall be repaired prior to installation, as per manufacturer's recommendations. Prior to the end of the one-year maintenance period, all hydrants shall be given one coat of new paint to the manufactures' specifications with approved paint and shall be serviced by the Contractor.

The Strathroy-Caradoc Fire Department reserves the right to select the required hydrant(s), appurtenances, and location of hydrant(s) depending on the fire risk of the area. Valves for buried installation shall have mechanical or push on ends as required.

All newly installed fire hydrants shall receive a flow test immediately prior to assumption, with the test results provided to the Municipality.

4.6.6 Service Connections

a) Connection Pipes

For new service connections in new subdivisions for 25 mm (1") services, the approved connection pipe material is:

Municipex: Cross-linked polyethylene service pipe shall conform to CSA-B137.5, ASTM F876 & F877, NSF 14 & 61; AWWA C904

For service connections with 38 (1 ½") and 50 mm (2") services, the approved pipe material is:

Municipex: Cross-linked polyethylene service pipe shall conform to CSA-B137.5, ASTM F876 & F877, NSF 14 & 61; AWWA C904

b) Service Fitting Appurtenances

OPSS 701.05.12 has been amended with the following:

i) Service Saddles:

25 mm (1") services may be direct tapped into all sizes of DI and CI watermains except a service saddle must be used for a 25 mm (1") service into a 100 mm (4") watermain. Service saddles must be used for all sizes of service into PVC pipe and for 38 mm (1 ½") and 50 mm (2") services into CI and DI pipe.

All saddles shall have AWWA thread outlet. Saddles for DI and CI pipe shall have ductile iron epoxy body with electro galvanized steel double straps and bolts.

Approved service saddles are:

- For PVC 100mm (4") to 400mm (16"):
  25 mm (1") outlets - Romac Style 304
  38 to 50 mm (1½ to 2") outlets - Romac Style 306
  25 to 50 mm (1 to 2") outlets – Ford Style FS303
  25 to 50 mm (1 to 2") outlets – Rockwell Style 372
  25 to 50 mm (1 to 2") outlets – Cambridge Brass "Teck" Series 403 double bolt
  25 to 50 mm (1 to 2") outlets – Robar Series 2616 double bolt

- For DI and CI:
  25 to 50 mm (1 to 2") outlets – Romac Style 202S and 202NS

Saddles for PVC pipe shall be full circumference wide band with stainless steel band, nuts, bolts and outlet. Band shall be Type 304 Stainless Steel of minimum 18-gauge thickness.

ii) Tapped Service:

The use of tapped service shall be reviewed on a case-by-case basis and must be approved by the Municipality.

iii) Watermain Stops:

Watermain stops shall be brass ball with inlet AWWA thread and outlet compression.

Approved watermain stops for Municipex pipe are:

Cambridge Brass, Series 301	Ford	Mueller
25 mm (1”) – 301-A3H4 38 mm (1½”) – 301-A3H6 50 mm (2”) – 301-A3H7	All Sizes – F100	All sizes – B-25008

For services connected to private watermains, main stops may be replaced by Ford F60 main stop with AWWA thread inlet and outlet compression.

iv) Curb Stops:

Curb stops shall be brass ball with both inlet and outlet compression.

Approved curb stops for Municipex pipe are:

Cambridge Brass, Series 202	Ford	Mueller
25 mm (1”) – 202-H3H4 38 mm (1½”) – 202-H3H6 50 mm (2”) – 202-H3H7	25 mm (1”) - B44-444 38 mm (1½”) - B44-666 50 mm (2”) - B44-777	All sizes – B-25209

v) Couplings:

Couplings shall be brass with both inlet and outlet compression.

Cambridge Brass, Series 119	Ford
25 mm (1”) – 119-H4H4 25mm	25 mm (1”) - C44-44
38 mm (1½”) – 119-H6H6	38 mm (1½”) - C44-66
50 mm (2”) – 119-H7H7	50 mm (2”) - C44-77

Mueller
All sizes - H15403

vi) Services Boxes and Rods:

Shall be CI type to suit curb stop and shall have 20mm (3/4”) 5 sided brass lid plug.

Length shall be adjustable to suit depth of service.

Approved boxes for 25 mm (1") curb stops are:

Mueller	Domestic
H10385 & H10386	Style No. DF900

Service rods including cotter pin shall be stainless steel of minimum 13 mm (1/2") diameter.

Approved boxes for 38 mm (1½") and 50 mm (2") curb stops are:

Mueller	Cambridge Brass
H10385 & H10386 - Operating rod to have modified top to enable use of same key as used on the H10385 & H10386 box	Series 161-1

vii) Removals and Abandonment

Disconnection of existing water services of all diameters to include disconnection at property line and watermain, removal of curb stop box and rod. On Ductile Iron and Cast-Iron Mains, an installation of a Corporation Stop Encapsulator must be installed at the watermain connection main stop. The Corporation Stop Encapsulator is to be manufactured by Smith-Blair, or an approved equivalent. Otherwise, a plug on the saddle must be installed.

4.6.7 Concrete

Concrete for thrust blocks shall conform to OPSS 1350 with a nominal minimum twenty-eight-day compressive strength of 20 MPa.

Concrete thrust blocks to be used for vertical bends only and must be used in conjunction with mechanical joint restraints for stability. All restraint shop drawings from the Manufacturer must be stamped by a Professional Engineer. Unstamped restraint shop drawings will not be accepted.

Granular materials greater than 20 mm (3/4") in size shall not be used for pipe bedding.

Concrete for bedding shall conform to OPSS 1350 with minimum 28-day strength of 15 MPa.

4.6.8 Pipe Bedding Materials

Granular materials greater than 20 mm (3/4”) in size shall not be used for pipe bedding.

Concrete for bedding shall conform to OPSS with minimum 28-day strength of 15 Mpa.

4.7 CONSTRUCTION

In general, the current version of OPSS 701.07 Construction Specification for Watermain Construction by open cut method, construction to be followed with the following amendments.

All installations shall be subject to the inspection, approval, and acceptance of the Municipality. Any portion of the work that is backfilled before inspection by the Municipality will not be approved unless the trench is reopened and the pipe inspected. The provision of inspection by the Municipality is not to be considered a substitute for supervision by the Developer.

The Developer must engage the services of a Consultant who shall provide a qualified inspector for full time inspection during construction. An inspector must have completed the MEA/MOE Inspectors Course for the Construction of sewers and watermains or a consultant may obtain approval from the Municipality upon written request for use of Inspectors with a minimum of ten (10) years related construction experience in lieu of the MEA/MOE Inspectors Course.

4.7.1 Site Preparation

Site preparation shall conform to OPSS 503.

4.7.2 Protection Against Flotation

Damage to the watermain and/or service connections due to hydrostatic pressure shall be prevented during construction.

4.7.3 Cold Weather Work

All work related to temporary aboveground or permanent below ground watermains shall be protected from freezing. Pipes and bedding materials shall not be laid on frozen ground.

4.7.4 Transporting, Unloading, and Storing Pipe

Delivery and unloading of pipes and fitting at the job site shall cause the least possible delay to traffic. All pipes, specials, fitting and gaskets that are unsound or damaged shall be removed from the site and replaced.

Protective shipping and storage end caps are required for watermain pipe material.

Manufacturer's handling and storage recommendations shall be followed.

4.7.5 Dewatering

Dewatering shall conform to OPSS 517 and be certified by Professionals experienced in dewatering.

4.7.6 Shoring and Bracing

Shoring and bracing shall conform to OPSS 538.

4.7.7 Connection to Existing Watermains

All connections are to be witnessed by the Municipality.

Dewatering and removal of any plugs, caps, blow offs and for thrust blocks from an existing watermain or fitting and reconstruction of the joint will be considered part of the work of constructing the new watermain.

Where connections are to be made to DI pipe using steel tapping sleeves the installation must be mastic coated. Clean sand bedding shall be used at least 300 mm (1') above and 150 mm (6") beneath the installation. Tapping of PVC pipe must be done as recommended by the pipe manufacturer. The sleeve must be supported and blocked during tapping and supports for the sleeve and valve must be left in place. Thrust blocks must be used.

Connecting to PVC watermains: Refer to UNI-B-3 - Section 5.3.6. Direct tapping is not permitted.

Watermain tapping will be completed by the Municipality and paid for by the Contractor/Developer at the applicable rates. The Contractor/Developer will also be required to provide all the necessary parts to complete the connections.

4.7.8 Shutting Down or "Charging Watermains"

The Contractor shall not shut down or fill any watermain that is in service or operate any gate valve or other control for any purpose. Operation of all valves, hydrants, blow-offs and curb stops shall be performed solely by the Municipality.

At least 48 hours' notice must be provided to the Municipality and Property Owners when valves which will shut off services to consumers are required to be operated.

The Contractor shall give notice of interruption of service to consumers at least forty-eight (48) hours before the interruption occurs. The Contractor shall prepare notice cards and submit to the Municipality for review at no charge and upon approval, shall distribute them at no expense to the Municipality.

4.7.9 Trenching, Backfilling, and Compacting

Trenching, Backfilling, and Compacting shall conform to OPSS 514.

Approved excavated materials may be used for backfill under roads, sidewalks, and driveways where an independent soils investigation carried out by a Soils Consultant indicates that it is practical to do so. Compaction of the material shall be carried out in accordance with the recommendations of the Soils Consultant.

If excavated material is unsuitable, the trench shall be backfilled with granular material conforming to MTO Granular 'B' and compacted to 95% of its maximum Standard Proctor Density.

4.7.10 Pipe Bedding

Pipe bedding shall be shaped true to the line and grade, free from sags and high points. Bedding shall be shaped to a cylindrical surface with the radius conforming to the pipe in accordance with pipe manufacturer's recommendations. Bedding materials shall be placed simultaneously on each side of the centre line of the pipe.

Bedding shall extend to a minimum depth of 100mm below the pipe barrel and shall be brought up around the pipe to a minimum depth of 300mm above the top of pipe and shall be compacted to 98% modified Proctor Density. The width of bedding shall be the width of the trench.

Granular bedding shall be per OPSD. Granular bedding shall be uniformly compacted in layers not exceeding 150mm (6") in thickness.

Compaction shall conform to OPSS 501 with a density of not less than 95 percent of the maximum dry density.

4.7.11 Installation of Pipes

All watermain installation shall be performed in accordance with manufacturer's instructions and the latest requirements of the relevant Watermain Installation regulations and Occupational Health and Safety Act.

4.7.12 Jointing

Joint surfaces shall be clean. Pipe ends shall be lubricated with material recommended by the pipe manufacturer. Manufacturer's instructions for jointing pipes shall be followed. Joints and all connections shall be made watertight.

Pipe shall be pulled or pushed only by hand power operated winch. A backhoe shall not be used for pushing pipe.

Joints shall be prevented from opening after the pipe has been laid.

a) Jointing Polyvinyl Chloride (PVC) Pressure Pipe

   i) Bell and Spigot Joints:

   Jointing of PVC pipe shall be in accordance with UNI-B-3-92 and manufacturer's specifications.

   ii) Restrained Joints and Thrust Blocking:

   Thrust block and joint restraining as per UNI-B-3-92, UNI-B-l 3-92 and manufacturer's specifications.

   Tie-rods and collars to be Denso paste, mastic and tape wrapped.

b) Cutting of Pipe

   Whenever cutting of pipe is required, the pipe shall be cut in conformance with the recommendations of the pipe manufacturer.

4.7.13 Change in Line and Grade

a) PVC Pipe

   PVC pipe may be deflected in order to follow the curvature of the trench. Such deflections may be accomplished by a combination of joint deflection and axial flexure of the pipe to the extent recommended by the pipe manufacturer.

Where it is not possible by using allowable joint deflection or pipe bending to lay pipe to the required radius or relocate pipe past an obstruction bends must be used including mechanical joint restraint.

4.7.14 Installation of Valves

Valves shall be installed at the locations shown on the approved design drawings. Valves and connecting pipes shall be aligned accurately and supported as specified. Damage to Epoxy coating shall be repaired prior to installation, as per manufacturer's recommendations.

4.7.15 Installation of Hydrants

Fire hydrants are to be installed at a grade, whereby the fire hydrant boot has a minimum bury of 1.7 m (5'7") to a maximum bury of 1.9 m (6'3"), measured from the base of the fire hydrant boot to finished grade.

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

A fire hydrant barrel extension of no greater than 300 mm may also be used.

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

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

Damage to the fire hydrant paint coating shall be repaired prior to installation, as per manufacturer's recommendations. Prior to assumption and as required, all hydrants shall be given one coat of new paint to the manufacturer's specifications with approved paint and shall be serviced and flow tested by the Developer.

Hydrant installation shall be according to Drawing SCSD-26.

Hydrants shall be set at a grade whereby the final grading of the street or area shall be 75 mm (3”) from the break flange of the hydrant. Grading which results in a depression or ponding at the hydrant will not be accepted.

Hydrant leads shall be constructed of the same material as the watermain line.

4.7.16 Installation of Services

Installation shall be in accordance with Drawing SCSD-24. For new installations, a blow off tail shall be installed from the curb stop to a minimum distance of 0.6 m (2’) above final grade. The tail shall be fastened to the marker stake securely.

All connections must be approved and inspected by the Contract Administrator (Developer’s Consulting Engineer).

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

For services of 100 mm (4”) in diameter and larger, the method of connection shall be prescribed by the Contract Administrator and approved by the Municipality. The method shall either cut out and install a tee, or the use of a tapping sleeve and valve.

Services 25mm (1”) can be complete via wet tap to the watermain, but such works must be witnessed by the Municipality.

The Developer/Owner is responsible for all cost to perform all connections, including supply all related appurtenances, to the watermain.

Water service connections shall be installed from the watermain to the property line at locations as shown in the Contract or as directed by the Municipality.

For services to new dwelling's where PEX water services are installed, this material must be used continuously from the watermain to curb stop, and curb stop to meter.

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

All service boxes that fall within a concrete sidewalk or driveway, shall have a 100 mm (4") pvc pipe around it.

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

4.8 WATERMAIN TESTING

At minimum, watermain testing is to be performed in accordance with the Municipality's requirements, Ontario Watermain Disinfection Procedure (latest revision) and all current provincial regulations. All stages of watermain testing must be witnessed by the Municipality. All costs associated with the testing shall be the responsibility of the Developer/Owner, including all time by the Municipality, materials, water, etc.

It should be noted that watermain leakage tests shall be performed until the measured leakage is zero.

4.8.1 Flushing, Swabbing, Pressure Testing, and Disinfecting Watermains

At minimum, all flushing and disinfection testing is to comply with all Municipal requirements and current regulations. The timing of testing works must be coordinated with the Municipality. Following completion of the flushing operation, the Contractor shall swab based upon their proposed methodology which requires Municipality approval prior to commencement.

Pressure Testing must be completed prior to disinfection. The pressure will need to be maintained at 1034 kpa. for two hours without the addition of any water. The entire water system must be included in the pressure testing which includes but not limited to the watermain, appurtenances, services, and hydrants. A pressure test will only be considered passed if there is zero pressure loss.

The Municipality must be present to witness all steps of the flushing, swabbing, pressure testing and disinfection. The Developer is responsible for all related costs including but not limited to time, materials, water, sampling, etc.

4.8.2 Disposal of Wastewater

Dispose of all chlorinated water used for testing, flushing, or disinfecting watermain in accordance with MECP requirements. No water shall be discharged to storm sewers or watercourses.

4.8.3 Bacteriological Testing

Bacteriological testing must conform to Ontario Watermain Disinfection Procedures, and any additional testing required by the Municipality.

4.8.4 Connecting Pipe

After testing has been completed and accepted, the Developer is required to complete construction connections in a timely fashion. If the connections are not completed in a timely fashion, the Municipality shall have the right to request additional re-commissioning or sampling at no cost to the Municipality.

All pipe used for connecting the new watermain to the existing system shall be thoroughly cleaned, swabbed and disinfected prior to the connection being completed to the existing system. All work is to be witnessed and approved the Municipality for the connection to the existing water system.

4.9 FINAL INSPECTION, ACCEPTANCE, MAINTENANCE, AND REPAIRS

This section applies only to waterworks constructed privately to be conveyed to the Municipality after completion.

4.9.1 Final Acceptance Inspection

Requests for "Final Acceptance Inspection" for water distribution systems shall be made directly to the Municipality.

Watermains, services, hydrants, valves and all other waterworks distribution installations will not be accepted by the Municipality until an inspection has been made by the Municipality who shall be assisted during the inspection by the Developer. The inspection shall not be made until all the finished roads, grades and lines are established. All costs incurred by the Municipality related to the Final Acceptance Inspection will be charged back to the Developer.

Any deficiencies found during acceptance inspection will be listed and submitted to the Developer for correction. The Developer remains responsible to correct all deficiencies before assumption.

4.9.2 Acceptance

After the area has been inspected and corrections made to the satisfaction of the Municipality, and the security deposit (against possible damage and/or adjustment to grade of curb boxes, valve chambers and hydrants fronting lots or blocks of land not built upon and/or the installation of additional hydrants that might be required on Municipal property) and "as-built" drawings in accordance with Municipal requirements are received, the Developer will be issued with a "Certificate of Acceptance". The Certificate of Acceptance will be in the form of a letter stating the area is accepted subject to a one-year guarantee period also listing the lots or blocks of land that are unfinished.

At the end of this guarantee period, providing all requirements herein have been met to the satisfaction of the Municipality, the Developer will be issued a Final Assumption Letter indicating the installations that, except for those covered by the security deposit, are the responsibility of the Municipality.

Regardless of the one-year guarantee period and the security deposit, lots not built upon will remain the responsibility of the Developer for the protection of the water installation.

Any required repairs to these installations, up to and including the time of the setting of the water meter, shall be the responsibility of the Developer and any work considered necessary and undertaken by the Municipality to correct deficiencies shall be charged to the Developer and withheld from the security deposit.

As the lots are built upon to the extent of no less than 30% of the lots listed as unfinished in the assumption letter and on request of the Developer, the Municipality will inspect the completed lots and on acceptance of those lots will then authorize release of security relative to the completed lots. This procedure will continue until the area is completely developed.

When a water service is provided to premises previously served by a private well, the new service will not be accepted nor turned on until the original supply is mechanically separated from the Municipality supply in accordance with the Public Health Act, latest revision and the Municipality.

4.9.3 General Maintenance by Developer

When repairs are undertaken by the Developer during the guarantee period, such repairs shall be made while the Municipality is present.

All costs incurred by the Municipality related to performing maintenance or repairs to the water system prior to assumption and during the maintenance period shall be reimbursed by the Developer.

SECTION 5 - STREET LIGHTING

5.1 GENERAL

All subdivisions shall be provided with streetlights in accordance with the standards in this section. These are the minimum acceptable standards for the Municipality and their Hydro Authority, if the developer wishes to modify the lights or light standards, permission must be received, in writing, from the Municipality, prior to commencing work.

5.2 DESIGN

Streetlights shall be located in accordance with the Utility Location Drawing SCSD 1, SCSD 2 and SCSD 3. All lighting systems shall meet the requirements of the current edition of the "Guide for the Design of Roadway Lighting" as published by the Roads and Transportation Association of Canada or as amended.

The post top luminaires shall be Light Emitting Diode (LED) fixtures in black paint finish or standard aluminum, installed with a 90-degree bracket arm (also black paint finish or standard aluminum). The appropriate fixtures shall be LED Roadway Lighting Ltd. NXT SERIES LUMINAIRES, or equivalent, with the following wattages: 50, 60, 80, 100, 113, 158 Watts.

The poles shall be Holophane 4" factory standard black , direct bury, Cat. #AB4RS18ELV-4 c/w 8: square base plate on bottom.

On streets with sidewalks on one side, light poles are to be located on the same side of the street as the sidewalk.

5.3 INSTALLATION

The installation of the electrical wiring, poles, lights, and connections will be carried out by the Municipality’s electrical contractor and the cost of the materials and installation shall be borne by the Developer.

SECTION 6 - TREE PROTECTION, TREE PLANTING, AND WOODLANDS

6.1 TREE PROTECTION

This Section outlines the requirements and measures required to ensure adequate protection for trees identified for retention including those within and adjacent to the project site for construction projects within the Municipality. The requirements and measures include, but are not limited to, the submission and approval of a Tree Protection Plan that provides for the identification of Tree Protection Zones, installation of tree protection barriers, pruning of branches and roots, and remediation measures (i.e., deep root fertilization, HVAC, drilling etc.) to mitigate the impact of damage to retained trees. Where a tree is not fully owned by the site owner (i.e., located on an adjacent property or on a shared Property Line) and may be damaged or removed, written consent from the adjacent property owner must be submitted to the Municipality.

The Municipality will consider the protection of trees throughout the application approval process, construction process and adopt reasonable requirements and precautionary measures for the purpose of protecting and mitigating the impact of damage to trees within and adjacent to a project site.

All new subdivisions and/or individual site plans will require an approved Tree Protection Plan and related supporting reports and assessments as deemed necessary by the Municipality.

6.1.1 Requirement for Approved Tree Protection Plan

A Tree Protection Plan shall be completed by a certified arborist or approved professional, such as a Landscape Architect or Registered Professional Forester, and submitted to the Municipality for approval prior to the start of construction or other works, including demolition. No on-site construction or other works that may cause damage to trees is permitted without a Tree Protection Plan approved by the Municipality.

Tree Protection Plans and related Assessment Reports are to include all trees within the site limits, and all “adjacent” trees. For the purpose of this policy, the term “adjacent” refers to BOTH trees whose canopies (drip line) extends onto the project site AND those within 10 meters of the site’s perimeter. It is preferred that the Municipality be provided documented evidence of consent being granted by the adjacent landowners for their trees to be measured and assessed.

Where landowner permission has not been granted and the trees located on adjacent lands have not been directly measured and assessed, a required 10 m off-set is required within the project site in the area unless permission to damage, injure or destroy, the trees have been given by the landowner.

In the event the canopy (dripline) or critical root zone of a tree located adjacent to a development site extends onto the project site, the Tree Protection Plan and related Report(s) must include a tree assessment and mitigation measures to ensure the health and stability of the tree is maintained. It is the responsibility of the Proponent to ensure all trees located adjacent to the project limits are protected and not damaged from proposed works.

a) Tree Protection Plan

The Tree Protection shall include, but is not limited to:

i) Identification of specific trees (species, size, and health) that are to be removed for safety, tree health, operational requirements, or aesthetics. A detailed description of the condition of the trees and factors on which the recommendation to remove were based must be included in the report. Pictures of the trees showing pertinent condition are recommended.

ii) Identification of specific trees (species, size, and health) that will be retained and protected during the operations as future forest cover. Pictures of the trees showing pertinent conditions are recommended.

iii) Identification of specific trees that will be dug up and relocated (transplanted) prior to the start of the operations and the locations where they will be replanted.

iv) Foreseeable remedial actions to ensure the health of the remaining trees such as but not limited to branch pruning, deep root fertilization, tree watering, soil replacement or amelioration, planting.

v) Specification of good arboriculture practices for root and branch pruning.

vi) Map showing:

- The location of all existing trees, within and adjacent to the site and the extent of their crowns/drip lines and critical root zones with tree id numbers that correspond to the supporting report(s)
- The location of all trees, within and adjacent to the site to be retained, removed, replaced or relocated with tree id numbers that correspond to the supporting report(s)
- Highlighted and labeled Tree Protection Zones and tree protection barriers
- Written consent from the owners of co-owned (boundary) and off-site trees that would be injured or destroyed, where applicable
- Silt fence may be required in conjunction with tree protection barriers for erosion and sediment control if deemed necessary by the Municipality

b) Operational Constraints

i) Operational constraints as per Ontario Provincial Standards Specification (OPSS) 801.07.01 apply except during emergency situations.

ii) All work relating to tree protection within and adjacent to the project site shall be supervised by Licensed Arborist. In the event a tree is injured, made unstable or killed during any on-site works and not in compliance with the approved Tree Protection Plan, on-site work shall cease immediately, the Municipality shall be notified immediately and a plan to remediate such injury or damage shall be prepared for review and approval by the Municipality before any on-site works can proceed.

c) Tree Protection Zones and Barriers

i) Tree Protection Zones (TPZ) shall be established surrounding all trees to be retained within and adjacent to the site. The outside boundary of the TPZ shall be delineated by a tree protection barrier.

ii) Barriers for Tree Protection Zones as per OPSS 801.07.02 apply except where:

- The tree is flanked by curb/sidewalk and/or an asphalt road the TPZ and barrier can be limited to furthest extent of the boulevard area; and
- A TPZ is not required or not feasible to establish beyond the main stem of the retained trees, banding boards (boards around the trunk for additional protection) shall be installed around the stems of the retained trees. The boards shall be installed in a vertical direction and remain in place for the duration of the project. Banding boards must not be nailed or screwed onto the tree stem. Bark must not be broken or torn during the installation of the banding boards. The banding boards must extend from ground level to a minimum height not less than 1.2 meters.

d) Cutting and Repair

i) The Ontario Standard Specification (OPSS) 801.07.03 for tree cutting and repair applies except as amended as follows:

The term "Specimen Trees" is deleted and replaced by the term "Trees to be retained".

ii) All trees identified in the approved Tree Protection Plan for pruning should be pruned before commencement of any on-site operations by a certified arborist.

iii) It is recommended that when underground services require replacement that the use of 'no dig' technology be used. Feasibility will be determined by the Municipality.

iv) Roots that are exposed should be covered with wet burlap or soil immediately and shall be kept damp at all times. Watering is required until such time as the topsoil and sod has been replaced satisfactorily or as otherwise directed by the Municipality. All trees identified in the Tree Protection Plan for relocation or removal must be relocated or cut and removed prior to the commencement of the on-site operations.

e) Tree Damage and Remediation

i) "Damage" means to carry out any activity that may injure or kill any tree, or make it unstable and including but not limited to:

- The topping or removal of branches from a tree other than in accordance with accepted arboricultural practices,
- the cutting or shattering of the roots of a tree within the drip line or root protection zone other than in accordance with accepted arboricultural practice,
- the scraping, gouging or denting of a tree's drip line,
- the compaction of the soil within the Tree Protection Zone by the storage of soil or fill, or the placement of heavy equipment, vehicles, building or other materials thereon or by the movement of vehicles or equipment thereover,
- depositing within the tree's drip line any toxic or harmful substance,
- the removal of soil from within a tree's drip line, or addition of fill or soil within a tree's drip line.

ii) No objects are permitted to be attached to trees protected by Municipality By-Laws.

iii) Costs associated with any remediation actions required as a result of damage to retained trees, as ordered by the Municipality, shall be borne solely by the Contractor/Developer.

f) Requirements for Post Construction Measures

i) A certified arborist or other tree professional, approved by the Municipality, shall inspect all retained trees and their rooting area to assess if any additional remediation work is required to ensure their future health and survival.

ii) If the inspection specified herein indicates damage to retained trees, the certified arborist or approved professional shall prepare a post-construction remediation plan. The remediation plan may include but is not limited to: pruning; deep root fertilization; irrigation, aeration, tree planting either as a single activity or in combination.

iii) A certified arborist or other tree professional (i.e., a Landscape Architect or Registered Professional Forester) shall inspect the project site and certify that any and all measures specified in the Tree Protection Plan or post-construction remediation plan have been completed as per the plan. This certification is required before final acceptance and approval of the work by the Municipality.

6.2 TREE PLANTING

Refer to the current Municipality of Strathroy-Caradoc Tree Planting By-Law.

Tree planting plans in accordance with Municipality standards are required for developments which will ultimately be assumed by the Municipality as well as for private roadway developments (Condo / Townhouse roads). County bylaws and requirements shall be consulted when a site fronts a County Road.

Certification from a licensed Landscape Architect or Registered Professional Forester confirming that the approved Tree Planting Plans were adhered to is required prior to assumption.

6.3 WOODLANDS

Specific requirements for woodlands and trails shall be provided by the Municipality on a case-by-case basis.

In such cases where woodlands and trails are subject to the requirements for a 'Development Assessment Report (DAR)" and the review and approval by external agencies (i.e., a Conservation Authority or a Provincial Ministry), the recommendations and mitigation measures contained within the DAR or the recommendations of the CA or Provincial Ministry may take precedence in relation to tree protection, fencing and buffering standards and requirements.

Where “Woodland” is referenced within the standards, it shall mean:

> Treed areas that provide environmental and economic benefits to both the private landowner and the general public, such as erosion protection, hydrological and nutrient cycling, provision of clean air and the long-term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide variety of woodland products. Woodlands include treed areas, woodlots or forested area and vary in their level of significance at the local, regional and provincial levels.

6.3.1 Tree Protection Zones (TPZ) and Barriers in Woodlands

Woodlands shall be protected from all proposed construction by tree protection barriers conforming to the following requirements:

a) Barriers shall be 1.2 meters high while maintaining visibility.

b) T-Bar supports or 2”x4” shall be used.

c) Top rails to be 2”x4” pieces of wood.

d) Maximum vertical spacing of vertical posts to be 2.4 meters.

e) Barrier to be constructed with continuous plastic mesh (i.e., snow fencing) in a manner that is highly visible.

f) In the event material is temporarily located adjacent to the TPZ, effort must be made to ensure material does not enter the TPZ.

g) All supports and bracing must be, at a minimum, located outside of the tree’s critical root zone and efforts made to minimize as much root damage as much as possible.

Silt fence may be required in conjunction with tree protection barriers for erosion and sediment control if deemed necessary by the Municipality.

Tree protection barriers must be maintained throughout construction and may only be removed immediately prior to topsoil fine grading and sod/seed installation.

6.3.2 Woodland Assumption

As a priority, it is the desire that woodlands be owned by public or non-profit groups recognizing their importance from an ecological and community health perspective. The Municipality is not the only public or non-profit authority that has the ability to own and maintain woodlands. The Conservation Authorities, Parks Canada, Land Trusts, as well as local groups such as the Rotary Club and Lions Club own or maintain woodlands in Middlesex County. Partnerships between such groups are also possible to achieve long term protection of woodlands in Strathroy-Caradoc.

Where a developer wishes to request the Municipality assume a woodland, the developer shall provide the Municipality a Woodland Assessment and Inventory. This Woodland Assessment and Inventory must be performed by a Registered Professional Forester for the review and approval by the Municipality. The Woodland Assessment and Inventory shall be accompanied by an Implementation Plan that includes both short- and long-term maintenance activities and cost estimate(s).

In evaluating whether to accept and assume a woodland, the Municipality shall consider whether any other local public or non-profit groups have interest in owning the Woodland, the findings of the Woodland Assessment and Inventory and the associated Implementation Plan, financial, staff, and operational implications, as well as the ecological and community health benefit.

In such cases that the Municipality, through a decision of Council, accepts to assume a woodland, the Municipality shall not assume until after:

a) A tree risk assessment has been completed and all hazard trees have been removed from the woodland as confirmed by a Licensed Landscape Architect or Registered Professional Forester,

b) A Woodland Assessment and Inventory (reflecting the removal of hazard trees) has been received,

c) Woodland / trail signage and fencing / buffering measures (as required) are in place,

d) An adequate and financially viable operation plan has been developed for future and on-going maintenance activities,

e) A financial contribution to the long-term maintenance activities is provided to the satisfaction of the Municipality with the terms and condition of such contribution included in an appropriate development agreement.

6.3.3 Woodland Signage

For development approvals wherein the Municipality has agreed to assume the Woodland in the future, prior to the Municipality issuing building permits for the development, the developer is responsible for the placement of appropriate signage at the perimeter of the Woodland, advising the public of permitted uses (if any) and that entry is at the user's own risk. Signage shall be provided in location(s) and to the specifications of the Municipality and must be approved by the Municipality before it is placed on site. Where the Woodland is to be used for trail purposes, signage shall be at the specifications of the Municipality and per the Trails Master Plan.

6.3.4 Woodland Fencing

Fencing may be required to maintain a buffer between the development and the adjacent woodland and/or natural feature. Fencing shall be 1.2 meters high, black commercial-grade chain link fence continuous with no gates around the perimeter of site, with no projecting spines, splines or crown pieces. Fencing shall be installed 150mm (6") from the property line on Municipality lands.

6.3.5 Woodland Buffering

There shall be a buffer area between a development and a woodland to protect the woodland. The buffer width shall conform to the table below, unless a Development Assessment Report is approved that specifies otherwise:

A minimum 10-meter buffer is required to a woodland that has been subject to a Development Assessment Report and does not contain Species at Risk habitat or species, does not contain wetland features (locally or Provincially Significant), has not been identified as a 'Significant Woodland' per the Middlesex County Natural Heritage Systems Study, 2014, or as updated and amended from time to time, and no recreation trails, roads, or parks are proposed adjacent to the woodland.

A minimum 20-meter buffer is required to a woodland that has NOT been subject to a Development Assessment Report, and a recreation trail, road, or park is proposed adjacent to the woodland.

A minimum 30-meter buffer is required to a woodland that has been subject to a Development Assessment Report and does contain more than one of the following: Species at Risk habitat or species; wetland features (locally or Provincially Significant); identified as a 'Significant Woodland' per the Middlesex County Natural Heritage Systems Study, 2014, or as updated and amended from time to time; or a recreation trail, road, or park is proposed adjacent to the woodland. However, buffer requirements or recommendations within an accepted DAR shall govern.

6.3.6 Trails at Woodlands

Trails installed by the Developer within the buffer between a development and a woodland shall conform to the requirements of the Trails Master Plan, unless otherwise approved by the Municipality.

Trail signage installed by the Developer shall conform to the requirements and specifications of the Trails Master Plan and the Municipal Wayfinding Strategy, unless otherwise approved by the Municipality.

SECTION 7 - LOT GRADING

7.1 GENERAL

All subdivisions shall be graded in accordance with these specifications and the details shown on SCSD-11. Lot grading plans shall be prepared and stamped by a Professional Engineer and approved by the Municipality along with the subdivision servicing drawings.

Lot grading plans are to list existing elevations and grading details and shall include sufficient area of adjacent lands to define total drainage patterns (i.e. to a minimum of 15m outside of the site perimeter). A full topography including all surface features is to be shown.

In the case of a single lot application, grading details shall be shown on a site plan to include sufficient area of adjacent lands to define total existing and proposed drainage patterns.

7.2 LOT GRADING SPECIFICATIONS

a) Yard surfaces shall have a minimum slope of 2%.

b) Front yard surfaces, including driveways, shall have a maximum slope of 10%.

c) Rear yard/side yard (walkouts/backsplits) surfaces including swale crossfalls shall have a maximum slope of 3H:IV.

d) Drainage flows shall be directed away from foundations.

e) Drainage flows which are carried around houses are to be confined in defined swales located as far from the houses as possible.

f) The desirable swale depth is to be 225 mm. The minimum allowable depth shall be 150 mm. The maximum swale depth is to be variable, but dependent on location and safety considerations. Swales to be located a minimum of 1.5m from the rear property line with minimum 4H:1V slope.

g) Ground elevations at buildings are to be a minimum of 450mm above any adjacent overland flow routes (i.e. no window wells) and minimum of 150mm above adjacent side yard swale elevations.

h) Maximum allowable depth of ponding:
   i) Rear Yards: 300mm
   ii) Roadways: 150mm

i) All ponding areas and elevations shall be clearly identified with ponding limits clearly shown for stormwater management purposes.

j) Where ground infiltration is proposed, an effective overland drainage outlet shall be included for events when infiltration is not effective (ie. frozen conditions, clogged systems and major storms).

k) Ground infiltration shall not be the primary or sole method of stormwater control. Under winter or frozen conditions, infiltration is less effective and developments require an increased reliance on overland flow routes. Proposed grading must minimize impacts of nuisance water in minor and major storm events including snow melt runoff. All proposed developments shall include an effective overland flow route design.

l) Grades:
   i) Minor swales - provides drainage for up to four lots. The minimum grade shall be 2% (special cases 1%).
   ii) Major swales – provide drainage for more than four lots – the minimum grade shall be 1 %.
   iii) Proposed grades must not remove cover from existing utilities and infrastructure.

m) The maximum flow allowable in a side yard swale shall be that from four back yards.

n) The maximum length of a rear yard swale shall be 50 meters outletting to a rear yard catch basin. The maximum flow in a rear yard swale which is discharged directly onto the road allowance is that from eight backyards.

o) No front yard catch basins shall be allowed.

p) Where possible, lots shall drain to the front of the property, rather than to a rear yard catchbasin. Rear yard catchbasins will only be considered where deemed necessary by the Municipality on a case-by-case basis.

q) Lot grading designs to consider surface flows from external adjacent properties onto the site (existing lot grades to a minimum of 15m outside of the site perimeter must be included within the design).

r) Where infiltration is proposed, a letter prepared by a Hydrogeologist confirming groundwater levels, design is adequate and confirmation of no adverse effects to the existing groundwater regime is required.

SECTION 8 - ROADWAY SIGNING

8.1 GENERAL

All new subdivision roadways or subdivision boundary roadways may require regulatory or warning signs or pavement markings and will require street name signs at various locations. All plans for signing shall be submitted for approval to the Municipality.

All required signage to be installed upon commencement of site servicing.

8.2 DESIGN

a) All regulatory signs shall be supplied and installed in accordance with the current edition (March 2000 as amended) of the Ontario Traffic Manual – Book 5.

b) All warning signs shall be supplied and installed in accordance with the current edition (July 2001 as amended) of the Ontario Traffic Manual – Book 6.

c) All pavement markings shall be supplied and placed in accordance with the current edition (March 2000 as amended) of the Ontario Traffic Manual – Book 11.

d) Street name signs are to be placed at every intersection and are to have double sided name plates. These signs are to be placed off the street lines in a location that will make the sign easily visible.

e) Posts are to be U-Channel split post, comprised of a 1.52m (5 ft) lower section and 3.05 (10 ft) upper portion.

f) Delineator posts are to be 2.54 cm (1”) x 2.54 cm (1”) and be 2.13 (7 ft) in length.

g) Stop signs are to be as per the MTO Standard Regulatory Street Sign.

8.2.1. Common Street Name Signage

a) Blade dimensions are to be as follows:
Length: 45.72 cm (18”), 60.96 cm (24”), 76.2 cm (30”) or 91.44cm (36”).
Height: 15.88cm (6 ¼”) to 20.32 cm (8”)

8.2.2 911 Municipal Number Signage

Where required, 911 Municipal Number designations must be installed based upon current policies and procedures. Signage to be white enameled 100mm thick numbering on a blue background. Signpost to have a minimum buried depth of 0.6m and stand 1.22m above grade.

8.2.3 Heritage Signage (Site Specific)

Heritage signage is to be constructed of 6.4mm (1/4”) to 12.7mm (1/8”) flat aluminum with high intensity prismatic sheeting. Blades are to be green in color with white lettering.

8.3 MATERIALS

a) Regulatory and warning signs will be of the size and materials as outlined in the current editions of the Ontario Traffic Manual - Books 5 and 6. Pavement markings can be applied using paint or more durable products such as thermoplastics, two-component cold-reacted materials or tapes as outlined in the current edition of the Ontario Traffic Manual - Book 11.

b) Street name signs shall be 14-gauge aluminum minimum with white enameled 100mm letters in a green background. These plates are to be secured and mounted on galvanized steel posts, 3.5 meters long.

c) Street names are subject to County approval, coordinated by the Municipality, prior to installation of street name signs.

8.4 INSTALLATION

All signing to be installed in accordance with the requirements of the most current editions of the Ontario Traffic Manual and as approved by the Municipality.

Posts are to be driven a minimum of 1.0m into the ground.

Sign to be installed a minimum of 1.98m (6'6") above the crown of road.

8.5 NO PARKING ZONES

Must be adequately signed.

8.6 TEMPORARY SIGNAGE

Temporary signage is to be installed throughout a development from the commencement of servicing and may only be removed immediately prior to installation of the permanent signage. Required temporary signage includes lot numbers and municipal numbers installed at each lot, and street name(s) at all intersections.

All intersecting roadways to have appropriate signage at all times throughout the construction.

All temporary signage must be AODA compliant. Wood posts to be driven into ground to the extent possible to ensure all signage is secure. Where not possible, sufficient bracing and support to be implemented to ensure the signage remains in place.

8.6.1 Unassumed Subdivision Signage

Unassumed subdivision signage is required at the entrance of all new developments and placed to ensure driver sight lines are not impeded. Sample text is as follows:

UNASSUMED SUBDIVISION

THIS SUBDIVISION IS CURRENTLY NOT ASSUMED BY THE MUNICIPALITY. RESPONSIBILITY FOR THE MAINTENANCE REMAINS WITH **DEVELOPER'S NAME and (###) ###-####**

ALL MUNICIPALITY OF STRATHROY-CARADOC BY-LAWS STILL APPLY

Unassumed subdivision signage shall be a minimum of 1.22m x 1.22m (4’ x 4’), with a white background and black lettering mounted on a 6” x 6” wooden post.

8.6.2 Subdivision Description Signage

All subdivisions to have temporary signage at the entrance to the development clearly describing the following:

a) Subdivision Name

b) Developer Name and Phone Number

c) Key Plan of Subdivision including all lot numbers and street names with a color legend describing the use of each area (i.e., ROW, Woodlot, Walkway, etc.).

Subdivision description signage shall be a minimum of 1.8mx 1.8m (6’ x 6’), with a white background and black lettering mounted on a 6” x 6” wooden post.

8.6.3 Private Property and Safety Signage

All subdivisions to have temporary signage at the entrance to the development clearly describing the following:

a) Private Property

b) The Developer’s name and contact information including phone number.

Subdivision private property and safety signage shall be a minimum of 1.8mx 1.8m (6’ x 6’), with a white background and black lettering mounted on a 6” x 6” wooden post.

8.6.4 Permanent Signage for Future Road

Roadway signage is required where a future roadway intersects with an existing roadway. Sample text is as follows:

FUTURE ROADWAY

THIS FUTURE ROADWAY WILL BE ESTABLISHED IN ACCORDANCE WITH APPROVED DEVELOPMENT PLANS.

FOR FURTHER INFORMATION, PLEASE CONTACT THE MUNICIPALITY OF STRATHROY-CARADOC PLANNING DEPARTMENT.

Future roadway signage shall be a minimum of 0.6m x 0.75m (2’ x 2.5’), with a white background, black lettering and mounted on a 6” x 6” wooden post.

SECTION 9 - DRAWINGS

9.1 GENERAL

All general plans, grading plans (except in single lot applications), plan and profile drawings and detail drawings shall be done on standard 'C' sized drawings.

All contract drawings are to be consistent with the A1 Standard drawing size and title block which includes project name, sheet number, sheet name and description, scale, Proponent information, Consultant information, revision block and drawing details (design, drawn by, checked, approved, and date), etc. Fonts and details must be able to be printed legibly at 11X17 size. All drawings are to be signed and sealed by a Professional Engineer at the location provided in the title block. All drawings shall be submitted in an electronic format, AutoCAD 2018 or 2019 and a pdf version. Base drawings are to be located in World Wide UTM (Canada) 17 North, NAD 1983 (Canada) with a geoid model correction of HT v2.0 in grid (i.e. ground coordinates are not acceptable).

9.2 DRAWING STANDARDS

All drawings must meet the following standards:

a) Existing conditions are to be drawn with a lighter pen than the proposed construction. All existing infrastructure to be plotted and clearly identified on plan and profiles.

b) North shall be shown on all drawings to the top or to the right.

c) All elevations shall be to Geodetic Survey of Canada Datum.

d) The zero chainage shall start at the projection of an intersecting street's center line. Chainages shall be indicated at 10 m stations. Where possible, the profile must be a vertical projection of the plan. Calculated chainages of the beginning and ending of horizontal or vertical curves must be noted on the plans and profile.

e) A legend shall be used to indicate services as shown in SCSD-12.

f) All revisions to original drawings must be recorded in a revision block including date.

9.3 DRAWINGS TO BE SUBMITTED

The developer will supply both digital and hard copy of the Plan of Subdivision drawings for the development or subdivision infrastructure to the Municipality. Digital copies shall be provided in a USB with the AutoCAD drawings/GIS shapefiles and PDF version of the project. Three complete sets must be submitted when applicable:

a) Cover Sheet. The cover sheet shall indicate the following:
   i) A list of drawings included in the Contract Set.

   ii) A Key Plan showing the location of the proposed development including adjacent intersections to adequately demonstrate project location.

   iii) The project title and name and address of the Owner and Consulting Engineer.

b) Master Plans - Services to be constructed. A drawing showing all services to be constructed using a scale of 1:1000.

c) Lot Grading Plans. The lot grading plan shall meet the following requirements:
   i) Indicate north by an arrow on the plan.

   ii) All grades to be clearly labelled including direction of flow and listed to a minimum of one (1) decimal place.

   iii) Where a lot grading plan requires multiple drawings to present, a minimum overlap of 30m between each plan is to be shown.

   iv) Lid elevations for all existing and proposed surface inlets (CBs) and manholes to be clearly labelled.

   v) Basic Plan: - scale 1:500;
      - Showing all existing and proposed lot numbers;
      - Show all street names;

- Show all lot frontages and depths;
- Show all sidewalks to be constructed by the subdivider;
- Indicate all lots that are semi-detached (SD), back split (BS) or walk-out (WO).
- Width of all easements to be labelled on all drawings as applicable.

d) Elevations to be shown on the Grading Plan are to be Geodetic:

i) Final ground elevations at lot corners and at the front and rear of the houses;

ii) Top of foundation and underside of footing elevations;

iii) Final center line road elevation every 15 meters;

iv) Proposed elevations to be shown by means of spot elevations. Existing ground elevations are to be shown by means of contours and spot elevations. These contours and spot elevations shall extend a minimum of 15 m beyond the property limits and with sufficient detail to outline external drainage patterns including flow direction, swales and surface features;

v) For single lot applications, the difference between the building sill elevation and the centre road elevation shall be shown. The rear lot difference to sill elevation shall also be shown.

e) Drainage Information. Show the location and direction of swale flows by means of waved arrows. At least one arrow is to be shown at the rear of each lot; - show all proposed rear lot catch basins, leads and easements. Location and direction of overland flow routes to be shown by means of bold arrows.

f) General Plan - Sanitary Sewer System. A drawing showing the Sanitary Sewerage System and Areas to a scale of 1:1000. Sanitary sewer design sheet must also be submitted for all developments.

g) General Plan - Storm Drainage System. A general plan to a scale of 1:1000 showing the Storm Drainage System and Drainage Areas. Storm sewer design sheet must also be submitted for all developments.

h) General Plan - Water Distribution System. A drawing showing the existing and proposed water distributing system to a scale of 1:1000.

i) General Plan - Street Lighting and Joint Utility Trench. A general plan to a scale of 1:1000 showing the proposed street lighting and joint utility trench layout, including all transformers and pedestals, as applicable.

j) Plan and Profile. A plan and profile drawing for each street in the subdivision and along all rear yard catch basin leads. The location and brief description of soil investigations shall be shown on the plan and profile drawings (Boreholes or Monitoring Wells). Benchmarks and control points to be clearly labelled on all plan and profile drawings. These drawings shall include all pertinent information as deemed necessary by the Municipality. Proponents of future developments not related to an approved or constructed development should confirm benchmarks and geotechnical information presented on existing design drawings by means of additional studies and investigations, as required.

Scale: Horizontal 1:250
i. Vertical 1:50

k) Typical Road Cross-Section.

l) Swale Cross-Section. A cross-section for all major swales and/or ditches must be submitted.

m) Temporary Conditions Drawings. Temporary Condition drawing for proposed sediment and erosion control measures during construction, miscellaneous construction phasing, and any temporary details as applicable.

n) Stormwater Management Drawings. Drawing(s) including a detailed plan and cross sections including detailed outlet and inlet configuration details.

o) Signage drawings. A signage drawing for both temporary and permanent conditions is required.

p) Detailed Drawings. The detailed drawings shall include all details necessary for the proper construction of the works. These drawings are to show details of manholes, catchbasins, curb and gutters, sidewalks, road allowance cross sections, headwalls, open channel cross sections and other special structures.

Detail drawings of watermain and sewer appurtenances are to be drawn to a scale of 1:20 and in no case less than 1:50. Except for details of bedding cross sections for sewers and watermains, all other details are not to be shown on the same drawing as plan and profiles. It will be the Developer's responsibility to ensure that the Contractor is provided with the miscellaneous details included in these Servicing Standards and other various details for the completion of the project.

9.4 'AS CONSTRUCTED' DRAWINGS

On completion of the project, the drawings must be revised to show the services as they were actually constructed. The completed works shall be provided on a USB and one printed set of “as-constructed” drawings may be requested by the Municipality. Digital supplies must be in AutoCAD 2018(19) and/or GIS shapefiles and PDF version. Base drawings to be located in UTM17 North, NAD83. Hard copies must be of a quality acceptable to the Municipality.

The following details shall be shown on the Contract Drawings and shall be amended to indicate the "as-constructed" locations of all services:

a) Street names.

b) Registered plan numbers, lot numbers and/or municipal number, lot lines, street lines, frontages, and easements.

c) Ties to property bars for all services.

d) The chainage of private drain connections measured from the nearest downstream manhole.

e) The location and elevation shown on the profile of all services encountered while undertaking the work.

f) Center line road profile (10m maximum intervals).

g) All roadwork, watermain, sanitary sewer, storm sewer and appurtenant works for all developments including Site Plans. All buildings and structures to be shown for Site Plans.

h) The full details for all services including abandoned buried infrastructure (i.e. size, slope, material, invert elevations, etc.).

SECTION 10 - STORMWATER MANAGEMENT

10.1 INTRODUCTION

When lands are developed, the proponent is required to implement Stormwater Management (SWM) measures to address water quantity, water quality, downstream erosion or flooding and water balance issues. This may be accommodated through a range of available strategies. This section will outline Stormwater Management requirements for several strategies, however the most current guidelines from the Ministry of the Environment Conservation and Parks (MECP) may be used to supplement this document. Stormwater Management measures shall be to the satisfaction of the Municipality. Consideration must be provided to downstream capacity, legal outlet, and cost sharing issues. The Stormwater Management requirements outlined in this document should be considered during the draft plan preparation stage prior to any formal design submission.

For most projects, an initial consultation meeting with the Municipality is recommended to establish SWM scope and acceptable methods to be included in the draft plan and/or predesign submission. A summary of preferred criteria is summarized in the table below:

Water Quality	Enhanced Level of Protection (80% S.S. Removal)
Erosion Protection	No overland discharge until storms greater than 10-year storm event unless released as sheet discharge
Quantity Control	All storms released at or below predevelopment release rates up to 250-year storm event
Low Impact Development	All Low Impact Development Systems must have emergency relief pipes to storm sewers, must be located outside of Road Right of Ways, and must have easements
Large Residential Development (> 50 homes)	Preferred design would include storm sewers and a wet pond(s). Low Impact Development Systems should have limited use and not be installed within road right of way.
Industrial/Commercial and Multi-Residential Developments	Preferred design would include a dry pond with oil and grit separators for sites smaller than 5 hectares and a wet pond for sites larger than 5 hectares
Small Developments or Expansions	Quantity control may be achieved through lot level grading with an oil and grit separator providing quality control

10.2 SUBMISSION / APPROVAL PROCEDURES

10.2.1 Initial Consultation Meeting

For most developments, an initial consultation meeting should be organized with the Municipality before the draft plan stage. This will allow the developer and Municipality to determine the scope of the project and the related requirements. This will ensure adequate consideration is given for Stormwater Management elements in the planning and layout stages. An initial consultation meeting with the Municipality will assist in accelerating the timeline for review and approval.

10.2.2 Predesign Submission

A design brief outlining the following for Stormwater Management design criteria should be submitted to the Municipality for approval prior to commencing detailed design. This submission should include:

a) An overview of existing predevelopment conditions

b) A summary of strategies and tools (including applicable software) which will be used to complete Stormwater Management calculations and modelling

c) A summary of the intended targets and criteria which will be used for the engineering design

d) Identification of external areas which travel through the site and issues caused by external flows that are to be conveyed through the site

e) The location and preliminary layout for proposed drainage and Stormwater Management features including accommodating external flows

10.2.3 Detailed Submission & Stormwater Management Report

An engineered design package must be submitted for approval which includes the following for all proposed developments:

a) Engineered drawings including detailed plan, profile, details, cross sections, grading and area plan and design sheet for all storm sewers, drainage features, water levels, Stormwater Management facilities (SWMF), infiltration features and Stormwater Management features including accommodations for external flows that are conveyed through the site including a sediment and erosion control plan.

b) Clearly identified overland flow routes, overland storage areas and related elevations.

c) Detailed Stormwater Management Report including quantity control, quality control and erosion control. This Report should include supporting calculations for all features, modeling (modelling output), hydrology summary, stage-storage-discharge (including design storms) and drawdown calculation tables. The Report shall also cover groundwater considerations, downstream receiving channel details/considerations, Stormwater Management phasing requirements, monitoring and maintenance procedures. Geotechnical Reports and Hydrogeological Reports will be required to support proposed Stormwater Management measures.

10.3 REFERENCES

The engineering design package should adhere and comply with the current version of the following Acts and references:

10.3.1 Applicable Acts

a) Provincial
   i) Clean Water Act (2006)
   ii) Conservation Authorities Act (1990)
   iii) Drainage Act (1990)
   iv) Environmental Bill of Rights (1993)
   v) Municipal Act (2001)
   vi) Ontario Water Resources Act (1990)
   vii) Ontario Endangered Species Act (2007)
   viii) Ontario Environmental Protection Act (1990)
   ix) Ontario Provincial Policy Statement
   x) Environmental Assessment Act (1990)

b) Federal
   i) Species at Risk Act (2002)
   ii) Fisheries Act (1985)
   iii) Canadian Environmental Assessment Act (1999)

10.3.2 General Stormwater Management Design References

a) Stormwater Management Practices Planning and Design Manual (MOE, 2003) Ministry of the Environment, 2003

b) Low Impact Development Stormwater Management Planning and Design Guide Sustainable Technologies Evaluation Program, Living Website

c) Low Impact Development Stormwater Planning and Design Guide Credit Valley Conservation and Toronto Region Conservation, 2011

10.4 DESIGN REQUIREMENTS

10.4.1 Quantity Control Requirements

All proposed developments must restrict their site outflow to equal or less than predevelopment release rates during all storm events. Sites (commercial, industrial) and smaller subdivisions shall include calculations for the 5,10, 25, 100 and 250-year storm events. For larger subdivisions (greater than 50 lots) or large sites (greater than 5 Hectares), calculations shall be for the 5, 10, 25, 50, 100 and 250-year storm events. If discharge from the site is conveyed as overland flow across downstream properties, it is preferred that the proponent overcontrols the design storms up to and including the 10-year storm event to be discharged into a subsurface pipe only. Overland discharge will only be allowed for storm events less than the 10-year storm if they are released in a sheet flow condition at less than predevelopment rates with municipal approval. Overland discharge should not be released as “point discharge” unless it is consistent with predevelopment conditions.

10.4.2 Water Quality Requirements

10.4.2.1 Target Total Suspended Solids Removal

All proposed developments should receive a minimum level of treatment for enhanced quality protection (80% T.S.S. Removal) unless otherwise approved in advance by the Conservation Authority (copy of approval to be supplied to Municipality).

10.4.2.2 Oil and Grit Separator

The application of Oil and Grit Separators (OGS) or comparable system is limited to developments of 4 Hectares or less. For developments larger than 4 Hectares, an OGS will not be considered adequate water quality protection regardless of how the development is delineated, unless otherwise approved.

When an OGS services a private site, the OGS must be located on private lands with consideration for how the owner will access the OGS for regular maintenance.

10.4.3 Erosion Control Requirements

All Stormwater Management Facilities require extended detention. However, developments with a receiving outlet that is sensitive to erosion will be required to provide adequate erosion control in addition to the quality control extended detention. All large developments, or developments with a receiving outlet that is sensitive to erosion, must design additional storage at reduced release rates for common rain events (less than 2 year) in accordance with the current design guidelines from the MECP.

10.4.4 Water Balance Requirements

Water balance measures shall be considered by the proponent within the predesign submission. The proponent shall be responsible to determine if the MECP will require water balance as part of an Environmental Compliance Approval (ECA). Where the MECP does not require water balance as part of an ECA approval, the Municipality promotes water balance methods through infiltration or exfiltration but does not require water balance calculations. If water balance is required by the MECP, the calculations shall also be submitted to the Municipality.

10.4.5 End of Pipe Facility Requirements

Stormwater Management Facilities (i.e., ponds, wetlands, etc.) are required to have the following design criteria:

10.4.5.1 SWMF Inlet Pipe Design Criteria

Stormwater Management facility inlets must function in gravity flow and the inlet pipe invert shall be above the projected 5-year storm ponding elevation. Special exceptions will be made to allow ponding to the spring line level of the pipe at the Municipality's discretion.

10.4.5.2 SWMF Outlet Pipe Design Criteria

All Stormwater Management facility outlets must be designed with consideration to allow debris removal if they fail to function. The preferred outlet configuration would include a headwall and safety railing at the end of pipe.

10.4.5.3 SWMF Safety Considerations

All Stormwater Management facilities must be designed in accordance with the current safety guidelines provided by the MECP. Proposed slopes steeper than the current MECP guideline shall be approved by the Municipality within or before predesign submission. The proponent must fence the Stormwater Management facility to the satisfaction of the Municipality.

10.4.5.4 SWMF Outlet Protection

Stormwater Management Facility Outlet Pipes shall be protected by a grate with vertical bars with a spacing no larger than Radius of the downstream orifice or pipe.

10.4.5.5 Vegetation / Plantings

All plantings should in accordance with the Ministry of the Environment, Conservation and Parks Guidelines. Vegetation shall be designed using local species that are considered natural/low maintenance. A plantings drawing must be submitted to the Municipality on large subdivisions (greater than 50 lots).

10.4.6 Low Impact Development Systems

10.4.6.1 General Requirements

If the proponent intends to implement Low Impact Development Systems (LIDS) a list of LID types, locations and extent shall be provided to the Municipality for approval at the predesign submission stage. While Low Impact Development Systems are promoted, they cannot be the sole source of quantity control. In addition to implementing Low Impact Development Systems, both the internal drainage system and Stormwater Management outflows shall be provided through a pipe system and outlet configuration capable of handling a minimum of 20% of the post development inlet flow for a 5-year storm.

10.4.6.2 Infiltration Gallery Requirements

a) No infiltration galleries are permitted within Road Right of Ways.

b) Permissible locations include infiltration corridors adjacent to Right of Way, parks, pond access areas, rear yards and maintenance setbacks to drains.

c) All infiltration galleries shall have a catchbasin with perforated pipe leads within stone trenches.

d) All catchbasins shall have an emergency relief flow outlet to the storm sewer or emergency relief flow pipe system.

e) All galleries and leads within private property shall have adequately sized easements designated for future maintenance.

f) Leads from road Right of Ways shall be located through rear yard access (preferred) or side yard access with larger lots on each side to account for maintenance requirements. Affected lots will require calculations of basement, underside of footing, and lead elevations.

g) Each rear yard infiltration catchbasin shall service a maximum of 8 lots.

h) All infiltration catchbasins shall be protected with a permanent sediment measure such as FleXstorm inlet sediment trap or approved equal.

i) Infiltration Catchbasins shall be located a minimum of 1.5m from any rear property line and 0.6m from a side yard property line.

j) The proponent shall submit detailed drawings including plan, layout, cross-sections and elevations for exfiltration and emergency relief pipes as well as supporting calculations. Emergency relief leads will require a detail plan and profile including elevations of exfiltration pipes leaving the catchbasins.

10.4.6.3 Groundwater Considerations

a) If Low Impact Development Systems are a proposed method of Stormwater Management, the proponent is required to prove that there is no risk of contamination to potable groundwater or risk to Designated Vulnerable Areas identified by MECP. A Report from the Hydrogeologist may be required if local wells or shallow groundwater are present in the vicinity of the development.

b) A Geotechnical Report and Hydrogeology Report stamped by a qualified professional shall be provided to:

   i. Support the implementation of Low Impact Development Systems.

   ii. Confirm that the long-term high groundwater elevation is 1m (minimum) below the invert of the infiltration galleries in all areas.

10.5 HYDROLOGY

Storm Water Management Facilities and/or measures shall be designed using accepted practices as outlined in the most current edition of the publication entitled "Stormwater Management Practices Planning and Design Manual" published be MECP/MOE and generally conform to the design criteria within this manual, all to the satisfaction of the Municipality. This section discusses potential systems to meet current SWM criteria.

10.5.1 Catchment Delineation

Area plans shall be included in the Stormwater Management Report clearly defining all tributary catchments. Area plans are required for the predevelopment conditions/modeling, storm sewer design areas, post development conditions including overland flow routes to Stormwater Management facility including identifying any ponding areas and related ponding depths.
All external areas tributary to the site shall be fully shown in plan view showing applicable areas and runoff conditions.

Area plans should include existing elevations and overland flow patterns outside of the development property for a minimum distance of 15m surrounding the entire perimeter.

10.5.2 Overland Flow Routes

Major flows must be safely conveyed via a defined Overland Flow Route (OFR) to an appropriate outlet without causing damage to private property or municipal infrastructure, and with minimum risk to the public. The maximum allowable ponding depth shall be 300mm in rear yards and 150mm on roadways during storms up to and including the 25-year storm. The maximum allowable ponding depth shall be 450mm in rear yards and 200mm on roadways during storms greater than the 25-year storm. The following information shall also be included:

a) Ponding limits and associated depths for areas used as quantity storage

b) Overland Flow Route conveyance calculations, where requested

It is strongly recommended that overland flow routes be constructed in Road right of ways (R.O.W.s). The proponent shall avoid overland flow routes from Road R.O.W.s through private lands or from rear yards to R.O.W.'s being directed between buildings. The Municipality may require easements for overland flow routes in this situation.

10.5.3 Design Storms

In the design of site plans or subdivisions, "critical design storms" shall be in accordance with section 10.4.1. Storm events should be modelled using a Modified Chicago Storm Distribution with a 3-hour duration and a Ratio of time to Peak to total duration of 0.33. Rainfall intensity duration frequency (IDF) parameters are summarized below.

Rainfall Parameters for Intensity Duration Frequency Curves

Parameter	25mm	5yr	10yr	25yr	50yr	100yr	250yr
A	538.850	1137.257	1425.011	1835.352	2225.884	2561.151	3048.220
B	6.331	7.184	7.382	7.844	8.620	9.093	10.03
C	0.809	0.830	0.843	0.858	0.871	0.880	0.888

These design storms and IDF parameters are for Stormwater Management only. Storm sewers shall be designed in accordance with Section 3.

10.5.4 Stormwater Management Calculations

SWMHYMO and Visual OTTHYMO are the accepted modelling software to be used for SWM engineering design. Other modelling software will be considered, but approval should be received from the Municipality (at their discretion) prior to commencing detailed design. For small sites (up to 2.0 ha), the Rational Method or Modified Rational Method may be appropriate.

For sites larger than 2.0 Hectare, the rational method or modified rational method will not be approved. Supporting documentation and references should be supplied at the predesign stage for the selected modeling parameters, if not provided within this document. Detailed standard parameters are outlined in Section 10.4.5.

10.5.5 Hydrology Modeling Parameters

For Stormwater Management modeling, the following parameters are required unless otherwise approved:

a) Percent Impervious

Land Use	Total impervious	Directly Connected Impervious
Single Family Residential (Lots smaller than 375m^2)	50%	40%
Single Family Residential (Lots 375m^2 to 550m^2)	40%	30%
Single Family Residential (Lots larger than 550m^2)	35%	25%
Multi-Family Residential	60 - 80%	50 - 60%
Undeveloped Residential	40 – 50%	30 - 40%
Commercial / Industrial	70 - 90%	50 - 80%

b) Infiltration Losses

The SCS curve method or Horton Method are acceptable models for calculating infiltration losses.

c) Initial Abstraction

Land Use	Accepted Value (mm)
Impervious	2
Lawn Area	5
Other Pervious Areas	8

d) Curve Numbers

Curve numbers should be AMC II conditions unless Modified curve numbers are used.

10.5.6 Rational Method Parameters

The following runoff coefficients should be used for all rational method or modified rational method calculations unless otherwise approved:

Single Family Residential (Lots smaller than 375m^2)	0.60
Single Family Residential (Lots 375m^2 to 550m^2)	0.50
Single Family Residential (Lots larger than 550m^2)	0.45
Multi-Family Residential	0.65 – 0.80
Undeveloped Residential	0.50
Commercial	0.70 – 0.85
Industrial	0.70-0.90
Parks, Cemetery, Playgrounds & Farmlands	0.20

10.6 MONITORING AND MAINTENANCE

10.6.1 Construction Phase

Details and instructions should be included within the Stormwater Management Report and construction drawings to prevent offsite migration of sediments during construction. Details should be provided for all Stormwater inlets and Stormwater flow paths.

10.6.2 Pre-Assumption Sediment Measures

Details and instructions should be included within the Stormwater Management Report and on construction drawings outlining the decommissioning construction phase sediment control measures and removal/disposal of sediment collected during construction. The Stormwater Management Report should describe procedures that the contractor shall undertake to ensure that all sediment accumulated during construction is properly removed from the system, including removal of all sediment from all structures and Stormwater Management features.

10.6.3 Post-Assumption Operation and Maintenance

Detailed instructions for monitoring and maintaining all Stormwater Management features within the system should be provided in the Stormwater Management Report. These instructions shall include details on inspection procedures, sediment removal and disposal procedures.

10.7 MECP & CONSERVATION AUTHORITY APPROVAL

The proponent is responsible to obtain all necessary approvals from the Conservation Authority and MECP. The proponent shall provide a copy of all approvals to the Municipality.

10.8 INTERIM / PHASING CONSIDERATIONS

Adequate details outlining various phasing and interim conditions must be included within the Stormwater Management Report for large developments. The proposed phasing plan shall include details on how water quantity and quality is protected at various phases of construction and clearly outline temporary sediment and erosion control features required between phases to protect downstream lands.

10.9 MONITORING OF PRIVATE SITE

Every 5 years (maximum) or upon the written request of the Municipality, the Owner shall hire a Professional Engineer (at their own cost) to verify the condition of all existing Stormwater Management features. The Engineer shall provide a Report to the Owner and Municipality which outlines if the Stormwater Management feature is functioning as intended. If the Stormwater Management feature is not functioning as intended, the Engineer shall provide a schedule of required maintenance activities or corrections which the Owner must undertake. Upon maintenance of the Stormwater Management feature, the Owner shall have the Engineer submit a formal certification of completion letter to the Municipality.

APPENDIX

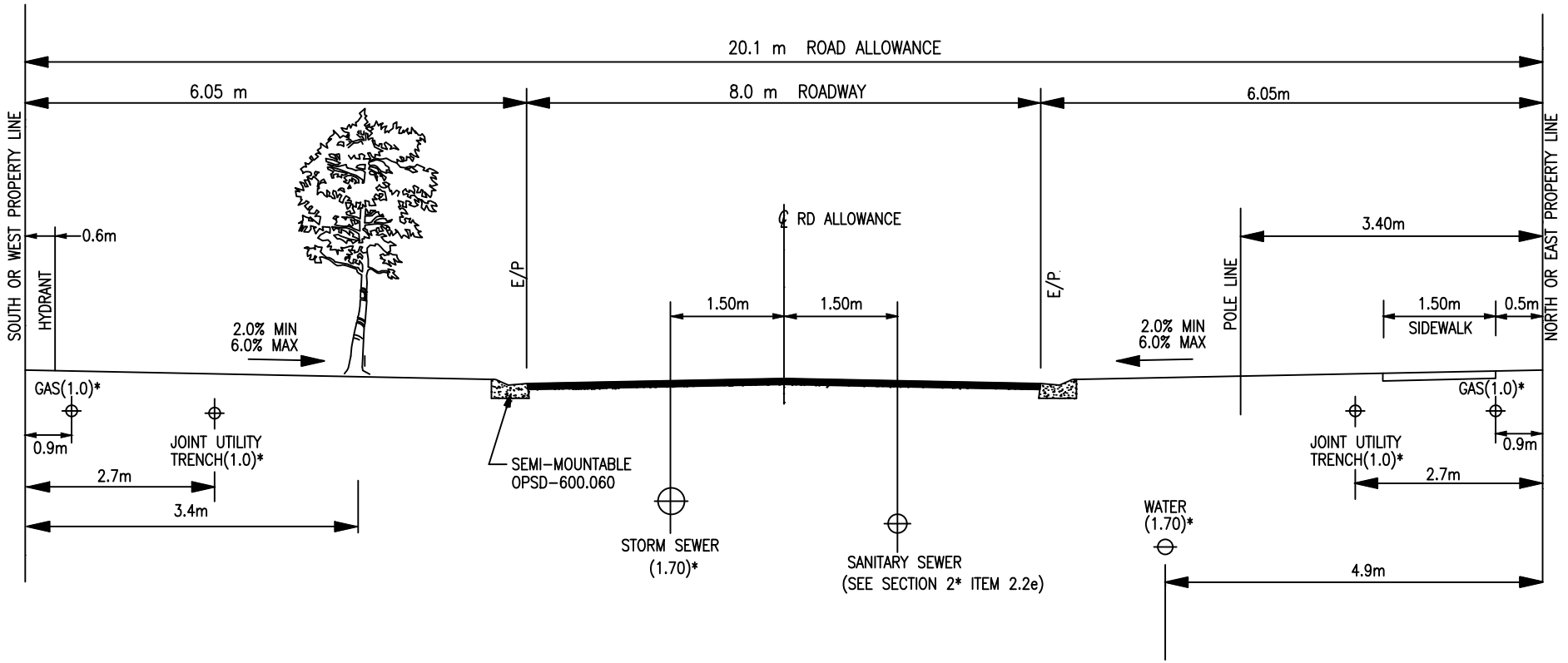
STRATHROY-CARADOC STANDARD DRAWINGS

STRATHROY-CARADOC STANDARD DRAWINGS

DRAWING NUMBER	DESCRIPTION
SCSD – 1	Utility Locations for Residential Roads, 20.1m Road Allowance
SCSD – 2	Utility Locations for Residential Roads, 26.1m Road Allowance
SCSD – 3	Utility Locations for Industrial Roads, 26.1m Road Allowance
SCSD – 4	Residential Cul-de-sac
SCSD – 5	Industrial Cul-de-sac
SCSD – 6	Standard Cross-Section – Local Roadway Residential, 20.1m Road Allowance
SCSD – 7	Standard Cross-Section – Collector / Arterial Roadway Residential, 26.1m Road Allowance
SCSD – 8	Standard Cross-Section - Industrial Roadway, 26.1m Road Allowance
SCSD – 9	Walkway Details
SCSD – 10	Residential Driveway Entrance
SCSD – 11	Typical Lot Drainage Plan
SCSD – 12	Plan and Profile Legend
SCSD – 13	Lot Servicing
SCSD – 14	Rainfall Intensity Duration Curves
SCSD – 15	Tree Planting Detail
SCSD – 16	Sanitary Service Cleanout Detail
SCSD – 17	Storm Service Cleanout Detail
SCSD – 18	Private Drain Connections at Street Line
SCSD – 19	Minimum Easement Width
SCSD – 20	Joint Thrust Restraints
SCSD – 21	Typical Restraint Details, up to 200mm diameter watermain
SCSD – 22	Standard Mechanical Joint Offset Installation Using Tiebolt Couplings

STRATHROY-CARADOC STANDARD DRAWINGS (CONTINUED)

DRAWING NUMBER	DESCRIPTION
SCSD – 23	Insulation of Shallow Mains and Offsets
SCSD – 24	Water Service Connection Detail, 25mm to 50mm diameter sizes
SCSD – 25	Standard Service Box
SCSD – 26	Hydrant Installation
SCSD – 27	Typical Plan and Profile Legend
SCSD – 28	Standard Location for Water Valves at Intersections, 9.0 m and 10.5 radii
SCSD – 29	Schematic Layout of Services
SCSD – 30	Typical Domestic Service Meter Installation, 25 mm Services
SCSD – 31	Typical Details of 100 mm and Larger Services
SCSD – 32	Tracer Wire Installation at Valves
SCSD – 33	Pressure Reducing Valve Chamber
SCSD – 34	Hydrant Bollard
SCSD – 35	Sampling Station
SCSD – 36	Standard 50 mm Blow Off Installation
SCSD – 37	Typical 50 mm Watermain Loop
SCSD – 38	9800 Automatic Flushing Device Detail
SCSD – 39	Metered Automatic Flushing Device Detail



NOTES:

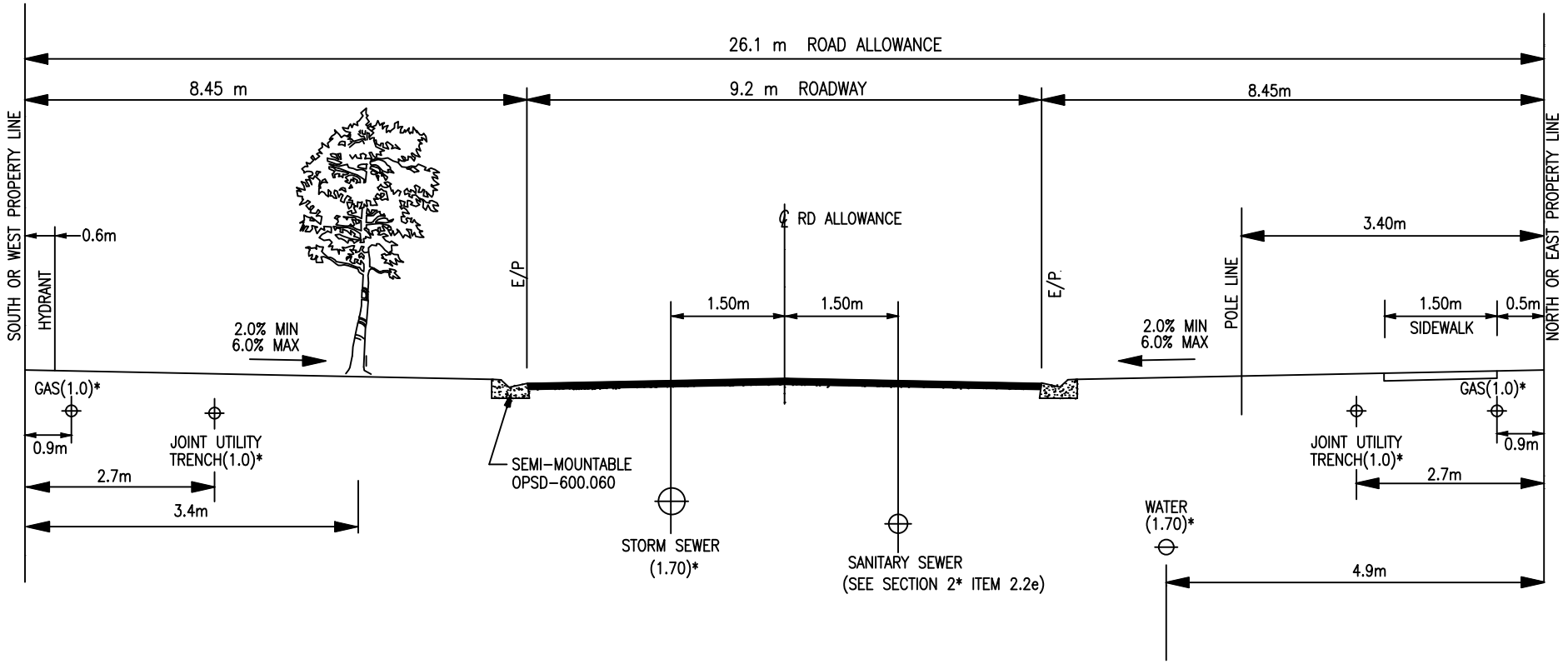
- -* MINIMUM DEPTH OF COVER SHOWN BELOW UTILITIES
- - ALL DIMENSIONS IN METERS UNLESS SHOWN OTHERWISE
- - WATERMAINS AND SANITARY SEWERS TO BE LOCATED ON NORTH OR EAST SIDES
- - STORM SEWERS TO BE LOCATED ON SOUTH OR WEST SIDES
- - TELEPHONE,HYDRO,CABLE AND LIGHTING TO BE LOCATED ON COMMON POLE AND/OR WITHIN COMMON JOINT UTILITY TRENCH

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

UTILITY LOCATIONS
FOR
RESIDENTIAL ROADS
20.1m ROAD ALLOWANCE

OCTOBER 2021	SCSD – 1



NOTES:

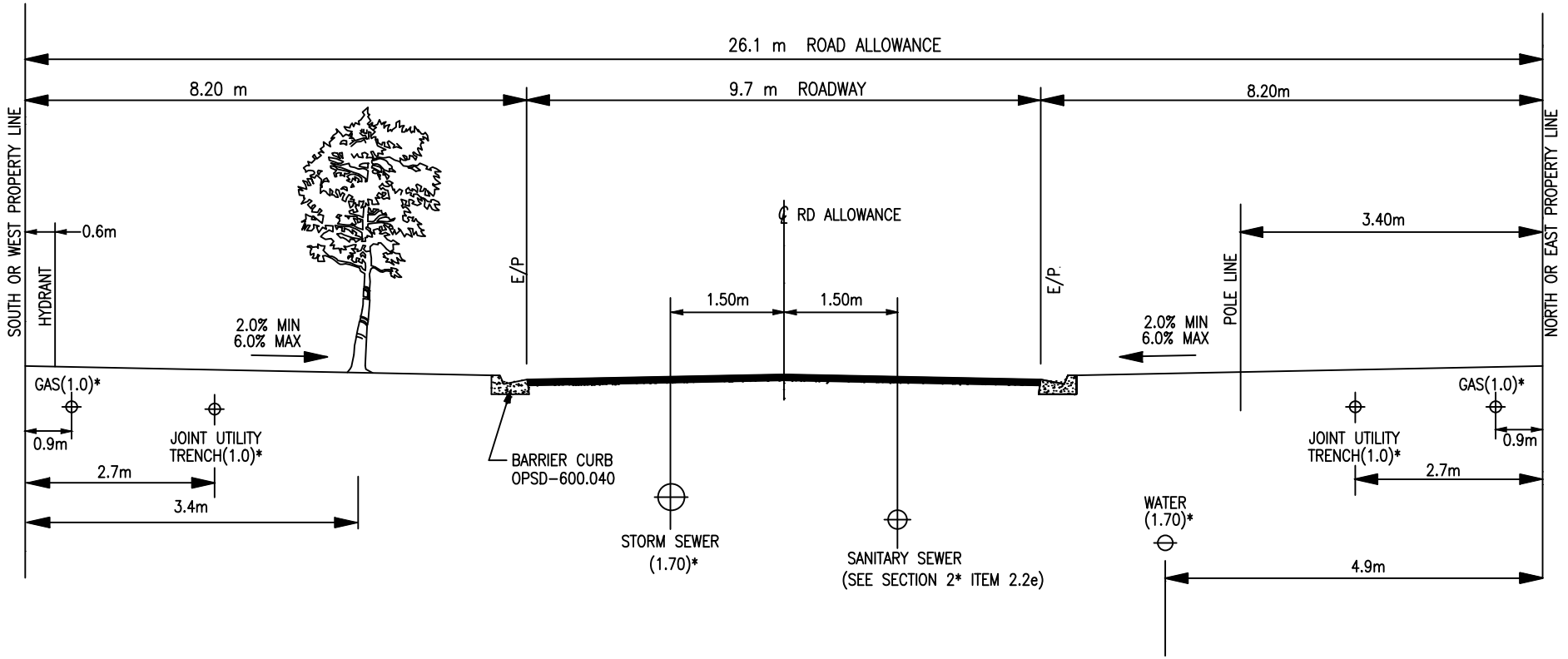
- -* MINIMUM DEPTH OF COVER SHOWN BELOW UTILITIES
- - ALL DIMENSIONS IN METERS UNLESS SHOWN OTHERWISE
- - WATERMAINS AND SANITARY SEWERS TO BE LOCATED ON NORTH OR EAST SIDES
- - STORM SEWERS TO BE LOCATED ON SOUTH OR WEST SIDES
- - TELEPHONE,HYDRO,CABLE AND LIGHTING TO BE LOCATED ON COMMON POLE AND/OR WITHIN COMMON JOINT UTILITY TRENCH

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY-CARADOC

UTILITY LOCATIONS
FOR
RESIDENTIAL ROADS
26.1m ROAD ALLOWANCE

OCTOBER 2021	SCSD – 2



NOTES:

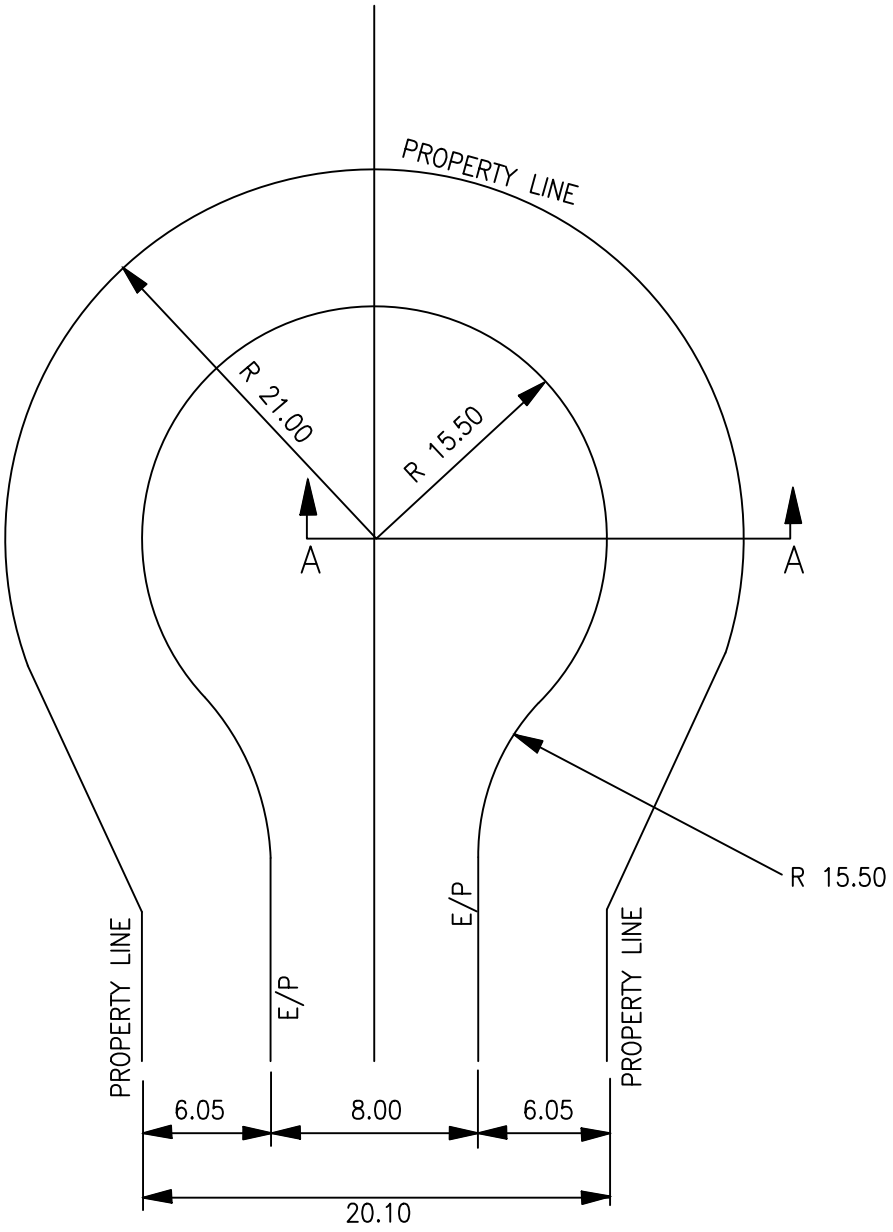
- -* MINIMUM DEPTH OF COVER SHOWN BELOW UTILITIES
- - ALL DIMENSIONS IN METERS UNLESS SHOWN OTHERWISE
- - WATERMAINS AND SANITARY SEWERS TO BE LOCATED ON NORTH OR EAST SIDES
- - STORM SEWERS TO BE LOCATED ON SOUTH OR WEST SIDES
- - TELEPHONE,HYDRO,CABLE AND LIGHTING TO BE LOCATED ON COMMON POLE AND/OR WITHIN COMMON JOINT UTILITY TRENCH

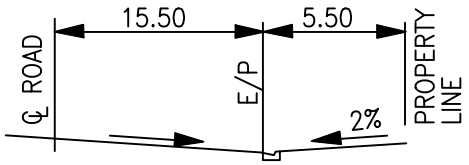
STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

UTILITY LOCATIONS
FOR
INDUSTRIAL ROADS
26.1m ROAD ALLOWANCE

OCTOBER 2021	SCSD – 3





SECTION A–A

NOTES:

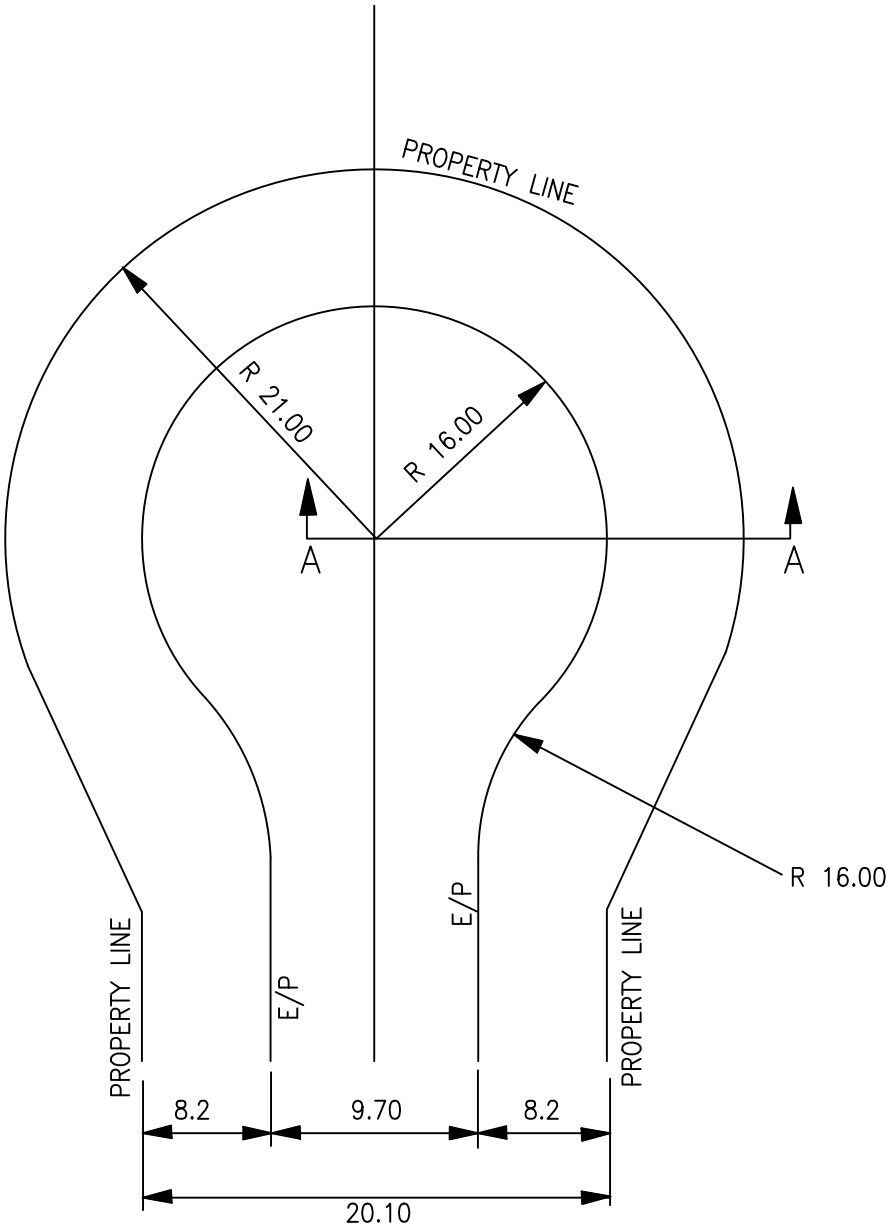
1. ALL DIMENSIONS IN METRES UNLESS SHOWN OTHERWISE
2. A 1.50 m WIDE SIDEWALK SHALL BE INSTALLED IF THE CUL–DE–SAC IS LONGER THAN 107m OR WHERE OTHERWISE SPECIFIED.
3. CURB AND GUTTER PER OPSD–600.060

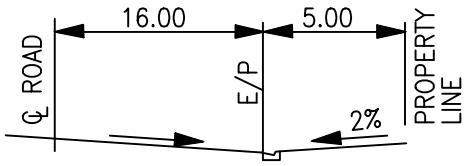
STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

RESIDENTIAL CUL–DE–SAC

OCTOBER 2021	SCSD – 4





SECTION A–A

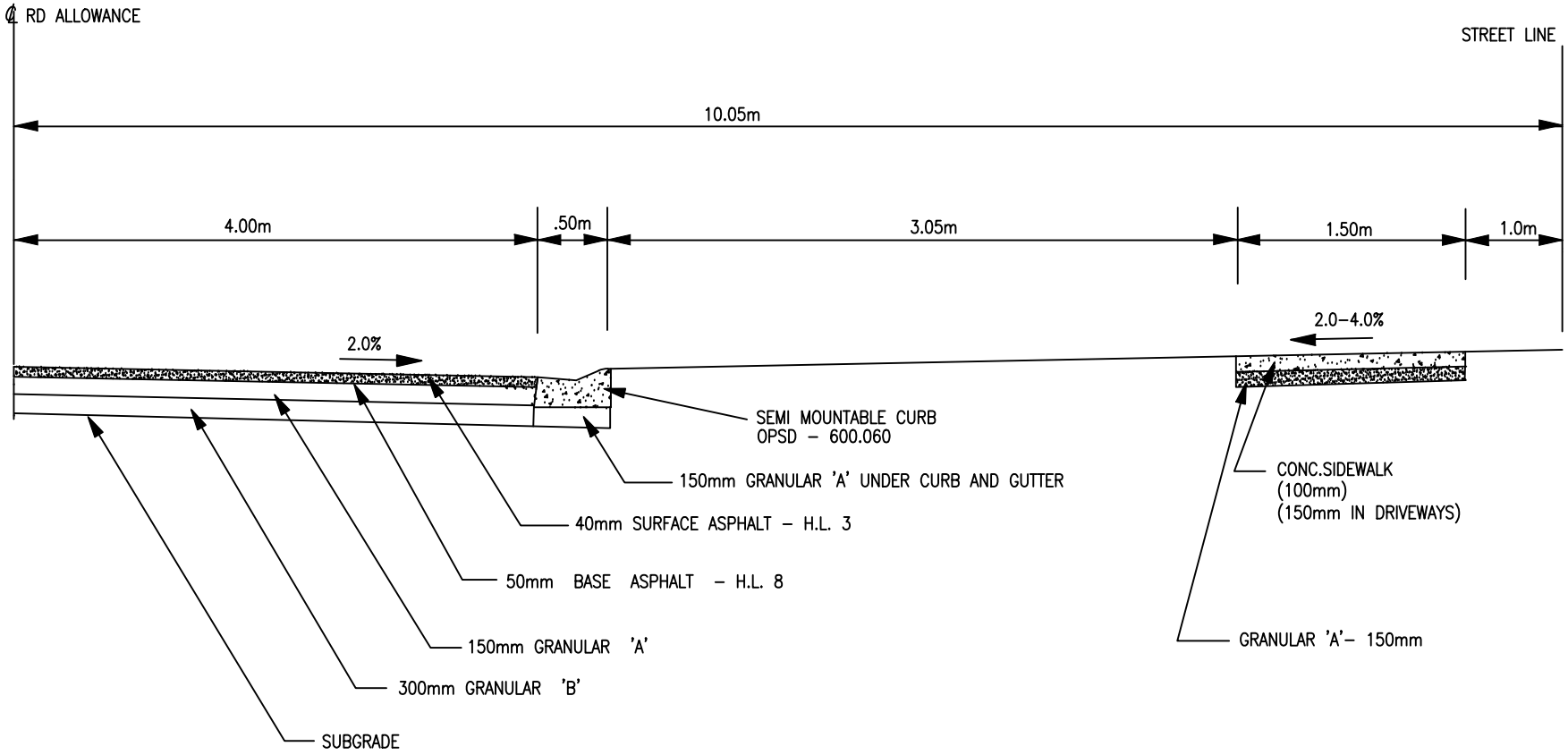
NOTES:

1. ALL DIMENSIONS IN METRES UNLESS SHOWN OTHERWISE
2. CURB AND GUTTER PER OPSD–600.040

MUNICIPALITY OF STRATHROY–CARADOC

INDUSTRIAL CUL–DE–SAC

OCTOBER 2021	SCSD – 5



NOTES:

1 – SEE SERVICING STANDARDS
2 – CROWN OF ROAD TO BE 2%
3 – 2% CROSSFALL TO BE USED IN SIDEWALK CONSTRUCTION.(MAX 4.0%)
4 – CONCRETE FOR CURBS AND SIDEWALKS TO BE 30 mpa AT 28 DAYS.
5 – ALL ASPHALT TO BE COMPACTED TO 97% MARSHALL DENSITY.
6 – ALL GRANULAR MATERIALS TO BE COMPACTED TO 100% S.P.M.D.D.
7 – THICKNESS OF ASPHALT AND GRANULARS WITHIN PROPOSED ROADWAYS SHALL BE CONFIRMED BY A GEOTECHNICAL ENGINEER.

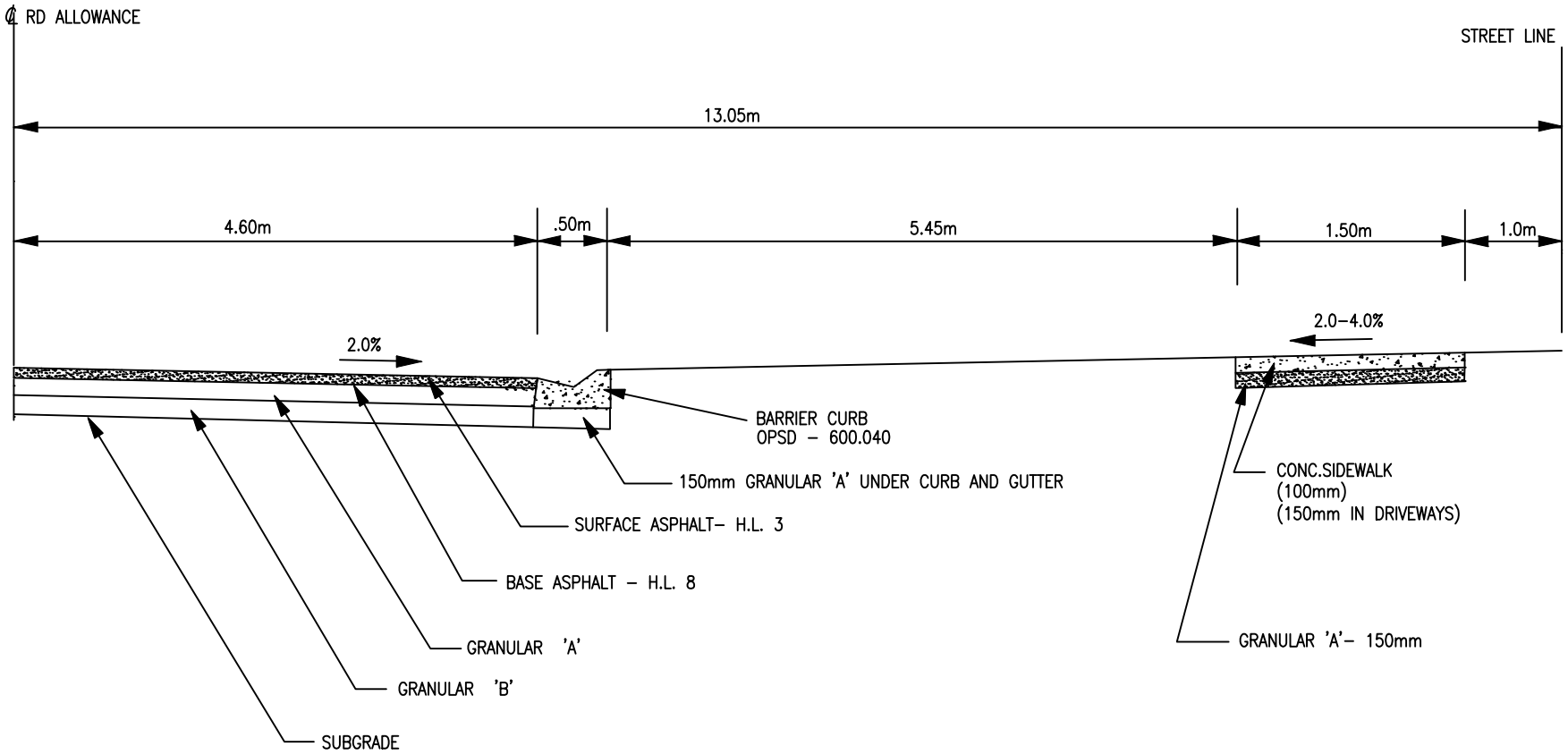
STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

LOCAL ROADWAY RESIDENTIAL

20.1m ROAD ALLOWANCE

OCTOBER 2021	SCSD – 6



NOTES:

1 – SEE SERVICING STANDARDS
2 – CROWN OF ROAD TO BE 2%
3 – 2% CROSSFALL TO BE USED IN SIDEWALK CONSTRUCTION.(MAX 4.0%)
4 – CONCRETE FOR CURBS AND SIDEWALKS TO BE 30 mpa AT 28 DAYS.
5 – ALL ASPHALT TO BE COMPACTED TO 97% MARSHALL DENSITY.
6 – ALL GRANULAR MATERIALS TO BE COMPACTED TO 100% S.P.M.D.D.
7 – THICKNESS OF ASPHALT AND GRANULARS WITHIN PROPOSED ROADWAYS SHALL BE CONFIRMED BY A GEOTECHNICAL ENGINEER.

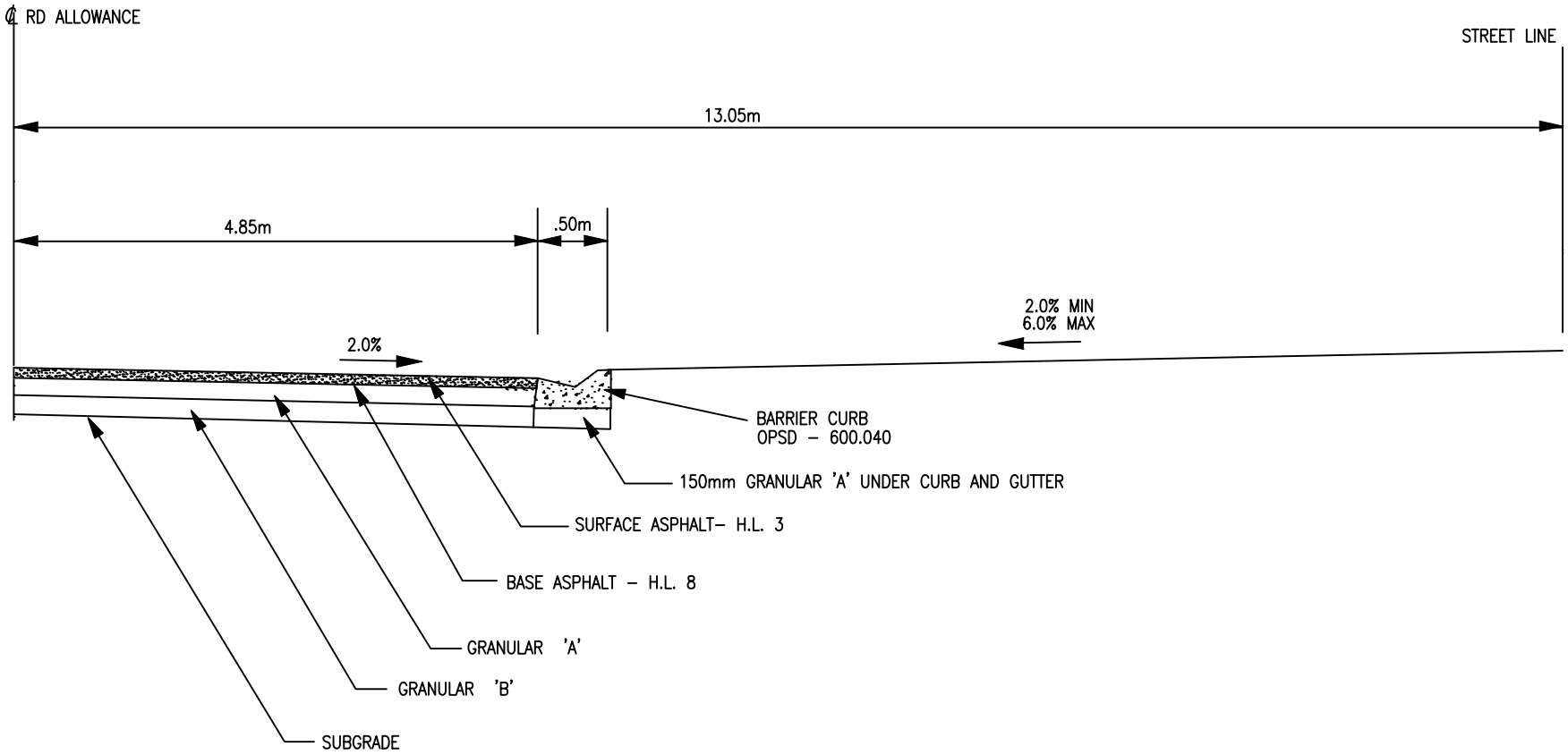
STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

COLLECTOR / ARTERIAL ROADWAY RESIDENTIAL

26.1m ROAD ALLOWANCE

OCTOBER 2021	SCSD – 7



NOTES:

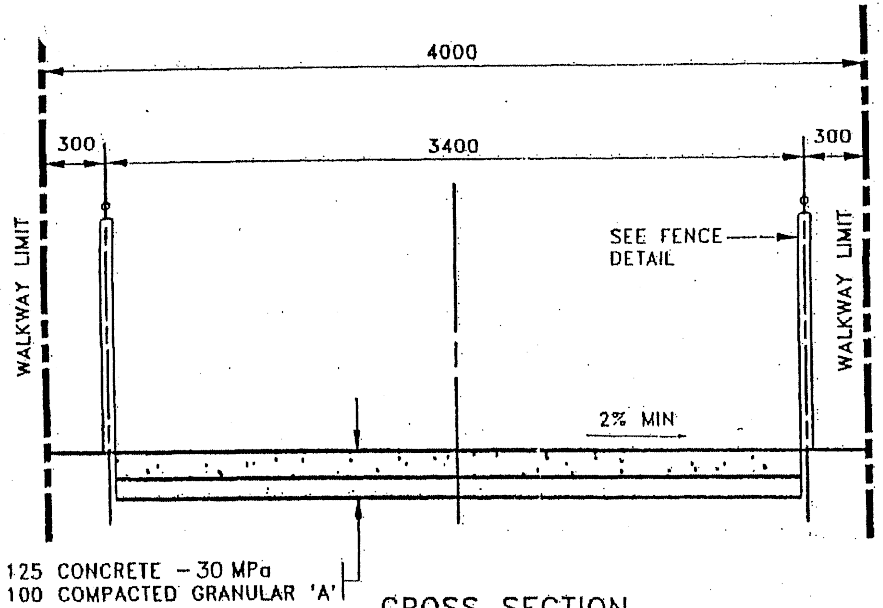
1 – SEE SERVICING STANDARDS
2 – CROWN OF ROAD TO BE 2%
3 – 2% CROSSFALL TO BE USED IN SIDEWALK CONSTRUCTION.(MAX 4.0%)
4 – CONCRETE FOR CURBS AND SIDEWALKS TO BE 30 mpa AT 28 DAYS.
5 – ALL ASPHALT TO BE COMPACTED TO 97% MARSHALL DENSITY.
6 – ALL GRANULAR MATERIALS TO BE COMPACTED TO 100% S.P.M.D.D.
7 – THICKNESS OF ASPHALT AND GRANULARS WITHIN PROPOSED ROADWAYS SHALL BE CONFIRMED BY A GEOTECHNICAL ENGINEER.

STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

INDUSTRIAL ROADWAY
26.1m ROAD ALLOWANCE

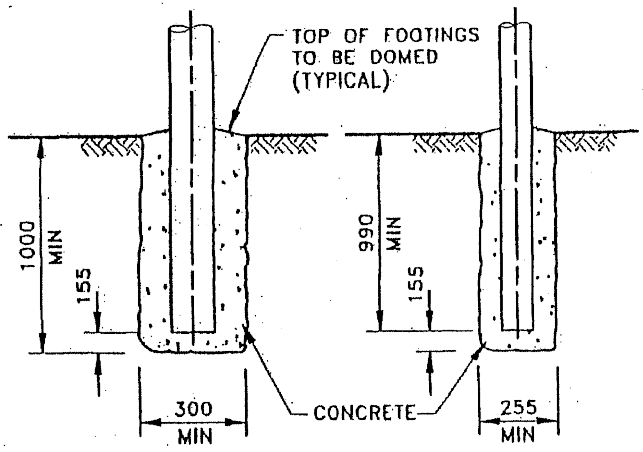
OCTOBER 2021	SCSD – 8



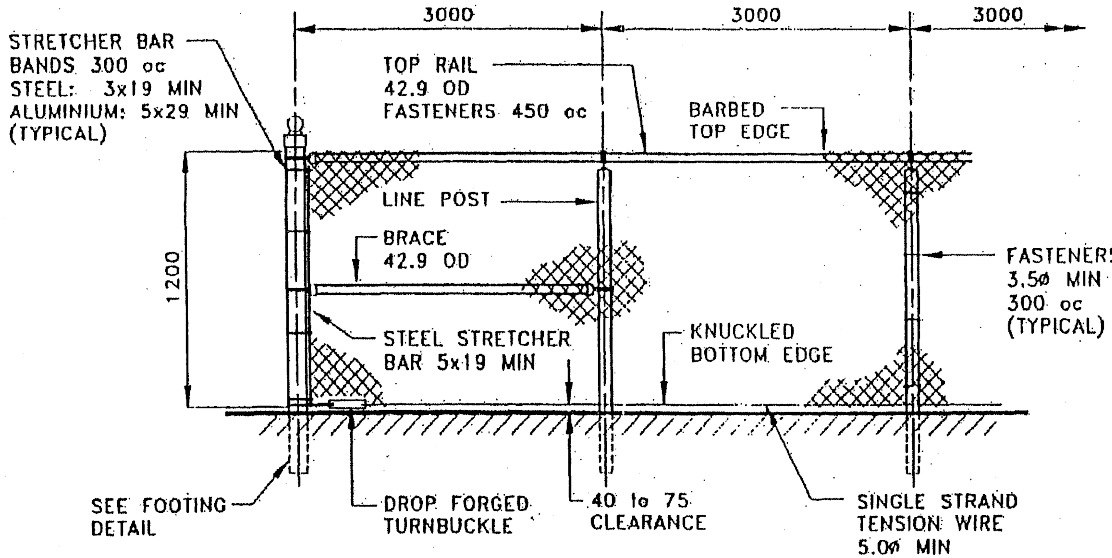
CROSS SECTION

END, CORNER, STRAINING OR GATE POST

LINEPOST



FOOTING DETAIL



FENCE DETAIL

NOTE:
ALL DIMENSIONS IN MILLIMETRES UNLESS SHOWN OTHERWISE

POST DETAILS			
DESCRIPTION	OD	LENGTH	
		STANDARD	RET. WALL
LINE	60.3	2700	2000
END, CORNER, STRAINING AND GATE (WITH 5.5m MAX OPENING)	88.9	2900	2300
GATE (WITH 10.0 MAX OPENING)	114.3	2900	–

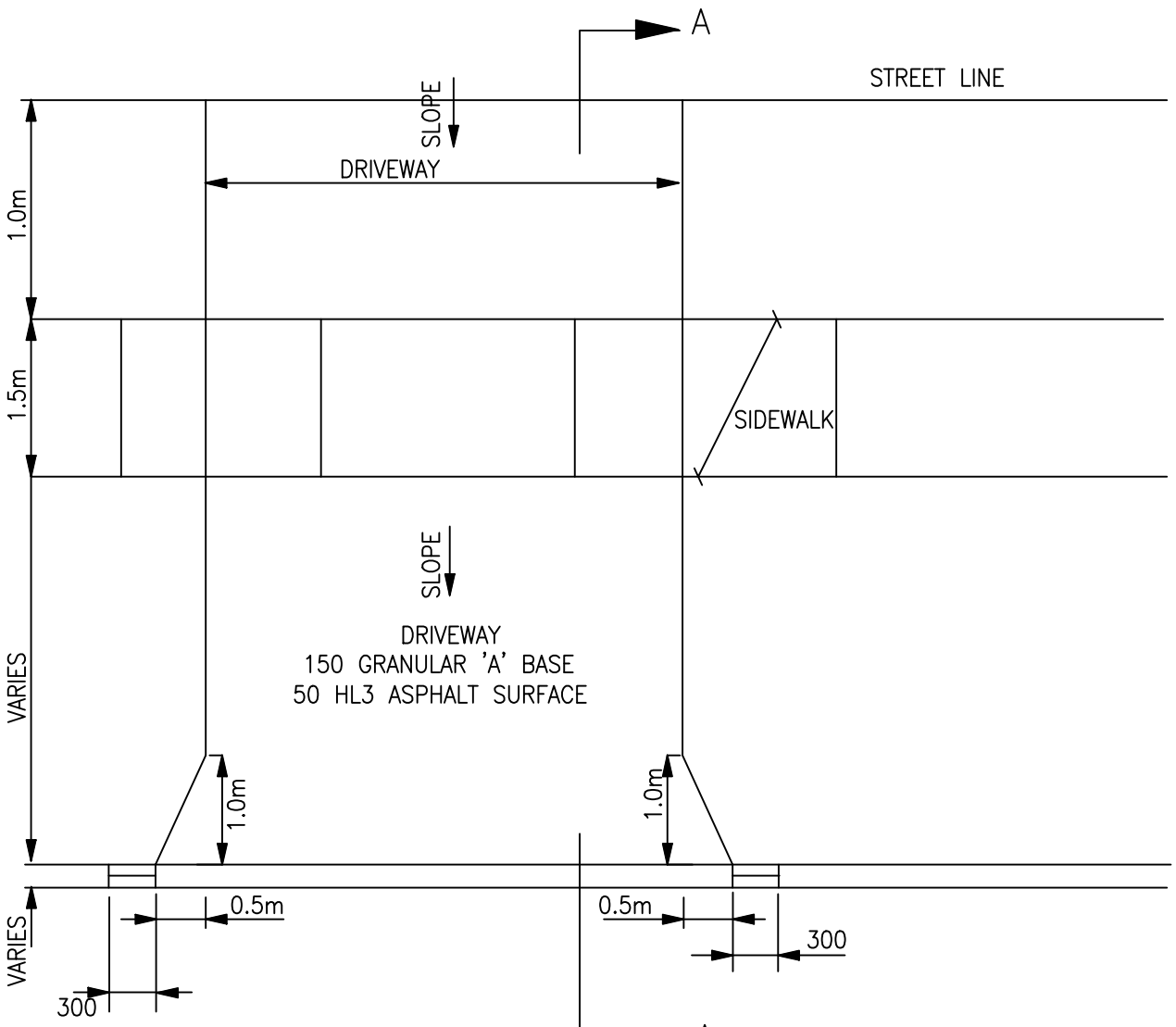
STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF STRATHROY–CARADOC

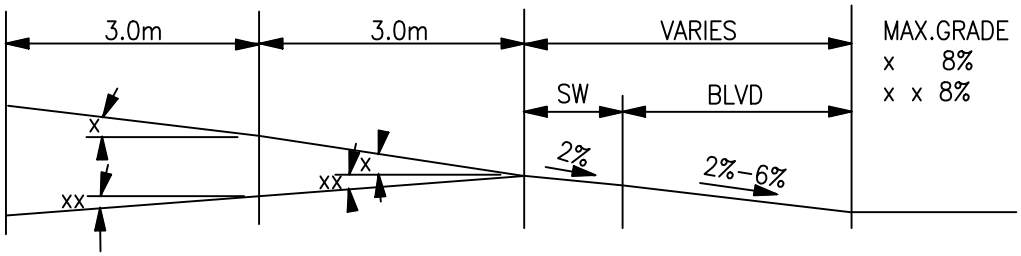
WALKWAY DETAILS

OCTOBER 2021

SCSD – 9



PLAN



SECTION A–A

NOTES:

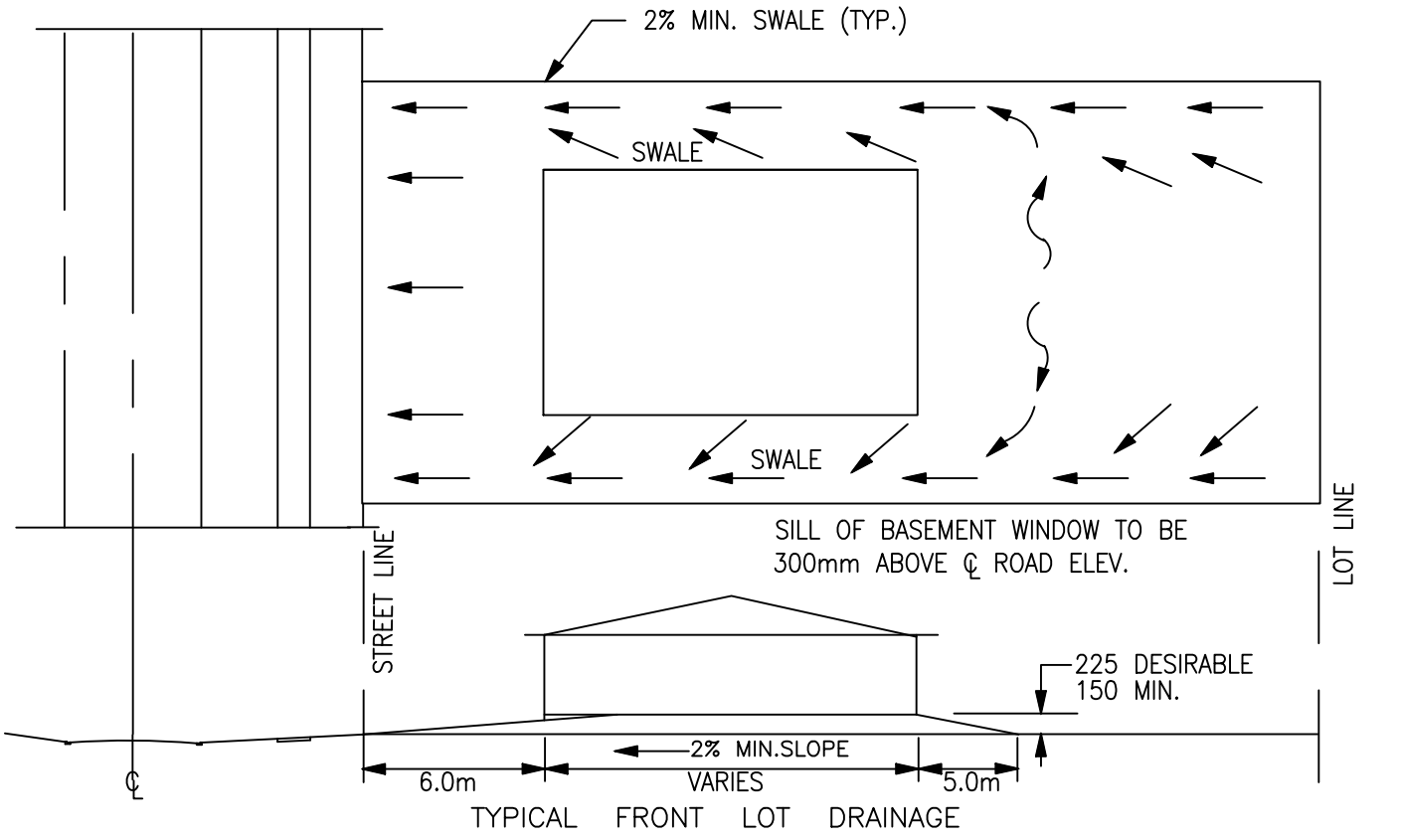
1. REFER TO THE CURRENT MUNICIPALITY ZONING BYLAW FOR ACCEPTABLE DRIVEWAY WIDTHS.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

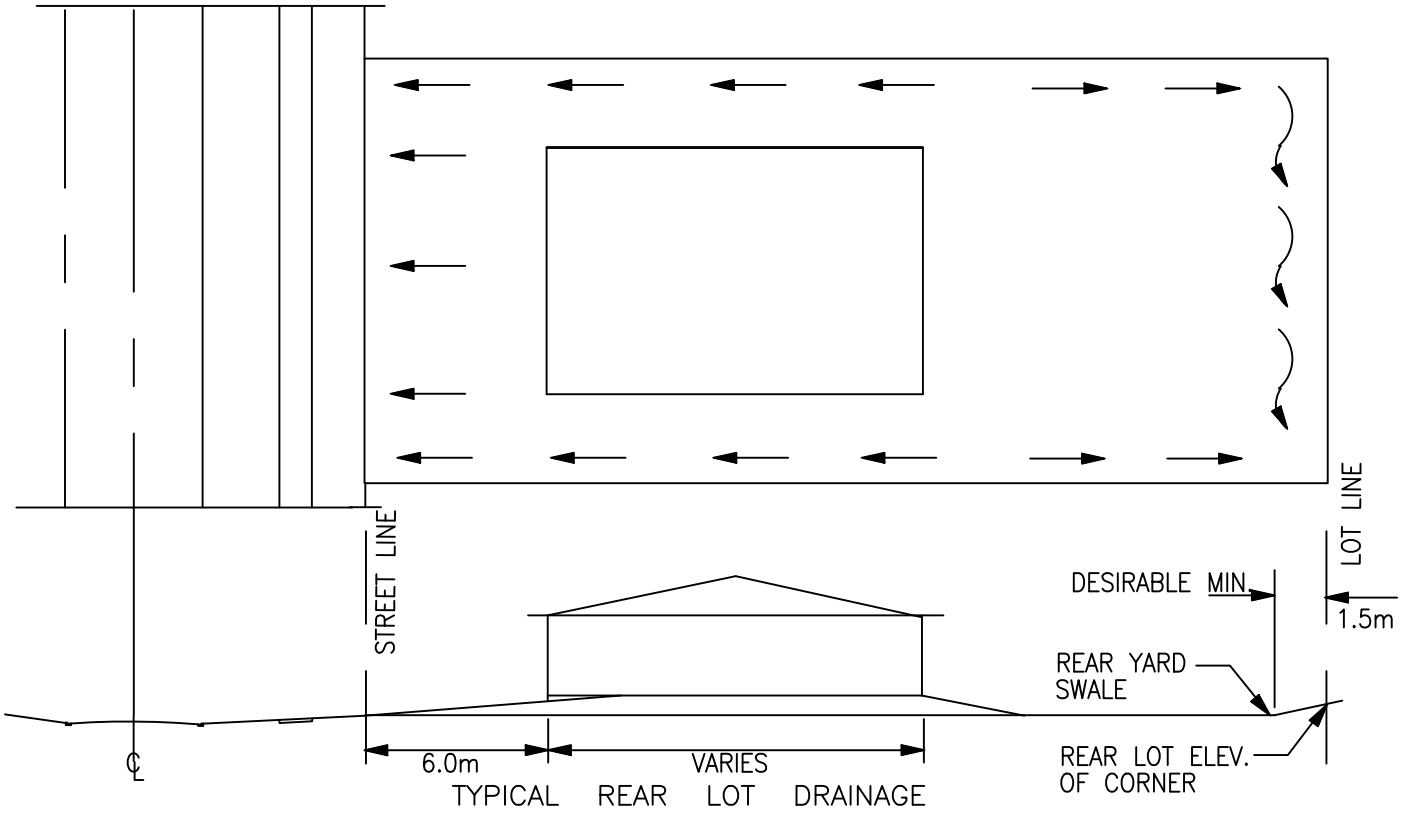
MUNICIPALITY OF
STRATHROY–CARADOC

RESIDENTIAL DRIVEWAY ENTRANCE

OCTOBER 2021	SCSD – 10



TYPICAL FRONT LOT DRAINAGE



TYPICAL REAR LOT DRAINAGE

NOTES:

MININUM LOT DIMENSIONS AND BUILDING SETBACKS IN ACCORDANCE WITH ZONING BY-LAW.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY-CARADOC

TYPICAL LOT DRAINAGE PLAN

OCTOBER 2021	SCSD – 11

LEGEND:

STORM SEWER — STORM

SANITARY(OR COMBINES)SEWER — SANITARY

WATERMAIN — WATERMAIN

WATER VALVE — WV

GAS MAIN — GAS MAIN

GAS VALVE — GV

BELL CABLE(UNDERGROUND) — BTUC

HYDRO CABLE(UNDERGROUND) — HUC

HYDRO,BELL,UTILITY POLES — H.P. B.P. U.P.

GUY ANCHOR

TREE

HEDGE,BUSH

HYDRANT — HYD

CATCH/TWIN INLET/DITCH INLET BASIN — C.B. T.I.C.B. D.I.C.B.

BUILDING

FENCE

EXISTING MANHOLE — MH

PROPOSED MANHOLE — MH

PROPERTY BARS — SIB IB RIB

RADIUS — R

BEGINNING/END OF CURVE — BC EC

NORTH/SOUTH STREET — NSL SSL

BOREHOLE — BH

BENCH MARK — BM or GBM or TBM

HYDRO TOWER

CULVERT

DIRECTION OF FLOW
MINOR SWALE

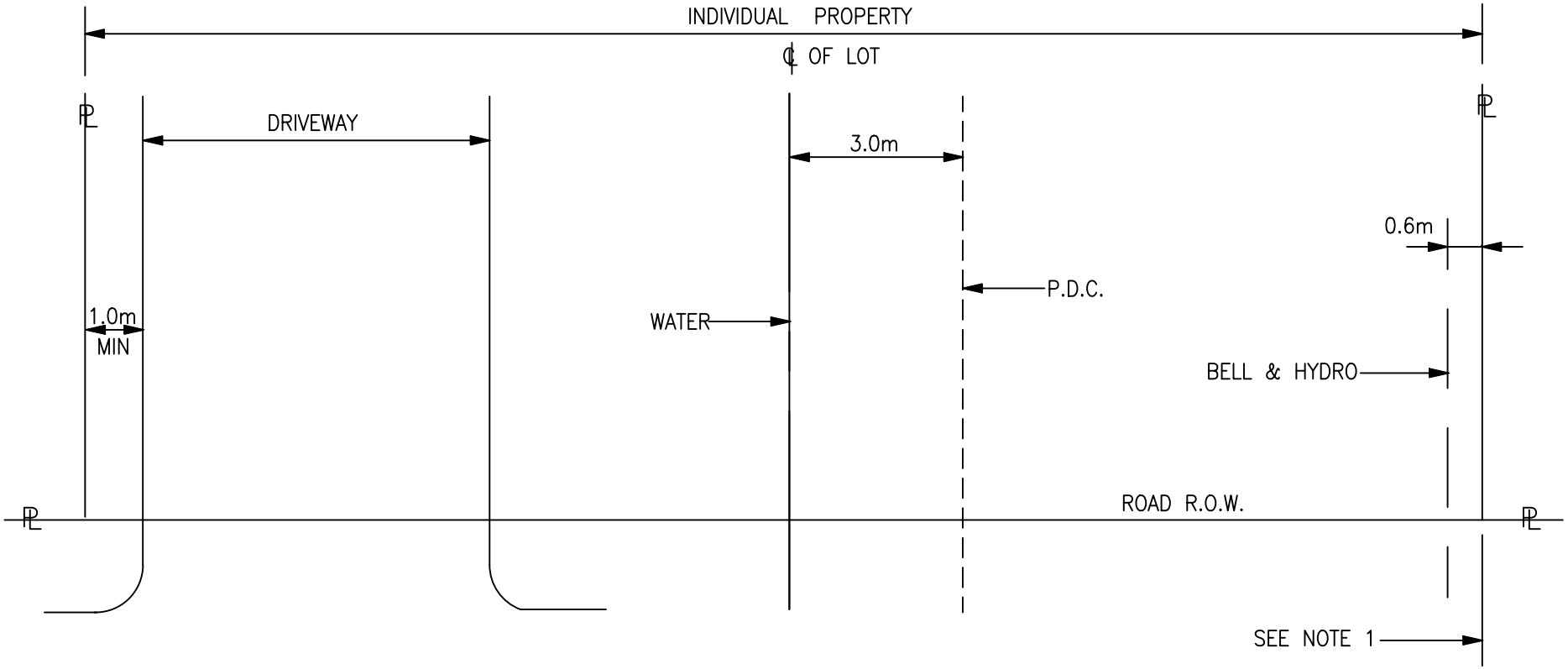
REAR YARD SWALE

OVERLAND FLOW ROUTE

MUNICIPALITY OF STRATHROY–CARADOC

PLAN AND PROFILE LEGEND

OCTOBER 2021 | SCSD – 12



NOTES:

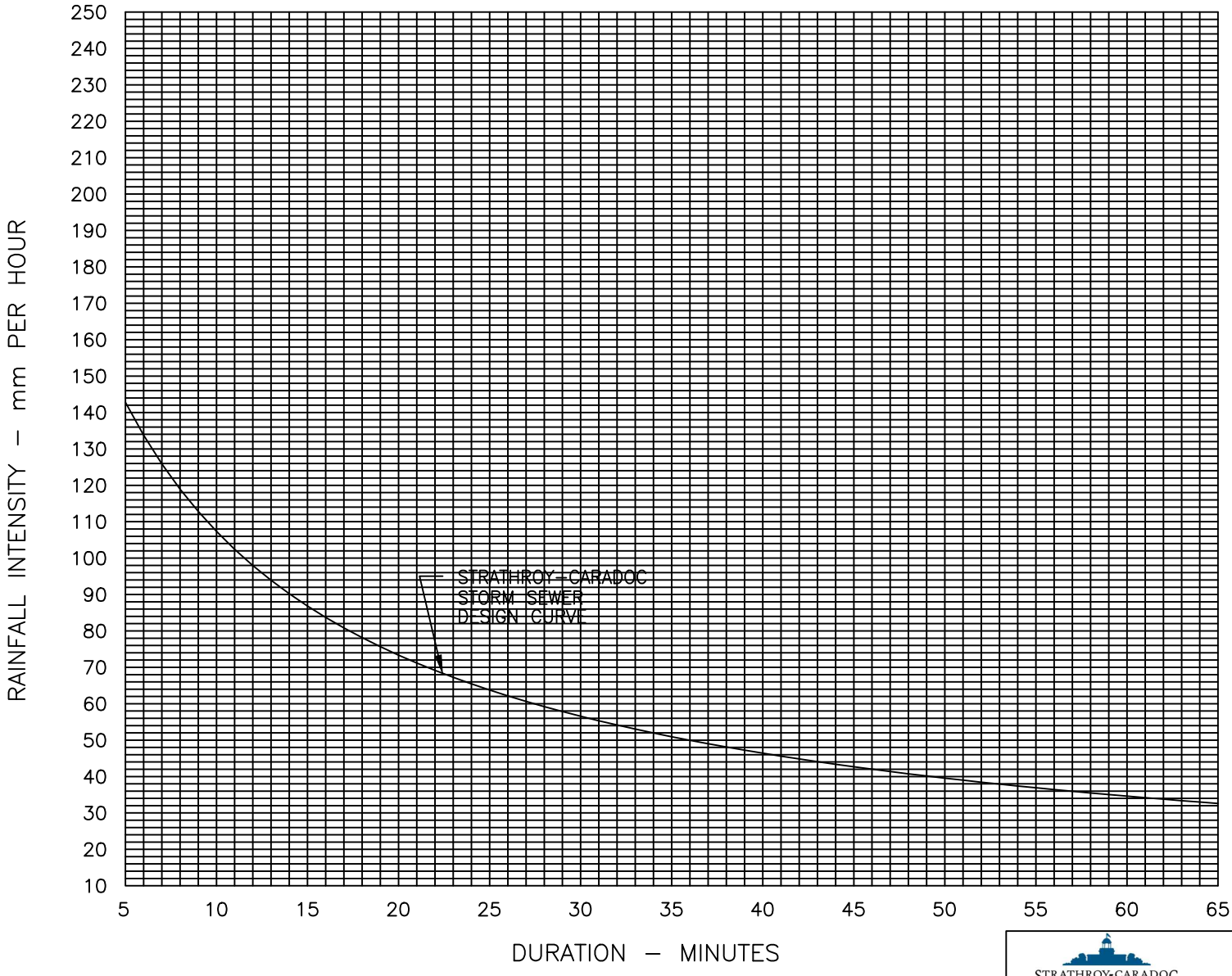
1. ALL HYDRANTS,PADMOUNTS TRANSFORMERS AND STREET LIGHT POLES ARE TO BE INSTALLED ON THE LOT LINES.
2. DRIVEWAY SHALL BE LOCATED ON THE OPPOSITE SIDE OF THE LOT TO A PADMOUNTED TRANSFORMER.
3. WATER SERVICES SHALL BE INSTALLED ON THE CENTRELINE OF SINGLE LOTS,AND 1.0m TO THE RIGHT AND LEFT OF CENTERLINE FOR SEMI–DETACTED LOTS.
4. SANITARY P.D.C. SHALL BE INSTALLED 3.0m RIGHT OF CENTERLINE FOR SINGLE LOTS AND 3.0m RIGHT AND LEFT OF CENTERLINE FOR SEMI–DETACHED LOTS
5. BELL, CABLE AND HYDRO TO BE INSTALLED IN COMMON TRENCH 0.6m FROM EITHER PROPERTY LINE.
6. REFER TO SECTION 1 (ROADWORKS) FOR ACCEPTABLE DRIVEWAY WIDTHS BASED ON INDIVIDUAL LOT FRONTAGE.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

LOT SERVICING

OCTOBER 2021	SCSD – 13

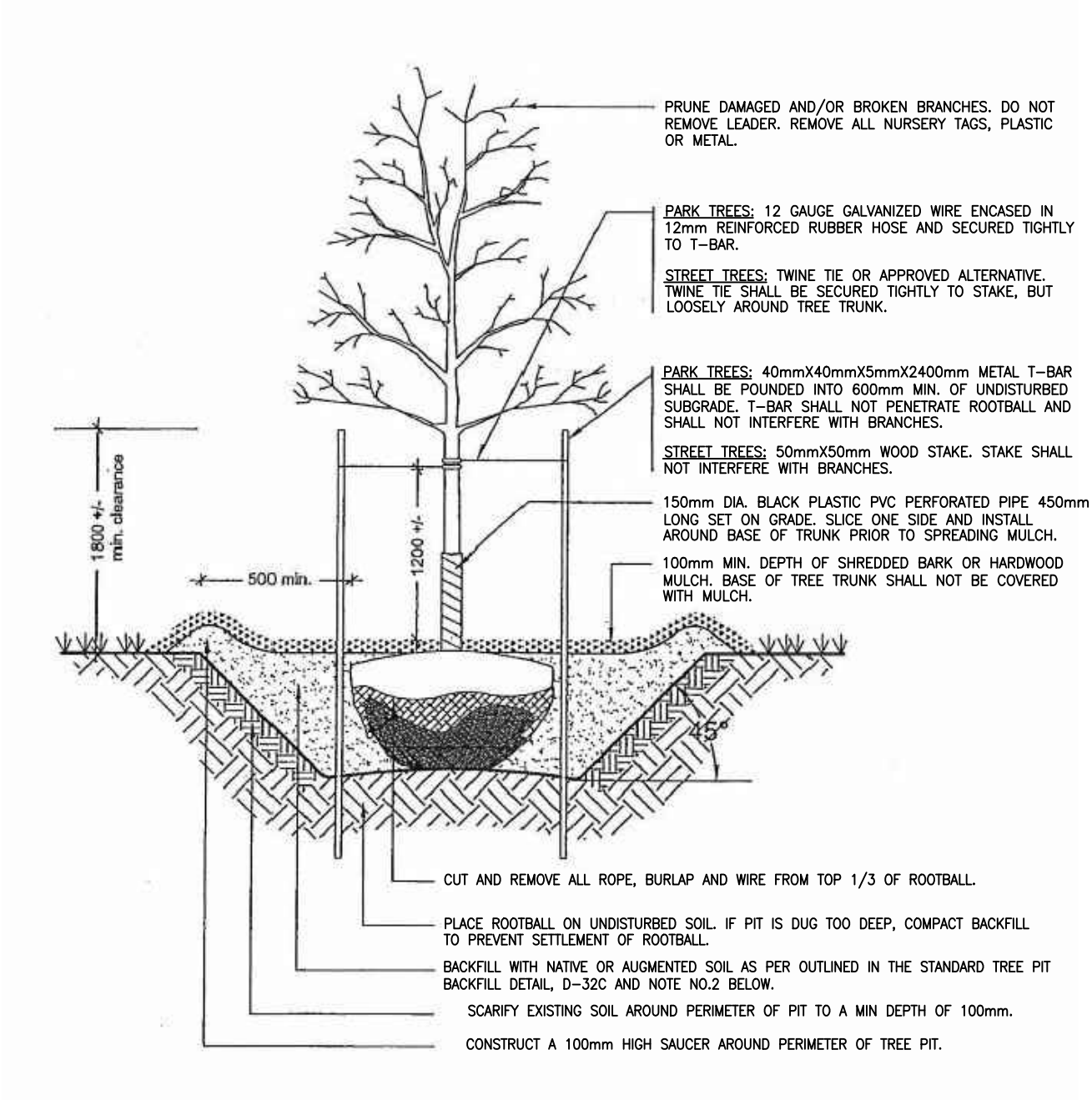


MUNICIPALITY OF
STRATHROY–CARADOC

RAINFALL INTENSITY DURATION CURVES

OCTOBER 2021

SCSD – 14



NOTES:

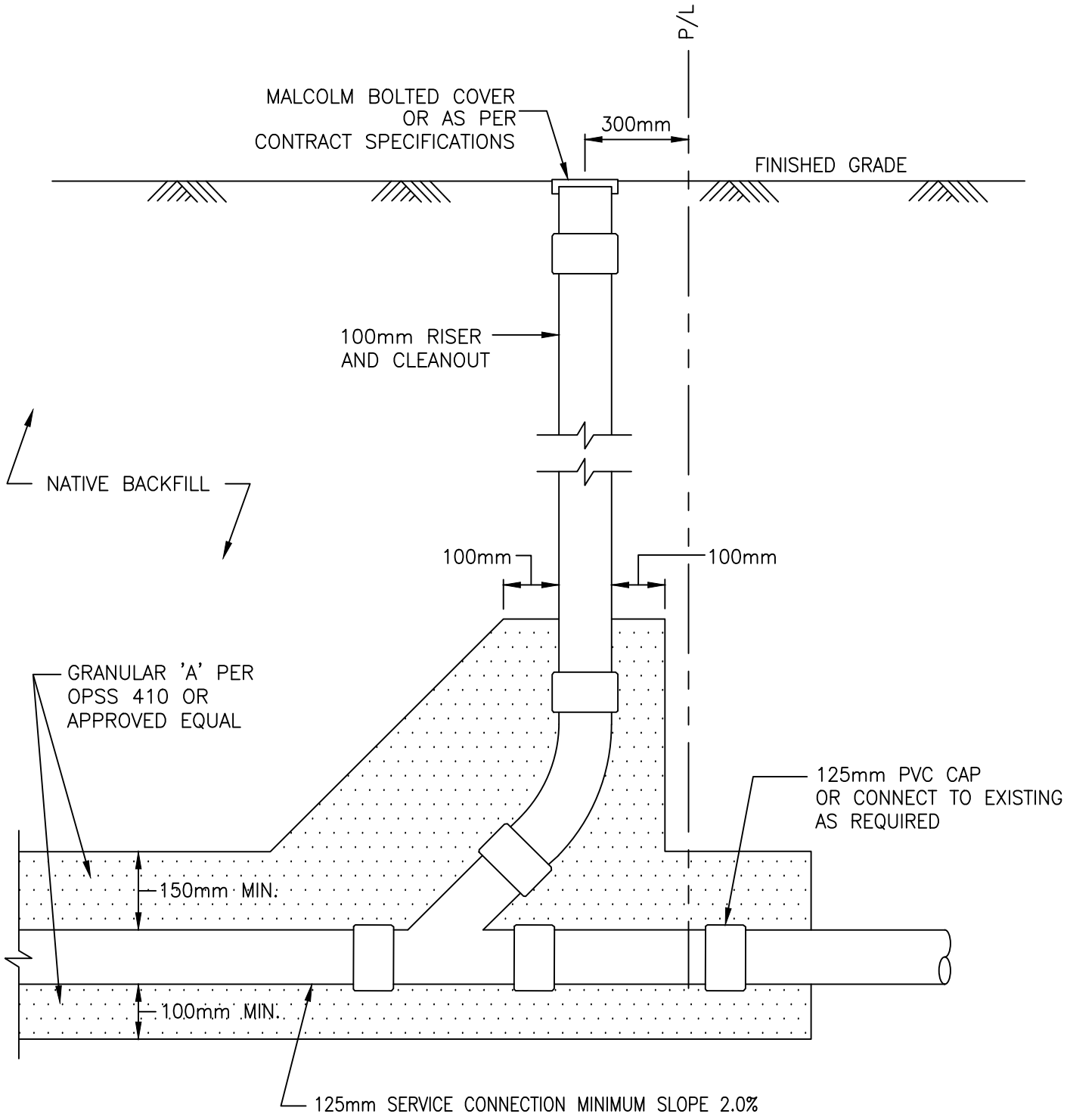
1. TRUNK TO HAVE SAME ELEVATION RELATIVE TO FINISHED GRADE AS PREVIOUSLY OCCUPIED PRIOR TO TRANSPLANTING.
2. SAUCER TO BE SOAKED WITH WATER AND MULCHED IMMEDIATELY FOLLOWING PLANTING.
3. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
4. ALL TWINE AND BURLAP AROUND ROOTBALL MUST BE BIO-DEGRADABLE. NYLON ROPE WILL NOT BE ACCEPTED.
5. CALIPER OR HEIGHT OF TREE MUST MEET CONTRACT REQUIREMENTS.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF STRATHROY-CARADOC

TREE PLANTING DETAIL

OCTOBER 2021	SCSD – 15



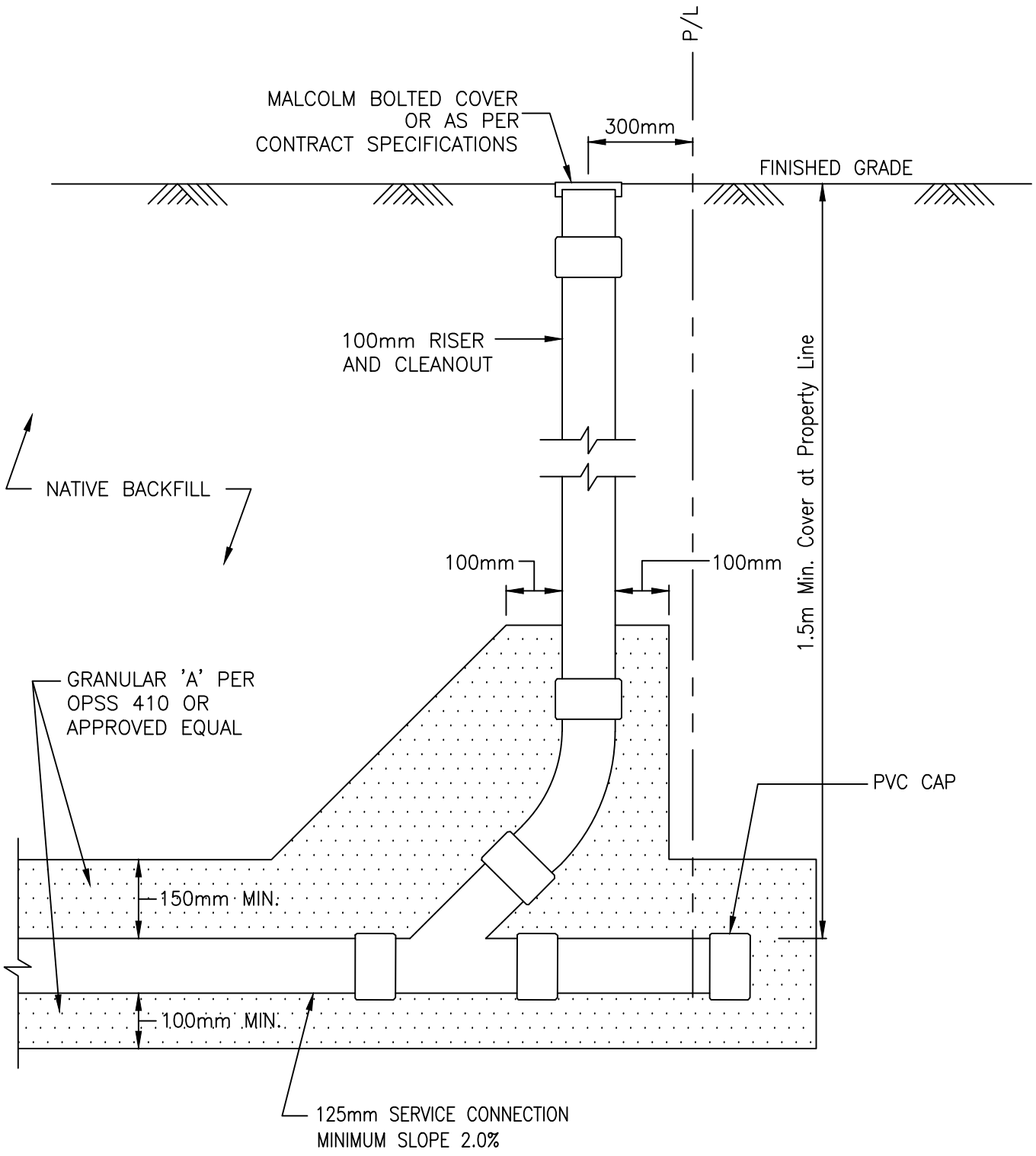
NOTES:

1. ALL BENDS TO BE A MINIMUM 60 CM IN LENGTH.
2. CLEAN OUT MUST BE EXPOSED AND ACCESSIBLE TO MUNICIPAL STAFF.

MUNICIPALITY OF
STRATHROY–CARADOC

SANITARY SERVICE CLEANOUT DETAIL

OCTOBER 2021	SCSD – 16



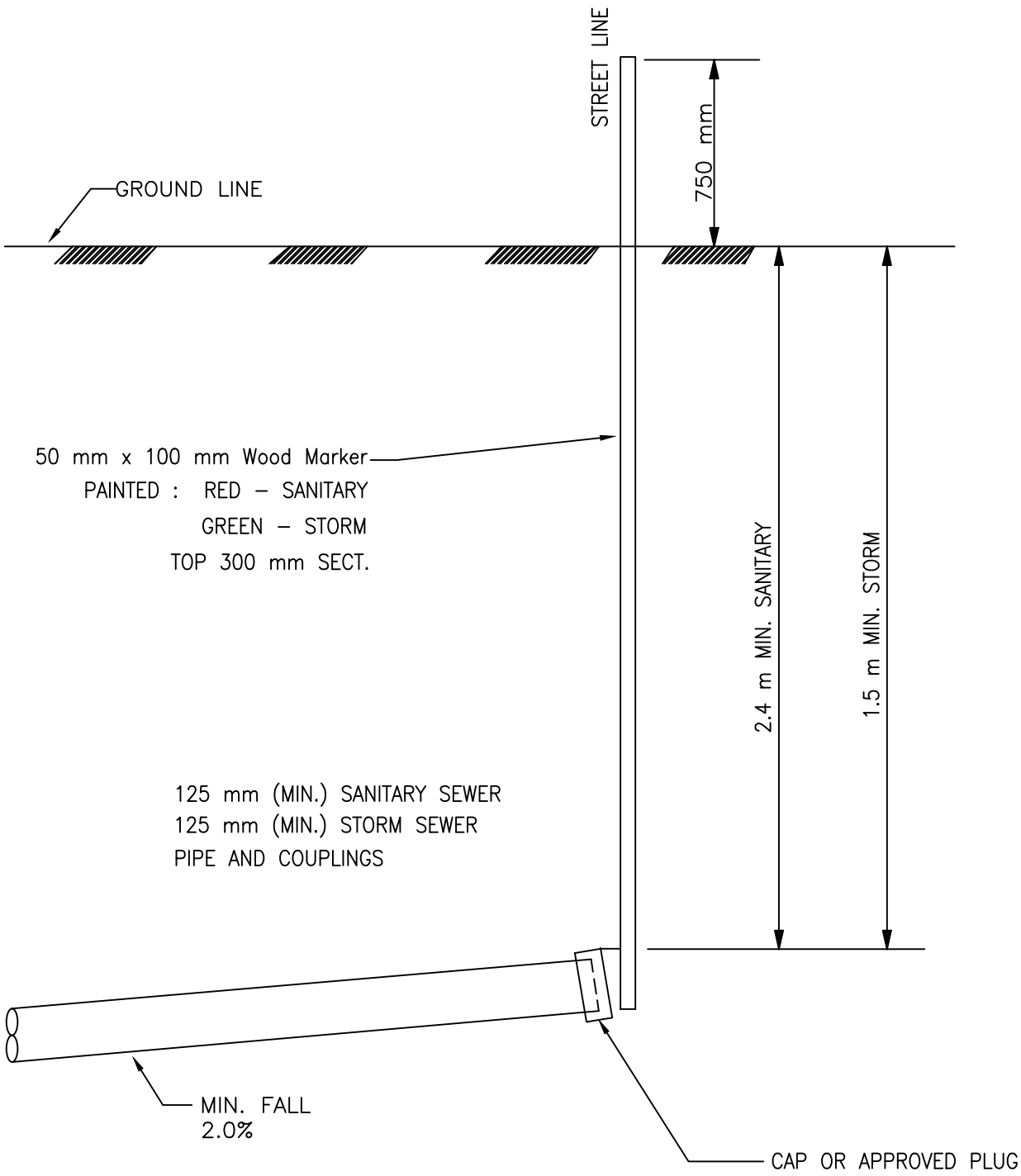
NOTES:

1. SIZE OF STORM SERVICE TO BE AS NOTED IN THE FORM OF TENDER.
2. CLEAN OUT MUST BE EXPOSED AND ACCESSIBLE TO MUNICIPAL STAFF.

MUNICIPALITY OF
STRATHROY–CARADOC

STORM SERVICE CLEANOUT DETAIL

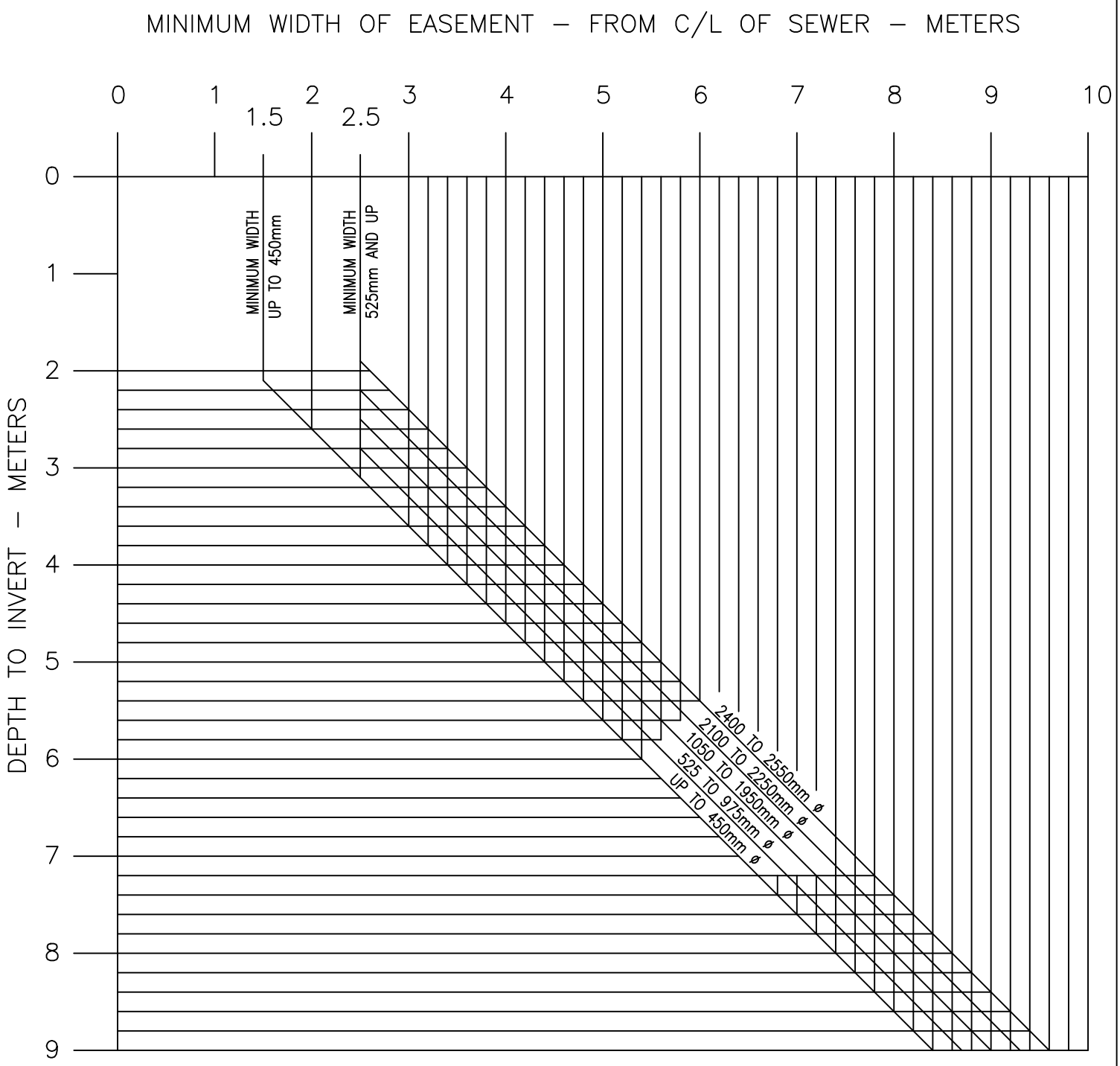
OCTOBER 2021	SCSD – 17



MUNICIPALITY OF
STRATHROY–CARADOC

PRIVATE DRAIN CONNECTIONS AT STREET LINE

OCTOBER 2021	SCSD – 18



NOTES:

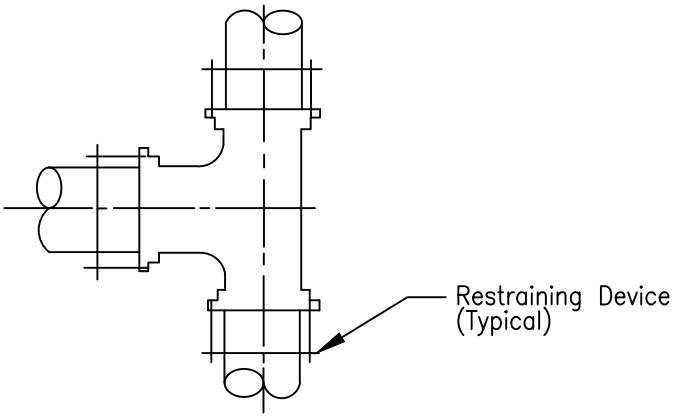
1. MINIMUM EASEMENT WIDTH MEASURED FROM C/L OF SEWER PIPE EG: 675mm DIAM. SEWER WITH INVERT 3.9m BELOW FINISHED SURFACE ELEVATION. WIDTH OF EASEMENT REQUIRED = 3.6m EACH SIDE OR A TOTAL WIDTH OF 7.2m.
2. THROUGH FIELDS, OPEN SPACE, ETC 9.1m AND 3.0m ON ONE SIDE OF SEWER C/L AND 6.1m ON THE OTHER, OR AT LEAST 3.0m WIDER THAN THE MIN WIDTH OBTAINED FROM THIS CHART, AS REQUIRED BY THE MUNICIPAL ENGINEER.

STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

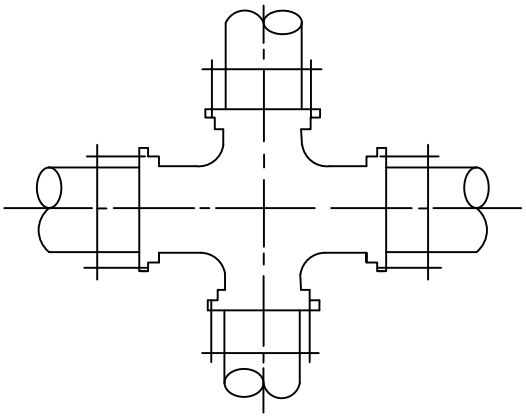
MINIMUM EASEMENT WIDTH

OCTOBER 2021 | SCSD – 19

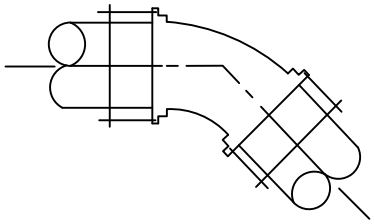


TEE

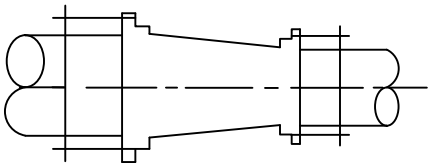
HYDRANT TEE – SEE NOTE 2



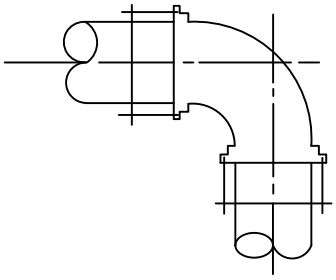
CROSS



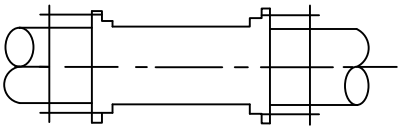
TYPICAL BEND



REDUCER

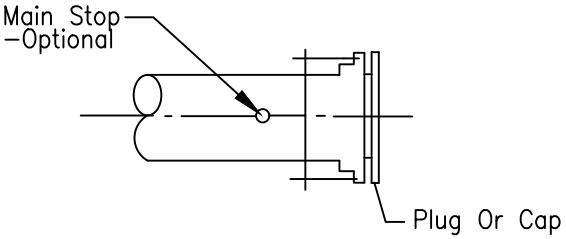


90° BEND



SLEEVE

SEE NOTE 1



DEAD END

NOTES:

1. All joints shall have thrust restraint devices. Sleeves require restraints when they are within the restrained length of other joints.
2. Unless otherwise stated, three pipes in each direction shall be restained from a joint and one pipe in each direction from a hydrant tee.

3. Fire Hydrants shall be fully restrained from the main to the hydrant boot.

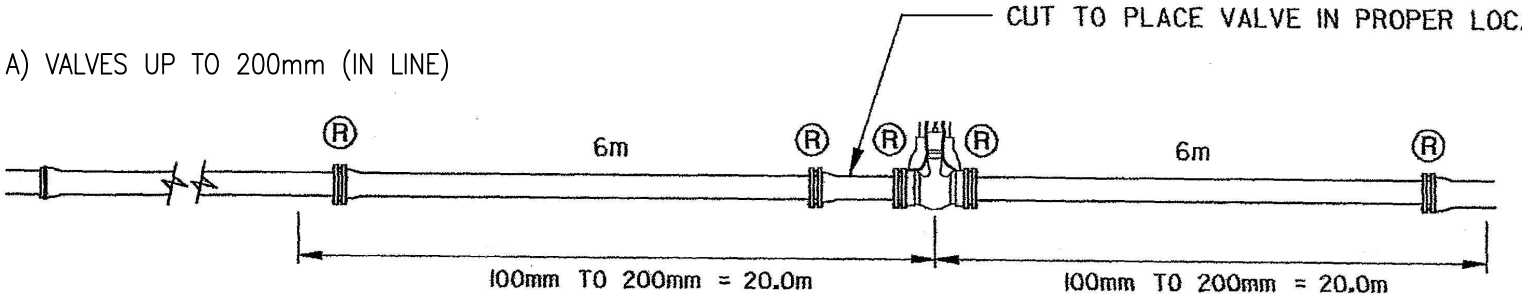
STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

JOINT THRUST RESTRAINTS

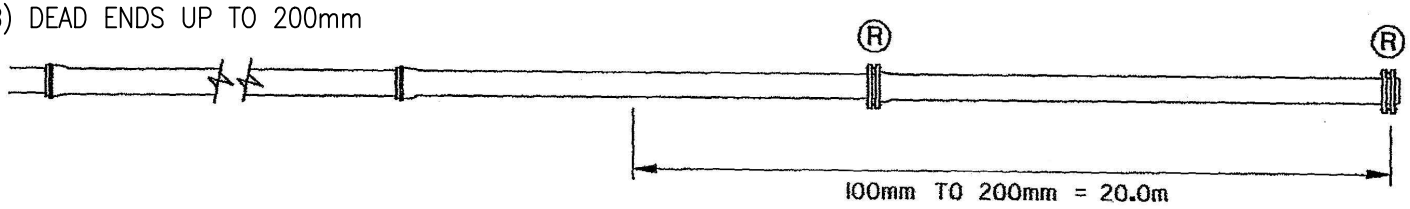
OCTOBER 2021	SCSD – 20

A) VALVES UP TO 200mm (IN LINE)



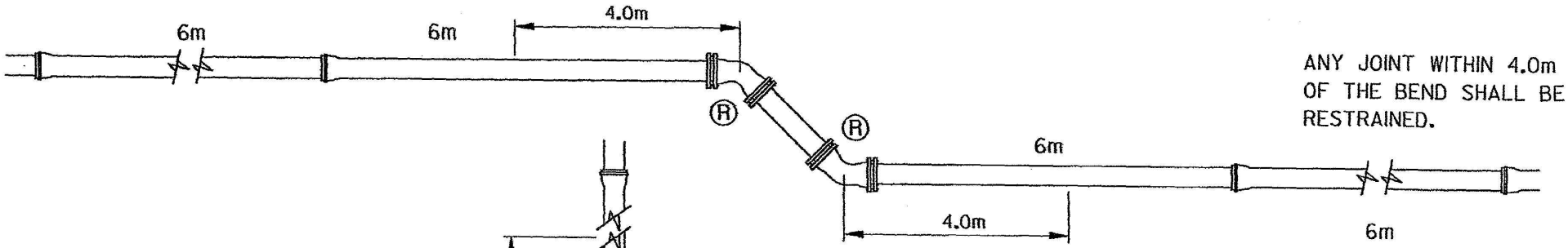
ALL VALVES MUST BE RESTRAINED AS NOTED INCLUDING ANY JOINTS WTHIN THE DISTANCE INDICATED.

B) DEAD ENDS UP TO 200mm



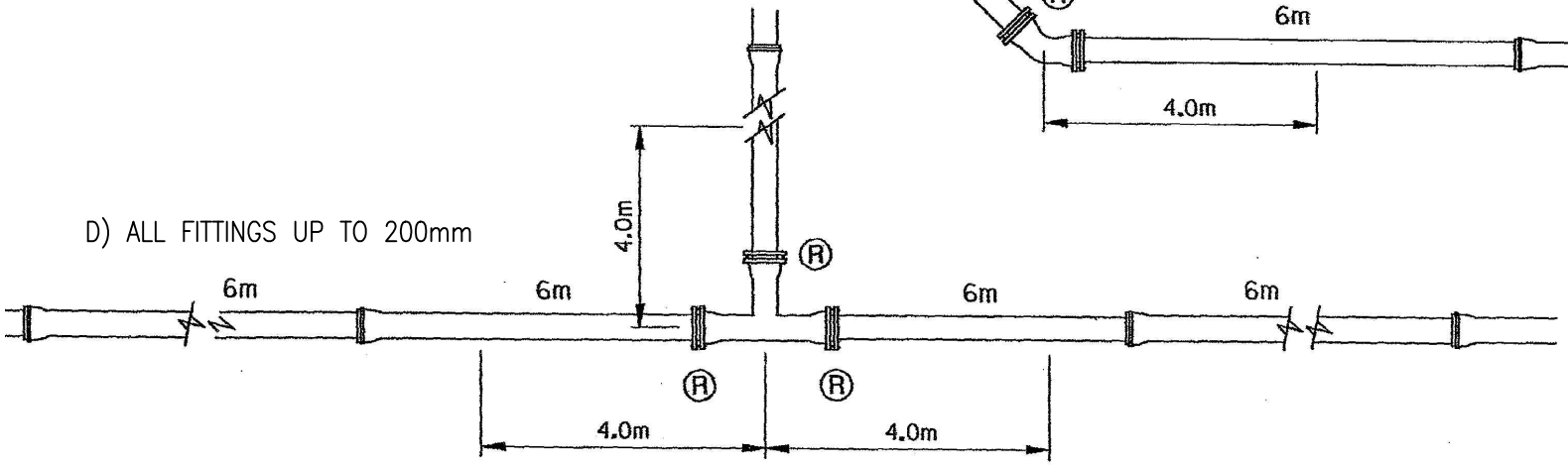
ALL DEAD ENDS MUST BE RESTRAINED AS NOTED INCLUDING ANY JOINTS WTHIN THE DISTANCE INDICATED.

C) BENDS UP TO 200mm



ANY JOINT WITHIN 4.0m OF THE BEND SHALL BE RESTRAINED.

D) ALL FITTINGS UP TO 200mm



ALL FITTINGS MUST BE RESTRAINED INCLUDING ANY JOINTS WITHIN 4.0m.

Ⓡ = RESTRAINT

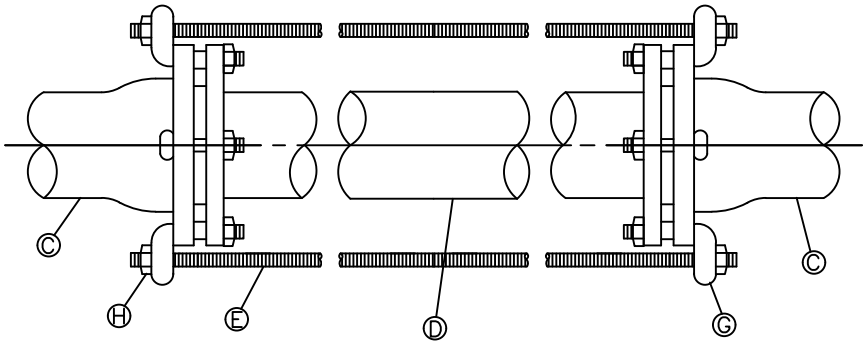
NOTES:

1. For watermains 250MM in diameter and larger, Engineer to provide joint restraint calculations.

MUNICIPALITY OF STRATHROY–CARADOC

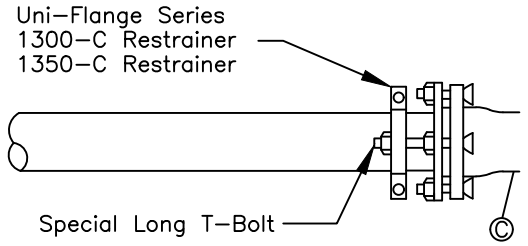
TYPICAL RESTRAINTS DETAILS (UP TO 200mm DIA. W.M.)

OCTOBER 2021 | SCSD – 21



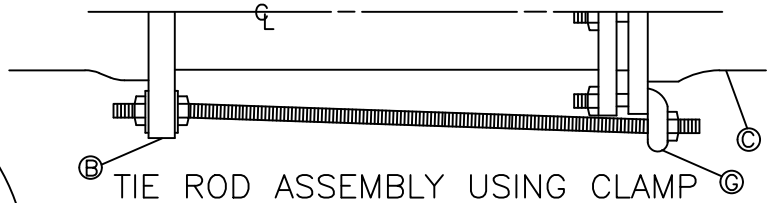
TIE ROD ASSEMBLY

FOR D.I. & P.V.C. PIPE



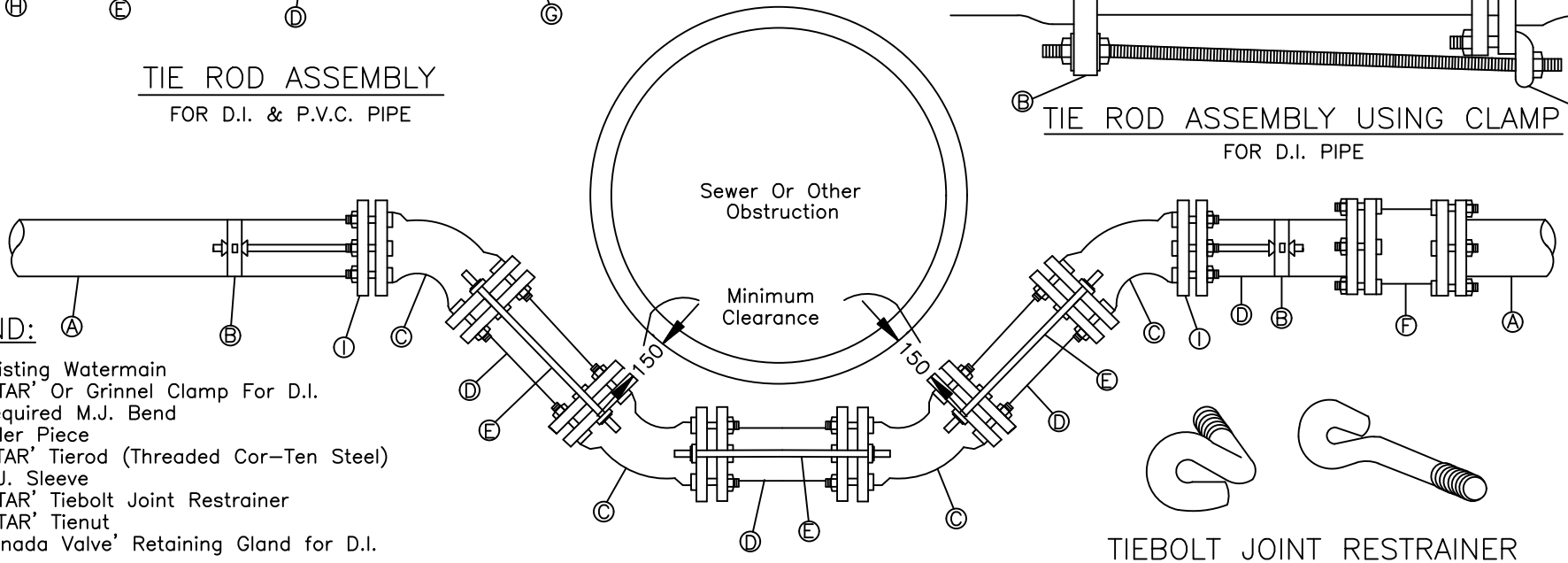
RESTRAINER ASSEMBLY

FOR P.V.C. PIPE



TIE ROD ASSEMBLY USING CLAMP

FOR D.I. PIPE



LEGEND:

A	Existing Watermain
B	'STAR' Or Grinnel Clamp For D.I.
C	Required M.J. Bend
D	Filler Piece
E	'STAR' Tierod (Threaded Cor–Ten Steel)
F	M.J. Sleeve
G	'STAR' Tiebolt Joint Restrainer
H	'STAR' Tienut
I	'Canada Valve' Retaining Gland for D.I.

TIEBOLT JOINT RESTRAINER

NOTES:

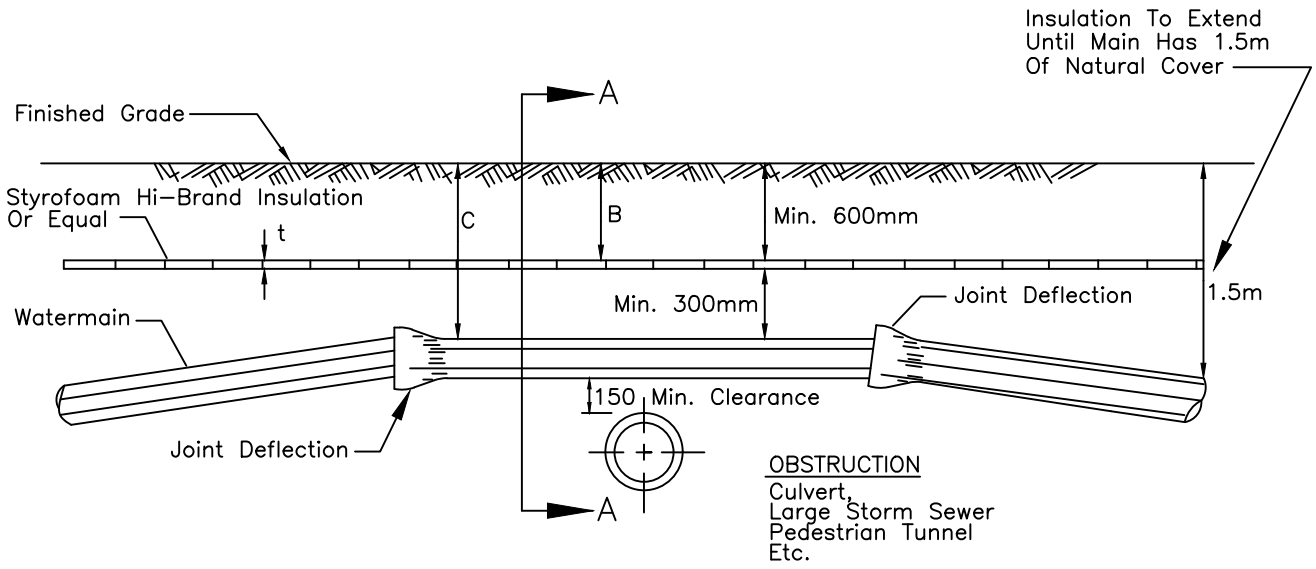
1. Dimensions are in millimeters unless shown otherwise.
2. This detail to be used for offsets on 100, 150 & 200mm diameter mains. Offsets on large mains require individual approval.
3. If offset is installed in horizontal or inverted position, minimum cover to be decided by the engineer.
4. 'STAR' joint restraint system is available from Canada Valve Inc.
5. One pair of 20mm diameter rods required for 100, 150, & 20mm diameter pipe.
6. Cover tiebolt assembly with Denso paste, mastic and tape.
7. Anodes to be installed on all M.J. fittings.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF STRATHROY–CARADOC

STANDARD MECHANICAL JOINT OFFSET INSTALLATION USING TIEBOLT COUPLINGS

OCTOBER 2021	SCSD – 22

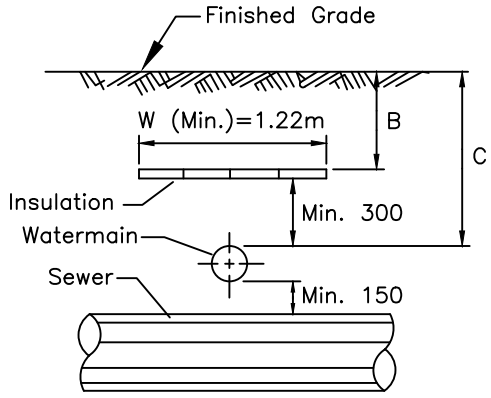


ELEVATION OF JOINT DEFLECTION OFFSET

SAME PROCEDURE WILL APPLY TO OFFSETS SHOWN ON DWG. W-4

INSULATION THICKNESS	
C (m)	t (mm)
0.90	50
1.09	50
1.20	25
1.35	25

INSULATION WIDTH	
B (m)	W (m)
0.60	1.83
0.75	1.54
0.90	1.22



SECTION "A-A"

NOTES:

1. All dimensions are in millimeters unless shown otherwise.

2. Minimum compressive strength of insulation to be 690 KPa. Insulation shall be installed in thickness required in strict accordance with the insulation manufacturer's directions. Insulation shall be installed over 150mm of fine granular fill screened smooth.

   Butt insulation tightly together without gaps, stagger end joints if more than one layer used.

   To hold in place, skewer insulation board to ground with 200mm hardwood skewers, min. 6mm dia. and 200mm long. 2 skewers per board.

   If 2 layers of insulation are used, skewer only the top layer through the first layer using a skewer 150mm longer than the combined thickness of the 2 layers of insulation. Insert skewers at approximately 30° angle.

   Place at least 200mm of fine granular fill over insulation before using compaction equipment.

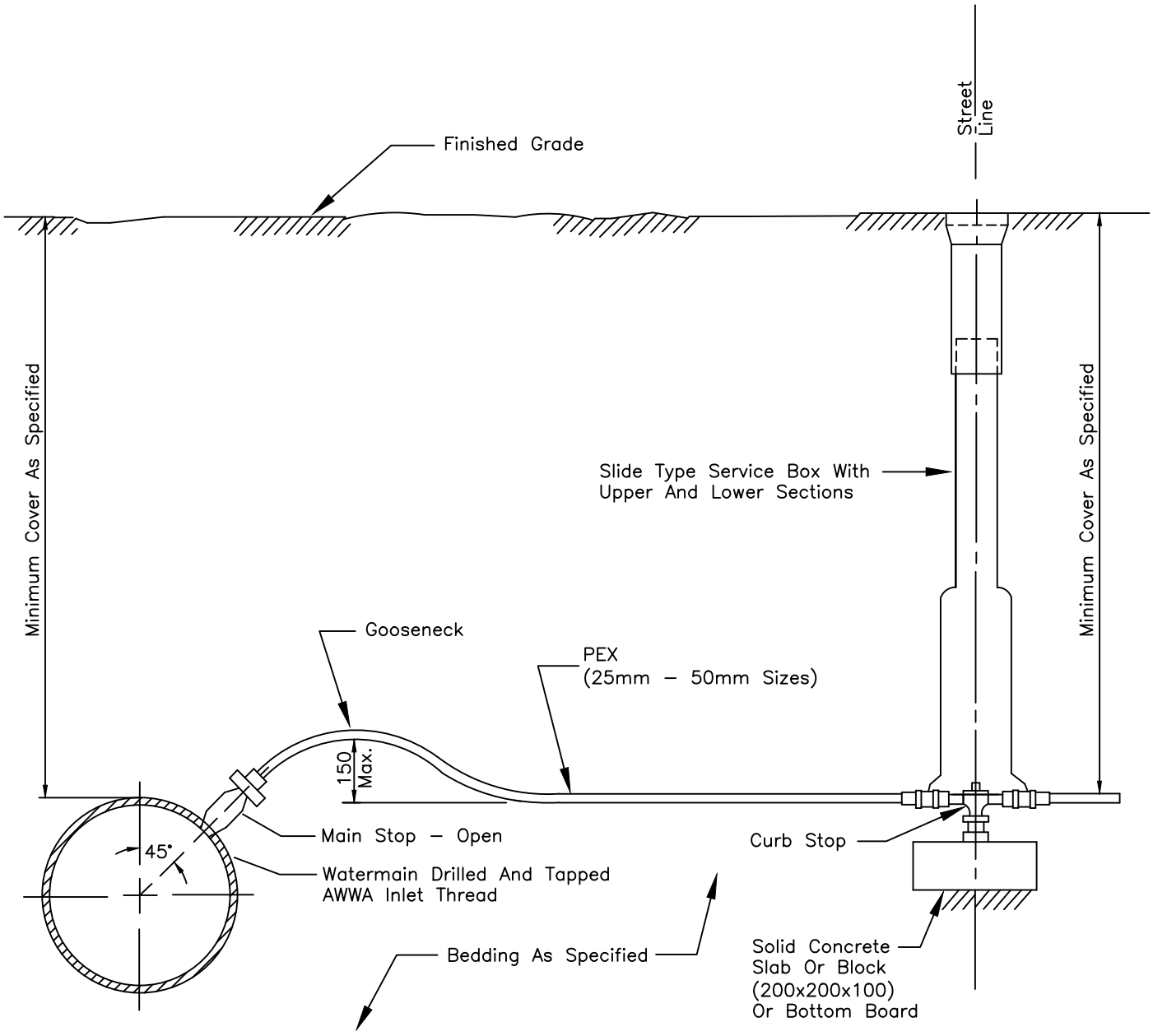
3. If pipe is P.V.C., offset must be made using Dwg. SCSD-22.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY-CARADOC

INSULATION OF SHALLOW MAINS & OFFSETS

OCTOBER 2021	SCSD - 23



NOTES:

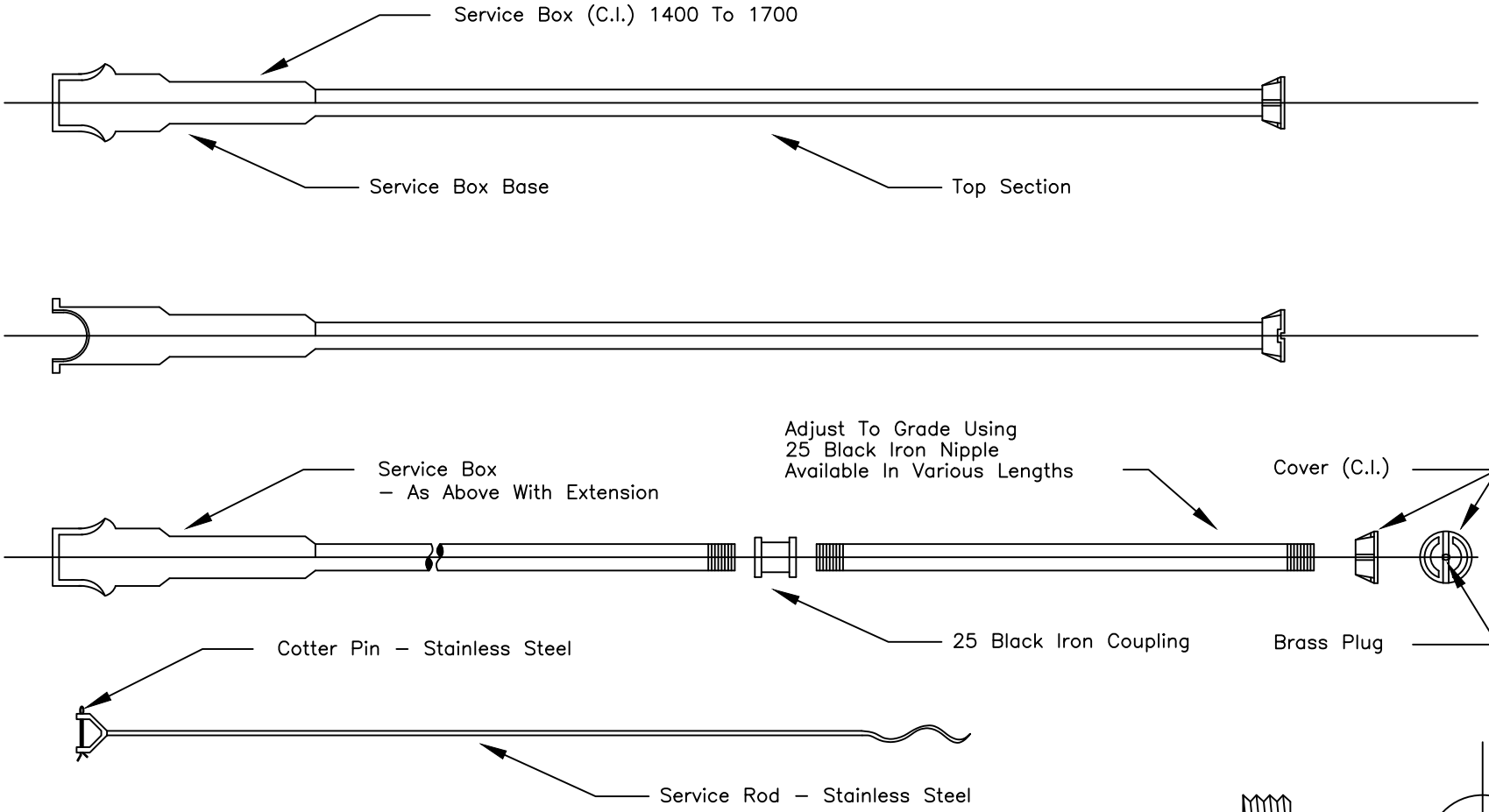
1. Service connections to plastic watermains to be made using service saddles or tapped service tee.
2. For any junction made in the service pipe between main stop and curb stop, couplings will not be permitted unless service length exceeds 20m.
3. All water services to be installed 90° to the longitudinal axis of the watermain.
4. For new installations a blow–off tail shall be installed from the curbstop to a minimum distance of 0.6m above final grade.
4. All dimensions are in millimeters unless otherwise shown.

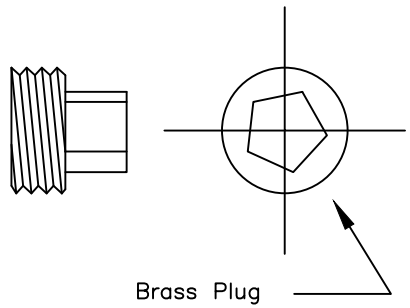
STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

WATER SERVICE CONNECTION DETAIL 25mm (1") to 50mm (2") DIAMETER SIZES

OCTOBER 2021	SCSD – 24





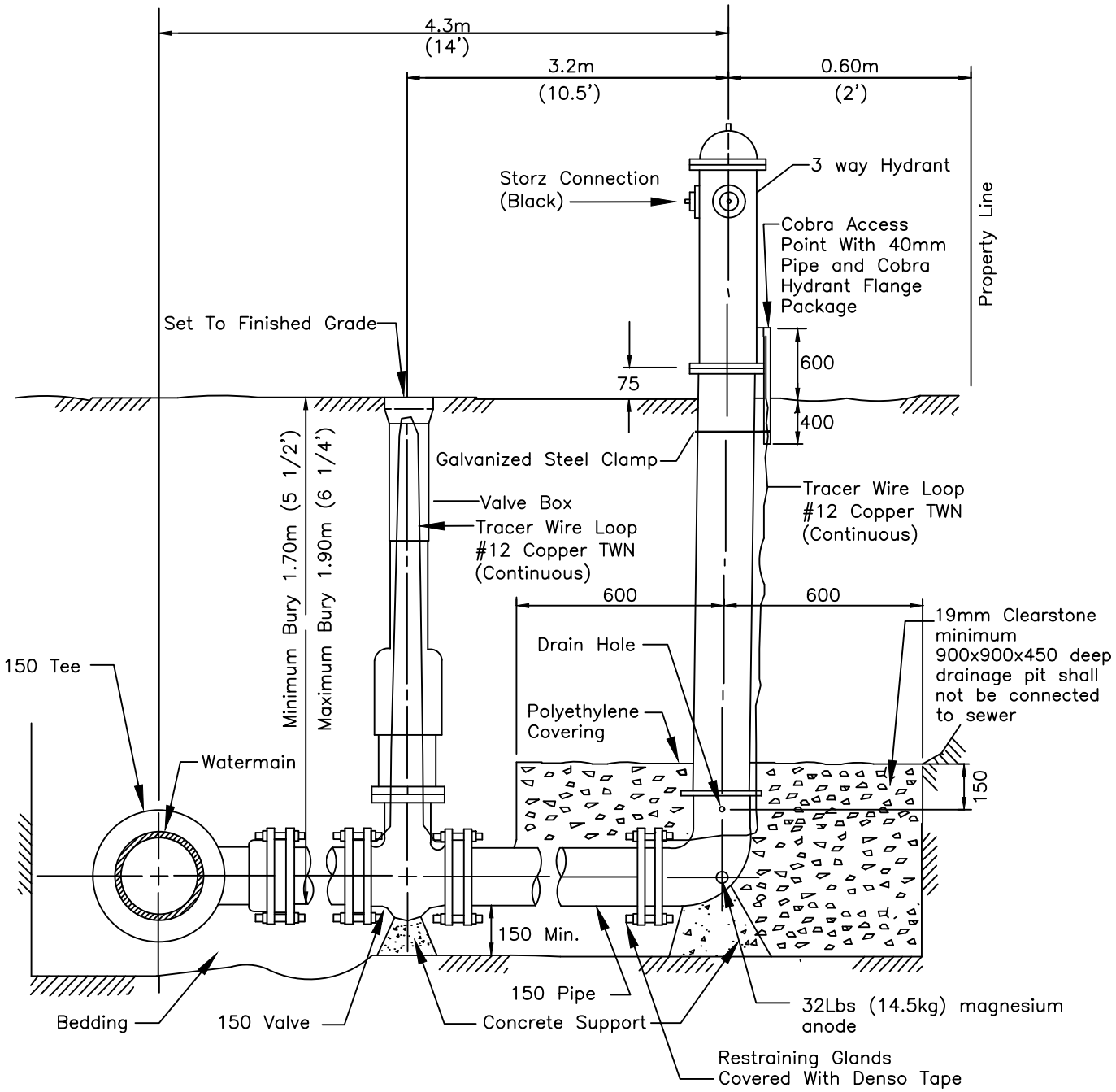
NOTES:

1. All dimensions are in millimeters unless otherwise shown.
2. Curb box must be installed squarely over curb stop and bottom board.
3. Service rod must be at least 300mm below grade and no more than 900mm below grade and must be operable with a 1400 key when installation of service box and extension piece is completed.

MUNICIPALITY OF
STRATHROY–CARADOC

STANDARD SERVICE BOX

OCTOBER 2021	SCSD – 25



NOTES:

1. Bolts for buried flange to flange connections are to be stainless steel.
2. All MJ Fittings to have cathodic protection.
3. All dimensions are in millimeters unless otherwise shown.
4. Hydrant to be 1500mm min. from a driveway and preferably centred on a lot line.
5. All joints to be mechanically thrust restrained.
6. Polyethylene bond breaker to be used between clear stone and fittings.
7. In cases where the depth of the watermain is greater than 1.9m. Bends may be used to offset the hydrant lateral (past the gate valve) to achieve the standard fire hydrant boot depth (as approved by the Municipality).
8. The use of a 300mm (max) fire hydrant barrel extension may also be used (as approved by the Municipality).

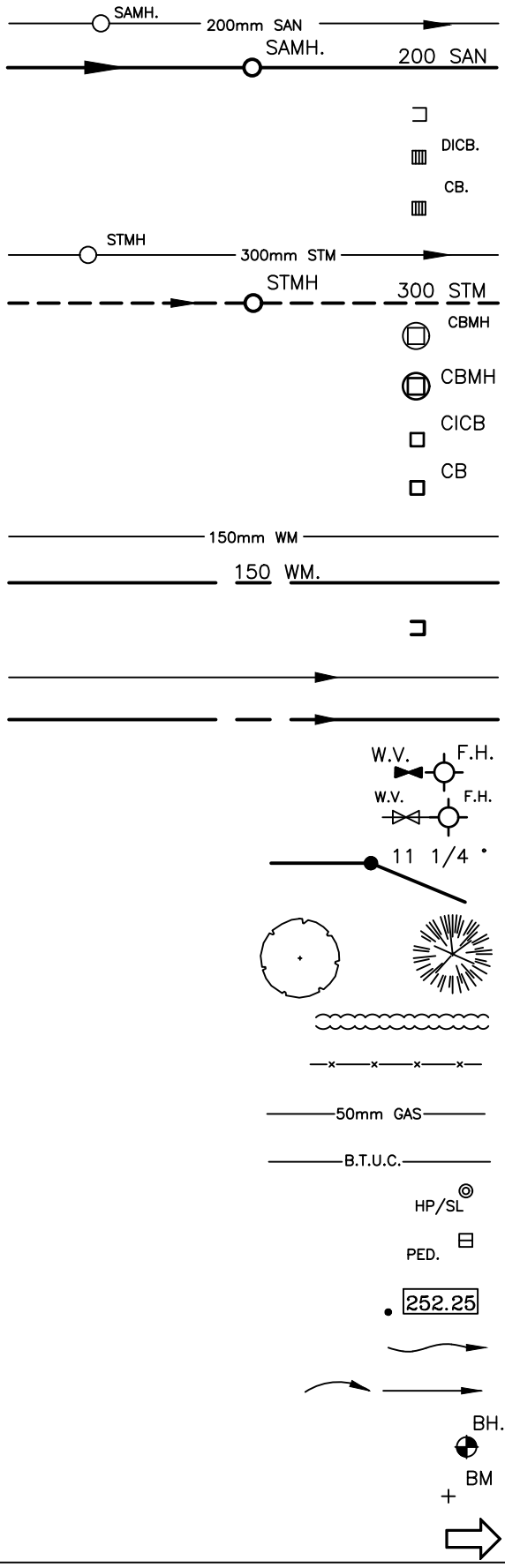
STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

HYDRANT INSTALLATION

OCTOBER 2021	SCSD – 26

LEGEND



EXISTING SANITARY SEWER AND MANHOLE

PROPOSED SANITARY SEWER AND MANHOLE

EXISTING PLUG

EXISTING DITCH–INLET CATCHBASIN

EXISTING CATCHBASIN

EXISTING STORM SEWER AND MANHOLE

PROPOSED STORM SEWER AND MANHOLE

EXISTING CATCHBASIN MANHOLE

PROPOSED CATCHBASIN MANHOLE

PROPOSED CURB INLET CATCHBASIN

PROPOSED CATCHBASIN

EXISTING WATERMAIN

PROPOSED WATERMAIN

PROPOSED WATERMAIN CAP

EXISTING WATERMAIN REDUCER

PROPOSED WATERMAIN REDUCER

FIRE HYDRANT AND VALVE (WITH STORZ CONNECTION)

EXISTING FIRE HYDRANT AND VALVE

PROPOSED WATERMAIN BEND

EXISTING TREE

HEDGE

FENCE

INDICATES BURIED GAS MAIN

INDICATES BURIED BELL TELEPHONE CABLE

EXISTING HYDRO POLE / STREET LIGHT

EXISTING BELL / TV PEDESTAL

PROPOSED ELEVATION

PROPOSED SWALE

DIRECTION OF SURFACE DRAINAGE

EXISTING BOREHOLE

BENCHMARK

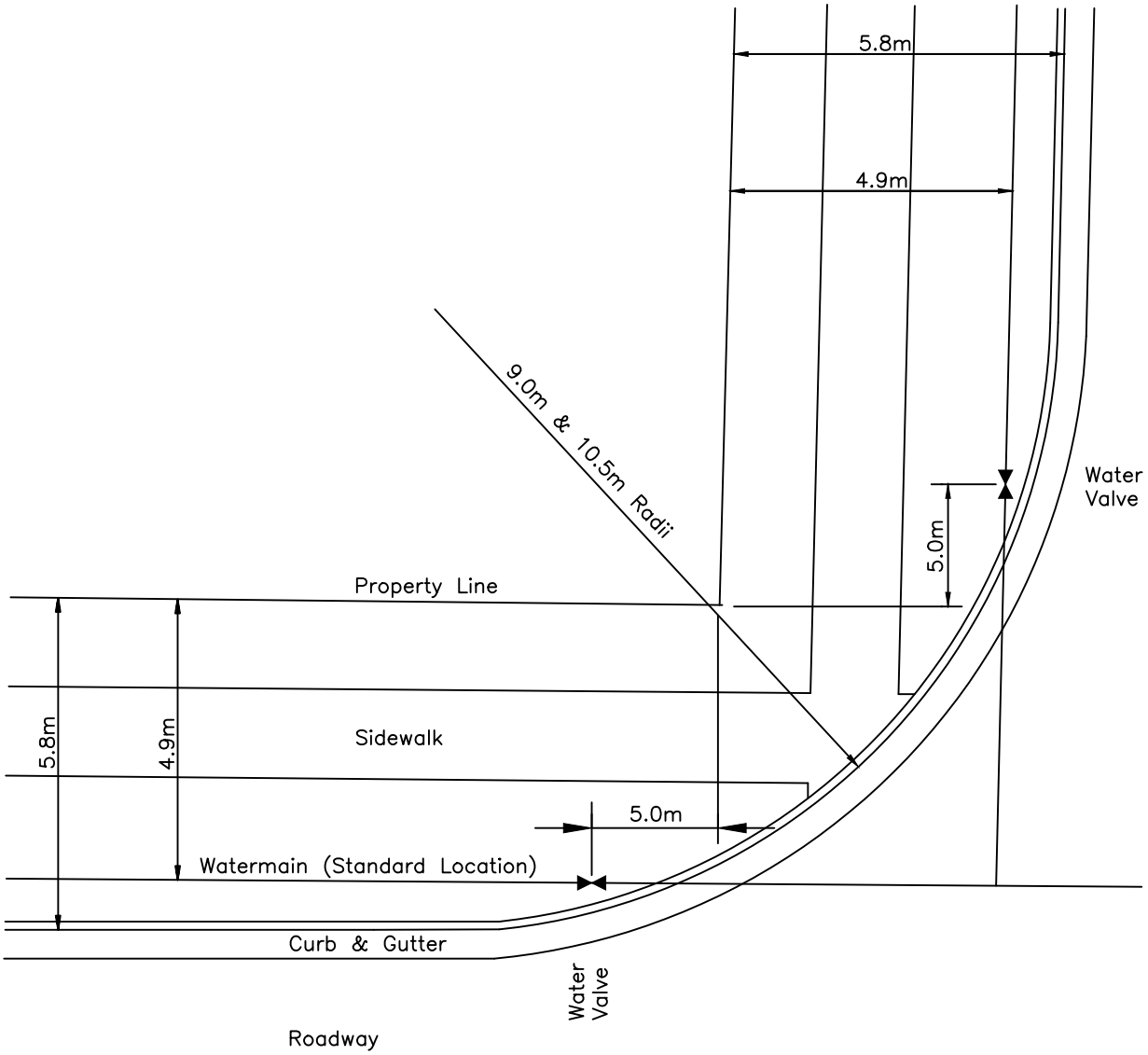
OVERLAND FLOW ROUTE

TYPICAL PLAN AND PROFILE LEGEND

MUNICIPALITY OF STRATHROY–CARADOC

OCTOBER 2021

SCSD – 27



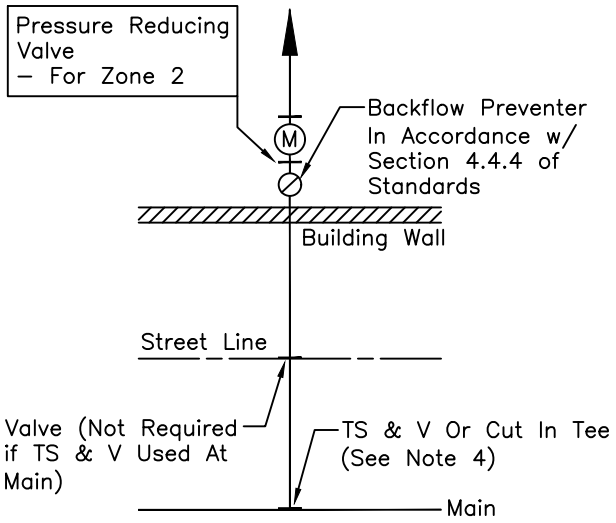
NOTE:

This standard may not apply if curbs are more than 5.8m from property line. The objective is to prevent valves from being installed in curb & gutter.

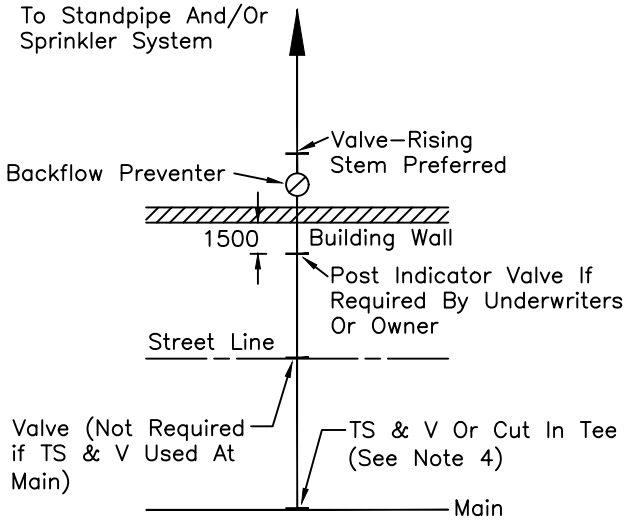
MUNICIPALITY OF STRATHROY–CARADOC

STANDARD LOCATION FOR WATER VALVES AT INTERSECTIONS 9.0m & 10.5m Radii

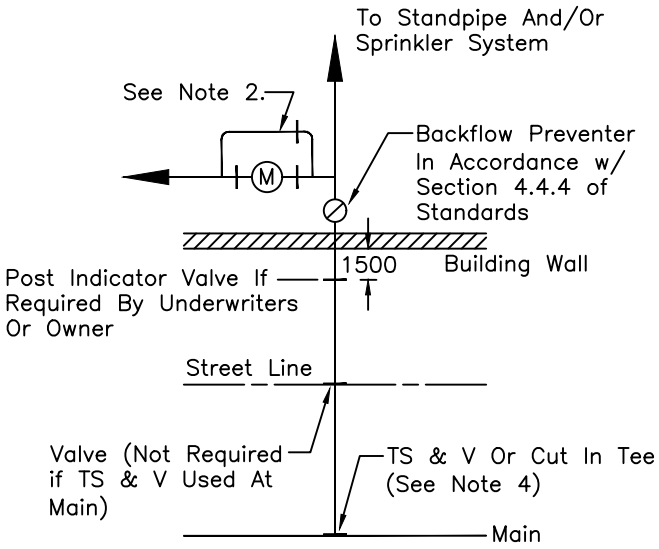
OCTOBER 2021	SCSD – 28



DOMESTIC, COMMERCIAL OR INDUSTRIAL SERVICE



STANDPIPE AND/OR SPRINKLER SERVICE



DOMESTIC SERVICE TAKEN OFF STANDPIPE AND/OR SPRINKLER SERVICE

NOTES:

1. The domestic water may be taken from the sprinkler service and/or the standpipe service inside the building if approved by fire underwriters. If not, the domestic service shall be installed to the main as shown with a minimum of 300mm separation from the fire service.
2. Domestic valves, meter, and by–pass, if by–pass is required, shall be immediately inside the structure wall.
3. Control and check valves on fire services shall be as required by the Ontario Building Code.
4. If the service is off a service main, a tapping sleeve and valve or a tee and valve shall be installed at the service main.
5. See Drawings SCSD–30 and SCSD–31 for details of service.
6. For backflow preventer requirements refer to Section 4.4.4 of the current standards.
7. All dimensions are in millimeters unless shown otherwise.

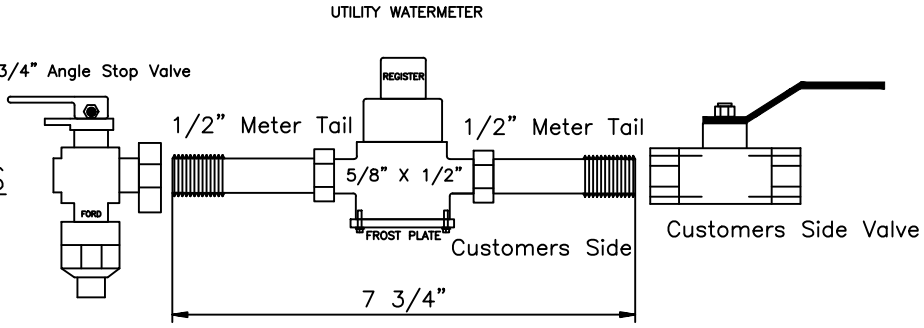
STRATHROY-CARADOC
URBAN OPPORTUNITY – RURAL HOSPITALITY

MUNICIPALITY OF STRATHROY–CARADOC

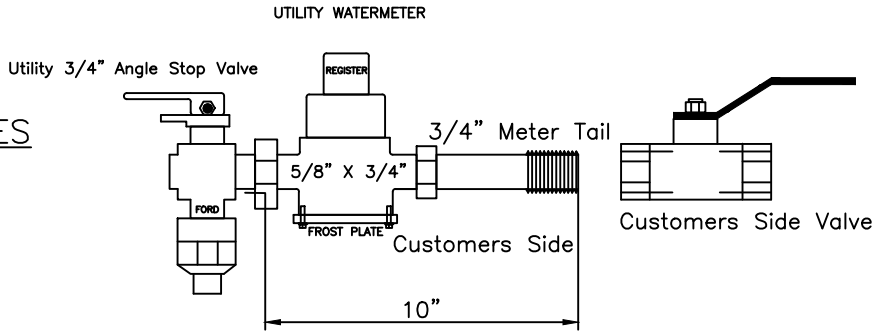
SCHEMATIC LAYOUT OF SERVICES

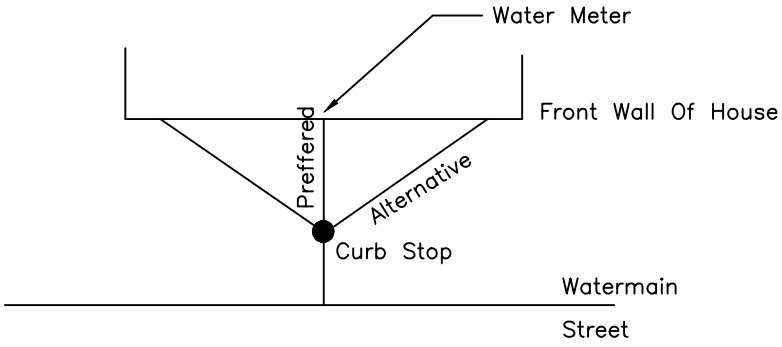
OCTOBER 2021	SCSD – 29

EXISTING HOMES



NEW HOMES





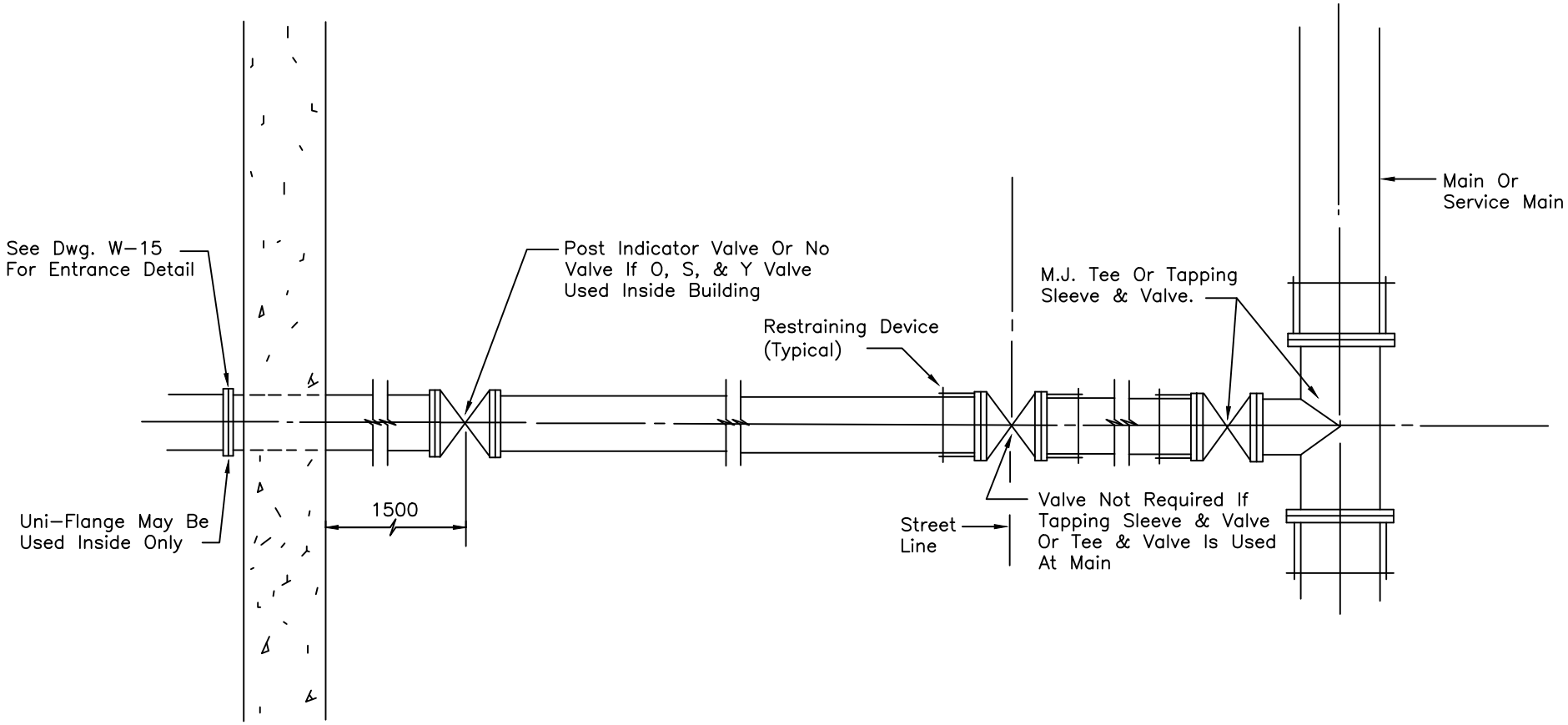
NOTES:

1. All water services must terminate 6 inches above the finished basement floor, immediately inside the front most wall of the building, and the water meter installed in a horizontal position at this location.
2. The meter must be accessible for reading and maintenance and must located in a heated room to protect from freezing. Meter to be properly supported.
3. The angle stop valve will be installed by the Water Dept. when the service is inspected and the PEX pipe is cut off near the final water meter location by the builder/contractor.
4. All new and replacement installations shall require a valve on each side of the water meter.
5. The developer must supply, install and maintain the outlet valve on the water meter.

MUNICIPALITY OF STRATHROY–CARADOC

TYPICAL DOMESTIC SERVICE METER INSTALLATION 25mm (1") Services

OCTOBER 2021	SCSD – 30



NOTES:

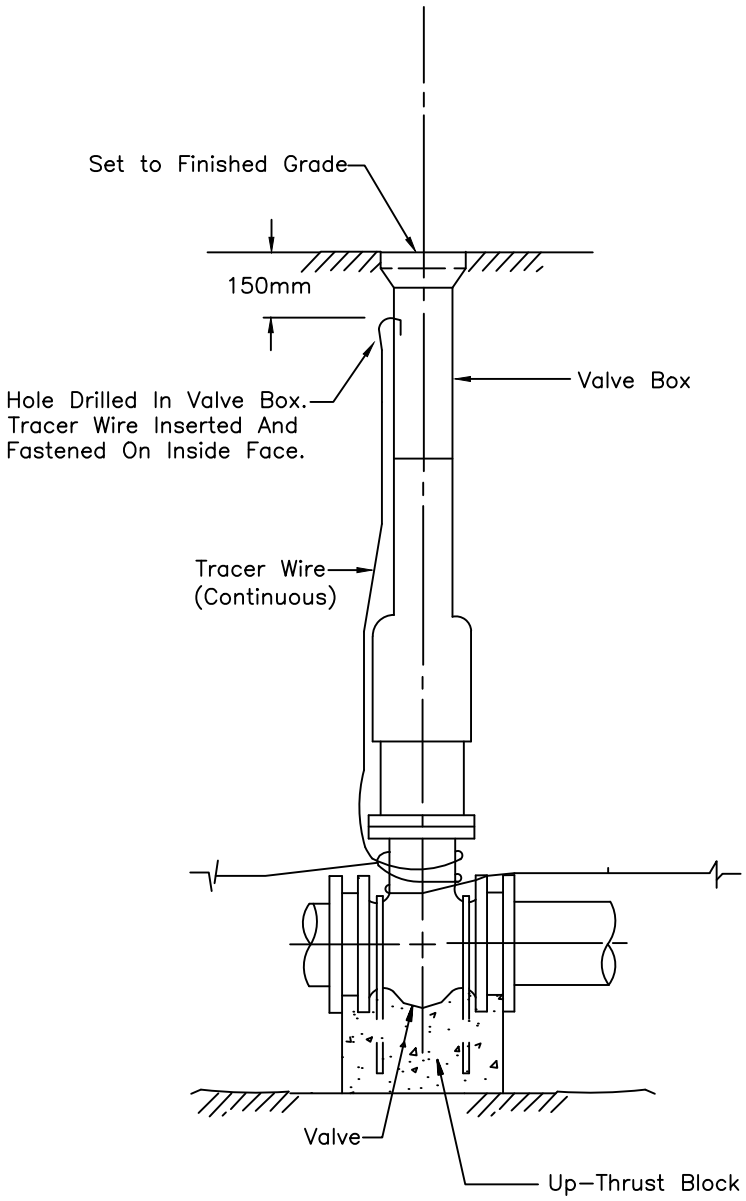
1. All dimensions are in millimeters unless shown otherwise
2. See DWG. SCSD–29 for typical service layouts.
3. Fire and domestic lines will terminate with flanged ends inside building.
4. All fittings outside buildings shall be M.J. cast iron.
5. If the service is off a service main a tapping sleeve and valve or a tee and valve shall be installed at the service main.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

TYPICAL DETAILS of 100mm (4") & LARGER SERVICES

OCTOBER 2021	SCSD – 31



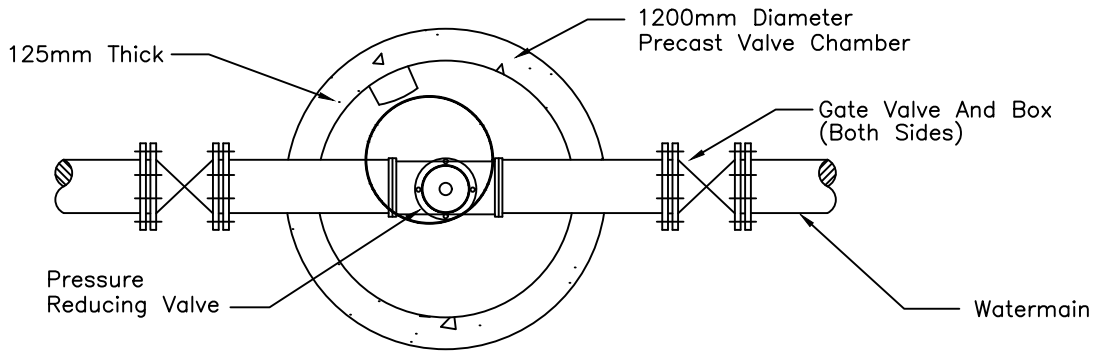
NOTE:

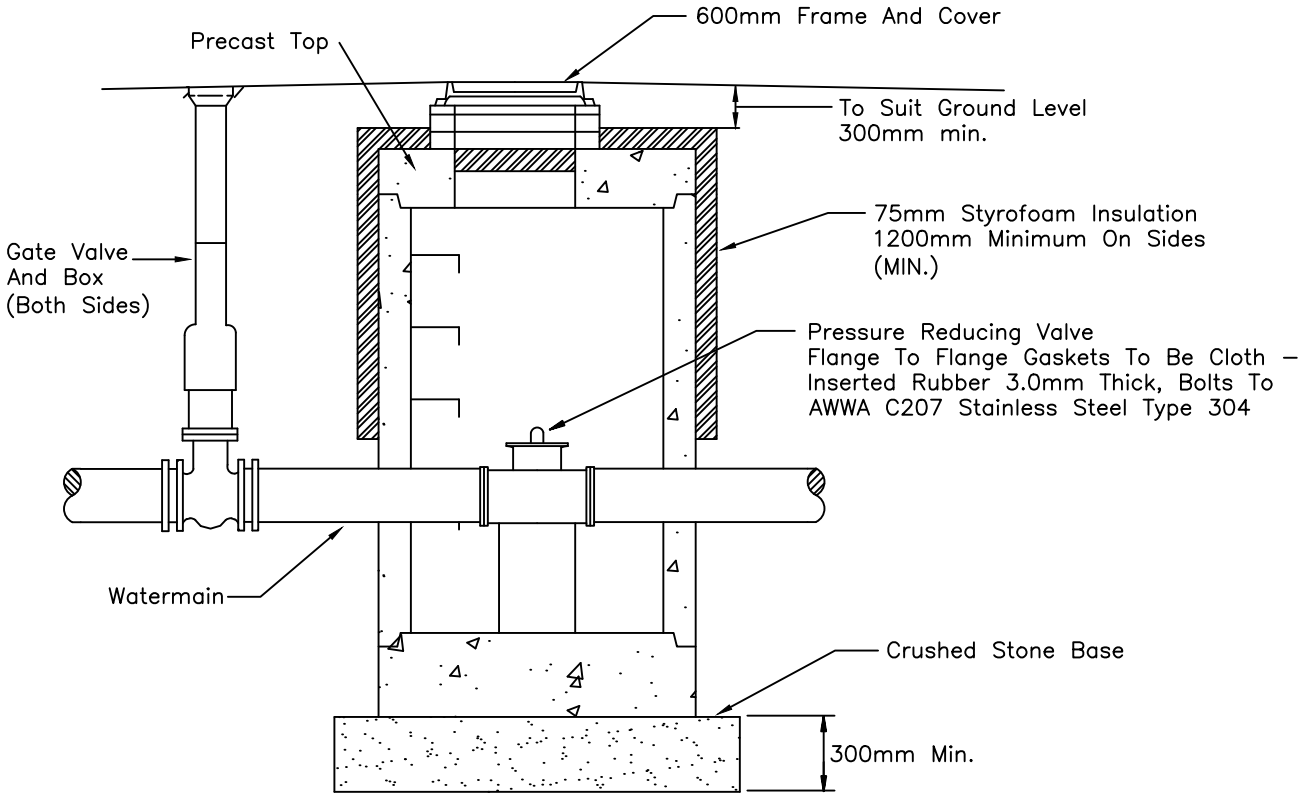
Tracer wire shall not be wrapped around operating nut.

MUNICIPALITY OF
STRATHROY–CARADOC

TRACER WIRE INSTALLATION AT VALVES

OCTOBER 2021	SCSD – 32

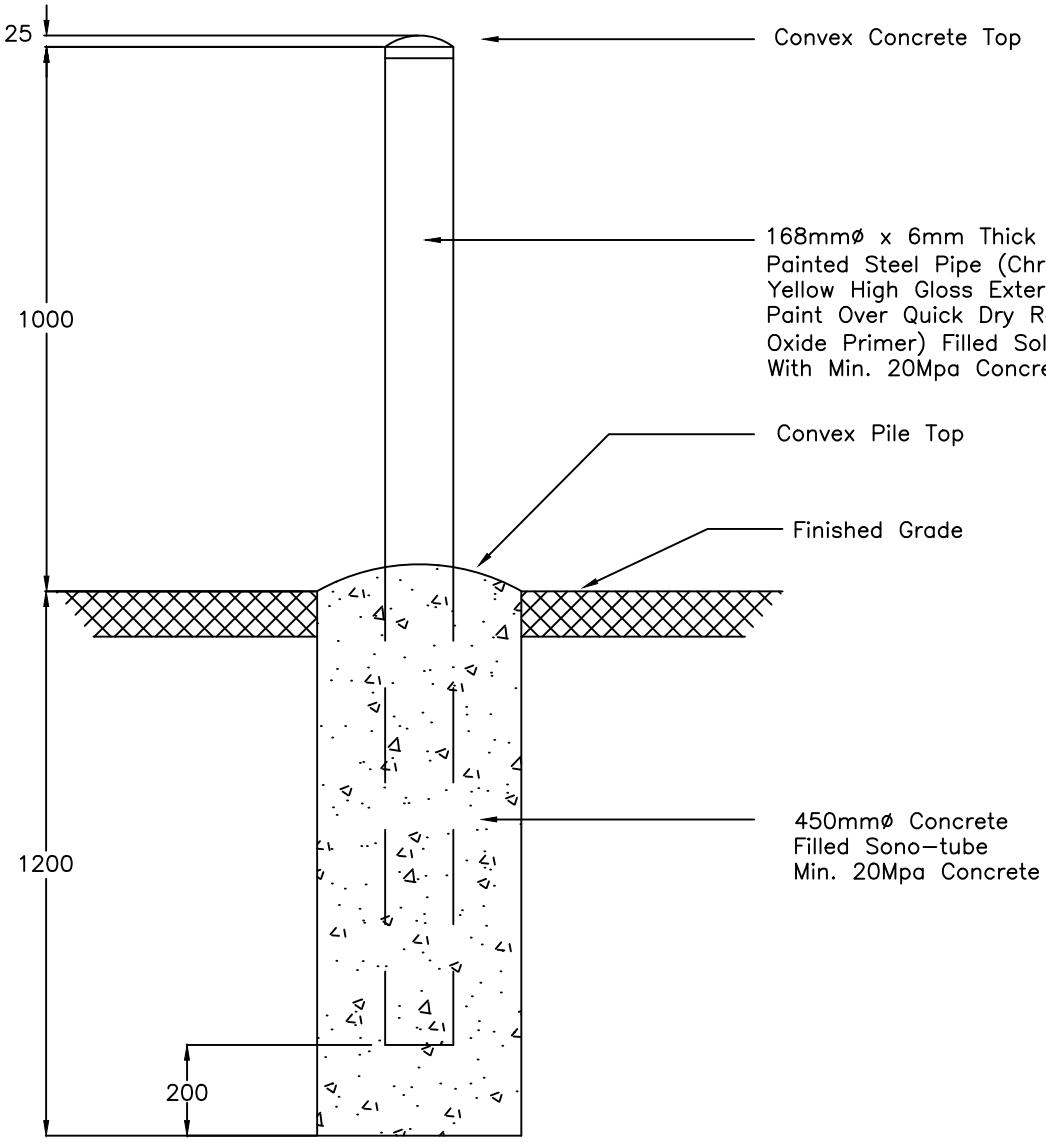




MUNICIPALITY OF
STRATHROY–CARADOC

PRESSURE REDUCING VALVE CHAMBER

OCTOBER 2021	SCSD – 33



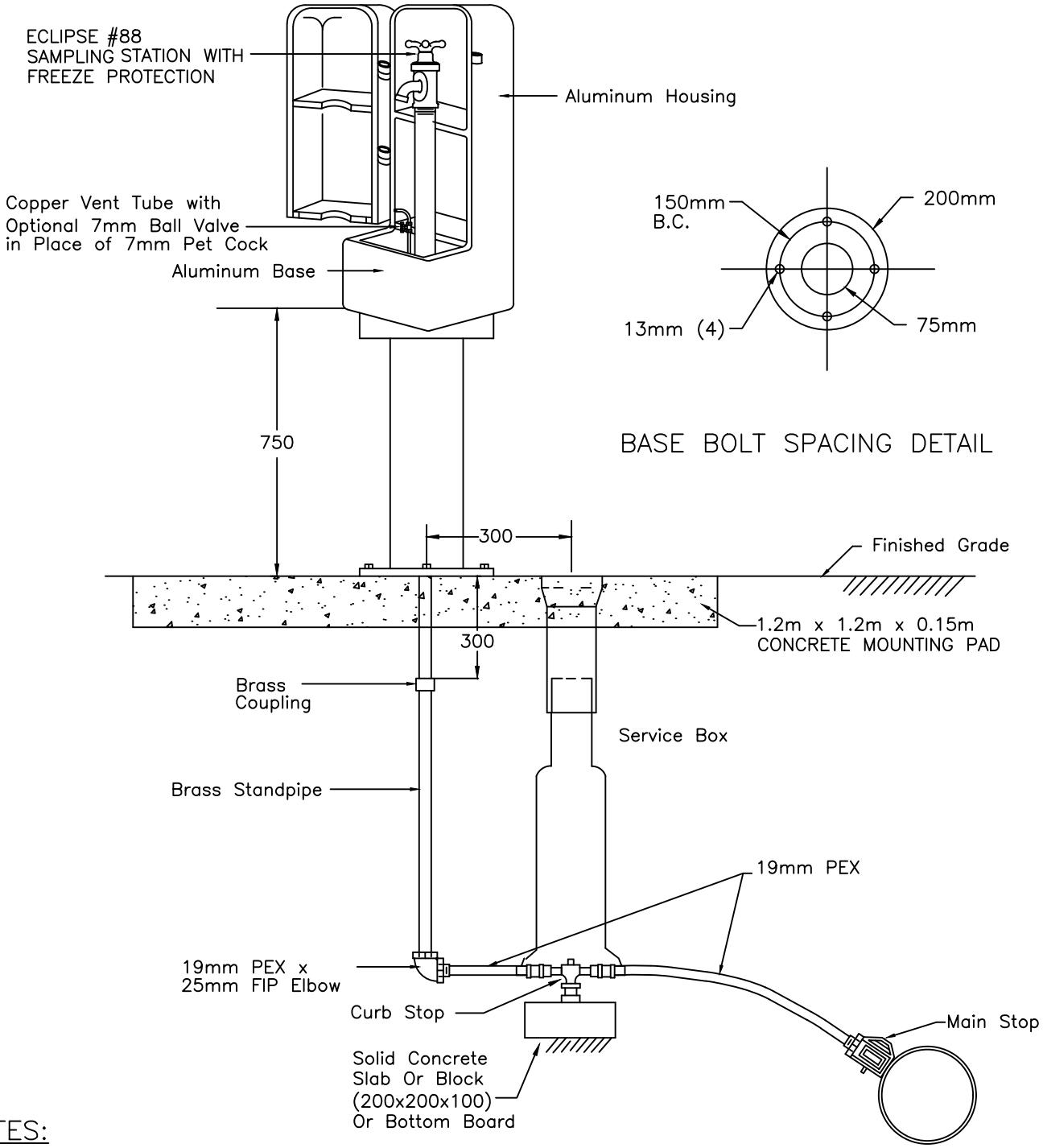
NOTES:

1. See Drawing SCSD-26 for hydrant installation.
2. Bollard to be installed in sufficient number to protect hydrant, 0.65m from hydrant.
2. All dimensions are in millimeters unless otherwise shown.

MUNICIPALITY OF
STRATHROY-CARADOC

HYDRANT BOLLARD

OCTOBER 2021	SCSD – 34



NOTES:

1. Sampling Stations shall be 1.70m min. depth, with a 19mm FIP inlet, and a (19mm hose or unthreaded) nozzle.

2. All stations shall be enclosed in a lockable, nonremovable, aluminum–cast housing. Housing shall be on a 750mm pedastal with a 200mm mounting flange.

3. When opened, the station shall require no key for operation, and the water will flow in an all brass waterway. All working parts will be of brass and serviceable from above ground with no Excavation.

4. A copper vent tube will enable each station to be pumped free of standing water to prevent freezing and to minimize backteria growth.

5. Sampling station, Eclipse No. 88, shall be manufactured by Kupferle Foundry, St Louis, MO.

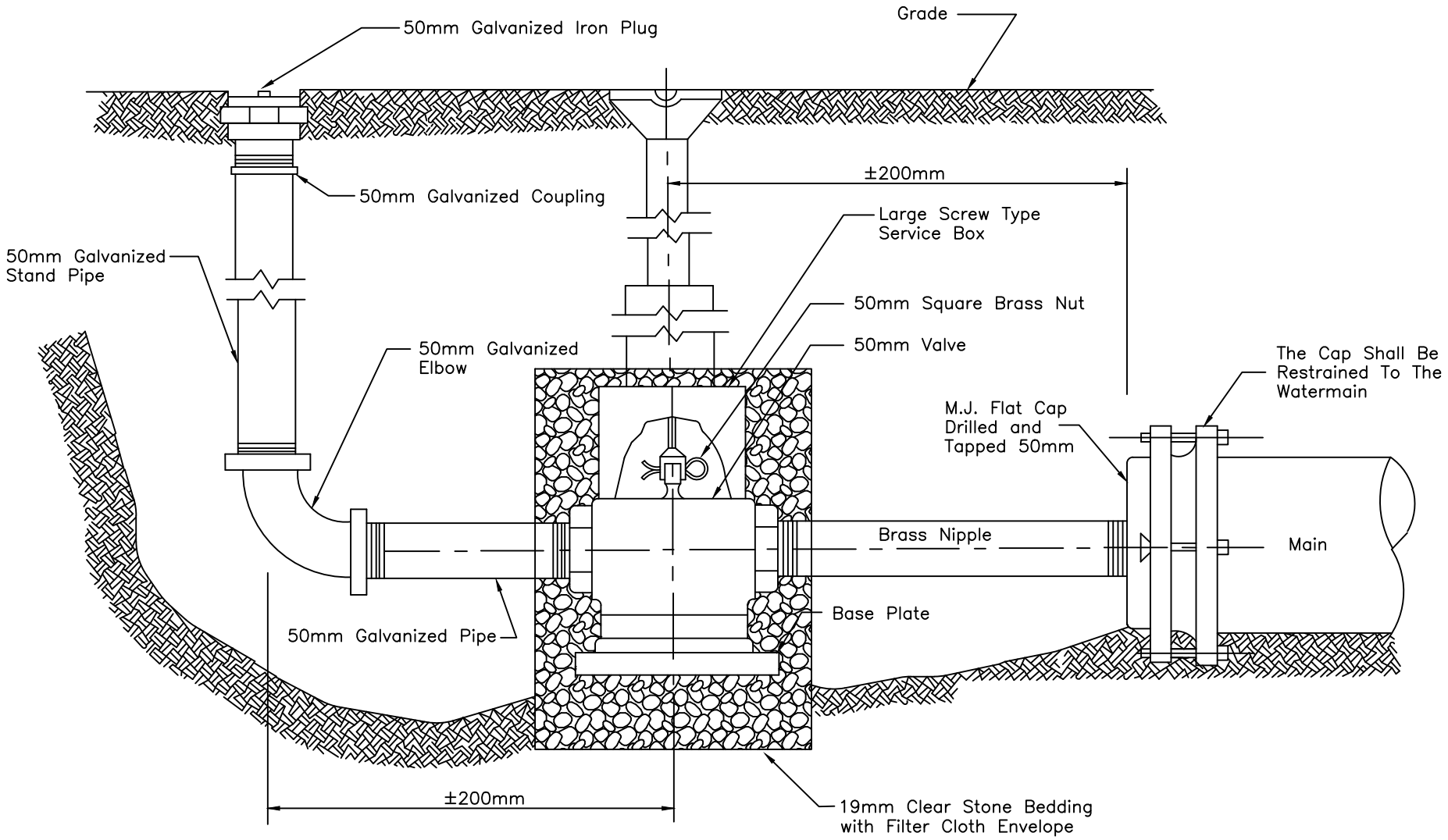
6. All dimensions are in millimeters unless otherwise shown

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY–CARADOC

SAMPLING STATION

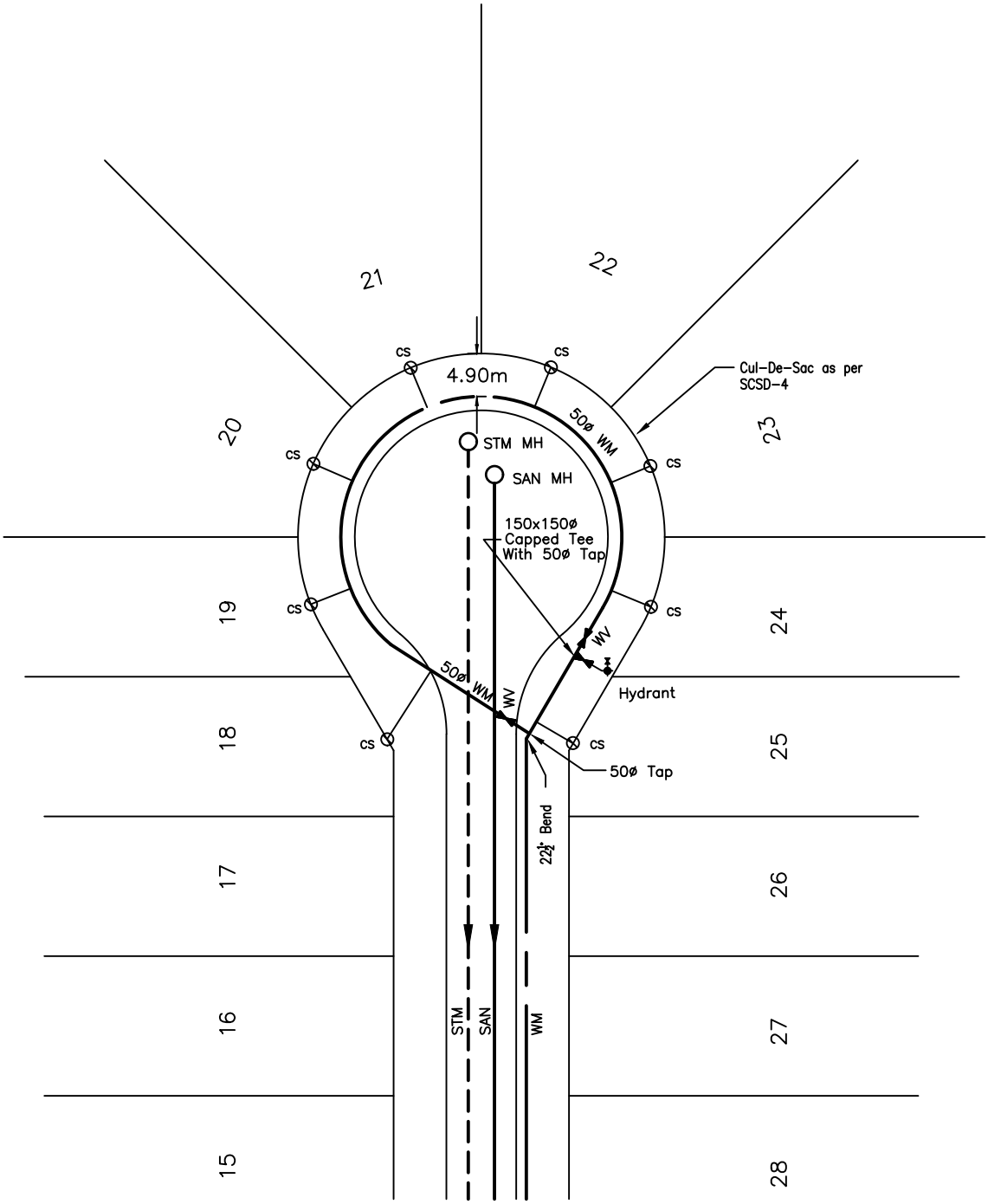
OCTOBER 2021	SCSD – 35



MUNICIPALITY OF
STRATHROY–CARADOC

STANDARD 50mm BLOW OFF INSTALLATION

OCTOBER 2021	SCSD – 36



NOTES:

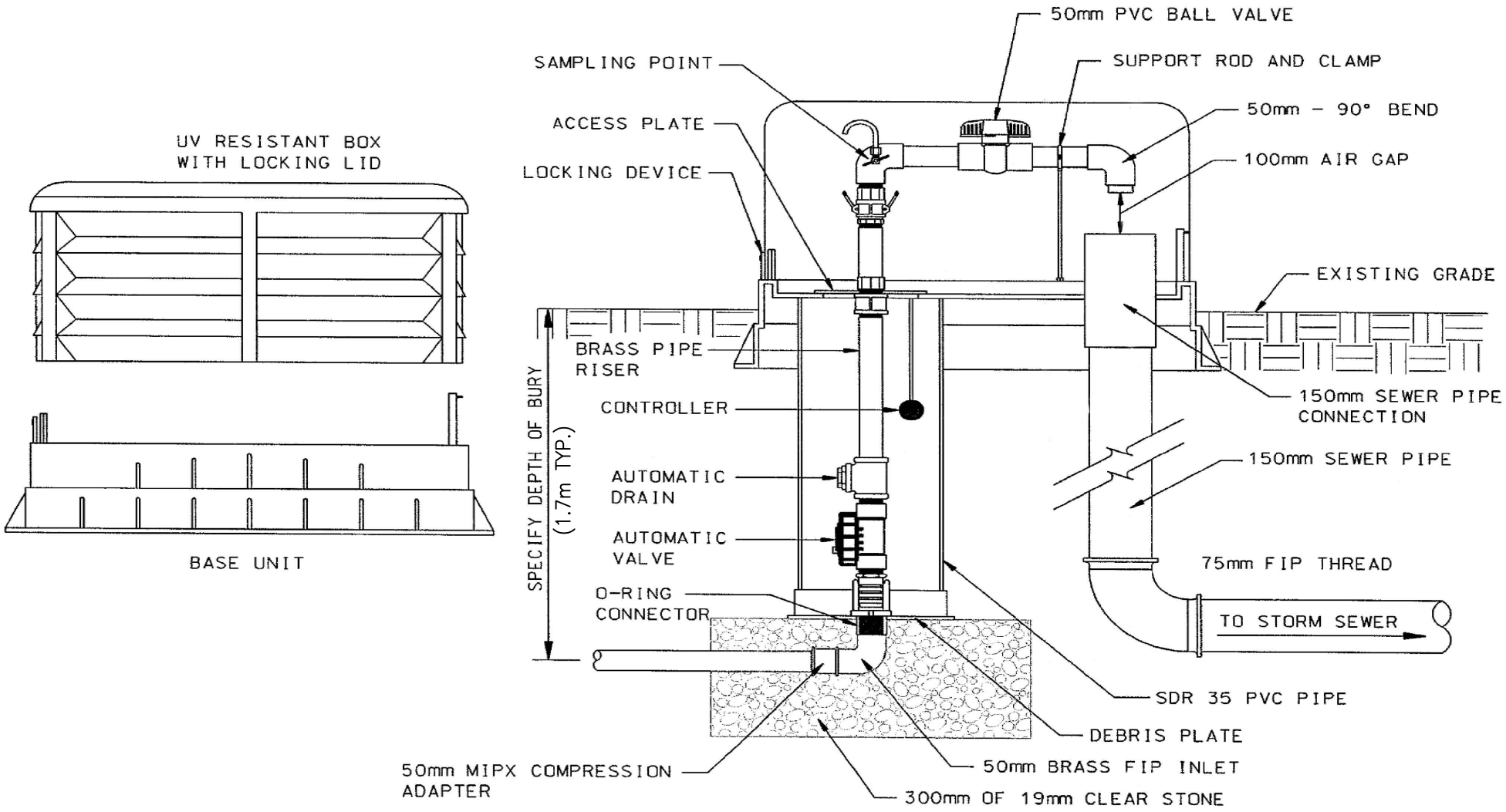
1. All pipe joints are to be restrained on the 50mm watermain loop.
2. Pipe radius as per manufacturers specifications.
3. For Lot Servicing, see Drawing SCSD–13 in the Municipality of Strathroy–Caradoc Servicing Standards.
4. All dimensions are in millimeters unless otherwise shown.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF STRATHROY–CARADOC

TYPICAL 50mm WATERMAIN LOOP

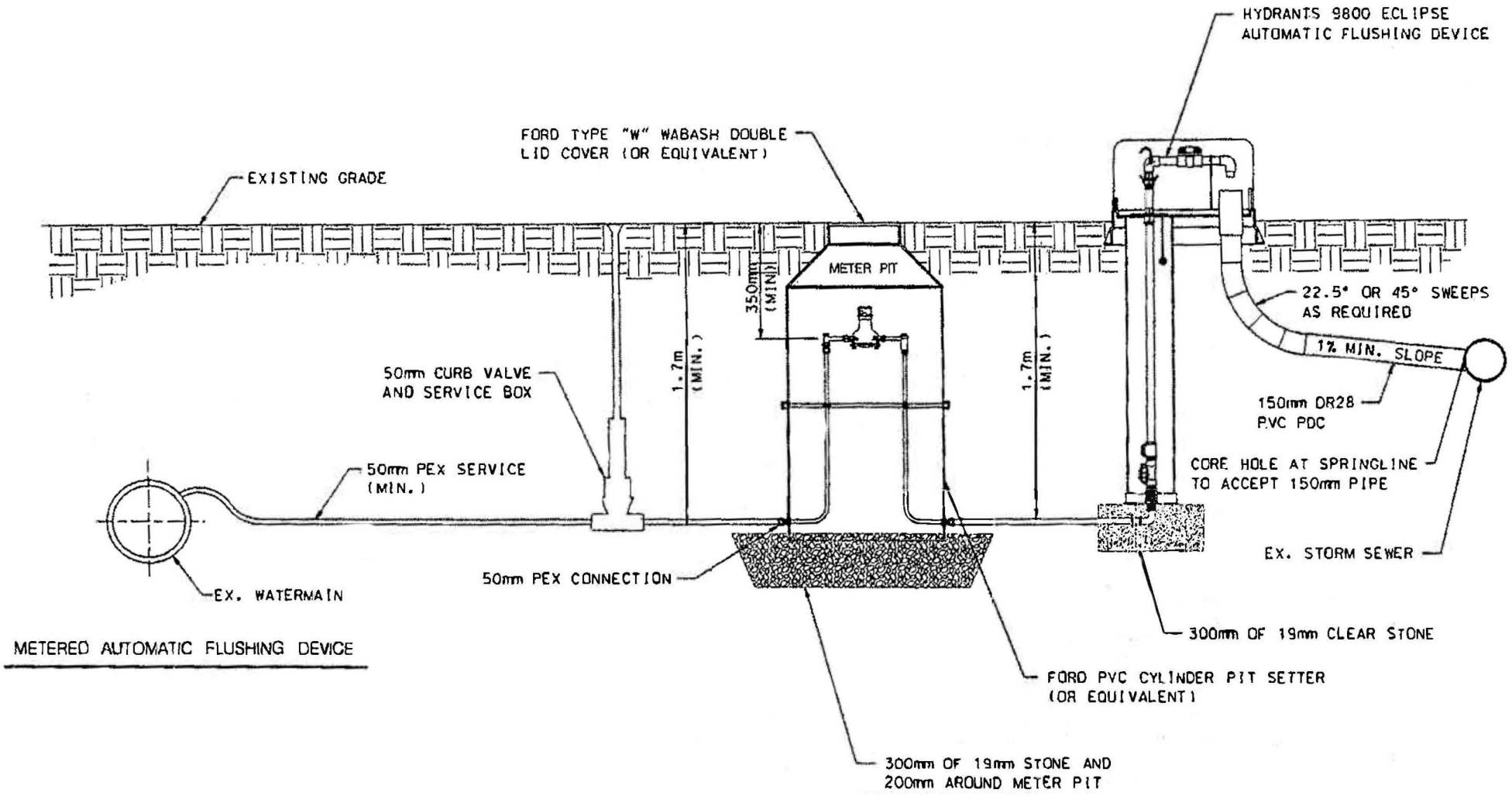
OCTOBER 2021	SCSD – 37



MUNICIPALITY OF
STRATHROY-CARADOC

9800 AUTOMATIC FLUSHING DEVICE DETAIL

OCTOBER 2021	SCSD - 38



METERED AUTOMATIC FLUSHING DEVICE

WATERMAIN AND WATERMAIN NETWORKS SHALL BE DESIGNED SUCH THAT WATER DOES NOT REMAIN UNUSED IN THE WATERMAIN FOR MORE THAN THREE (3) DAYS UNDER AVERAGE DAY DEMAND. THE MUNICIPALITY HAS PRIMARY RESPONSIBILITY TO ENSURE THAT THE MINIMUM CHLORINE RESIDUALS ARE MAINTAINED IN THE DISTRIBUTION SYSTEM AND THEREFORE RESERVES THE RIGHT TO REQUIRE WATERMAIN LOOPING AND/OR AUTOMATIC FLUSHING DEVICES AND/OR BLOW-OFFS TO FACILITATE THE MAINTENANCE OF THE CHLORINE RESIDUAL. WATER METER PITS ARE TO BE IN ACCORDANCE WITH THE MUNICIPAL STANDARDS.

STRATHROY-CARADOC
URBAN OPPORTUNITY - RURAL HOSPITALITY

MUNICIPALITY OF
STRATHROY-CARADOC

METERED AUTOMATIC FLUSHING DEVICE DETAIL

OCTOBER 2021	SCSD – 39