



TSAWWASSEN FIRST NATION

Supplementary

**Design Guidelines
and
Construction Specifications**

October 2020



June 3, 2020

RE: Tsawwassen First Nation Supplementary Standards and Construction Specification

On behalf of Tsawwassen First Nation (TFN), we hereby give you notice that effective immediately the TFN Supplementary Design Criteria and Construction Specifications are updated to a June 2020 revision. All design and construction work that is not the subject of a fully executed and secured Works and Services Agreement will be subject to compliance with this document in accordance with the TFN Subdivision and Development Regulation. The document is available on the TFN web site.

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TFN Supplementary Design Criteria to MMCD Design Guideline Manual

Introduction

This document supplements the requirements of the “MMCD Design Guide Manual” (2014) and outlines additional design criteria for water distribution and sanitary collection and conveyance systems, storm drainage collection and conveyance systems, roads, roadway lighting, and landscape that must be considered in the planning and detailed design phases for these roads and utilities on TFN lands.

Section 1.0 - General Design Considerations

1.6 Seismic Design Standards

Replace this section with the following:

Underground water utilities (pipes, fittings, pressure/flow control and measuring devices, and various associated smaller size manholes, vaults and chambers) have shown themselves to be prone to high damage rates in a seismic event whenever there is significant permanent ground deformations (measured as PGD) or excessively high levels of ground shaking and resulting permanent ground accelerations and velocities (measured as PGA and PGV). Seismic design standards are necessary to be considered in seismically active zones with a potential for soil liquefaction such as Tsawwassen First Nation (TFN) lands. This is even more important considering a shared fire flow and potable water distribution system, which, during a severe seismic event, must remain functional to provide fire suppression throughout the community.

Design of pressurized distribution systems (water distribution pipes and sanitary forcemains) including small chambers shall be performed in general compliance with the document “Seismic Guidelines for Water Pipelines”, March 2005, prepared by ALA (American Lifelines Alliance). Please refer to the following web link: http://www.americanlifelinesalliance.com/Products_new3.htm

Pipe Function Class II should be used in evaluating design needs to accommodate seismic events. In addition, use of redundant pipe and frequent isolation valves are required to increase post-earthquake reliability and help ensure critical pipes, if damaged, can be disconnected from the system while minimizing loss of service to other areas.

This section does not cover seismic design considerations of larger size chambers (typically in excess of 10 m² in footprint), pump station structures, storage tanks, reservoirs and similar large components of the water and sanitary systems. These structures, along with seismically resistant pipe connections, shall be individually assessed by civil, geotechnical and structural engineers using the latest edition of BC Building Code to meet post-disaster requirements and other specialty seismic standards applicable to buried and above ground structures.

Add 1.7 Work near Existing Dykes

For all proposed works in the vicinity or within the ocean dyke envelope, the designer must notify TFN and as the relevant diking authority and obtain necessary approvals through the Provincial Inspector of Dykes office prior to performing any permanent or temporary work within the dyke, including fill placement, excavation, installation of new permanent utilities, removal of existing utilities and connections/tie-ins to existing operational utilities.

Add 1.8 Decommissioning

A. Existing Pipe Utilities

Unless otherwise approved, all abandoned pipes within public rights-of-way shall be removed and disposed of off-site as per applicable environmental requirements. Trench backfilling shall be performed in accordance with trench backfilling procedures required for new pipe installation or as required by the diking authority. All disturbed surfaces shall be restored to equal or better conditions.

In certain situations pipes may be abandoned in place. One such situation is when pipes are abandoned within, or in close proximity of the existing ocean dyke. The other situation is when removal of the existing pipes may potentially cause instability of the existing underground utilities, or above ground structures and features. As such, the following procedure must be performed:

- If the pipe is 150mm diameter or smaller, flush the pipe and plug/cap all pipe ends before completely abandoning it in place.
- If the pipe is greater than 150mm diameter, fill the pipe with controlled density fill (light weight grout or cellular concrete) which shall have an unconfined compressive strength of 1MPa at 28 days and be designed to minimize shrinkage.
- Remove lids to all manholes, chambers and vaults. Remove all pipes, fittings and controls within the chambers and manholes. Abandon pipes connecting to the structure as per the above note and backfill the structure with lightly compacted river sand.

B. Existing Sanitary Lift Stations

The preferred method of decommissioning abandoned sanitary lift stations includes total removal of the pump tank (wet well) and all associated works within the tank, electrical and instrumentation components, and abandoning and permanently sealing off all pipes connecting to the tank. If a concern exists that the removal of the below ground tank may cause soil instability and disturbance to the existing nearby structures, the tank may be abandoned in place after the following procedure is followed:

- Thoroughly flush the tank and all connecting pipes,
- Isolate pump tank entirely from all piping, electrical and instrumentation connections by disconnecting and removing services and sealing off the pipes with concrete grout or similar material,
- Strip the inside area of the tank off of any metallic and non-metallic components,
- Remove tank lid and cut off and remove tank wall to minimum 1m depth below finished surface

- Drill 8 horizontal symmetrical 100mm dia. holes per each metre of height of remaining tank in place starting at the bottom of the tank, and
- Fill the tank with lightly compacted clean river sand and install a single layer of non-woven filter fabric against each drilled hole.

Section 2.0 - Water Distribution

2.2 Metering

Replace this section with the document “TFN Water Meter Design Manual and Supplementary Specifications”, March 2019, provided in Appendix A.

2.3 Per Capita Demand

Table 2.3 Potable Water System – Status Quo

Land Use	Maximum Day Flow	Peak Hour Flow
Residential Single Family Detached – Large Lot	980 l/cap/day	1588 l/cap/day
Residential Single Family Detached – Small Lot	980 l/cap/day	1588 l/cap/day
Residential Multi-Family Townhouse	620 l/cap/day	1004 l/cap/day
Residential Multi-Family Apartment	620 l/cap/day	1588 l/cap/day
Residential TFN Community	980 l/cap/day	1588 l/cap/day
Non Revenue Water*	5% of MDD	5% of MDD

*Applied at a rate of 5% of MDD for all other water uses

2.4 Non-Residential Demand

Commercial, industrial, institutional, and irrigated park demands should be determined using specific data related to the development or zoning. In the absence of such data, the following demands should be applied:

Table 2.4 Non-Residential Water Demands

Land Use	Maximum Day Flow	Peak Hour Flow
Commercial Retail	46,800 l/ha/day	71,604 l/ha/day
Commercial Other	22,500 l/ha/day	34,425 l/ha/day
Industrial	9,153 l/ha/day	12,631 l/ha/day
Institutional	21,000 l/ha/day	55,440 l/ha/day
Irrigated Parks	83,333 l/ha/day	240,832 l/ha/day
Non Revenue Water*	5% of MDD	5% of MDD

*Applied at a rate of 5% of MDD for all other water uses

2.5 Fire Flows

All water demands generated on TFN lands will be supplied through two designated water supply connections to Metro Vancouver feeder main on 52nd Ave. As such, it is important to correlate calculated water demands for residential and commercial developments with the projected overall

demand of TFN lands. In case of discrepancy, and especially if estimated demands are significantly higher than previously evaluated, TFN shall be informed immediately.

Table 2.5 Minimum Fire Flow Requirements

Land Use	Fire Flow
Residential Single Family Detached – Large Lot	70 l/s
Residential Single Family Detached – Small Lot	70 l/s
Residential Multi-Family Townhouse	170 l/s
Residential Multi-Family Apartment	170 l/s
Residential TFN Community	70 l/s
Commercial Retail	250 l/s
Commercial Other	170 l/s
Industrial	270 l/s
Institutional	120 l/s
Irrigated Parks	n/a
Non Revenue Water	n/a

2.7 Water Pressure

Minimum pressure at Maximum Day Demand	280 kPa
Minimum pressure at Peak Hour Demand	275 kPa
Minimum pressure in system during design Fire Flow and Maximum Day Demand	140 kPa

Service connections must be individually protected by pressure reducing valves located in the building being serviced.

2.8 Hydraulic Design

Replace “C = Roughness Coefficient = 125” with the following: “C = Roughness Coefficient = 130”.

Add the following:

For analysis of the proposed local distribution system, the availability of the total demand and operational pressure under design conditions shall be confirmed by TFN.

The hydraulic grade line in mains larger than 250 mm diameter shall not exceed 0.5%.

The velocity of flow shall not exceed 2 m/s under peak hourly flow scenario for the ultimate design flow conditions.

2.9 Minimum Pipe diameter

Add the following:

When watermains cross railroads, major regional roads including Provincial Highways, or watercourses, a steel carrier pipe must be provided and must be designed to all applicable static, dynamic and seismic loadings and all other requirements of the authority having jurisdiction. The size of the casing pipe must be at least the greater of 25% or two diameters larger than the outside diameter of the watermain pipe bell or pipe, respectively. Service connection crossings across highways and railroads are not permitted.

2.13 Corrosion Protection

Corrosion protection shall be installed for all metallic fittings. The *Applicant's Engineer* shall provide detailed designs for the supply and installation of sacrificial anode cathodic protection. The designs shall include all specifications for magnesium anodes, bond cables, wells, test stations and reference electrodes. Anodes shall be sized by the *Applicant's Engineer* based on the number of fittings protected.

Test points shall be installed in cast iron water valve boxes at locations specified by the *Applicant's Engineer*.

Record drawings, testing and certification of the installation shall be provided to TFN prior to any application for a Completion Certificate.

2.14 Valves

Replace this section with the following:

A. Valve Size and Type

Watermain maintenance programs on TFN lands may include pigging, therefore the valve sizing and type selection will be as follows:

- The valves shall be the same diameter as the watermain up to 300 mm diameter
- The main line valves on feeder mains 350 mm and 400 mm diameter may be smaller by one (1) size with the use of proper reducers
- The main line valves on feeder mains 450 mm diameter and larger may be smaller by two (2) sizes with the use of proper reducers and confirmation that head loss is not excessive
- Geared operators, with risers and extension rods shall be provided on main line gate valves 350 mm diameter and larger
- Unless use of butterfly valves is approved in advance, all valves shall be gate valves

B. Valve Spacing

Gate valves on major grid and distribution mains 300 mm diameter and smaller shall not be spaced greater than 200 m apart.

Gate valves on feeder mains (over 300 mm diameter) shall not be spaced greater than 800 m apart.

Gate valves shall be spaced to limit isolation of not more than one (1) hydrant, and twenty (20) service connections impacted by a shutdown.

C. Location Configuration

Line valves at road intersections shall be installed at the projected lot lines.

Normally, three (3) valves will be required at an “X” intersection of mains, and two (2) valves are required at a “T” intersection of mains.

Tie-in of a major grid or distribution mains to a feeder main shall be valved.

2.15 Hydrants

Add the following:

Hydrant locations relative to a building are also regulated by the BC Building Code. In case of difference between standards, the more stringent criteria pertaining to number of hydrants and location shall apply.

2.16 Blow Offs and Blow Downs

Add the following:

Temporary blow offs shall be sized to accommodate required flushing velocities in the main in accordance with AWWA requirements.

2.19 Thrust Restraint

Add the following:

Thrust block sizing, alternative thrust block design and adequate pipe restraining methods shall be based on undisturbed soil bearing strength in accordance with geotechnical recommendations combined with forces developed by transient flow, testing flow, and normal operation for site specific conditions. Thrust block design calculations and restrained pipe length requirements must be shown on design drawings.

2.21 Service Connections

Replace this section with the following:

Service connection size should be calculated on the basis of the designated land use. The minimum size is 20mm diameter service. Where fire sprinkler systems and/or on-site hydrants are required, a separate service for fire prevention shall be provided.

Each service shall have a shut-off valve located within 300mm of the property line on the public side. Each domestic supply connection requires a backflow prevention device in accordance with TFN regulations. As a minimum, a dual check valve is required. For high hazard reduced pressure backflow devices are required in an above ground location.

All service connections shall have a water meter installed as per “TFN Water Meter Design Manual and Supplementary Specifications” (see **Appendix A**).

2.22 Alignments and Corridors

Add the following:

All watermains servicing hydrants or multiple service connections must be located within rights-of-way for maintenance access by TFN.

Section 3.0 - Sanitary Sewers

3.2 Per Capita Flow

Add the following:

Table 3.2 Sanitary Sewer System Flows

	Peak Dry Weather Flow (PDWF)
Residential Single Family Detached – Large Lot	1191 l/cap/day
Residential Single Family Detached – Small Lot	1270 l/cap/day
Residential Multi-Family Townhouse	854 l/cap/day
Residential Multi-Family Apartment	854 l/cap/day
Residential TFN Community	1191 l/cap/day

3.3 Non-residential Flows

Add the following:

Commercial, industrial, and institutional sanitary flows should be determined using specific data related to the development or zoning. In the absence of such data, the following demands should be applied:

Table 3.3 Sanitary Sewer System Flows

	Peak Dry Weather Flow (PDWF)
Commercial Retail	68,024 l/ha/day
Commercial Other	30,983 l/ha/day
Industrial	11,999 l/ha/day
Institutional	49,896 l/ha/day

3.4 Peaking Factor

The flow rates provided in Sections 3.2 and 3.3 are peak flow rates. Peaking factors are not applicable.

3.5 Infiltration

Design flows should include an infiltration allowance to cover groundwater infiltration into the system and inflows. The infiltration allowance should be:

- For all land use designations 8,640 l/ha/day

3.6 Design Flow

Sections 3.2 to 3.6 have been revised as per status quo sanitary flow calculation recommendations provided in the final document "TFN Bulk Water and Sewer Trunk Master Plan". All sanitary flows generated on TFN lands will be pumped through a series of community lift stations for distribution to the regional trunk system or final sewage treatment locations. As such, it is important to correlate sanitary flows from residential and commercial developments with the projected capacity of the lift station within each sanitary catchment. In case of discrepancy, the projected capacity of the lift station shall be adjusted to reflect the change, and TFN must review the hydraulic performance of downstream pressurised system under the new conditions.

The design flow Q = Peak Wet Weather Flow (PWWF)

Residential PWWF = population x PDWF + infiltration

Non-residential PWWF = area x PDWF + infiltration

3.9 Alignment

Add the following:

Sewer alignments and flow directions shall accommodate the shortest practical distance to the proposed lift station site in order to minimize wet well depth.

Proposed exposed bridge-type crossings of sanitary sewers or inverted siphons shall be reviewed and approved by TFN prior to detailed design.

3.11 Minimum Grade

Replace this section with the following:

In order to limit lift station wet well depth, sanitary sewer grades shall be designed at the following grades:

- The most upstream gravity sewer reach to be set at 1% grade
- All other sewers to be set at 0.5% grade

The above grades must be designed as minimal grades for long-term operation after all ground movements due to settlement have taken place. If required, sewer corridors may be preloaded to reduce effects of settlement and secure minimum grades in place. Settlement data shall be provided by a Geotechnical Engineer.

Force main grades are as indicated in Section 2.0 - Water Distribution.

3.12 Curved Sewer

Replace this section with the following:

Curved sewers are not permitted at TFN unless approved in writing. TFN will accept mitred pipe and bends on large diameter storm sewer where it is demonstrated that there is an operational advantage.

3.18 Pump Stations

Replace entirely Section 3.18 with the following:

3.18.1 Design Accommodations for Forcemain Pressure Testing, Commissioning, Operation and Maintenance

A. Forcemain Pressure Testing

Forcemain design must ensure that sections of the forcemain can be easily isolated from other branches for pressure testing during construction with only a straight forcemain run tested at time. Flanged connections are required for both pipe ends of the pressure tested section (preferably at valve locations) to the rest of the forcemain system. The overall length of tested section shall not exceed 500 m in length or more than one (1) diameter increase in pipe size.

B. Forcemain and Pump Station Commissioning

A formal commissioning plan shall be submitted to TFN in advance of commissioning.

C. Forcemain Maintenance Requirements

All forcemains 150 mm diameter and smaller will require cleanouts at each end of the pipe and the maximum length of forcemain between cleanouts shall not exceed 200 m, and the cleanouts must also be provided at vertical and horizontal bends exceeding 22.5 degrees. Cleanout connections must be installed in such a way to allow advance of cleaning swab, mechanical scraper or chemical cleaning solution in the general sewage flow direction.

All forcemains 200 mm diameter and larger will require pig launch and retrieving assembly. Maximum length of forcemain section between launch and retrieving assembly shall not exceed 500 m or two (2) pipe diameters. Typical pig launch and pig retrieving assembly drawing is provided in the Supplementary Standard Drawings section. The pigging shall be performed in the general sewage flow direction.

Forcemain valve type shall be eccentric plug valves and sizes shall be selected to allow uninterrupted passage of swabs and pigs.

3.18.2 Sanitary Lift Station Design

3.18.2.1 General

The purpose of this section is to serve as a general guideline for the design of sanitary pump stations within Tsawwassen First Nation (TFN) lands. This document contains two parts: the design criteria and the typical drawing set. The design criteria pertain to all sanitary pump stations while the typical drawing set is primarily relevant to duplex pump stations with individual pump sizes less than 35 kW.

The criteria and typical drawings have been prepared for use by Professional Engineers (the Consultant) who are suitably qualified for the completion of this work. Specific site criteria and criteria not contained within this document or associated documents shall be in accordance with good engineering practice, as determined in consultation with TFN representative or assigned professional acting as Owner's Engineer.

These standards are provided as a guide, and the Consultant shall remain fully responsible for the design and construction of proposed infrastructure in accordance with good engineering practice to address the specific needs and site conditions of their project.

This document is to be used in conjunction with the approved edition of MMCD Design Guideline Manual, Master Municipal Construction Documents, and these TFN Supplementary Design Criteria and Supplementary Construction Specifications and Detailed Drawings.

3.18.2.2 Process

The process outlined below has been chosen to ensure that pump station design and construction works can be completed in a timely manner while optimizing the amount of involvement required of TFN staff.

Task	Explanation
1. Project Award	
2. Project Initiation Meeting	<ul style="list-style-type: none">• Confirm Scope of Work• Confirm Site Location• Confirm catchment boundaries• Confirm land-use designations for OCP and proposed uses
3. Draft Pre-Design Report	<ul style="list-style-type: none">• Submit as outlined in Section 3.17.2.3 for Review by TFN
4. Review by TFN	<ul style="list-style-type: none">• Review of Draft Pre-Design Report
5. Final Pre-Design Report	
6. Draft Construction Documents	<ul style="list-style-type: none">• Draft Detailed Design Drawings• Draft Supplementary General Conditions• Draft Construction Cost Estimate
7. Review by TFN	<ul style="list-style-type: none">• Review of Construction Documents

8. Final Construction Documents	<ul style="list-style-type: none"> Detailed Design Drawings Supplementary General Conditions Construction Cost Estimate
9. Tendering	<ul style="list-style-type: none"> Technical assistance to be provided by the Consultant to answer Tender questions
10. Shop Drawings	<ul style="list-style-type: none"> To be reviewed and approved by Consultant with copy sent to TFN
11. Programming Provided by TFN	<ul style="list-style-type: none"> TFN to provide programming for SCADA system
11. Shop Testing/Inspection	<ul style="list-style-type: none"> Shop testing is required for the completed electrical kiosk Shop inspection may be required, at TFN's discretion for the fibreglass wet well
11. Construction	<ul style="list-style-type: none"> Inspection services to be provided by the Consultant
12. Draft O&M Manuals	<ul style="list-style-type: none"> Contractor to prepare and submit O&M Manuals to Consultant for completion and submission to TFN (as outlined in Section 3.17.2.3)
13. Review by TFN	<ul style="list-style-type: none"> Review of O&M Manuals
14. Commissioning	<ul style="list-style-type: none"> Consultant to arrange for Commissioning with TFN in attendance Commissioning procedure to be sent to TFN and Contractor in advance (as per Section 3.17.2.3)
15. Final O&M Manuals	<ul style="list-style-type: none"> Revised O&M Manuals based on Review by TFN and Commissioning
16. Record Drawings	<ul style="list-style-type: none"> Record drawings submission in accordance with Section 3.17.2.3

3.18.2.3 Submissions

A. Pre-Design Report

The purpose of the Pre-Design Report is to provide TFN with a review of the design alternatives and recommended configuration and equipment selection for the proposed station. Where appropriate, at least two design alternatives shall be shown with a recommendation by the Consultant on which alternative to proceed with. Attached in **Appendix B** is a sample table of contents for the Pre-design Report. The following is a description of the items that must be included in the report:

- a) Flow Calculations
 - A catchment map showing how the existing and future land parcels will be serviced
 - A summary of the design flows based on present and future conditions
- b) Force Main Design
 - A review of force main sizing alternatives based on cleansing and head loss considerations

- A review of transient analysis requirements
- c) Pump Selection
 - System curve for existing and future design conditions
 - Pump curves superimposed on system curve for all standard accepted pumps that suite the design points
- d) System Configuration
 - A review of inlet pipe sizes and required wet well storage
 - An indication of the length of inlet pipe that will be operating submerged and the storage volume contained within the submerged portion
 - A description of the general station configuration
- e) Controls and Operation
 - A description of the station instrumentation and control logic
 - A description of the wet well ventilation design
 - A description of the radio communication path and issues to be resolved during detailed design
- f) Seismic Design and Geotechnical Concerns
 - A review of foundation requirements as outlined in Geotechnical Report
 - A review of dewatering and construction slope requirements
 - A review of seismic design requirements
 - A review of site preloading requirements
- g) Pump Station Configuration and Equipment
 - A table listing the major system components, manufacturer, and delivery schedule
- h) Site Design
 - A review and recommendation of right-of-way and easement requirements
 - An outline of access requirements, including integration into surrounding designs
 - An outline of any landscaping issues and how there are to be addressed
- i) Schedule
 - Projected schedule through to completion of commissioning including an estimate for work by other agencies and developers (if appropriate)
- j) Construction Cost Estimate
 - Class B cost estimate (15% Contingency)
- k) Site Plan
 - A plan showing the sanitary pump station, surrounding area, inlet sewers, force main, right-of-way, construction easement, access, and other associated items.
- l) Geotechnical Report

B. Construction Documents

The construction documents submission shall include the following:

- a) Supplementary General Conditions including:
 - all site specific specifications
 - supplementary technical specifications necessary (ie. fibreglass wet well and piping specification)
 - O&M manual submission requirements
 - testing and commissioning requirements
- b) Construction Drawings to adopted drafting standards
- c) Construction Class A cost estimate (5% contingency)

C. Operations and Maintenance Manual

The manual should be laid out as follows:

- a) Title Sheet labelled “Operating and Maintenance Manual, (Insert Name) Pump Station” and containing the date.
- b) List of Contents
- c) Section 1 – Introduction (information to be inserted by the Consultant)
- d) Section 2 – Design Description (information to be inserted by the Consultant)
- e) Section 3 – Commissioning
 - Commissioning Procedure and Record Sheet (information to be inserted by the Consultant)
- f) Section 4 – Mechanical
 - Description of mechanical equipment and its operation
 - Equipment manufacturer’s data and service manuals
- g) Section 5 – Electrical and Controls
 - Description of electrical and controls equipment and the systems operation
 - Level and Alarm Settings
 - Test Certificates or Reports and Approval Certificates of Tests
 - PLC Ladder Logic Printout and SCADA System Screen
 - Equipment manufacturer’s data and service manuals
- h) Section 6 – Maintenance Program
 - Listing of equipment with associated warranty schedule, recommended spare parts, nearest service centre

- i) Appendix A – Construction Record Drawings (information to be inserted by the Consultant)
- j) Appendix B – Approved Shop Drawings
- D. Commissioning Procedure

A Commissioning Procedure is to be prepared by the Consultant and submitted to the Contractor and TFN at least two weeks in advance of the scheduled commissioning date. This procedure is to outline what tests will be conducted and what data will be recorded. At the completion of the commissioning the procedure and record sheet are to be included in the O&M Manuals.

E. Record Drawings

Record Drawings are to be submitted in accordance with the drafting standards adopted by TFN, within one month of successful commissioning.

3.18.2.4 Design Requirements

The following section outlines the necessary design requirements that are to be addressed during the design of sanitary lift stations.

- A. Flow Calculations
- a) Catchment Areas

Sanitary sewer catchment areas are to be developed in consultation with TFN. Consideration shall be given to the preliminary lift station locations as outlined in the document “TFN Bulk Water and Sanitary Trunk Master Plan” or such other document. The following issues shall be addressed in finalizing the catchment area:

- Minimize the number of pump stations
- Avoid double pumping of sewage where possible
- Keep the depth of the pump stations as shallow as possible (approximate maximum depth of 5.8m)
- Ensure the grades of sanitary sewers can withstand settlement concerns

b) Land Use

Consideration must be given to the proposed land uses and development plans. The time frame for each phase of the development should also be considered when determining if an initial smaller pump may be upsized in the future to accommodate future growth or if the ultimate pump should be installed at the onset.

c) Design Flows

Design flows shall be determined in accordance with the adopted design guidelines stipulated in this document. Consideration should be given to potential variations in proposed development plans to determine if sewage generation rates will be higher than the estimated flow based on originally approved land use.

B. Force Main Design

Force mains shall be designed in accordance with the adopted design guidelines stipulated in this document. The Consultant shall consider and advise TFN if a transient analysis is warranted to determine if transient conditions will affect elements of the pump station or force main design. Any variations from the proposed community forcemain system, general lift station layout and sanitary catchment boundaries are subject to approval by TFN at the onset of the design process.

C. Pump Selection

For duplex stations, pumps shall meet maximum flow condition with one pump in failure mode. For multiple pumping stations, the largest capacity pumping unit shall have an equal standby unit – which can be operated in the alternating pump sequence.

The TFN standard pump station design includes rail mounted submersible pumps. TFN will maintain spare parts for a set of future standard pumps. The List of Approved Materials contains a list of the pre-approved TFN standard pumps. (See 33 34 02 TSS). All pumps must adapt to standard discharge elbows and rails that conform to Flygt dimensions.

D. Pump Station Configuration and Design

There are two main categories that govern pump station configuration. The first category is the adopted TFN standard that is reflected in Supplementary Standard Drawing consisting of a duplex pumping arrangement with pumps up to 35 kW. The second category relates to stations that either include pumps larger than 35 kW or those that contain more than 2 pumps. It is expected that the majority of future TFN lift stations will fall into Category 1.

Category 1: Duplex Stations up to 35 kW

The standard design for TFN duplex pump stations consists of a customized fabricated wet well with electrical and controls in an above ground kiosk. The fabricated well is to be constructed of FRP material complete with all piping penetration through the wall. Proper connection details are provided in Appendix C - Specifications for FRP Pipes, Wall Penetrations and Connections.

A key feature of these stations is the inlet pipe(s) that enter the wet well submerged. Three key parameters must be met to ensure that these pipes are capable of delivering the flow rate demanded by the pump and to ensure that during pump draw down the pipe(s) receive sufficient scouring action:

- 1) The inlet pipe flow capacity at 50% depth must equal the maximum pumping rate (with one pump running) for the station.

- 2) The velocity in the inlet pipe(s), including oversized sections for additional storage, at 20% depth is at least 0.9 m/s.
- 3) The distance between the invert of the inlet pipe(s) and the pump off elevation must ensure sufficient volume exists to fully drain the inlet pipe(s) without cycling the pumps on and off. A minimum distance of 100mm is required.

The volume in the wet well outlined in the third parameter is to ensure the gravity sewer fully drains on each pump cycle.

The minimum distance between pump starts and stops must be based on a maximum of 10 pump starts per hour per pump (total of 20 starts per hour for two alternating pumps) at an inflow rate equal to half the pump discharge capacity. The submerged volume within the inlet pipes may be included in the operating volume. The operating volume must be a minimum of 30 cubic metres.

Other tank design requirements include:

- 1) Minimum tank diameter is 2400mm or corresponding cross-sectional area if the tank does not have cylindrical shape, provided pump hydraulic requirements are met.
- 2) Benching is required at the tank bottom to direct sewage into pump suction intake.
- 3) Hatches must be water tight, and the access hatch must be elevated at least 200mm above ground or 3.5 m geodetic or 100mm above 200-year major storm system HGL, whichever produces the higher elevation. The designer must confirm with TFN if the effects of sea level rise should be considered in this evaluation based on the anticipated life expectancy of the infrastructure. The Consultant shall make design provisions for safe and easy access into the tank.
- 4) A fully removable intermittent FRP platform above maximum design sewage level is required for access into the tank for maintenance purposes. Ladders must be installed for access.
- 5) The design shall consider Health and Safety requirements of the TFN operators.

Category 2: Other Stations

For stations that are not covered by Category 1 (employing larger pumps or more than two pumps) specific design requirements must be determined by the Consultant and approved by TFN.

E. Controls and Operation

Category 1: Duplex Stations Up to 35 kW (45 HP)

Category 1 pump stations are to operate as a duplex pumping station, alternating pumps with each cycle. Each station is to include a sonic level sensor that is the primary sensor for pump starts and stops, low level alarm, and continuous level monitoring. A high level float is required as a back-up control. In addition, temperature sensors are to be provided on each pump to monitor overheating and a magnetic flow meter installed to provide continuous flow measurement.

In the event of a power failure each station is to be equipped with an automatic transfer switch and stand-by diesel generator. Fuel storage is required for 8 hours of continuous operation at design flow rates.

Ventilation at each station is to be by forced air using a fixed speed fan that runs continuously. The minimum ventilation rate is to be 12 air changes per hour or higher if required for safety considerations. Ventilated air is to be exhausted through a vent pipe from on the wet during operation.

Communication between TFN SCADA system and the pump station is via radio transmission. The Consultant shall verify and identify any radio path issues at the pre-design stage. The SCADA system shall be updated with the first new pump station installed. All other pump stations installed after shall also be compatible with the new system. In addition, the existing pump stations shall be equipped accordingly for remote monitoring and control as part of the adopted SCADA system.

For pumps over 10kW (15HP) the Consultant shall give consideration to including soft start and stop control, and if required, variable frequency drives (VFD).

Category 2: Other Stations

The requirements for controls and operations of Category 2 stations should be developed by the Consultant and approved by TFN. In general the control logic should conform to the philosophy implemented at Category 1 stations.

F. Seismic and Settlement Design

A geotechnical investigation is required for each pump station. This investigation must include consideration for both engineering design and construction issues. Included in the investigation must be the assessment of liquefaction potential during 1:2,475 year seismic event and long term settlement potential. Where preloading of the pump station site is required it shall extend sufficiently beyond the boundary of the site area so as to prevent movement of the pump station from future preloading of abutting properties.

To ensure the stations have a reasonable level of protection during long term settlement and seismic activities each station is to provide the following:

- 1) Force main and gravity sewer connections are to be designed to allow for up to 300mm of vertical ground movements.
- 2) Wet well and electrical kiosk foundations sized to prevent overturning.
- 3) Wet well design to be specifically designed to withstand flotation due to buoyancy forces under the worst case scenario (empty tank with flooding above ground as per TFN flood level input).

E. Site Design

The site design of each pump station should give consideration for the local area. This must include right-of-way, construction easement, and long term maintenance access requirements. The site plan must indicate how the station grading ties into the adjacent sites. All site drainage must be directed away from the wet well and kiosk. Landscaping of the site should suit the local area. Special requirements for landscaping, if applicable, will be provided by TFN. Protection in the form of bollards or other means must be provided where appropriate to ensure accidental damage risk is limited.

Sufficient space must be provided to:

- 1) Allow maintenance vehicles to park off of the travelled roadway.
- 2) Allow for safe movement of vehicles entering and exiting the site.
- 3) Allow lifting equipment to park sufficiently close to hatches to permit the removal of pumps.
- 4) All control panels shall have the power supply side away from the wet well, and the controls side nearest the wet well.

Site access must be provided from the public roadway unless otherwise approved by TFN.

A water service connection must be provided to each site in accordance with the typical drawings. Sufficient access must be provided to allow TFN crews room to connect a washdown hose. A hose of length suitable to washdown all chambers within the site (min. 15m) must be provided with the station.

Installation of flow meter located in a separate chamber on discharge forcemain is required and shall be provided within the general lift station site arrangement.

Detailed design of each sanitary pump station must include odour control as described in the previous sections.

Kiosk hatches must include door straps and shock absorbers to prevent hatches from slamming open.

3.20 Corrosion Protection

Corrosion protection shall be installed for all metallic fittings. The *Applicant's Engineer* shall provide detailed designs for the supply and installation of sacrificial anode cathodic protection. The designs shall include all specifications for magnesium anodes, bond cables, wells, test stations and reference electrodes. Anodes shall be sized by the *Applicant's Engineer* based on the number of fittings protected. For a single metallic fitting isolated from other fittings a single 8kg high potential magnesium anode may be acceptable at TFN's discretion.

Test points shall be installed in cast iron water valve boxes at locations specified by the *Applicant's Engineer*.

Record drawings, testing and certification of the installation shall be provided to TFN prior to any application for a Completion Certificate.

SECTION 4.0 – STORMWATER MANAGEMENT

4.2 STORM WATER CONTROL

Replace this section with the following:

4.2 INTEGRATED RAINWATER MANAGEMENT PLAN

TFN has conducted a community wide Integrated Rainwater Management Plan (IRMP, December 2013) and may update it from time to time and track system performance through a monitoring and adaptive management program. All proposed developments are required to submit a Rainwater Management Plan (RMP) for their subject properties that demonstrate conformance with the IRMP, and in response to new information that is available from TFN through the monitoring and adaptive management program. As long as the proposed development and works are in conformance with the community wide IRMP, the RMP may be limited to the boundaries of the proposed property. However, at the discretion of TFN, where proposed works are not in conformance with the community wide IRMP, where there is a lack of available information, or where there is insufficient understanding of the inter-relationship between on-site and off-site drainage systems, the RMP may be required to extend beyond the boundaries of the proposed property(ies). The developer is encouraged to consult TFN staff on the required limits of study prior to initiating the RMP.

At a minimum the RMP should include the following:

- i. Description of the property boundary(ies) and land uses (land use type, total impervious fraction and effective impervious fraction) and tributary catchments in both existing and proposed conditions.
- ii. Description of proposed landscaping for pervious areas (i.e., topsoil thickness) and discharge locations for roof downspouts.
- iii. Inventory of existing water and habitat features on the property, including environmental classifications and/ or fish presence information.
- iv. A physical and geometric description of off-site¹ drainage systems bordering the subject property(ies).
- v. Descriptive statements indicating how the proposed development conforms or differs from information contained in the current community wide Integrated Rainwater Management Plan (IRMP) prepared by TFN.
- vi. Application and presentation of supplementary information obtained from TFN's monitoring and adaptive management program, if available.
- vii. Assumed hydraulic boundary conditions at connection points to off-site drainage systems.
- viii. Description of all analysis conducted.

¹ Off-site means lands and infrastructure beyond the legal boundaries of the subject property(ies).

- ix. Layout of existing and proposed drainage systems with a clear description of their connection points, and their relevant catchment areas, to off-site drainage systems.
- x. Minor and major flow paths, design flows, and maximum hydraulic grade line (HGL) elevations within the limits of study.
- xi. Lot grading details.
- xii. Flood protection elevations for proposed buildings / structures (refer to Section 4.9).
- xiii. Proposed source control and/or runoff quality treatment facilities (e.g., type, size, location, hydraulic performance, water quality treatment performance) (refer to Section 4.7).
- xiv. Other proposed mitigation measures, if appropriate.
- xv. Construction sedimentation control plan.

4.3 MINOR AND MAJOR SYSTEMS

4.3.1 The Minor System

Replace this section with the following:

Consists of local pipes, catch basins, bioswales, driveway culverts, open channels, appurtenances and other rainwater management features designed to carry flows of a 10-year return frequency.

All minor system components are to be sized to ensure that the hydraulic grade line (HGL) of 10-year frequency flows remain below ground surface and the flood protection elevation of buildings / structures (refer to Section 4.9), or within bank limits in the case of open channels and bioswales.

4.3.2 The Major System

Replace this section with the following:

Consists of overland flow paths, roadway culverts, trunk pipes, trunk open channels, and other rainwater management features designed to carry flows of a 100-year return frequency.

Pump stations are designed to the 25-year return frequency and, therefore, influence the hydraulic grade line (HGL) in the community wide drainage system. As such, major system drainage infrastructure may surcharge, but shall be sized to achieve the following performance targets during the 100-year return frequency:

- Water within public lands does not enter private lands;
- Roadway culverts do not allow the entrance boulevard, collector roads, or local roads with greenways to overtop;
- Maximum hydraulic grade lines (HGL) in the proposed condition do not exceed those in the existing condition;

- Public safety is protected;
- Habitable area² and vulnerable infrastructure³ is protected.

4.4 RUNOFF ANALYSIS

Replace this section with the following:

Rainwater management design should be carried out using one or more of the following methods as indicated below. Calculations must be submitted with designs.

- *Rational Method*: Applicable in most cases for the purposes of conveyance design only and for areas less than 10 hectares in size.
- *Hydrograph Method*: Applicable for complex systems involving multiple catchments with highly variable land use conditions, where flow attenuation features are involved (e.g., detention pond, constructed wetland, etc.), or for gross areas exceeding 10 hectares (refer to Section 4.11).
- *Mass Balance*: Volumetric based computations may be used to supplement flow analysis for the design of water quality treatment facilities and rainwater management features (RMF).

Note: The performance of the community wide drainage system is under the influence of ocean levels and pump stations, and therefore is expected to surcharge under certain conditions. Aside from the runoff analysis method applied, hydraulic grade lines (HGL) and associated system performance shall consider governing downstream hydraulic boundary conditions, which may be available from TFN. If not available from TFN, or available but not to the degree necessary to support the design, additional off-site analysis may be required.

4.6 Minimum Building Elevations (MBE)

Replace this entire section with the following:

4.6 FLOOD PROTECTION ELEVATION (FPE)

The FPE applies to the elevation of the lowest floor slab on grade in a building / structure, or the underside of the floor joists where the lowest floor is constructed over a crawl space. Crawl space is defined as the space between a floor and the underlying ground having a maximum height of 1.2 m or

² Habitable area means any space or room, including a manufactured home, that is or can be used for dwelling purposes, business, or the storage of goods which are susceptible to damage by floodwater.

³ Vulnerable infrastructure means any infrastructure that may be damaged by floodwater.

the underside of the joists and not used for the storage of goods or equipment damageable by floodwaters.

FPE's shall satisfy all of the following conditions:

- *Minimum Floor Elevation* – The FPE shall meet the minimum floor elevation requirements as outlined in the *TFN Development Permit Areas Regulation*.
- *Storm Sewer Service Connection Invert* – The FPE shall be at least 0.60 m above the storm sewer service connection invert and allow for 2% gradient on the on-lot drains.
- *Hydraulic Grade Line* – The FPE shall be at least 0.30 m above the major drainage system hydraulic grade line (HGL). Any crawl space stall be at least 0.30m above the pipe HGL.

Additionally, for sites near a watercourse or ocean for which a floodplain elevation has been established, the FPE shall be at least 0.30 m above the 200-year return period instantaneous flood elevation.

4.7 RATIONAL METHOD

4.7.1 Runoff Coefficients

Replace this section with the following:

The following runoff coefficients are for use with the Rational Formula. These coefficients are for general application only. Design values are subject to verification by the designer and approval by TFN.

Table 4.4: Runoff Coefficients

Land Use	Percent Impervious	Runoff Coefficient	
		10 Year Storm	100 Year Storm
Suburban Residential (Lots>0.4 ha)	20	0.35	0.40
Single Family Residential (Lots > 650m ² to 0.4ha)	40	0.50	0.55
Single Family Residential (Lots <650 m ²)	65	0.60	0.65
Street Townhouse	75	0.65	0.70
Apartment / Stacked Townhouse	85	0.70	0.75

Commercial	90	0.80	0.85
Industrial	90	0.80	0.85
Institutional (e.g. Schools)	80	0.75	0.80
Parks/Grasslands	20	0.20	0.30
Cultivated Fields	30	0.30	0.40
Woodlands	5	0.10	0.30

4.7.3 RAINFALL INTENSITY

Replace this section with the following:

4.7.3 CLIMATE DATA

4.7.3.1 Rainfall Data

Climate change is predicted to influence rainfall pattern distribution. A 2008 report⁴ predicts future changes to total annual rainfall as well as to rainfall storm events, based on climate change model results conducted by Ouranos Consortium (using the Canadian Regional Climate Model). Predicted changes in rainfall distribution are shown in Table 4.1.

Table 4.1 Rainfall Pattern Changes (for Climate Change)

Event	Average Estimated Change to 2050's (%)	Range in Model Estimates: (%)
Average Annual 1-day Maximum Precipitation (Design Storms)	+17%	1%
Total Annual Rainfall (Continuous Modeling)	+14%	4%

The community wide IRMP accounted for the changes noted in the above table; Table 4.1 values are also to be accounted for in the preparation of all RMP's and in design calculations for storm sewers and rainwater management features. Precipitation datasets to be used as the basis for design are provided in Appendix C; these datasets do not account for climate change as per Table 4.1.

⁴ Kerr Wood Leidal Associates Ltd. Vulnerability of Vancouver Sewerage Area Infrastructure to Climate Change. 2008.

4.7.3.2 Sea Level Rise and Land Subsidence

A study commissioned by the BC Ministry of Environment⁵ indicates that climate change will result in a sea level rise (SLR) of 1.0 metre over existing levels for the BC South Coast by the Year 2100. This is double the amount stated in previously adopted reports⁶. The report suggests that, while the actual rate of SLR is predicted to be moderate to the Year 2025 then increase more rapidly between 2025 and 2100, for the purposes of assessment and analysis a constant rate for SLR should be assumed between today and 2100. A constant rate of SLR (to 1.0 metre by the Year 2100) was incorporated in the IRMP future conditions analysis.

A study commissioned by the Government of Canada⁶ contains the latest predictions for land subsidence for the Lower Mainland. For the Fraser River / Delta area (on which TFN is situated), land is predicted to subside at a constant rate of 1 to 2 mm per year. The higher value (2 mm per year) for land subsidence was incorporated in the IRMP future conditions analysis.

Hydraulic design boundary conditions provided by TFN (per the IRMP) may have both sea level rise and land subsidence factored into them; however, any new analysis where new boundary conditions are being established, or for the purposes of setting flood protection elevations, consideration to sea level rise and land subsidence must be given and reflected in the RMP submission.

4.8 Hydrograph Method

Replace this section with the following:

Drainage designs using the Hydrograph Method require computer models capable of modelling the hydrologic characteristics of the watershed and of generating flow hydrographs from each subcatchment for a critical storm or a series of storms and routing the hydrographs through the drainage network pipes, open channels and other rainwater management facilities. The model must also be able to handle hydraulic boundary conditions.

4.8.1 Model Selection

Add the following after the first paragraph:

For compatibility reasons, unless otherwise approved for special application by TFN staff, all modelling (hydrologic / hydraulic) shall be prepared using one or a combination of the following programs:

- Mike Urban (DHI)

⁵ Ausenco Sandwell. Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use – Draft Policy Discussion Paper. 2011.

⁶ Bornhold, Brian D. Projected Sea Level Changes for British Columbia in the 21st Century. 2008.

- Mike 11 (DHI)
- Mike SHE (DHI)
- XP SWMM (XP Software)
- PC SWMM (CHI)
- InfoSWMM (Innovyze)
- HEC-RAS

4.8.2 Modelling Procedures

Replace this section with the following:

Whenever possible, modelling results should be calibrated using observed rainfall and flow data from the design watershed or a similar watershed. The applicant should inquire with TFN staff to obtain information that may be available. Sensitivity of the model predictions to variations of key parameters should also be tested and the findings used to develop realistic and conservative models. Downstream boundary conditions are of particular importance, which again may be available from TFN; however, it may also be necessary for the applicant to test a range of boundary conditions when uncertainties exist. Hydrographs should be generated at key points for the 10-year, 25-year, and 100-year design storms with durations of 1, 2, 6, 12, and 24 hours for each development condition. This will identify the critical storm event to be used in designing the system component. Note that the storm durations that generate the critical peak flow rate may be different from the durations that generate the critical volume or water levels.

Detailed designs should include maximum hydraulic grade lines (HGL) of the minor and major systems plotted on profiles of the minor system components and compared with flood protection elevations (FPE) to demonstrate levels of flood protection.

4.8.3 Submission of Modelling Results

Replace this section with the following:

Modelling results are to be submitted in the RMP and shall include the following information, at a minimum:

- Plans showing catchment and subcatchment boundaries, slopes, soil conditions, land uses and flow control facilities.
- Name and version of modelling program(s).
- Parameters and simulation assumptions.
- Design storm details.
- Pre-development and post-development hydrographs.
- Hydraulic grade line (HGL) elevations used for design, including a clear description of assumed boundary conditions and any sensitivity analysis conducted.

4.9 Minor System Design

4.9.1 Level of Service

Replace this section with the following:

The minor drainage system consists of local pipes, catch basins, bioswales, driveway culverts, open channels, appurtenances and other rainwater management features sized to convey peak 10-year return period rainwater runoff by gravity flow. The minor system shall be designed to prevent surcharged conditions; however, there may be instances where downstream boundary conditions result in backwater effects in the minor drainage system. Such instances are to be avoided wherever possible. Trunk drainage systems shall be designed to convey the major system (refer to Section 4.13). The hydraulic grade line (HGL) in the proposed drainage system must not detrimentally impact roads, services, public or private property, or habitable structures under the minor system event.

4.9.3 Flow Velocities

Replace this section with the following:

Minimum design velocity under normal conditions is desired to be 0.6 m/s; however, is recognized that this is potentially challenging to achieve in some locations. Velocities for normal conditions should be checked assuming pipe full (non-surcharged) conditions.

Where a storm sewer discharges into an open channel, provisions for erosion protection of the channel bank and invert shall be provided.

4.9.7 Minimum Grade

Replace this section with the following:

Minimum grades of main line storm sewers and open channels should be 0.25%, except for catch basin leads and service connections, for which minimum grades are as indicated elsewhere. At the discretion of TFN, minimum grades may be reduced but shall in no instances be less than 0.10%.

All vertical alignment pipe design shall take into account settlement criteria for the soils of the site as established by a geotechnical study. The designer will be required to acknowledge that settlement criteria have been considered in the design.

4.9.8 Curved Sewers

Replace this section with the following:

4.9.8 Curved Sewers

Curved sewers are not permitted for pipes less than 1200mm diameter. Curves or bends may be approved for pipes 1500 mm diameter and larger where it is demonstrated that there are operational advantages.

4.9.9 Depth

Delete the following bullet:

- Prevent freezing. Minimum depths are shown on Figure 2.1.

4.9.12 Manholes

Add the following:

Given that storm sewers are unlikely to have sufficient cleansing velocity, all mainline manholes shall be sump manholes.

4.9.13 Catch Basin Spacing

Add the following:

All catch basins shall be sump catch basins.

4.9.14 Service Connections

Replace this section with the following:

Every legal lot and each unit of a residential duplex is to be provided with a separate service connection. Unless otherwise approved by TFN, connections are to serve the perimeter (foundation) drains of all buildings by gravity. Pumped connections will not be permitted for new construction, but may be permitted to protect existing connections or structures, subject to the advance agreement of TFN and if appropriate covenants are provided.

Unless otherwise approved, roof drains are to discharge to on-site landscaped areas for all land use types and not directly to service connections. Landscaped areas are to be configured accordingly (refer to Section 8.0 – Landscape).

Other requirements include the following:

.1 Size

- Pipe size is to accommodate peak design flow.
- Minimum pipe sizes are as indicated elsewhere.

.2 Location and Depth

- Connections to large lots are to be located at the lower portion of each lot.
- The connection elevation at the property line is to be above the minor system hydraulic grade line (HGL).
- Other depth requirements are as indicated for storm sewer mains.

.3 Grade

Minimum grade from property line to storm sewer main:

- 100 mm diameter pipe: 1.50%
- 150 mm and larger diameter pipe: 1.00%

.4 Details

- Use standard wye fittings for connections to new mains. For connections to existing mains use wye saddles or insertable tees.
- Service connections should connect to the sewer mains and may only connect to manholes under unique circumstances, to be approved by TFN.
- Inspection chambers are required on residential connections unless the service is less than 2.5 m long and connects to a manhole.
- Manholes are required on service connections larger than 250 mm diameter.
- Connections exceeding 30 m in length will be treated as mains.

4.9.15 Locations and Corridors

Replace this section with the following:

Storm sewers should be located within roadways as shown on the applicable standard drawings. Rear yard sewers, side yard sewers, and pumped connections are to be avoided, and will require advanced approval of the Director.

Where a storm sewer crosses private land, right-of-way requirements are as indicated in Section 1.0 – General Design Considerations, Subsection 1.3 – Utility Rights-of-Way.

Clearance from water mains is as indicated in Section 1.0 – General Design Considerations, Subsection 1.4 – Utility Separation.

4.10 Major System Design

4.10.1 General

Add the following:

The hydraulic grade line (HGL) in the proposed drainage system cannot detrimentally impact structures under the major system event.

4.10.2 Surface Flow Routing

Delete the following bullet:

- HGL is to be at least 600 mm below the MBE of adjacent buildings.

Add the following bullet:

- HGL is to be at least 300 mm below the FPE of adjacent buildings.

4.10.4 Piped System

Replace “Storm Water Management Plan”, with “RMP”.

4.11 RUNOFF CONTROLS

Replace this section with the following:

Runoff controls are required to meet the objectives indicated in the preceding sections.

Location and maintenance options for control facilities include:

- On-site: For all land uses other than single family residential, all rainwater management and treatment objectives shall be met by implementing engineered facilities on site. Registered covenants are required to ensure appropriate maintenance by the property owners.
-
- Off-site: For roadways and single family residential development, rainwater management and treatment objectives shall be met on public lands, common road right-of-ways or parks. Maintenance is to be carried out by the local authority.

DISCHARGE RATES AND QUALITY

4.11.1 Targeted Pollutants

There are a number of potential organic and inorganic substances found in rainwater runoff, referred to as “non-point source” (NPS) pollution because the sources tend to be highly dispersed across the landscape. For TFN, the ones of greatest relevance and targeted for treatment are:

- Total suspended solids (TSS)
- Oil and grease (O&G)
- Trace metals; as represented by copper and zinc

Focusing on the removal of these constituents is expected to yield adequate removal of other associated constituents. For purposes of consistency, these pollutants should be considered to exhibit the concentrations shown in **Appendix E**.

Performance targets and water quality treatment requirements for various land uses are described in Section 4.11.2.

4.11.2 Performance Targets

All developments shall incorporate water quality treatment provisions into the design to meet the following performance targets; the targets are expected to be met for every new development and redevelopment site through the use of rainwater management facilities (RMFs), as defined in this section.

- **Basic Control** – Basic treatment focuses on removal of TSS along with associated pollutants attached to those sediments, including low levels of petroleum hydrocarbons (oil and grease and PAHs). Basic control is applicable to all non-agricultural lands within TFN. The performance target is:
 - 80% removal of TSS for influent event mean concentrations (EMCs⁷) greater than 100 mg/L but less than 200 mg/L; for influent EMCs less than 100 mg/L, meet a goal of 20 mg/L effluent TSS. For sites generating TSS greater than 200 mg/L, provide Enhanced Control (see below); and,
 - Treatment should be applied to a runoff volume generated by 25 mm of rainfall per hectare of impervious surface; runoff above this volume may bypass the treatment system(s); for systems requiring the use of a flow rate for design, base the computations on Table 4.2. Alternate hydrologic methods may be approved for use in determining design flow rates if prepared by a professional engineer, at TFN’s discretion.

⁷ The “event mean concentration” (EMC) is the total mass of pollutant in runoff from a storm event divided by the total volume of runoff from that same storm event.

- **Oil Control** – Oil removal is specifically required for sites where there is significant likelihood that higher concentrations of petroleum hydrocarbons will be released; in general, this includes sites with significant presence or use of vehicles. The performance target is:
 - No on-going or recurring visible sheen in receiving watercourse(s), and 24-hour average Total Petroleum Hydrocarbon (TPH) concentration no greater than 10 mg/L with a maximum discrete (grab sample) concentration no greater than 15 mg/L; and,
 - Treatment should be applied to all runoff with no bypass allowed, and the catchment area to the treatment system may be restricted to drives, roads and parking areas.
- **Enhanced Control** – Enhanced control is intended to achieve a higher level of dissolved metals removal and applies to sites experiencing intense vehicle usage, for example, industrial sites, or other activities likely to yield higher levels of pollutants. The performance target is:
 - Exceed basic removal of TSS;
 - Greater than 50% removal of the dissolved fractions of copper and zinc; and,
 - Treatment should be applied to a runoff volume generated by 25 mm of rainfall per hectare of impervious surface; runoff above this volume may bypass the treatment system(s); for systems requiring the use of a flow rate for design, base the computations on Table 4.2. Alternate hydrologic methods may be approved for use in determining design flow rates if prepared by a professional engineer, at TFN's discretion.

Table 4.2: Design Flow Rates for Rainwater Management Features

Storm Duration (Time of Concentration, T_c) (hrs)	Flow Rate per Impervious Area (L/s/impervious ha)*
0.1	167.2
0.2	83.1
0.3	54.9
0.4	40.6
0.5	31.9
0.6	25.0
0.7	20.1
0.8	16.5
0.9	13.9
1.0	11.9
1.5	6.6
2.0	4.4

*Values may be interpolated (for $T_c < 2$ hours) and extrapolated (for $T_c > 2$ hours) on log-log plots of the data in this table.

Table 4.3 shows how these performance targets are to be applied to various land uses. As well, the table lists rainwater management features (RMFs) presumed to achieve the performance targets, if properly designed, installed and maintained, and are accepted for use on properties within TFN. Oil/grit separators, while nonetheless remaining an important RMF tool for runoff treatment, may not be used alone to satisfy TFN's performance targets nor may they be used in lieu of oil/water separators when

such devices are required in Table 4.3; they may, however, be used in combination with other RMFs as listed in Table 4.3 to achieve performance targets. In all cases, rainwater source controls and landscape-based, surface-oriented RMFs will be encouraged over below ground, manufactured (or engineered) devices. Proposed use of manufactured devices must be accompanied by documentation of performance from a reputable testing or certification program⁸.

Amended topsoil, 300mm deep (minimum), is expected to be used for all pervious areas in new development and redevelopment sites, both public and private, but must not be the sole RMF applied on any site. Disconnected downspouts are strongly encouraged for use on all single-family residential properties, as well as on other sites as feasible.

Note that two public roads and streets land use classifications are listed separately from other land uses as classifications unto themselves.

Table 4.3: Performance Targets by Land Use Classification

LAND USE CLASSIFICATION	WATER QUALITY POLLUTANTS OF CONCERN	PERFORMANCE TARGETS	ACCEPTABLE RMFs TO ACHIEVE PERFORMANCE TARGETS
Residential - Single Family	TSS	Basic	Rain Gardens Vegetated Bioswales Porous Asphalt Drives, Sidewalks, Parking Areas Sand Filters Filter Strips Stormwater Treatment Wet Ponds Stormwater Treatment Wetlands Manufactured Filter Systems ⁹
Residential - Multi-Family	TSS O&G	Basic + Oil Control	Oil/water separator (API or coalescing plate type) ¹⁰ , plus RMFs listed under "Residential – Single Family"

⁸ These programs include, in order of preference, (1) Canadian Environmental Technology (ETV) Program; (2) State of Washington (USA) Technology Assessment Protocol – Ecology (TAPE) program; and (3) Technology Acceptance and Reciprocity Partnership (TARP) Protocol for Stormwater Best Management Practice Demonstrations. Other testing or certification programs administered by third parties, such as universities or independent testing labs, may also be acceptable, at the discretion of TFN.

⁹ Including media filter and membrane filter systems as well as manufactured biofiltration systems, at TFN's discretion.

¹⁰ Requirement for an oil/water separator at multi-family residential sites may be waived at TFN's discretion, if a development or redevelopment proponent can show that the site design has minimized impermeable surfaces and arranged buildings, roads and parking elements in a manner similar to single-family residential areas. Typically, this will mean that total impermeable surfaces constitute less than 50% of the site and, more specifically, that large open parking lot areas must not be present. For purposes of rainwater management, impermeable surfaces includes all buildings, patios, decks, driveways, sidewalks and parking areas on a single property; note that this is different than "parcel coverage" as defined in TFN's Zoning Regulation.

Commercial – offices with primarily employee daily parking	TSS	Basic	Same as those listed under “Residential – Single Family”
Commercial – retail use with significant daily traffic (>100 vehicles per 100 m² of building)	TSS O&G	Basic + Oil Control	Same as those listed under “Residential – Multi Family”
<ul style="list-style-type: none"> Includes service station(s) 	TSS	Basic	Same as those listed under “Residential – Single Family”
Industrial – medium intensity use, with truck traffic and employee daily parking	TSS O&G	Basic + Oil Control	Same as those listed under “Residential – Multi Family”

Table 4.3: Performance Targets by Land Use Classification (continued)

LAND USE CLASSIFICATION	WATER QUALITY POLLUTANTS OF CONCERN	PERFORMANCE TARGETS	ACCEPTABLE RMFs TO ACHIEVE PERFORMANCE TARGETS
Industrial – high intensity use <ul style="list-style-type: none"> Industrial machinery & equipment, and railroad equipment maintenance Log storage and sorting yards Railroad yards Fueling stations Vehicle maintenance and repair Construction businesses 	TSS O&G Trace Metals	Basic + Oil Control + Enhanced	Oil/water separator (API or coalescing plate type) plus: Stormwater Treatment Wetlands Stormwater Treatment Wet Ponds Manufactured Filter Systems ¹¹ Subsurface Infiltration Sand Filters Amended Sand Filters
Institutional (Schools; government; hospitals; cultural buildings)	TSS O&G	Basic + Oil Control	Same as those listed under “Residential – Multi Family”
Parks and Open Space (Buildings, parking lots and other hard surfaces)	TSS	Basic	Same as those listed under “Residential – Single Family”
Roads & Streets – low intensity use (<15,000 ADT) <ul style="list-style-type: none"> Local roads Lanes 	TSS	Basic	Same as those listed under “Residential – Single Family”
Roads & Streets – high intensity use (>15,000 ADT) <ul style="list-style-type: none"> Arterials / Highways Collectors 	TSS O&G (high) Trace metals	Basic + Oil control + Enhanced	Oil/water separator (API or coalescing plate type) plus: Stormwater Treatment Wetlands Stormwater Treatment Wet Ponds

¹¹ Including media filter and membrane filter systems, as well as manufactured biofiltration systems, at TFN’s discretion.

<ul style="list-style-type: none"> • High use intersections (>15,000 ADT on main road; >10,000 ADT on intersecting road) 	<div> <div>Manufactured Filter Systems¹²</div> <div>Subsurface Infiltration</div> <div>Sand Filters</div> <div>Amended Sand Filters</div> </div>
Agricultural	Follow Applicable Provincial Rules and Guidelines for Agricultural Lands

Implementation of water quality treatment facilities and best management practices on both private and public lands to achieve the performance targets is a requirement of the community wide IRMP. Implementation is expected to be accompanied by application of other non-structural actions which will enhance runoff quality at TFN. These include, but are not limited to:

- Minimizing the extent of impermeable, or “hard”, surfaces;
- Incorporating significant areas of absorbent landscaping, especially trees;
- Using street and parking lot cleaning on a regular basis; and
- Applying source controls (e.g., separation of potentially polluting materials from contact with rainwater and use of alternative de-icing agents in lieu of salt during inclement winter weather).

4.11.7 Biofiltration Swales and Constructed Wetlands

Delete this section.

4.11.8 Oil and Grit Separators

Delete this section.

4.11.9 Oil/Water Separators

Delete this section.

4.12 Erosion and Sediment Control

Add the following after the first paragraph:

ESC designs are required for land development activities such as clearing, grading, road construction, excavation, utility construction, stockpiling of excavation and backfill materials, and housing construction. Site specific measures must be defined through detailed design and in accordance with the Environmental Development Permit requirements of the *TFN Development Permit Regulation*. Design details to be in accordance with current technologies as outlined in the Urban Runoff Quality Control Guidelines for British Columbia, applicable TFN Regulations, and related documents.

¹² Including media filter and membrane filter systems, as well as manufactured biofiltration systems, at TFN’s discretion.

Section 5.0 – Roads

5.3 Cross-Section Elements

Replace this section with the following:

Recommended road cross sections elements are shown on the typical sections in the TFN Supplementary Detail Drawings.

Right-of-way and pavement widths shown in the TFN Supplementary Design Criteria and the TFN Supplementary Detail Drawings are subject to increases to accommodate the following:

- Intersections
- Turn lanes
- Bike lanes
- Bus bays
- Vehicle turning templates
- Snow storage.

Unless noted otherwise in the typical road sections of the TFN Supplementary Design Guidelines and TFN Supplementary Detail Drawings, or by condition of the Development Permit, topsoil with sod or hydroseed is required on medians and boulevards. Where the width is insufficient for maintenance of vegetation, hard surfaces may be permitted.

Note: Table 5.1 from Section 5.3 is deleted in lieu of the TFN Supplementary Detail Drawings. The designer is required to provide design criteria sheets for each roadway that summarizes all horizontal and vertical geometric criteria for the roadway.

5.11 Sidewalks and Walkways

Replace 5.11.1 section with the following:

The requirement for sidewalks is as shown in the TFN Supplementary Detail Drawings.

In the absence of specific standard requirements, sidewalk details should be as follows:

- Minimum width 1.5 m (excluding adjacent curb)
- Cross-slope 2%, except at driveways and wheelchair ramps
- Drainage Towards gutter

Sidewalks on collector and arterial streets will be separated.

Walkway widths and grade requirements are as indicated in TFN Supplementary Detail Drawings.

For pedestrian bridges or underpasses, the minimum walkway width is 3.0 metres.

Wheelchair ramps from sidewalks, medians and traffic islands to crosswalks must be provided at intersections and walkways. Locations and details of ramps and related pedestrian safety features should be in accordance with local bylaws and the TAC Geometric Design Guide.

All wheel chair letdowns shall include tactile tiles cast integrally into concrete in accordance with TFN Supplementary Detail Drawings.

All multi-use paths shall be in accordance with the Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines.

5.12 Bikeways

Replace 5.12.2 section with the following:

5.12.2 Off Street Multi-Use Paths

The requirement for multi-use paths is as shown in the TFN Supplementary Detail Drawings.

5.13 Transit facilities

Replace this section with the following:

The requirement for transit facilities will be established by the local transit authority and by Tsawwassen First Nation.

5.16 Underground Utility Locations

Replace section 5.16 with the following:

Underground utility locations shall be as shown in the TFN Supplementary Detail Drawings, or as approved by TFN. Manhole and utility covers shall generally be located outside of wheel paths.

Bus bay locations will be established in cooperation with the local transit authority. Bus bay details should be in accordance with the Pullouts section of the TAC Geometric Design Guidelines. Assume local residential roads shall be serviced by community shuttle vehicles, while commercial/industrial arterial roads will be serviced by full size City buses.

Transit signs should be in accordance with MUTCD.

Additional guidelines are included in TransLink – Transit Infrastructure Design Guidelines and Canadian Urban Transit Association and TAC – Canadian Transit Handbook.

Where the transit authority is unable to provide routes, allowance will be made within the road section for future transit to the satisfaction of TFN.

Section 6.0 - Roadway Lighting

LED lighting criteria subject to pending 2014 MMCD Design Guidelines

CONTACT TFN FOR CRITERIA

8.0 – Sustainability Considerations 2014

Delete section in its entirety

9.0 – Sustainability Considerations 2014

Delete section in its entirety

Section 12.0 – Landscape Requirements

12.1 Plans

Designs and drawings shall be prepared by a Landscape Architect currently registered in British Columbia. All drawings shall be sealed by the Landscape Architect. Plans shall clearly show all survey, existing and proposed soft and hard landscape features and all existing and proposed roads and above ground services.

Plans shall be at minimum 1:200 [1/16" = 1'-0"] scales and shall include cross sections and sight clearance if requested by the Director.

Landscape plans must clearly show:

- Materials and character of the surface treatment at entire site.
- Planting plan and a plant list. Planting plan shall indicate the general planted size and spacing of plants. Plant list shall document quantity, scientific and common name, and scheduled size of plants at the time of planting.
- Existing trees to be retained / removed. Tree protection strategy during construction shall be noted. Refer to section 8.4 of this document for further information regarding existing tree retention.
- Hard landscape features, e.g., paving, walls, lighting, fencing, furniture, signage, trellis, water feature, drainage, etc. Materials for such hard landscape features shall be clearly indicated.
- Grading at entire site, including location and elevation of all area drains in hard landscape, storm drainage swales, lawn basins in soft landscape areas.

12.2 Boulevard Trees

Boulevard trees serve multiple purposes. They support the structure of the development pattern, provide vertical scale articulation, express seasonal change, and add colour, texture and scale. The following is the list of trees recommended for use at TFN. Preferred locations are illustrated on Figures 8.2.1 to 8.2.4, provided in Appendix D. **This list and location maps supersede the Boulevard Trees list and Figure 9.1 on pages 33-34 of "Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines" issued March, 2012.**

12.2.1 Boulevard Tree Planting Standards

Drawing TSSD-L2.0 shows the typical boulevard tree planting detail. All planting and landscape installations are to meet or exceed the current edition of BCLNA/BCSLA Landscape Standards.

Boulevard Tree Materials

Tree selection, handling, planting and maintenance must meet the current editions of BCSLA/BCLNA Landscape Standards and the CNTA Nursery Stock Standard, be in good health and condition without wounds, have normal form, and be free of diseases and pests.

All tree's root balls and pots to be free of noxious weeds.

All trees of excurrent genera to have single leaders (no trees with co-dominant stems permitted).

All trees to have encircling/girdling roots removed at the time of planting.

All tree species to be approved by TFN and to be a minimum of 6cm caliper, branched at or above 1.3m if deciduous, or 3m in height if coniferous. No pruning of the scaffold branches or leader should be undertaken; only broken branches should be pruned.

Protect tree from danger during planting. Ensure rootball is protected from sun, frost or desiccation.

Planting

Planting holes must be free draining to the extent that rainwater and/or supplemental water does not accumulate and drown the roots. If necessary, the subgrade must be graded with positive slope and/or drainage services such as but not limited to percolation holes, french drains or drain pipes must be installed to suit.

Watering of the root ball must be undertaken immediately after planting and then for the first growing season so that the root ball is thoroughly wetted once per week (minimum).

The tree should be pruned to ANSI A3000 standards after establishment and from time to time to train it for structure to conform to the form of the species and to respond to growing site constraints. All pruning must be undertaken by or performed under the direction of a qualified arborist certified by the International Society of Arboriculture and who demonstrates proficiency in pruning.

The mulched root zone should be refreshed annually to replace the mulch. This area must be weeded by hand to avoid trunk and root damage from string trimmers or mowers.

In situations where designed boulevard area does not provide adequate rooting volume, structural soil and/or Silva Cells may be utilized to provide further soil volume. Section xxxxx of the TFN Supplementary Specifications gives direction on proper design and installation of structural soil. Silva Cells are considered an experimental product at the time of publication of this manual. The use of Silva Cells must be approved by TFN prior to installation on public property. Design and installation techniques are to be provided by Silva Cell suppliers and approved by TFN.

Root barriers must be installed at the time of planting whenever a tree is installed within 2 metres of a sidewalk or other hardscape features, excluding roads; or where specified on approved drawings. Barriers must be made commercially, produced for the purpose of deflecting roots downward, and be of a specification approved by TFN. Placement of root barriers must be as per manufacturer's instructions.

Tree Spacing

Boulevard trees are to be spaced at 8-10m [26'-33'] on centre.

Clearances

The following table is the guidelines for minimum clearances for all of boulevard trees. Clearances shall be measured from the closest edge of the listed items to the centre of tree:

Light Standards	4 metres
Electrical / Communication Poles	1.5 metres
Driveways / Crossings	2 metres
Fire Hydrants	1.8 metres
Corner Clearance (from extended PL)	3 metres
Stop Signs	6 metres
Manholes, Valve Boxes, Service Kiosks	1.5 metres

Preferred Boulevard Tree Species

Proposal for alternative boulevard tree species shall be considered during the project approval process. Such alternative species must be consistent within the proposed area, i.e., it is not allowed to have more than one boulevard tree species along one continuous street unless otherwise specified on Figures 8.2.1 to 8.2.4, as provided in Appendix D. Boulevard trees should be straight in form, non aphid-bearing species, and free of disease. Generally deciduous trees should be used for boulevard trees. It is the designer's responsibility to ensure that the tree selection is suitable to the specific location and environment.

Boulevard Trees

Acer rubrum fastigiata varieties	Columnar Red Maple varieties
Acer rubrum 'Morgan'	Morgan Red Maple
Acer rubrum 'October Glory'	October Glory Red Maple
Acer rubrum 'Red Sunset'	Red Sunset Maple
Acer x freemanii 'Autumn Blaze'	Autumn Blaze Maple
Aesculus x carnea 'Briotii'	Red Horsechestnut
Carpinus betulus	Hornbeam
Cercidiphyllum japonicum	Katsura
Cercis canadensis	Eastern Redbud
Cornus 'Eddie's White Wonder'	Eddie's White Wonder dogwood
Fagus sylvatica	European Beech
Fraxinus americana	'Skyline' Skyline White Ash
Gleditsia triacanthos var. inermis 'Skyline'	Honeylocust varieties
Liquidambar styraciflua 'Worplesdon'	Worplesdon Sweet Gum
Magnolia galaxy	Galaxy Magnolia
Nyssa sylvatica	Sour Gum
Prunus serrulata 'Kwanzan'	Kwanzan Cherry
Prunus x yeodensis 'Akebono'	Akebono Cherry
Pyrus calleryana 'Chanticleer'	Chanticleer Pear
Quercus acutissima	Sawtooth Oak
Styrax japonica	Japanese Snowbell
Zelkova serrata	Japanese Zelkova

12.3 Trees, Shrubs and Ground Covers

Public Realm (Other than Boulevard Trees)

Planted areas of the public realm include road rights of way, site arrival points, easements, greenways and green corridors, and areas within the Village Centre. Different plant categories with recommended species are identified. While it is not required that final plant selections conform to these lists, it is recommended that designers use them as a guide to inform plant selection. Plant material characteristics should reflect relative site prominence and land use. Plants with higher visual impact should be used in important areas such as site arrival points, parks and the Village Centre. Use of native species is also to be encouraged.

Private Realm

Private realm planting areas include residential front yards, side yards when fronting a street, and lanes. Also included is the Village Centre. It is important that the designers consider the relationship to planting within adjacent public realm areas such as street corridors, green corridors and parks so that a seamless relationship is created.

The following is the list of plants recommended for use at TFN. **This list supersedes the lists of plants on pages 35 -37 of “Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines” issued March, 2012.** All planting and landscape installations are to meet or exceed the current edition of BCLNA/ BCSLA Landscape Standards. Trees (other than boulevard trees) to be minimum 5-6cm caliper.

Trees

Acer circinatum	Vine Maple
Acer rubrum varieties	Red Maple varieties
Amelanchier alnifolia	Saskatoon
Chamaecyparis nootkatensis	Nootka Cypress
Cornus ‘Eddie’s White Wonder’	White Wonder Dogwood
Cornus florida ‘Rubra’	Pink Dogwood
Cornus kousa varieties	Kousa Dogwood varieties
Cornus nuttallii	Pacific Dogwood
Crataegus douglasii	Black Hawthorne
Fraxinus Americana	White Ash
Gleditsia triacanthos varieties	Honeylocust varieties
Liquidambar styraciflua ‘Worplesdon’	Worplesdon Sweet Gum
Magnolia soulangeana varieties	Saucer Magnolia varieties
Malus fusca	Pacific Crabapple
Populus balsamifera	Balsam Poplar
Populus tremuloides	Trembling Aspen
Picea sitchensis	Sitka Spruce
Pinus contorta ssp. Contorta	Shore Pine
Pseudotsuga menziesii	Douglas Fir
Pyrus calleryana ‘Chanticleer’	Chanticleer Pear
Thuja plicata	Western Red Cedar
Tsuga heterophylla	Western Hemlock

Native Shrubs

Amelanchier alnifolia	Saskatoon
Arctostaphylos uva-ursi	Kinnickinnick
Ceanothus species	California Lilac species
Cornus sericea	Red Osier Dogwood
Gaultheria shallon	Salal
Juniperus communis	Common Juniper
Kalmia microphylla ssp. occidentalis	Western Bog-laurel
Mahonia aquifolium	Oregon Grape
Mahonia nervosa	Low Oregon Grape
Pachystima myrsinites	Oregon Box
Paxistima myrsinites	Oregon boxleaf
Philadelphus lewisii	Mock Orange
Physocarpus capitatus	Pacific Ninebark
Potentilla fruticosa varieties	Cinquefoil varieties
Rhododendron macrophyllum	Pacific Rhododendron
Ribes sanguineum	Flowering Currant
Rosa nutkana	Nootka Rose
Rubus parviflorous	Thimbleberry
Rubus spectabilis	Salmonberry
Salix species	Willow shrub species
Sambucus racemose	Red Elderberry
Symphoricarpos alba	Snowberry
Vaccinium species	Huckleberry/Blueberry species

Non-Native Shrubs

Escallonia x exoniensis 'Frades'	Pink Princess Escallonia
Euonymus japonicus 'Silver King'	Silver King euonymus
Forsythia x intermedia	Forsythia
Hydrangea macrophylla 'Mariesii Variegata'	Variegated Lace cap Hydrangea
Lonicera nitida 'Red Tips'	Boxleaf Honeysuckle
Osmanthus x burkwoodii	Burkwood Osmanthus
Physocarpus opulifolius 'Dart's Gold'	Dart's Gold ninebark
Prunus laurocerasus 'Otto Luyken'	Otto Luken Laurel
Rhododendron 'Snow Lady'	Snow Lady rhododendron
Spiraea japonica 'Goldmound'	Goldmound spirea
Taxus x media	Yew
Viburnum davidii	David Viburnum

Groundcovers, Grasses, Ferns, Perennials

Blechnum spicant	Deer Fern
Calamagrostis canadensis	Bluejoint
Carex stipata	Owlfruit sedge
Cornus canadensis	Bunchberry
Deschampsia caespitosa	Tufted Hair Grass
Dicentra Formosa	Pacific Bleeding Heart
Echinacea purpurea	Coneflower

Elymus glaucus
Epilobium angustifolium
Festuca idahoensis
Fragaria chiloensis
Fragaria vesca
Hemerocallis 'Stella d'Oro'
Hosta species
Juncus balticus
Juncus effusus
Juncus ensifolius
Maianthemum dilatatum
Pennisetum alopecuroides 'Little Bunny'
Polystichum munitum
Rudbeckia fulgida 'Goldsturm'
Solidago canadensis
Typhja latifolia

Blue wildrye
Fireweed
Idaho Fescue
Beach Strawberry
Woodland Strawberry
Yellow Daylily
Hosta species
Baltic Rush
Soft Rush
Swordleaf Rush
False Lily-of-the-Valley
Dwarf Fountain Grass
Sword Fern
Goldsturm Coneflower
Canada Goldenrod
Common Cattail

Median Plants

Bergenia cordifolia
Erica carnea
Helectrotrichon sempervirens
Lavendula angustifolia
Juniperus squamata 'Blue Star'
Spiraea japonica "Limemound"
Stipa tenuissima
Yucca filamentosa 'Bright Edge'

Bergenia
Heather
Blue Oat Grass
English Lavender
Blue Star Juniper
Limemound Spirea
Mexican Feather Grass
Variegated Adam's Needle

Swale Plants

Wet zone:

Trees

Alnus rubra
Amelanchier Canadensis
Betula nigra heritage
Fraxinus latifolia
Malus fusca
Salix lucida
Metasequoia glyptostroboides

Red Alder
Serviceberry
Heritage River Birch
Oregon Ash
Pacific Crabapple
Pacific Willow
Dawn Redwood

Shrubs & grasses & Perennials

Carex appressa
Caltha palustris
Hammamalis
Juncus effuses
Typha spp.

Tall Sedge
Marsh Marigold
Witch Hazel
Common Rush
Cattails

Semi wet zone (moist soils- not wet):

Trees

Acer truncatum	Pacific Sunset Maple
Amalanchier alnifolia	Western serviceberry
Crataegus douglasii	Douglas Hawthorn
Fraxinus oxycarpa	Raywood Ash
Nyssa aquatica	Swamp Tupelo
Populus temuloides	Trembling Aspen
Thuja plicata	Western Red Cedar

Shrubs, Perennials & Grasses

Aronia melanocarpa	Black Chokecherry
Aster subspecies	Douglas Aster
Astilbe sp.	Astilbe
Carex Sp.	Sedge
Cornus sericea	Red Osier dogwood
Cornus sericea	Yellow Dogwood
Echinacea purpurea	Coneflower
Iris siberica	Siberian Iris
Rosa rugosa	Rugosa Rose
Physocarpus capitalus	Ninebark
Salix purpurea	Dwarf Arctic Willow
Symphocarpus	Snowberry
Tiarella grandifolia	Foamflower

12.4 Tree Retention

All of the existing trees that are 20cm DBH (Diameter Breast Height) or more must be surveyed and assessed by certified Arborists. Landscape plans shall clearly indicate whether such trees are to be retained or removed. Tree protection zones during construction shall be consulted with certified Arborists and shown on plans.

Retention of existing trees is encouraged in park lands and in areas that do not require major re-grading.

12.5 – Parks

General

Park types are identified as Neighbourhood Parks, Local Parks, and Linear Parks per the “**Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines**” issued March, 2012. Refer to sections below for specific guidelines for each park type.

All park design shall consider the following:

- Universal design principles to accommodate all park visitors
- Crime Prevention through Environmental Design (CPTED) principles to enhance safety in parks
- Rainwater/stormwater management to control stormwater on site

- Amenities that promote creativity and interest, active lifestyles, interactive play and socializing, and environmental and cultural awareness

Planted areas of parks should consider recommended species as identified in section 8.2 above and section 9.2 of the **“Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines”** issued March, 2012. While it is not required that final plant selections conform to these lists, it is recommended that designers use them as a guide to inform plant selection. Plant material characteristics should reflect relative site prominence and microclimate conditions. Plants with higher visual impact should be used in important areas such as site arrival points, and plaza spaces. Use of native and adaptive species is also encouraged.

Deciduous trees shall be a minimum of 70 mm caliper (80mm preferred) caliper. Coniferous trees shall be a minimum of 2m height (2.5m preferred). Plants to be installed per section 8.2 above, TFN Supplementary Specifications section 32 93 01 TSS and TFN Supplementary Detail Drawings TSSD-L2.0, TSSD-L2.1, and TSSD-L2.2.

Hardscape materials in parks shall be per section 9.4 of the **“Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines”** issued March, 2012, which includes standards for unit pavers, concrete, granular, stone and special paving for multi-use paths. Paths shall consider logical circulation patterns (“desire lines”) through parks and connect to all amenities within the park. Paths shall be a minimum of 2m wide. Multi-use paths shall be included through parks or along park boundaries where parks are connected with Greenways. Multi-use paths shall be constructed per TFN Supplementary Detail Drawings TSSD-L3.0, TSSD-L3.1 and TSSD-L3.2. Hardscape construction shall refer to TFN Supplementary Specifications section 03 30 20 TSS.

Furnishings in parks shall be per section 9.5 of the **“Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines”** issued March, 2012, which includes standard models for bollards, bench, trash receptacle, bicycle rack, and planter. Furnishings shall be installed per manufacturers specifications.

Lighting in parks shall be per section 9.3 of the **“Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines”** issued March, 2012, which includes standard models for post top lights and bollard lights. Post top down lighting for parks is preferred over bollard lighting. Lighting shall be constructed per TFN Supplementary Specifications section 26 56 01 TSS.

Signs and way finding in parks shall be per section 9.8 of the **“Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines”** issued March, 2012, and the **“Tsawwassen First Nation Cycle Path Signage Standards”** adopted in October 2014.

Fencing and walls in parks shall be per section 9.9 of the **“Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines”** issued March, 2012.

Public art and custom components shall be per section 9.7 and 9.10 of the **“Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines”** issued March, 2012.

Neighbourhood Park

Neighbourhood Parks are destinations for the TFN community and beyond. They shall be a minimum of 2 hectares and include space for active play, picnics, special events, sports, recreation and access to nature. Amenities shall include sports fields, sport courts, play areas, gathering areas, paths, fieldhouse/washrooms,

and parking lots. The following amenities should be considered where possible: creative nature-based playgrounds, community gardens, and dog-off leash areas. Special features such as public art and custom components shall be included to add interest and promote cultural awareness.

A variety of tree species and sizes shall be used to line paths, provide buffers, offer shade and act as focal points in the landscape.

Planted areas should include shrub borders to buffer the site from adjacent land uses where appropriate. Fencing shall be used along edges of private property. Visual and physical permeability to the community shall be maintained to provide open site access. Access shall be provided from all four sides if possible, and from two sides at a minimum. At least one entire side of the park shall front on a road. Existing trees and natural areas shall be protected within the park where possible. Naturalized areas shall be considered where appropriate.

Permanent irrigation shall be provided for all ornamental plantings, grass used for sports and mowed grass areas. Naturalized areas shall be irrigated until establishment.

Lighting shall be provided at gathering areas, buildings, parking and along primary paths. Lighting may be considered on sports fields and sport courts. Lighting shall be dimmed at 11pm.

Parking shall be designed efficiently to minimize the amount of hard surface. Keep parking as close to the perimeter of the park as possible to reduce pedestrian and vehicle crossings. Include trees, plantings and rain gardens in large parking lots.

Bike racks shall be installed at two to three locations in the park, including at entrances and key amenities. When designing for bike racks consideration should be given to providing space for bike trailers especially where adjacent children's play areas. Trash receptacles shall be installed at park entrances and gathering areas. Benches shall be installed at gathering areas and along paths at approximately 50m intervals. Signage shall be installed as necessary. Bollards, planters and picnic tables may be considered where necessary.

Local Park

Local Parks form the physical and social focus of the local neighbourhood, serving residents within a 5-minute walking distance. They shall be a minimum of 0.12 hectare per the **"Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines"** issued March, 2012. The recommended typical park size is 0.2 hectare. TFN identification should be provided at park entry points and may be incorporated into arbour/trellis elements or signage elements. Amenities shall include paths, lighting, open grass, seating, gathering areas and picnic areas. Special features shall be included to add interest, promote cultural awareness and/or provide active play opportunities. Special features may include entry arbours, play equipment, custom components or public art to the satisfaction of the Director of Lands.

Plazas with paving stones or special paving shall be included as gathering areas at key entry points and at one central location within the park.

A variety of tree species and sizes shall be used to line paths, provide buffers, offer shade and act as focal points in the landscape. The recommended number of trees per site is 20. Provide 750mm diameter mulched tree rings around each tree in lawn areas.

Planted areas shall include shrub borders to buffer the site from adjacent land uses and road right of ways where appropriate. Visual and physical permeability to the community shall be maintained to provide open site access. The recommended coverage of shrub areas is approximately 15% of the site.

Open grass areas shall be provided for picnicking and play. The recommended coverage of grass areas is approximately 70% of the site. Sod shall be installed for rapid establishment and resilience. Consideration should be given to specification of a tall fescue sod to discourage Chafer Beetle infestation.

Permanent irrigation shall be provided for all trees, plantings and mowed grass areas.

Lighting shall be provided at gathering areas. Lighting shall be dimmed at 11pm.

Bike racks shall be installed at one location in the park, at a key amenity. When designing for bike racks, consideration should be given to providing space for bike trailers especially where adjacent children's play areas. Trash receptacles shall be installed at park entrances and gathering areas. Benches shall be installed at gathering areas. Signage shall be installed as necessary. Bollards, planters and picnic tables may be considered where necessary.

Fences shall be supplied and installed within the park at all limits abutting residential uses. The fence shall be in accordance with section 9.9 of the **"Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines"** issued March, 2012. Where approved by the Director of Lands black vinyl coated chain link fence mesh, posts, and fittings 1200mm in height may be installed.

Linear Park

Linear Parks add to the greenway network, provide buffer between different land uses and facilitate active transportation through the community. They shall be a minimum of 10m wide per the **"Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines"** issued March, 2012. There is no standard area for the parks. Linear parks should connect to schools, recreation amenities, major destinations, and other parks where possible. They should cross through residential blocks and connect to the end of cul-de-sacs to reduce walking distances and improve overall neighbourhood walkability. Amenities shall include paths, seating and buffer plantings. Community gardens should be considered where possible.

A variety of tree species and sizes shall be used to line paths at approximately 8m to 10m intervals. Additional trees may be used to provide interest and/or buffer adjacent land uses where appropriate.

Planted areas shall include shrub borders to buffer the site from adjacent land uses where appropriate. Visual and physical permeability to the community shall be maintained to provide open site access. Naturalized areas shall be considered where possible. Shrub areas are recommended to cover approximately 15% of the site.

The recommended coverage of grass areas is approximately 70% of the site. Sod shall be installed for rapid establishment and resilience. Naturalized areas may be hydroseeded with a low maintenance lawn mix appropriate to the site conditions.

Permanent irrigation shall cover all trees, ornamental plantings and amenity grass. Naturalized areas shall be irrigated until establishment.

Lighting shall be provided along paths.

Bike racks and trash receptacles shall be installed at park entrances. Benches shall be installed along paths at approximately 50m intervals. Signage shall be installed as necessary. Bollards may be considered where necessary.

Fences shall be supplied and installed within the park at all limits abutting residential uses. The fence shall be in accordance with section 9.9 of the "Tsawwassen First Nation Neighbourhood Plan Area Design Guidelines" issued March, 2012. Where approved by the Director of Lands black vinyl coated chain link fence mesh, posts and fittings 1200mm in height may be installed.

12.6 – Irrigation

General

Fully automatic underground irrigation shall be provided for all public realm areas including parks, and adjacent boulevards. The irrigation system shall be complete and operable. The developer may undertake the system design by a design-build process submitting shop drawings to TFN for approval prior to construction. The system must include all sleeving, piping, fittings, solvent weld, primer, control valves, isolation valves, wire, sprinklers, valve boxes, timers, controller, backflow prevention devices, and other components necessary for a fully functioning system. Design work must be completed by a British Columbia Certified Irrigation Design Professional in accordance with the IABC Standards for Landscape Irrigation Systems, most recent edition. All components must be included in the TFN Approved Products List.

Prior to application for Completion TFN shall be provided with Operations and Maintenance Manuals including record drawings signed and sealed by the designer, and to the satisfaction of the Director of Lands.

**APPENDIX A
WATER METER DESIGN MANUAL AND SUPPLEMENTARY SPECIFICATIONS**

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PREAMBLE

INTRODUCTION

This document outlines the requirements for the installation of cold-water meters on municipal water services. It is divided into two separate parts: the Design Manual and the Supplementary Specifications.

INTENT OF STANDARDS

The Design Manual is intended to provide direction to the *Applicant* and *Applicant's Engineer* on the elements required to be considered in the design of new water meter installations. It is intended to be used in conjunction with the MMCD Design Guideline Manual and TFN Supplementary Design Guidelines.

The Supplementary Specifications are intended to provide direction to the *Applicant* and *Applicant's Engineer* on the specifications that must be incorporated into building servicing contracts for the installation of new water meters. The Supplementary Specifications are to be used in conjunction with the TFN Supplementary Construction Specifications document and the MMCD.

GLOSSARY OF TERMS

" <i>Applicant</i> "	Refers to a property <i>Owner</i> , <i>Developer</i> , or authorized agent who makes an application for connection to a water service.
" <i>Applicant's Engineer</i> "	Refers to a professional engineer hired by the <i>Applicant</i> to design the installation of the meter.
" <i>ASTM</i> "	Refers to the American Society for Testing and Materials.
" <i>AWWA</i> "	Refers to the American Water Works Association.
" <i>TFN</i> "	Means the Tsawwassen First Nation.
" <i>CSA</i> "	Means the Canadian Standards Association.
" <i>Developer</i> "	Means person(s) or organization(s) developing property as per TFN approvals and guidelines.
" <i>Owner's Engineer</i> "	Refers to the TFN employee, engineer or professional hired by TFN;
" <i>Owner</i> "	Means the Tsawwassen First Nation.
" <i>Chamber</i> " or " <i>Pit</i> "	Means the below ground meter enclosure.

METERING RESPONSIBILITIES

All new service connections require water meters. For new connections, the installation of a meter is triggered by a Building Permit application. This requirement for a meter applies to:

- connections to a new or existing service;
- temporary service connections; and
- connections that include an underground irrigation system, including TFN parks and boulevards.

For all new connections, the *Applicant* must supply and install all piping, fittings, meter chamber(s) / pit(s) and equipment.

For residential meters up to 25mm diameter, the meter is supplied and installed by the *Owner's* contractor within the *Applicant* installed pit assembly. Costs to be distributed as per TFN regulations.

All meters 38mm or larger, and all meters supplying institution, commercial, or industrial or apartment developments are to be supplied and installed by the *Applicant*.

Backflow prevention devices, although not covered within this document, are to be installed at every service connection.

TIMING

For single family residential dwellings water meter pits, setters, and lids are to be installed to final grade by the *Applicant*. The meter area must be kept free and accessible at all times in order to permit the installation of the meter. The *Applicant* is responsible for the protection of installation from damage and must repair any damage that occurs to the pit, setter, meter, or lid.

For meters servicing other land uses, the meters must be installed prior to turning on the water supply to the site.

In the case where a drawing submission is required, installation of the water service, chamber, or meter within private property should not begin prior to the *Owner's* approval of the drawings.

DESIGN MANUAL

1.0 WATER METER DESIGN CRITERIA

1.1 Meter Sizing Methodology

For all single family residential homes without fire sprinklers, the water meter size shall be 19mm except in the case where the *Applicant's Engineer* can demonstrate the need for a larger meter. All other meters should be sized in accordance with *AWWA M22 Sizing Water Service Lines and Meters* and form contained in Appendix I. *Note that this methodology is based on the fixture value method and not the fixture unit method employed in the BC Building Code for piping within buildings.*

The maximum operating range for a water meter shall not exceed 90% of the maximum instantaneous flow capacity as outlined by the meter manufacturer, with a maximum pressure loss of 48 kPa (7 psi) at the design flow rate. The size selection should not compromise the operating range or the long term life of the meter and must ensure that pressures supplied to the property are appropriate for the intended use.

For developments that are proposed to be phased, the meter chamber and piping must be sized for the meter required for the ultimate buildout of the development. However, the initial meter installed must be sized to accurately capture the range of flows for the first phase.

It is expected that in most cases the water meter size will be at least one pipe size smaller than the water service connection, providing it meets the size selection criteria. The *Applicant's Engineer* must ensure the meter selection and installation requirements are appropriate for the designed application.

1.2 Meter Selection

Meters approved by TFN are listed in Section 1.1 of the Supplementary Specifications.

One domestic meter is to be supplied per building or dwelling unit, unless otherwise approved by TFN. For multi-family residential developments, including duplexes and townhouses, a separate water service and meter is to be installed for each unit.

Unless otherwise approved, a separate fire service line must be supplied to each property that employs fire sprinklers. The fire service line must be equipped with metering technology to detect unauthorized use of water in accordance with *AWWA* standards and applicable Provincial codes through the use of a double check detector valve assembly. All other uses that require service from the potable water system (including domestic, process, and irrigation) must be serviced from the domestic service line with tees and branches located after the water meter. The exception to this is for single family residential homes that employ fire sprinklers. In this case a separate un-metered 38mm fire line is acceptable with a 19mm metered residential line.

1.3 Meter Location

All meters must be located at the property line in a chamber or pit in accordance with the TFN Supplementary Detail Drawings.

Meter pits must be located on private property 300mm from the property line as per the TFN Supplementary Detail Drawings. . For meters 75mm or larger (as well as double check detector assemblies), chambers shall be located on the private side of the property line at a site specific location to be confirmed with TFN. This shall be reviewed at the design stage.

Where the watermain is within private property, in a statutory right-of-way, the meter pit or chamber should be placed outside the right-of-way.

An area at least 1.0 m horizontal and 2.0m vertical around the meter pit or chamber should be free of major landscaping or objects, including shrubs, etc., to facilitate the future maintenance work of the meter installation. Grading of the area around the chamber must ensure positive drainage away from the chamber.

1.4 Meter Configuration

The general configuration for meter installations has been illustrated in the TFN Supplementary Detail Drawings. For all meters 75mm and larger, configuration details shall be confirmed by the *Applicant's Engineer* and outlined in detailed engineering design drawings, and confirmed through the preparation of shop drawings acceptable to TFN.

For all meters 75mm and greater adequate straight length pipe should be provided upstream and downstream of the meter in order to comply with manufacturer's recommendations for maximum accuracy. Bypass tees and isolation gate valves may be located within the straight length distance in accordance with manufacturer's recommendations. A restrained coupling must be provided on the downstream side of the meter for flexibility in case of meter removal.

A. Isolation Valves

For all meters 75mm and larger, isolation valves are required to be installed upstream and downstream of the meter assembly. The isolation valves may be located within the same chamber as the meter, or outside the chamber.

Isolation valves shall be the same size as the (ultimate) water meter size.

B. Bypass

A locking bypass is required to be installed on all 38mm and larger meters. The by-pass shall be sized as follows:

- For domestic services, the bypass shall be half the size of the service connection;
- For combined fire / domestic services, where approved, a full size bypass shall be provided; and
- For facilities with critical flow requirements, the bypass shall be sized to ensure impacts are minimized during meter maintenance.

For 38mm and 50mm meters, the bypass is part of the setter assembly.

For meters 75mm and larger, the bypass may be in the same chamber as the meter, or configured around the outside of the chamber.

After testing the installation, the bypass valve must be closed and sealed by the installer.

C. Remote Receptacles

Remote receptacles form a component of the TFN approved water meters and include an integrated encoded register / radio transmitter and antenna pad.

Antenna pads shall be secured to pit / chamber lids as per the TFN Supplementary Detail Drawings and recessed where possible.

D. Chambers

Meter chambers, must meet the requirements of the Supplementary Specifications, and be selected to provide adequate space for removal and testing of all equipment within the meter. Access lids, latches, and ladders must comply with the current requirements of the Workers Compensation Board and provide adequate space for testing and removal of meters and where applicable backflow prevention devices. This includes positioning the meter and hatch opening to facilitate a vertical lift of the meter (or backflow prevention device).

Thrust beams must be designed for all chambers housing equipment 75mm or larger to ensure that the force caused by a closed valve is transferred to the full width of the chamber. The *Applicant's Engineer* shall ensure that the chamber manufacturer is in agreement with the thrust bearing area on the chamber.

All chambers for meters 75mm or larger must be equipped with a sump and drained by either a gravity connection to the storm sewer or where this is not possible by an electric sump pump. Power to the sump pump to be in accordance with the BC Electrical Code and to the satisfaction of TFN, to be confirmed at design stage. All gravity drains shall be equipped with a backwater valve.

1.5 Submissions

All domestic meters larger than 19mm must be supported by a meter sizing calculation as per Appendix I.

Plans must be submitted by the *Applicant* as part of the Plumbing Permit application for all 75mm and larger meter installations. This application must be accompanied by:

- a) Site plan that depicts the meter location relative to the overall development plan, including connections to the TFN watermain;
- b) Chamber layout plan and profile details encompassing all components of the meter assembly, including but not limited to the, chamber, isolation valves, bypass, and meter;
- c) Thrust beam design, including structural / manufacturer signoff;
- d) Chamber drainage details, including discharge location;
- e) Future phasing details of the development, if applicable;
- f) Proposed meter size, type, and manufacturer, as per TFN Approved Products List;

- g) Site specifics (ie. building use type and specifics);
- h) Onsite fire system (hydrants, fire sprinklers);
- i) Irrigation systems; and
- j) Meter sizing calculations as per Appendix I as well as design fire flow where applicable.

For all meter installations 75mm and larger, the *Applicant's Engineer* must provide detailed sealed drawings and shop drawings of the installation and relevant calculations, to demonstrate the appropriateness of the sizing of the meter, for approval prior to installing the meter.

For all meter installations 75mm and larger, the *Applicant's Engineer* must provide detailed Operation and Maintenance Manuals that include sealed record drawings, shop drawings and all cut sheets for material and equipment of the installation for approval by TFN prior to an application for a Completion Certificate.

SUPPLEMENTARY SPECIFICATIONS

1.0 PRODUCTS

1.1 Water Meters

.1 Unless a variation is justified, the *Owner* will only accept approved makes and models of meters for all metering applications including double check detector meters. The following meters are approved by TFN.

- Neptune T-10 positive displacement meters for domestic 19mm to 50mm sizes.
- Neptune TRU/FLO compound meters, including strainer, for domestic sizes 75mm and larger.
- Neptune HP Protectus III fire service meters for combined fire / domestic meters, where approved.

1.2 Registers / Remote Receptacles

.1 Meters shall be equipped with integral Neptune Enhanced E-Coder R900i high resolution encoded registers complete with radio antenna pad.

.2 Registers shall provide at least eight-digit visual and digital registration for transmission via the remote receptacle (radio) and return reads to the nearest cubic metre.

.3 All registers must be provided with factory podded moisture protection for internal components suitable for operation in flooded or humid pit / chamber conditions.

.4 Registers must be new. Used or reconditioned registers are not acceptable.

1.3 Pipe and Fittings

.1 Connections 75mm in diameter and greater must be restrained to the TFN watermain.

.2 All pipe material 75mm in diameter or greater within chambers shall be epoxy coated ductile iron or stainless steel and all joints must be restrained.

1.4 Valves

.1 Valves 75mm in diameter or greater on domestic services must be ductile iron, resilient seat, with non-rising stem (NRS), gate valves with flanged ends, and must meet AWWA C509 and TFN Approved Products List.

Valves within chambers shall be hand-wheel actuated. Valves located outside of chambers shall be installed within a Nelson style valve box with standard square nut operating nut.

.2 All valves on fire service lines must comply with NFPA and Fire Code requirements and be OS&Y type.

- 1.5 Flange Adaptors** .1 Flange adaptors for 38mm (1 ½ inches) to 200mm (8 inches) sizes must conform to *AWWA C219*.
- 1.6 Bolts and Nuts** .1 Bolts and nuts must be stainless steel - to *ASTM F-599* or *F-731* for bolts, and *ASTM F-574* or *F-836* for heavy hex nuts. Threads, fit, and dimension must conform to *AWWA C111*.
- 1.7 Meter Chambers** .1 Meter pits and chambers must be pre-cast concrete.
- .2 Lids / hatches must be capable of withstanding H-20 static loading (except where lids are located in travelling surfaces where H-20 dynamic loading applies) and be equipped with 45mm (1 ¾ inches) holes for mounting the remote receptacles (antenna pads). These holes must be sealed until the installation of the receptacles. Where possible, lids with recessing to accommodate antenna pads shall be provided, as indicated on the TFN Supplementary Detail Drawings.
- Meter box lids for meters up to 50mm shall be ductile iron with recessed hole for antenna pad. Chamber hatches for meters 75mm and larger shall be aluminum, spring assisted, trough type with drain directed to sump. Hatches should be divided into multiple sections where the dimensions exceed 900mm in any direction. Manhole access is not acceptable unless approved by the *Owner's Engineer*.
- .3 Exterior of all chambers must be damp proofed by applying an asphalt emulsion coating to all exterior surfaces. Construction joints must be made water tight with an appropriate sealant. All pipe entrances on the vault must be sealed and waterproof.

2.0 EXECUTION

- 2.1 Meter Installation**
- .1 Meters must be installed horizontally with the register casing plumb, facing upward. For single family residential dwellings the meter setter assembly should be centred as much as possible in the box.
- .2 Meters, valves, and by-passes should be supported with appropriate steel pipe stands. Meter installations must be checked for leakage at completion of the installation. Assembly should be flushed and air must be eliminated from the system. By running water through the meter and performing a visual check of the low-flow indicator, the proper operation of the meter should be established.
- .3 For all temporary connections, meters are required and must be installed at the upstream end of the connection.
- .4 Rigid foam insulation must be installed for all single family and townhome installations.

2.2 Receptacle Installation

- .1 Remote register receptacles (antenna pads) must be mounted to box lids and chamber hatches as per manufacturer recommendations and TFN Supplementary Detail Drawings. The length of wire should be sufficient to allow hatches to be opened completely with appropriate slack. Exceed wire should be neatly bundled and secured with ties.

3.0 SUPPLEMENTARY DETAIL DRAWINGS

(REFER TO TFN SUPPLEMENTARY DETAIL DRAWINGS)

Appendix I – Water Meter Sizing Calculation Sheet and Example

Water Meter Sizing Calculation Methodology

The following methodology is based on the AWWA M22 Sizing Water Service Lines and Meters. *Applicant's Engineers* are expected to purchase and use this publication when completing this methodology. A 31 unit townhouse site has been chosen as an example to demonstrate the use of this method.

Methodology	Example
Step 1 – Calculate Customer Total Fixture Values	
<p><i>The key point to make is that this method is based on the Fixture Values (which are actual peak flows that the device produces) and not Fixture Units which is used in the BC Building Code for building piping design.</i></p>	<p>In this example there are the following fixtures in each unit:</p> <p>1 bathtub, 1 stand alone shower, 3 tank type toilets, 3 bathroom sinks, 1 kitchen sink, 1 washing machine and 2 ½" (13mm) hose bibs.</p> <p>If a fixture is provided that is not listed then the peak flow value (fixture value) can be included based on the manufacturer's information.</p>
Step 2 – Calculate Customer Unadjusted Peak Demand	
<p><i>This step is a summation of the total fixture values in the development, adjusted based on the probability of simultaneous use.</i></p>	<p>The total fixture value for this development is approximately 1400 usgpm. In other words this is the peak flow that would be realized if all fixtures were turned on at the same time. The corresponding actual estimated peak flow based on probability of services being on at the same time is 65 usgpm. This is calculated using the Apartments curve on Figure 4-3 Water flow demand per fixture value – high range.</p>
	<p>Figure 4-3 Water flow demand per fixture value—high range</p>

Step 3 – Apply Pressure Adjustment Factor

This step increases or decreases the peak demand based on the pressure at the outlet of the meter. The pressure adjustment factors can be found in Table 4-1.

The pressure after the meter in this case is 80 psi. Therefore the adjustment factor is 1.17 and the adjusted flow is 76 usgpm.

Table 4-1 Pressure adjustment factors*

Working Pressure at Meter Discharge (psi)	Average Flow from 50 ft of 5/8-in. Hose and Sprinkler (gpm)	Pressure Adjustment Factor
35	6.7	0.74
40	7.2	0.80
50	8.1	0.90
60	9.0	1.00
70	9.8	1.09
80	10.5	1.17
90	11.2	1.25
100	12.1	1.34

*derived from Table 4-1 and 4-2 of Manual M22 (1975).

NOTE: To convert psi to kPa: psi \times 6.89476; to convert gpm to m³/hr: gpm \times 0.227.

Step 4 – Add Underground Irrigation Demand

There are two types of underground irrigation system included in the calculation: spray and rotary. The total irrigation demand is calculated using the total irrigated area and dividing it by 100 ft² to convert it to sections. The number of sections is multiplied by the appropriate factor to arrive at the irrigation rate.

In this example the total irrigation area is 4,300 ft² (400 m²) and it is irrigated by a spray irrigation system. The corresponding peak demand is 50 usgpm. Any irrigation demands greater than 50 usgpm are required to be divided into zones, such that demands are not unnecessarily high.

Step 5 – Calculate Total Peak Fixed Demand

Add up the flows from Step 3 and Step 4.

The total peak fixed demand is 126 usgpm.

Step 6 – Size and Select Water Meter

The meter size and type must be evaluated against two requirements:

- 1) The total peak fixed demand must be less than 90% of the rated maximum instantaneous flow rating of the meter; and*
- 2) The pressure loss at the total peak fixed demand must be less than 48 kPa (7psi).*

Typically the pressure loss criteria will govern.

The total peak flow is 126 usgpm.

Based on the TFN Approved Products List, a Neptune T-10 meter is appropriate.

For the 2" (50mm) Neptune T-10 meter the rated peak instantaneous flow is 160 usgpm. 90% of this is 144 usgpm (which is greater than the 126 usgpm design flow).

The pressure loss at 126 usgpm is 41 kPa (6 psi), (which is less than the 7 psi maximum).

Therefore the 50mm Neptune T-10 meter is selected for this application.



Water Meter Sizing Calculation Sheet For Non-Fire Service Meters

Methodology: AWWA M22

Customer Name: Example 1
 Address: Example 1
 PID Number: Example 1 Folio Number: Example 1
 Legal Description: Example 1

Type of Occupancy: ☒ Multifamily ☐ Institutional ☐ Industrial
☐ Commercial ☐ Other

No. of Strata Units: _____

Is this a Phased Development: ☐ Yes ☒ No

Calculations Presented Below are for: ☐ Phase ____ ☒ Buildout

Separate calculations must be provided for both current phase and buildout

Step 1. Calculate Customer Total Fixture Values

Fixture	Fixture Value (gpm) @ 414 kPa (60 psi)		No. of Fixtures		Fixture Value
Bathtub	8	X	31	=	248
Bedpan Washers	10	X		=	
Bidet	2	X		=	
Dental Unit	2	X		=	
Dishwasher	2	X		=	
Drinking Fountain - Public	2	X		=	
Hose Bibs (c/w 50 ft Wash Down)					
- 1/2 inch	5	X	62	=	310
- 5/8 inch	9	X		=	
- 3/4 inch	12	X		=	
Kitchen Sink	2.2	X	31	=	68.2
Lavatory	1.5	X	93	=	139.5
Showerhead (Shower only)	2.5	X	31	=	77.5
Service Sink	4	X		=	
Toilet					
- Flush Valve	35	X		=	
- Tank Type	4	X	93	=	372
Urinal					
- Pedestal Flush Valve	35	X		=	
- Wall Flush Valve	16	X		=	
Wash Sink (Each Set of Faucets)	4	X		=	
Washing Machine	6	X	31	=	186
Other:					
		X		=	
		X		=	
		X		=	
		X		=	

Combined Fixture Value Total 1401.2 gpm (A)

Step 2. Calculate Customer Unadjusted Peak Demand

Customer Peak Demand From Fig. 4-2 or 4-3 = 65 gpm (B)



Step 3. Apply Pressure Adjustment Factor

551 kPa (80 psi) Pressure Factor From Table 4.1 1.17 (C)

Customer Adjusted Peak Demand (B X C) = 76.05 gpm (D)

Step 4. Add Underground Irrigation Demand

Underground Sprinklers

- Spray Systems 1.16 X Sections* 43 = 50 gpm (E)

- Rotary Systems 0.4 X _____ = _____ gpm (F)

Total Irrigation Flow (E + F) = 50 gpm (G)

Step 5. Calculate Total Peak Fixed Demand

Total Fixed Demand (D+ G) = 126 gpm (H)

Step 6. Size and Select Water Meter

Meter Section

Water Meter Make & Model: Neptune T-10

Meter Size based on (H < 90% of Meter Rated Peak Instantaneous Flow) 50 mm (I)

Meter size based on maximum 48 kPa (7 psi) pressure drop 50 mm (J)

Meter Size Recommended (Greater of I & J) 50 mm

Inside or Outside Installation Outside

Water Service Connection Size (for information) 100 mm

Water Meter Sizing Professional Certification

Name: _____ Created Date: _____

Company: _____ Revised Date: _____

Comments:

*100 ft² area = 1 section



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Water Meter Sizing Calculation Sheet For Non-Fire Service Meters

Methodology: AWWA M22

Customer Name: _____

Address: _____

PID Number: _____ Folio Number: _____

Legal Description: _____

Type of Occupancy: ☐ Multifamily ☐ Institutional ☐ Industrial
☐ Commercial ☐ Other

No. of Strata Units _____

Is this a Phased Development: ☐ Yes ☐ No

Calculations Presented Below are for: ☐ Phase ____ ☐ Buildout

Separate calculations must be provided for both current phase and buildout

Step 1. Calculate Customer Total Fixture Values

Fixture	Fixture Value (gpm) @ 414 kPa (60 psi)	No. of Fixtures	Fixture Value
Bathtub	8	X	=
Bedpan Washers	10	X	=
Bidet	2	X	=
Dental Unit	2	X	=
Dishwasher	2	X	=
Drinking Fountain - Public	2	X	=
Hose Bibs (c/w 50 ft Wash Down)			
- 1/2 inch	5	X	=
- 5/8 inch	9	X	=
- 3/4 inch	12	X	=
Kitchen Sink	2.2	X	=
Lavatory	1.5	X	=
Showerhead (Shower only)	2.5	X	=
Service Sink	4	X	=
Toilet			
- Flush Valve	35	X	=
- Tank Type	4	X	=
Urinal			
- Pedestal Flush Valve	35	X	=
-Wall Flush Valve	16	X	=
Wash Sink (Each Set of Faucets)	4	X	=
Washing Machine	6	X	=
Other:			
_____	X	=	
_____	X	=	
_____	X	=	
_____	X	=	

Combined Fixture Value Total _____ gpm (A)

Step 2. Calculate Customer Unadjusted Peak Demand

Customer Peak Demand From Fig. 4-2 or 4-3 = _____ gpm (B)



PID Number: _____

Step 3. Apply Pressure Adjustment Factor

_____ kPa (_____ psi) Pressure Factor From Table 4.1 _____ (C)

Customer Adjusted Peak Demand (B X C) = _____ gpm (D)**Step 4. Add Underground Irrigation Demand**

Underground Sprinklers

- Spray Systems _____ Sections* 1.16 X _____ = _____ gpm (E)

- Rotary Systems _____ 0.4 X _____ = _____ gpm (F)

Total Irrigation Flow (E + F) = _____ gpm (G)**Step 5. Calculate Total Peak Fixed Demand****Total Fixed Demand (D+ G) = _____ gpm (H)****Step 6. Size and Select Water Meter****Meter Section**

Water Meter Make & Model: _____

Meter Size based on (H < 90% of Meter Rated Peak Instantaneous Flow) _____ mm (I)

Meter size based on maximum 48 kPa (7 psi) pressure drop _____ mm (J)

Meter Size Recommended (Greater of I & J) _____ mm

Inside or Outside Installation _____

Water Service Connection Size (for information) _____ mm**Water Meter Sizing Professional Certification****Name:** _____ **Created Date:** _____**Company:** _____ **Revised Date:** _____**Comments:***100 ft² area = 1 section

**APPENDIX B
SAMPLE PRE-DESIGN TABLE OF CONTENTS – SANITARY PUMP STATIONS**

SAMPLE TABLE OF CONTENTS

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2.1 SANITARY SEWER CATCHMENT AREA	2
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APPENDICES

Appendix A Geotechnical Report

Appendix B Calculations

**APPENDIX C
PRECIPITATION DATA SETS**

GREATER VANCOUVER SEWERAGE AND DRAINAGE DISTRICT

RAINFALL INTENSITY - DURATION DATA FOR FERRY ROAD PUMP STATION (DT55) BASED ON RECORDING RAIN GAUGE DATA FOR THE PERIOD 1996 - 2004 (9 Years)

TABLE 1 - MAXIMUM RAINFALL INTENSITIES (mm/hr)

YEAR	5 min	15 min	30 min	1 h	2 h	6 h	12 h	24 h	48 h	72 h
1996	76.8	42.4	26.8	13.4	7.2	5.5	3.4	2.1	1.4	1.0
1997	43.2	23.2	13.6	8.6	6.9	4.6	3.3	2.0	1.5	1.1
1998	40.8	23.2	13.6	8.0	6.9	2.9	2.1	1.5	1.1	0.9
1999	48.0	24.0	12.8	7.8	5.2	3.3	2.9	1.8	1.3	0.9
2000	38.4	28.8	22.4	16.0	10.8	4.2	2.2	1.1	0.6	0.4
2001	31.2	24.0	14.4	9.0	6.9	3.6	2.8	1.7	1.2	0.8
2002	88.8	40.8	21.6	10.8	5.4	2.3	1.6	1.5	1.0	0.7
2003	24.0	12.0	9.2	8.6	7.6	5.8	5.0	3.6	2.7	1.9
2004	36.0	21.6	14.0	10.0	7.5	3.8	2.8	2.0	1.0	0.7
X' (Mean)	47.5	26.7	16.5	10.2	7.2	4.0	2.9	1.9	1.3	0.9
Sx (Std.Dev.)	21.4	9.6	5.7	2.8	1.6	1.2	1.0	0.7	0.6	0.4

GREATER VANCOUVER SEWERAGE AND DRAINAGE DISTRICT

RAINFALL INTENSITY-DURATION FREQUENCY DATA (SHORT DURATION) FOR
FERRY ROAD PUMP STATION (STATION DT55)
BASED ON RECORDING RAIN GAUGE DATA
FOR THE PERIOD 1996 - 2004 (9 YEARS)

TABLE 2 - RAINFALL INTENSITY DURATION FREQUENCY VALUES (mm/h)
COMPUTED BY USING THE GUMBEL EXTREME VALUE TYPE I DISTRIBUTION

DURATION	RETURN PERIOD					
	2 year	5 year	10 year	25 year	50 year	100 year
5 min	44.6	70.7	88.0	109.8	126.0	142.1
15 min	25.4	37.1	44.8	54.5	61.8	69.0
30 min	15.7	22.7	27.3	33.2	37.5	41.8
1 h	9.9	13.3	15.5	18.3	20.4	22.5
2 h	6.9	8.9	10.2	11.8	13.1	14.3
6 h	3.9	5.3	6.2	7.4	8.3	9.2
12 h	2.8	4.0	4.7	5.7	6.5	7.2
24 h	1.8	2.7	3.2	4.0	4.5	5.0

GREATER VANCOUVER SEWERAGE AND DRAINAGE DISTRICT
RAINFALL INTENSITY-DURATION FREQUENCY DATA (SHORT DURATION) FOR
FERRY ROAD PUMP STATION (STATION DT55)
BASED ON RECORDING RAIN GAUGE DATA
FOR THE PERIOD 1996 - 2004 (9 YEARS)

TABLE 3 - RAINFALL INTENSITY-DURATION FREQUENCY INTERPOLATION EQUATION

$$I = A \cdot T^B$$

I = intensity in mm/h

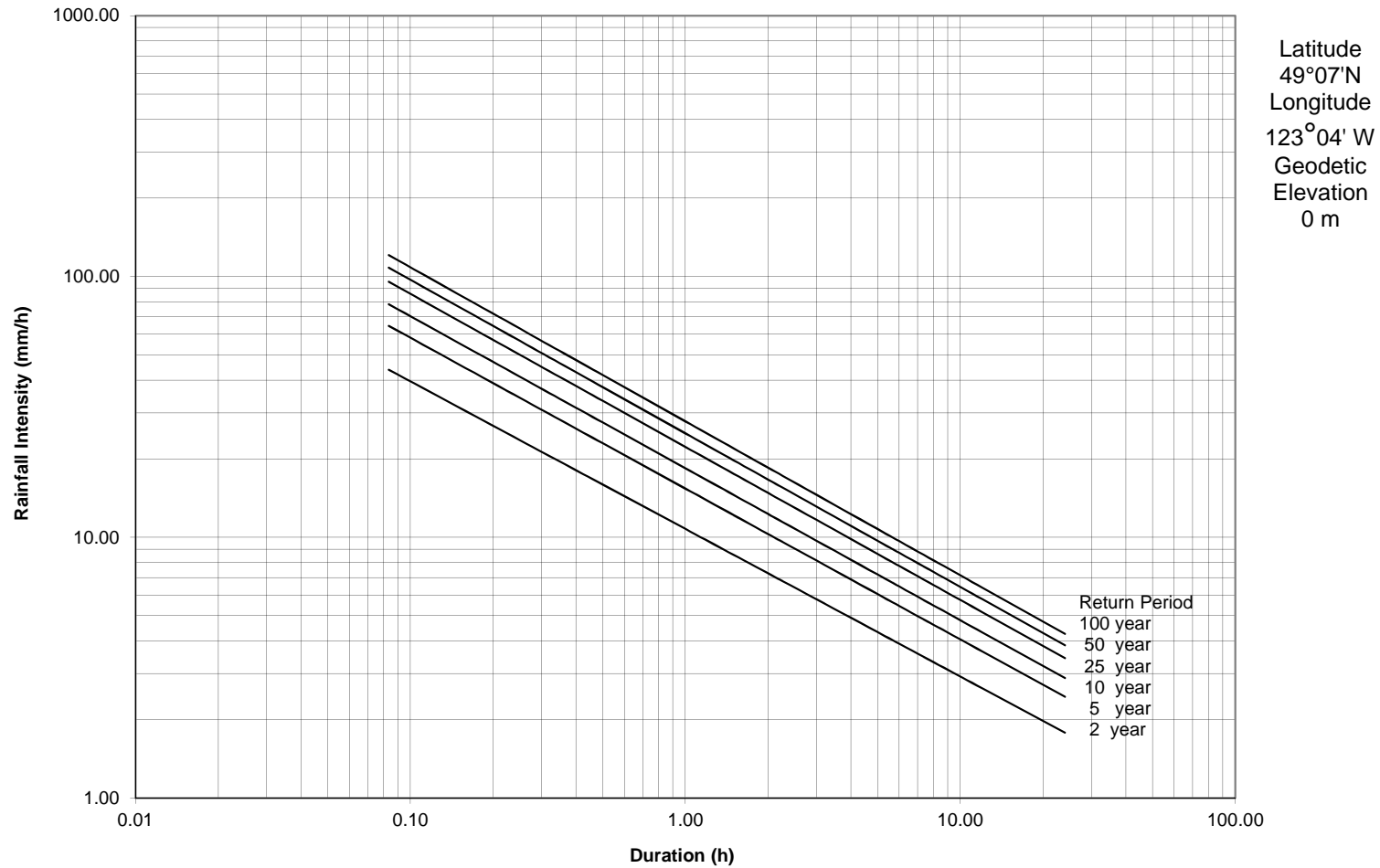
T = storm duration in hours

IDF EQUATION PARAMETERS	RETURN PERIOD					
	2 year	5 year	10 year	25 year	50 year	100 year
Coefficient A	10.765	15.370	18.398	22.214	25.039	27.841
Exponent B	-0.566	-0.578	-0.583	-0.587	-0.589	-0.591

**TABLE 4 - RAINFALL INTENSITY-DURATION FREQUENCY VALUES
COMPUTED FROM THE INTERPOLATION EQUATION**

DURATION	RETURN PERIOD					
	2 year	5 year	10 year	25 year	50 year	100 year
5 min	43.9	64.7	78.3	95.5	108.2	120.8
15 min	23.6	34.3	41.3	50.1	56.7	63.1
30 min	15.9	23.0	27.6	33.4	37.7	41.9
1 h	10.8	15.4	18.4	22.2	25.0	27.8
2 h	7.3	10.3	12.3	14.8	16.6	18.5
6 h	3.9	5.5	6.5	7.8	8.7	9.7
12 h	2.6	3.7	4.3	5.2	5.8	6.4
24 h	1.8	2.4	2.9	3.4	3.9	4.3

**GREATER VANCOUVER SEWERAGE AND DRAINAGE DISTRICT
RAINFALL INTENSITY-DURATION FREQUENCY DATA (SHORT DURATION) FOR
FERRY ROAD PUMP STATION (STATION DT55)
BASED ON RECORDING RAIN GAUGE DATA FOR THE PERIOD 1996 - 2004 (9 YEARS)**



GREATER VANCOUVER SEWERAGE AND DRAINAGE DISTRICT

**RAINFALL INTENSITY-DURATION FREQUENCY DATA (LONG DURATION) FOR
FERRY ROAD PUMP STATION (STATION DT55)
BASED ON RECORDING RAIN GAUGE DATA
FOR THE PERIOD 1996 - 2004 (9 YEARS)**

**TABLE 2 - RAINFALL INTENSITY DURATION FREQUENCY VALUES (mm/h)
COMPUTED BY USING THE GUMBEL EXTREME VALUE TYPE I DISTRIBUTION**

DURATION	RETURN PERIOD					
	2 year	5 year	10 year	25 year	50 year	100 year
1 h	9.9	13.3	15.5	18.3	20.4	22.5
2 h	6.9	8.9	10.2	11.8	13.1	14.3
6 h	3.9	5.3	6.2	7.4	8.3	9.2
12 h	2.8	4.0	4.7	5.7	6.5	7.2
24 h	1.8	2.7	3.2	4.0	4.5	5.0
48 h	1.2	2.0	2.5	3.1	3.5	4.0
72 h	0.9	1.4	1.7	2.2	2.5	2.8

GREATER VANCOUVER SEWERAGE AND DRAINAGE DISTRICT

RAINFALL INTENSITY-DURATION FREQUENCY DATA (LONG DURATION) FOR
FERRY ROAD PUMP STATION (STATION DT55)
BASED ON RECORDING RAIN GAUGE DATA
FOR THE PERIOD 1996 - 2004 (9 YEARS)

TABLE 3 - RAINFALL INTENSITY-DURATION FREQUENCY INTERPOLATION EQUATION

$$I = A \cdot T^B$$

I = intensity in mm/h

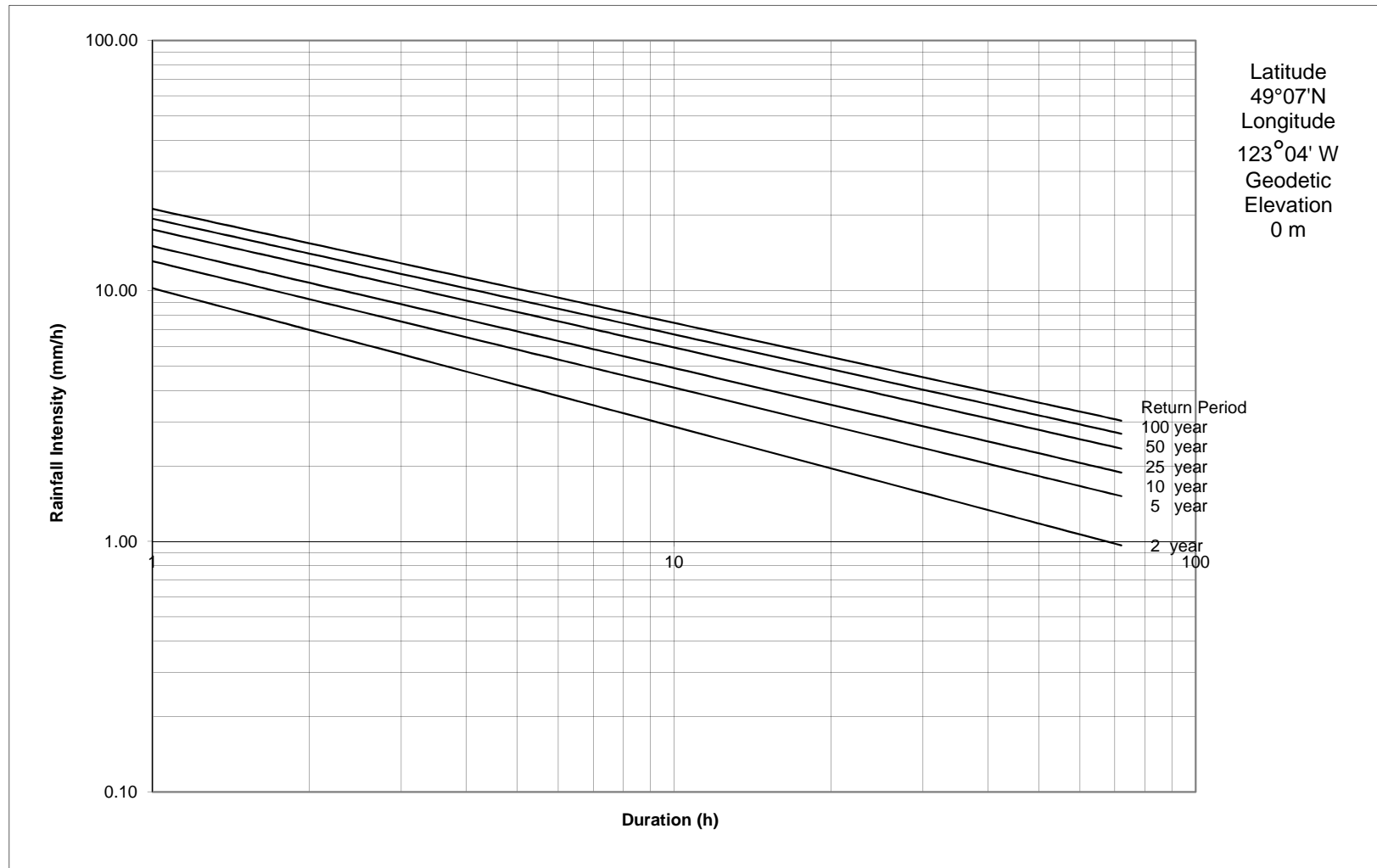
T = storm duration in hours

IDF EQUATION PARAMETERS	RETURN PERIOD					
	2 year	5 year	10 year	25 year	50 year	100 year
Coefficient A	10.255	13.153	15.103	17.581	19.426	21.261
Exponent B	-0.553	-0.505	-0.487	-0.471	-0.462	-0.455

**TABLE 4 - RAINFALL INTENSITY-DURATION FREQUENCY VALUES
COMPUTED FROM THE INTERPOLATION EQUATION**

DURATION	RETURN PERIOD					
	2 year	5 year	10 year	25 year	50 year	100 year
1 h	10.3	13.2	15.1	17.6	19.4	21.3
2 h	7.0	9.3	10.8	12.7	14.1	15.5
6 h	3.8	5.3	6.3	7.6	8.5	9.4
12 h	2.6	3.8	4.5	5.5	6.2	6.9
24 h	1.8	2.6	3.2	3.9	4.5	5.0
48 h	1.2	1.9	2.3	2.8	3.3	3.7
72 h	1.0	1.5	1.9	2.3	2.7	3.0

**GREATER VANCOUVER SEWERAGE AND DRAINAGE DISTRICT
RAINFALL INTENSITY-DURATION FREQUENCY DATA (LONG DURATION) FOR
FERRY ROAD PUMP STATION (STATION DT55)
BASED ON RECORDING RAIN GAUGE DATA FOR THE PERIOD 1996 - 2004 (9 YEARS)**



RAINFALL HYETOGRAPH 1:10 YEAR FREQUENCY (Source: Rainfall Station Ferry Road Pump Station – DT55)							
MODIFIED AES SHORT STORM (mm/hr)				AES LONG STORM (mm/hr)		SCS Type 1A (mm/hr)	
Rain (mm) Duration Time (min)	18.40 1 hour	24.60 2 hour	Duration Time (min)	39.00 6 hour	Duration Time (min)	54.09 12 hour	77.21 24 hour
0	0	0	0	0	0	0	0
5	11.04	7.38	10	4.68	15	2.71	1.93
10	13.25	7.38	20	4.68	30	2.70	1.93
15	19.87	8.86	30	4.68	45	2.70	1.95
20	19.87	8.86	40	5.46	60	2.71	1.91
25	22.08	13.28	50	5.45	75	3.57	1.91
30	24.29	13.28	60	5.45	90	3.57	1.95
35	30.91	13.28	70	7.04	105	3.57	1.95
40	24.29	13.28	80	7.02	120	3.57	1.91
45	17.66	14.76	90	7.02	135	4.87	2.53
50	15.46	14.76	100	6.25	150	4.87	2.56
55	13.25	16.24	110	6.22	165	4.87	2.56
60	8.83	16.24	120	6.25	180	4.87	2.53
65		20.66	130	6.25	195	6.71	2.56
70		20.66	140	6.22	210	6.71	2.53
75		16.24	150	6.25	225	16.98	2.63
80		16.24	160	9.36	240	16.99	2.47
85		11.81	170	9.36	255	11.90	3.40
90		11.81	180	9.36	270	8.65	3.71
95		10.33	190	7.04	285	6.49	3.40
100		10.33	200	7.02	300	5.84	3.40
105		8.86	210	7.02	315	5.19	3.40
110		8.86	220	7.02	330	4.98	3.71
115		5.90	230	7.02	345	4.54	3.40
120		5.90	240	7.02	360	4.11	3.40
			250	7.04	375	4.11	4.94
			260	7.02	390	3.89	4.63
			270	7.02	405	3.89	4.94
			280	6.25	420	3.68	4.63
			290	6.22	435	3.46	12.04
			300	6.25	450	3.46	12.35
			310	6.25	465	3.46	12.04
			320	6.22	480	3.46	12.04
			330	6.25	495	2.87	8.65
			340	5.45	510	2.86	8.34
			350	5.48	525	2.87	6.18
			360	5.41	540	2.87	6.18
					555	2.87	4.63
					570	2.86	4.63
					585	2.87	4.32
					600	2.87	4.01
					615	2.54	3.71
					630	2.54	3.71
					645	2.54	3.71
					660	2.54	3.40
					675	2.54	3.40
					690	2.54	3.09
					705	2.54	3.09
					720	2.54	2.78
					735		3.09
					750		2.78
					765		2.78
					780		2.78
					795		2.78
					810		2.78
					825		2.78
					840		2.47
					855		2.47
					870		2.47
					885		2.47
					900		2.47
					915		2.47
					930		2.47
					945		2.47
					960		2.47
					975		2.16
					990		1.85
					1005		2.16
					1020		1.85
					1035		2.16
					1050		2.16
					1065		1.85
					1080		2.16
					1095		2.16
					1110		1.85
					1125		2.16
					1140		2.16
					1155		1.85
					1170		2.16
					1185		1.85
					1200		2.16
					1215		1.85
					1230		1.85
					1245		1.85
					1260		1.54
					1275		1.85
					1290		1.85
					1305		1.85
					1320		1.85
					1335		1.85
					1350		1.85
					1365		1.85
					1380		1.54
					1395		1.85
					1410		1.85
					1425		1.85
					1440		1.85
Rain (mm)	18.40	24.60		39.00		54.09	77.21

RAINFALL HYETOGRAPH 1:25 YEAR FREQUENCY (Source: Rainfall Station Ferry Road Pump Station – DT55)							
MODIFIED AES SHORT STORM (mm/hr)				AES LONG STORM (mm/hr)		SCS Type 1A (mm/hr)	
Rain (mm) Duration Time (min)	22.20 1 hour	29.60 2 hour	Duration Time (min)	46.80 6 hour	Duration Time (min)	65.52 12 hour	94.58 24 hour
0	0	0	0	0	0	0	0
5	13.32	8.88	10	5.62	15	3.28	2.36
10	15.98	8.88	20	5.62	30	3.27	2.36
15	23.98	10.66	30	5.62	45	3.27	2.38
20	23.98	10.66	40	6.55	60	3.28	2.35
25	26.64	15.98	50	6.53	75	4.33	2.35
30	29.30	15.98	60	6.54	90	4.32	2.38
35	37.30	15.98	70	8.45	105	4.32	2.38
40	29.30	15.98	80	8.42	120	4.33	2.35
45	21.31	17.76	90	8.42	135	5.90	3.10
50	18.65	17.76	100	7.50	150	5.90	3.14
55	15.98	19.54	110	7.47	165	5.90	3.14
60	10.66	19.54	120	7.50	180	5.90	3.10
65		24.86	130	7.50	195	8.12	3.14
70		24.86	140	7.47	210	8.12	3.10
75		19.54	150	7.50	225	20.57	3.22
80		19.54	160	11.23	240	20.57	3.03
85		14.21	170	11.23	255	14.41	4.16
90		14.21	180	11.23	270	10.48	4.54
95		12.43	190	8.45	285	7.86	4.16
100		12.43	200	8.42	300	7.08	4.16
105		10.66	210	8.42	315	6.29	4.16
110		10.66	220	8.42	330	6.03	4.54
115		7.10	230	8.42	345	5.50	4.16
120		7.10	240	8.42	360	4.98	4.16
			250	8.45	375	4.98	6.05
			260	8.42	390	4.72	5.67
			270	8.42	405	4.72	6.05
			280	7.50	420	4.46	5.67
			290	7.47	435	4.19	14.75
			300	7.50	450	4.19	15.13
			310	7.50	465	4.19	14.75
			320	7.47	480	4.19	14.75
			330	7.50	495	3.47	10.59
			340	6.54	510	3.47	10.21
			350	6.57	525	3.47	7.57
			360	6.49	540	3.47	7.57
					555	3.47	5.67
					570	3.47	5.67
					585	3.47	5.30
					600	3.47	4.92
					615	3.08	4.54
					630	3.08	4.54
					645	3.08	4.54
					660	3.08	4.16
					675	3.08	4.16
					690	3.08	3.78
					705	3.08	3.78
					720	3.08	3.40
					735		3.78
					750		3.40
					765		3.40
					780		3.40
					795		3.40
					810		3.40
					825		3.40
					840		3.03
					855		3.03
					870		3.03
					885		3.03
					900		3.03
					915		3.03
					930		3.03
					945		3.03
					960		3.03
					975		2.65
					990		2.27
					1005		2.65
					1020		2.27
					1035		2.65
					1050		2.65
					1065		2.27
					1080		2.65
					1095		2.65
					1110		2.27
					1125		2.65
					1140		2.65
					1155		2.27
					1170		2.65
					1185		2.27
					1200		2.65
					1215		2.27
					1230		2.27
					1245		2.27
					1260		1.89
					1275		2.27
					1290		2.27
					1305		2.27
					1320		2.27
					1335		2.27
					1350		2.27
					1365		2.27
					1380		1.89
					1395		2.27
					1410		2.27
					1425		2.27
					1440		2.27
Rain (mm)	22.20	29.60		46.80		65.52	94.58

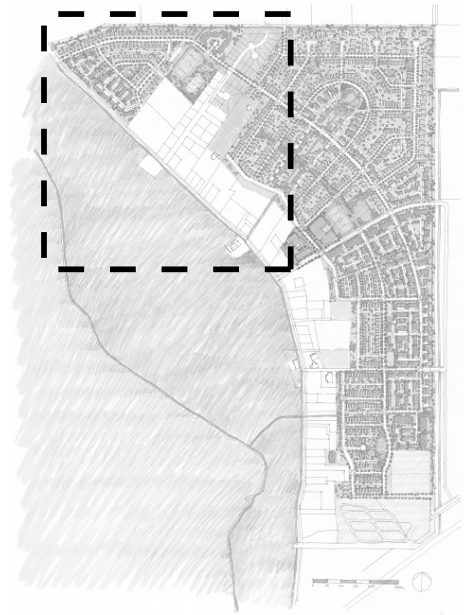
RAINFALL HYETOGRAPH 1:100 YEAR FREQUENCY (Source: Rainfall Station Ferry Road Pump Station – DT55)							
MODIFIED AES SHORT STORM (mm/hr)				AES LONG STORM (mm/hr)		SCS Type 1A (mm/hr)	
Rain (mm) Duration Time (min)	27.80 1 hour	37.00 2 hour	Duration Time (min)	58.20 6 hour	Duration Time (min)	82.38 12 hour	120.19 24 hour
0	0	0	0	0	0	0	0
5	16.68	11.10	10	6.98	15	4.12	3.00
10	20.02	11.10	20	6.98	30	4.12	3.00
15	30.02	13.32	30	6.98	45	4.12	3.03
20	30.02	13.32	40	8.15	60	4.12	2.98
25	33.36	19.98	50	8.13	75	5.44	2.98
30	36.70	19.98	60	8.14	90	5.44	3.03
35	46.70	19.98	70	10.51	105	5.44	3.03
40	36.70	19.98	80	10.48	120	5.44	2.98
45	26.69	22.20	90	10.48	135	7.42	3.94
50	23.35	22.20	100	9.32	150	7.41	3.99
55	20.02	24.42	110	9.29	165	7.41	3.99
60	13.34	24.42	120	9.32	180	7.42	3.94
65		31.08	130	9.32	195	10.22	3.99
70		31.08	140	9.29	210	10.22	3.94
75		24.42	150	9.32	225	25.87	4.09
80		24.42	160	13.97	240	25.87	3.85
85		17.76	170	13.97	255	18.12	5.29
90		17.76	180	13.97	270	13.18	5.77
95		15.54	190	10.51	285	9.89	5.29
100		15.54	200	10.48	300	8.90	5.29
105		13.32	210	10.48	315	7.91	5.29
110		13.32	220	10.48	330	7.58	5.77
115		8.88	230	10.48	345	6.92	5.29
120		8.88	240	10.48	360	6.26	5.29
			250	10.51	375	6.26	7.69
			260	10.48	390	5.93	7.21
			270	10.48	405	5.93	7.69
			280	9.32	420	5.60	7.21
			290	9.29	435	5.27	18.75
			300	9.32	450	5.27	19.23
			310	9.32	465	5.27	18.75
			320	9.29	480	5.27	18.75
			330	9.32	495	4.37	13.46
			340	8.14	510	4.36	12.98
			350	8.17	525	4.37	9.62
			360	8.07	540	4.37	9.62
					555	4.37	7.21
					570	4.36	7.21
					585	4.37	6.73
					600	4.37	6.25
					615	3.87	5.77
					630	3.87	5.77
					645	3.87	5.77
					660	3.87	5.29
					675	3.87	5.29
					690	3.87	4.81
					705	3.87	4.81
					720	3.87	4.33
					735		4.81
					750		4.33
					765		4.33
					780		4.33
					795		4.33
					810		4.33
					825		4.33
					840		3.85
					855		3.85
					870		3.85
					885		3.85
					900		3.85
					915		3.85
					930		3.85
					945		3.85
					960		3.85
					975		3.37
					990		2.88
					1005		3.37
					1020		2.88
					1035		3.37
					1050		3.37
					1065		2.88
					1080		3.37
					1095		3.37
					1110		2.88
					1125		3.37
					1140		3.37
					1155		2.88
					1170		3.37
					1185		2.88
					1200		3.37
					1215		2.88
					1230		2.88
					1245		2.88
					1260		2.40
					1275		2.88
					1290		2.88
					1305		2.88
					1320		2.88
					1335		2.88
					1350		2.88
					1365		2.88
					1380		2.40
					1395		2.88
					1410		2.88
					1425		2.88
					1440		2.88
Rain (mm)	27.80	37.00		58.20		82.38	120.19

**APPENDIX D
PREFERRED BOULEVARD TREES**

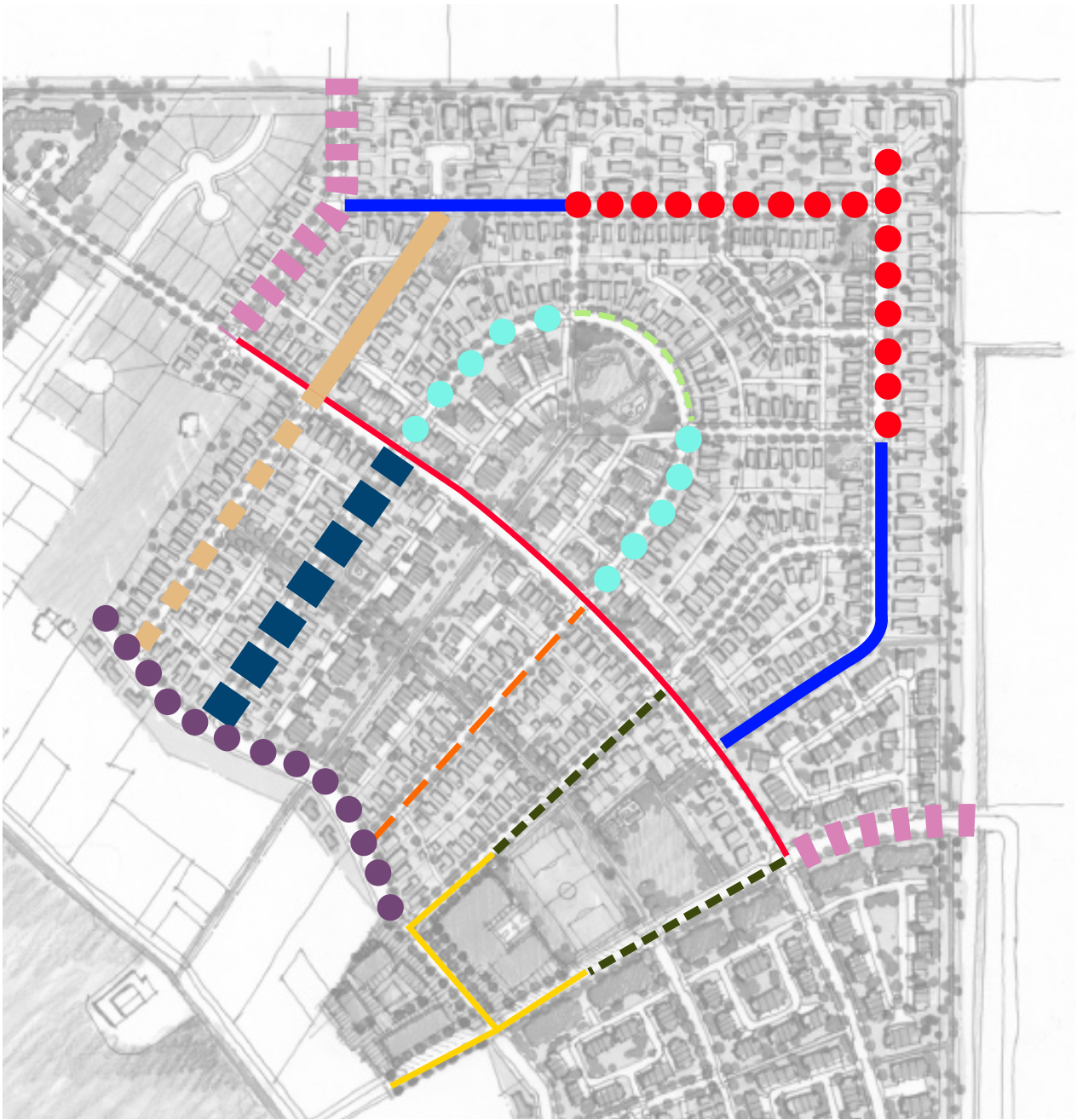
BOULEVARD TREES



- Acer rubrum 'October Glory'
- Acer x freemanii 'Autumn Blaze'



BOULEVARD TREES



- ● ● ● ● *Prunus x yeodensis* 'Akebono'
- *Prunus serrulata* 'Kwanzan'
- ||||| *Fraxinus americana* 'Skyline'
- *Acer rubrum* 'Red Sunset'
- *Gleditsia tricanthos inermis* 'Halka'
- *Nyssa sylvatica*
- *Quercus acutissima* (North of D)
- *Carpinus betulus* (South of D)
- ● ● ● ● *Pyrus chancierei*
- ■ ■ ■ ■ *Fagus sylvatica*
- *Aesculus x carnea* 'Briotii'
- *Zelkova serrata*
- ● ● ● ● *Styrax japonica*



BOULEVARD TREES



- Liquidambar worplesdon (Blvd)
- Styrax japonica (Median)
- ● ● ● Magnolia galaxy
- ■ ■ ■ Cornus 'Eddies White Wonder'
- Acer rubrum 'Morgan'



BOULEVARD TREES



- Prunus x yeodensis 'Akebono'
- Cercidiphyllum japonicum
- Gleditsia tricanthos var. inermis 'Skyline'
- Acer truncatum 'Pacific Sunset' or Liquidambar worplesdon (Blvd)
- ... Pyrus chaticleer (Median)



TFN SUPPLEMENTARY SPECIFICATIONS - CONSTRUCTION

Supplementary Specifications General Use Description

The "**Master Municipal Construction Document (MMCD)**", **platinum version, dated 2009** save and except the following sections and clauses of the MMCD which are not applicable to have been deleted or amended, will reflect those standards to be applied within Tsawwassen First Nation lands.

Section

Description

1.0 GENERAL

- 1.0.3 TSS

Add Clause 1.0.3

The proposed works are subject to environmental regulation and monitoring. The Contractor shall not commence any construction adjacent to open watercourses until the Contractor has submitted a detailed work plan to the Contract Administrator for Approval.

- 1.0.4 TSS

Add Clause 1.0.4

The Environmental Monitor shall be identified by the Contract Administrator prior to construction. The Environmental Monitor will confirm that the Work is being completed in accordance with the work plan and environmental regulations. The Contractor will not rely on the Environmental Monitor to oversee his work. The Contractor is responsible for ensuring that all appropriate environmental protection measures are implemented properly.

**1.5 Work Adjacent to
Watercourses**

- 1.5.10 TSS

Add Clause 1.5.10

The Contractor shall be responsible to supply, place and maintain all necessary materials required to isolate the working area from the active watercourse. The Contractor shall, if required, coordinate with the Environmental Monitor to conduct a "fish salvage" during the isolation of the work area. The Contractor shall assist the Environmental Monitor as necessary.

1.6 Pollution Control

- 1.6.1 TSS

Delete clause 1.6.1 and replace with the following:

All work will be undertaken and completed in a manner to prevent the release of sediment or sediment laden water, raw concrete or concrete leachate, or any other deleterious substance into the water course or the storm sewer system.

END OF SECTION

Section

Description

1.0 EXECUTION

- 1.1 TSS

Add clause 1.1

Dewatering for installation of pre-fabricated lift station must incorporate installation of tank bottom at around -3.0m geodetic. This elevation is substantially lower than the average groundwater level on TFN lands which is tidally influenced and generally sits within the upper 2m of subsurface. As such, the Contractor will likely be required to use wellpoint approach with significant pumping capacity to locally depress the groundwater table below construction zone. In order to evaluate groundwater recharge and filtration rates and properly size the dewatering system, the designer will be required to seek input from a qualified geotechnical engineer and/or hydrogeologist. As a minimum, detailed underground soil logs, continuous groundwater table observations, and saturated hydraulic conductivity results through laboratory testing shall be provided to evaluate recharge potential in deep excavations.

Discharge from dewatering will have saline content that requires treatment. Wellpoint discharge can be directed to the tidal salt marsh where approved by the Environmental Monitor. Supply suitable energy dissipation.

If the tidal salt marsh cannot be reached the wellpoint discharge shall be infiltrated through a facility supplied by the Contractor or reduced in salinity by mixing to the approval of the Environmental Monitor.

Well point dewatering will likely be required along deeper sewer runs, especially along oversized sanitary sewers in the vicinity of sanitary lift station. The designer must make necessary provisions for this requirement.

When the multiple wellpoint dewatering system includes a large above ground pump system and a diesel generator, noise reduction measures must be performed is the equipment is installed in the vicinity of the existing residences.

These clauses equally apply to any other proposed permanent structure that will be installed below the groundwater table on TFN lands unless conventional dewatering procedures within the excavation extents are not sufficient.

END OF SECTION

Section

Description

3.0 EXECUTION

3.9 Expansion Joints

- 3.9.5 TSS

Add clause 3.9.5

Expansion joints in concrete sidewalks shall be tooled without leaving trowel markings on surface.

3.10 Control Joints

- 3.10.5 TSS

Add clause 3.10.5

Control joints in concrete sidewalks shall be tooled without leaving trowel markings on surface.

3.13 Special Effects

- 3.13.3 TSS

Add clause 3.13.3

Tactile strips shall be cast integrally into concrete wheel chair letdowns. See Supplemental Standard Drawings for detail and specifications.

END OF SECTION

Section

Description

1.0 GENERAL

- 1.0.1 TSS

Delete clause 1.0.1 and substitute the following:

Section 25 56 01 refers to those portions of the works that are unique to the supply and installation of lighting and power for streets, bikeways, crosswalks, sidewalks, walkways and 120V receptacles. This section must be referenced to and interpreted simultaneously with all other sections pertinent to works described herein.

2.0 PRODUCTS

2.1 General

- 2.1.3 TSS

Delete clause 2.1.3 and substitute the following:

All roadway lighting products to conform to the British Columbia Ministry of Transportation and Infrastructure publication "Electrical and Signing Materials Standards - Volume 1" (BCMOT E&SMS V1) and as specified in the Tsawwassen First Nations Supplementary Specifications and Supplementary Detail Drawings, except where otherwise noted on the Contract Drawings.

2.7 Poles and Anchor Bolts

- 2.7.1 TSS

Delete 2.7.1 and substitute the following:

Traffic Signal, Luminaire and Sign Poles to conform to Section 301 - Traffic Signal, Luminaire and Sign Pole Structures, BCMOT E&SMS V1 and as specified in the Tsawwassen First Nations Supplementary Specifications and Supplementary Detail Drawings.

- 2.7.5 TSS

Delete 2.7.5 and substitute the following:

Steel Decorative Poles: Fabrication to Section 301 - Traffic Signal, Luminaire and Sign Pole Structures, BCMOT E&SMS V1 and as specified in the Tsawwassen First Nations Supplementary Specifications and Supplementary Detail Drawings, with the following requirements notes on Contract Drawings:

- .1 Poles shall be hot-dipped galvanized steel.
- .2 Finish shall be polyester powdercoat, colour RAL7031 (blue grey)
- .3 Shop drawings of poles and base covers signed and sealed per 1.3 of this Section.

- 2.7.9 TSS

Add clause 2.7.9:

Pole handhole covers located less than 3.0m above finished grade shall be Loss Prevention Fasteners "Ultra-Lok HHC" series, cat. #44-704 (for 4" poles), cat. #44-705 (for 5" poles) as follows:

- .1 3/16" outer plate welded to 1/4" inner plate (total thickness 7/16") with two shrouded openings for backer bar bolts.
- .2 Backer bar fabricated from 1/4" thick U-channel steel.
- .3 Galvanized steel construction. Powder coated RAL7031 (blue grey) to match pole.
- .4 Stainless steel backer bar bolts with tamper-resistant keyed head (2 per cover). Keying to be per Tsawwassen First Nation standard pattern or as directed by engineer.
- .5 Provide driver with matching keying pattern for backer bar bolts to Tsawwassen First Nation maintenance staff. (1 driver for every 20 poles).
- .6 Confirm correct fit of handhole covers to handholes prior to ordering.

2.13 Receptacles

- 2.13.3 TSS

Add clause 2.13.3:

Weatherproof metallic covers for post-mounted receptacles shall be Thomas & Betts "Red Dot" series, cat. #CKMUV (or approved equal) as follows:

- .1 Cast-aluminum construction with grey powder coat finish.
- .2 Single-gang, vertical-mounting with 3.25" internal depth.
- .3 Padlock hasp for 1/4" shackle, lockable with cord in receptacle.
- .4 EEMAC 3R rating

- 2.13.4 TSS

Add clause 2.13.4:

Receptacles for under-grate receptacles shall be Hubbell cat. #HBL52CM69C (or approved equal) as follows:

- .1 NEMA 5-15R receptacle with corrosion-resistant yellow nylon body.
- .2 Complete with Hubbell cat. #HBL6018 black elastomer weatherproof cover and Hubbell cat. #HBL6019 black elastomer closure plug.

- 2.13.5 TSS

Add Clause 2.13.5:

GFCI line cords for under-grate receptacles shall be Hubbell cat. #GFP4C15M (or approved equal) as follows:

- .1 18" long, 3-wire, 15A yellow industrial line cord with GFCI circuit interrupter and NEMA 5-15R receptacle and NEMA 5-15P plug
- .2 -30°C to +66°C operating temperature
- .3 To be supplied loose to Tsawwassen First Nation maintenance personnel (1 per under-grate receptacle).

2.14 Luminaires, Mounting Arms and Control Equipment

Rename section 2.14 "Luminaires, Mounting Arms and Control Equipment".

- 2.14.3 TSS

Delete 2.14.3 and substitute the following:

Approved decorative luminaires are as follows:

- .1 Roadway Luminaires: Kim Lighting Inc. "Era LED RA25" series:

- .1 Die-cast aluminum driver housing, reflector housing and lens frame with stainless steel fasteners and mounting bolts.
- .2 Sealed optical chamber with one-piece extruded silicone gasket.
- .3 Electronic module with: Driver rated for -40°C starting and 0-10VDC dimming interface, Lifeshield temperature control device, and surge protector all mounted on a single removable plate.
- .4 Optical module with individually-replaceable LED lamps with aluminum heat sinks, thermal sensors for overtemperature protection.
- .5 Flat, tempered-glass lens.
- .6 Type 1, 2, 3, 4, 5, R or L distribution pattern (as needed to suit application).
- .7 3500K LED colour temperature.
- .8 Polyester powdercoat finish, colour RAL7031 (blue grey).
- .9 ETL listed for wet locations.
- .10 Warranty: 5 years on metal parts, 10 years on exterior paint finish, 6 years on LED light engines, 5 years on LED power components.

- .1 Pedestrian Luminaires: Kim Lighting Inc. "Era LED RA17" series:

- .1 Die-cast aluminum driver housing, reflector housing and lens frame with stainless steel fasteners and mounting bolts.
- .2 Sealed optical chamber with one-piece extruded

- silicone gasket.
- .3 Electronic module with: Driver rated for -40°C starting and 0-10VDC dimming interface, Lifeshield temperature control device, and surge protector all mounted on a single removable plate.
- .4 Optical module with individually-replaceable LED lamps with aluminum heat sinks, thermal sensors for overtemperature protection.
- .5 Flat, tempered-glass lens.
- .6 Type 1, 2, 3, 4, 5, R or L distribution pattern (as needed to suit application).
- .7 3500K LED colour temperature.
- .8 Polyester powdercoat finish, colour RAL7031 (blue grey).
- .9 ETL listed for wet locations.
- .10 Warranty: 5 years on metal parts, 10 years on exterior paint finish, 6 years on LED light engines, 5 years on LED power components.

- 2.14.4 TSS

Delete 2.14.4 and substitute the following:

Approved mounting arms are as follows:

- .1 Roadway Luminaires: Kim Lighting Inc. "HA11 Side Pole Swept Cast Arm" series, Cat. #HA11L:
 - .1 Die-cast aluminum mounting arm with 686mm offset.
 - .2 Mounts to side of pole.
 - .3 Polyester powdercoat finish, colour RAL7031 (blue grey).
- .2 Pedestrian Luminaires: Kim Lighting Inc. "HA11 Side Pole Swept Cast Arm" series, Cat. #HA11S:
 - .1 Die-cast aluminum mounting arm with 533mm offset.
 - .2 Mounts to side of pole.
 - .3 Polyester powdercoat finish, colour RAL7031 (blue grey).

- 2.14.5 TSS

Delete 2.14.5 and substitute the following:

Approved luminaire control equipment is as follows:

- .1 Wireless Control Module: Hubbell Building Automation Inc. "wiHUBB In-fixture Module" series, Cat. #WIH-IM-2RD-1277:
 - .1 120-277VAC input, 10A max., 60hz.
 - .2 2 x SPST 120VAC relay outputs.
 - .3 1 x 0-10VDC dimming output, 30mA max.
 - .4 902-928 Mhz wireless communications, peer-to-peer self-organizing self-healing mesh network.

- Spread-spectrum frequency-hopping with AES-128 security. +20 dBm output power, -118 dBm receive sensitivity (~100m range between devices). Antenna not included.
- .5 -40°C to +90°C operating with temperature, 0-95% relative humidity.
- .6 CSA certified and Industry Canada approved.
- .7 5-year limited warranty
- .8 One control module required per luminaire.
- .2 RF Surge Arrester / Bulkhead Connector: Terrawave Solutions cat. #TW-LP-RPSMA-P-BHJ:
 - .1 Gas-discharge surge arrester with 50Ω characteristic impedance, 90VDC discharge voltage.
 - .2 0-6 Ghz frequency range with <0.7 db insertion loss
 - .3 10 x 20 kA (8/20 μS) wave impulse discharge rating
 - .4 RP-SMA plug to RP-SMA jack.
 - .5 -40°C to +85°C operating temperature.
- .3 Coaxial Cable: Times Microwave Systems type LMR-200:
 - .1 50Ω characteristic impedance.
 - .2 32.6 dB/100m attenuation at 900 Mhz.
 - .3 4.95mm diameter, UV-resistant polyethylene jacket designed for 20-year outdoor service use. 13mm installation bending radius.
 - .4 -40°C to +85°C installation & operating temperature.
 - .5 Times Microwave Systems type RP-SMA & N connectors to suit.
- .4 Antennas: Laird Technologies cat. #TRAB9023NP:
 - .1 902-928 Mhz frequency range.
 - .2 3 dB-MEG gain.
 - .3 Vandal-resistant, 2.7" high, black ABS housing suitable for direct surface mounting.
 - .4 N-female connector.

- 2.14.6 TSS

Add clause 2.14.6:

Shop drawings and Manufacturer's data sheets required for decorative luminaires, mounting arms and control equipment.

**2.18 Powder Coat
Materials**

- 2.18.2.3 TSS Add clause 2.18.2.3:

 Colour shall be RAL7031 (blue grey).

**2.19 Electrical Service
Kiosk and
Components**

Add section 2.19 "Electrical Service Kiosk and Components".

- 2.19.1 TSS Add clause 2.19.1:

 Electrical service kiosks shall conform to BCMOT E&SMS V1 (Section 402 - Electrical Kiosks) and as specified in the Tsawwassen First Nations Supplementary Specifications and Supplementary Detail Drawings.
- 2.19.2 TSS Add clause 2.19.2:

 Concrete bases for electrical service kiosks shall conform to BCMOT Standard Specifications for Highway Construction (Section 635 - Electrical and Signing) and as specified in the Tsawwassen First Nations Supplementary Specifications and Supplementary Detail Drawings.
- 2.19.3 TSS Add clause 2.19.3:

 Utility meter bases for electrical service kiosks shall be Cutler-Hammer "Heavy Duty" series (or approved equal) as follows:
- .1 Meter base shall comply with BC Hydro requirements.
 - .2 System voltage, ampacity, phases: As shown on drawings.
 - .3 EEMAC3 steel enclosure.
 - .4 CSA-approved for copper or aluminum conductors.
 - .5 Tunnel-type line, load and neutral lugs.
- 2.19.4 TSS Add clause 2.19.4:

 Loadcenters for electrical service kiosks shall be Cutler-Hammer "CH" series (or approved equal) as follows:
- .1 250V loadcenters: bus and breakers rated for 10,000A symmetrical interrupting capacity unless shown otherwise on drawings.
 - .2 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and

- phase.
- .3 Loadcenters: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .4 Mains:
 - .1 Copper with neutral of same ampere rating as mains.
 - .2 Suitable for plug-in breakers.
- .5 Breakers: Trip-free type with thermal and magnetic tripping.
- .6 Trim and door finish: baked grey enamel.
- .7 Complete circuit directory with typewritten legend showing name of each circuit.

- 2.19.5 TSS

Add clause 2.19.5:

Surge protective devices for electrical service kiosks shall be Cutler-Hammer "CVX" series (or approved equal) as follows:

- .1 System voltage, phases, wiring: As shown on drawings.
- .2 MOV-based with thermal protection for each MOV.
- .3 Minimum 50kA per phase peak surge current capacity.
- .4 Minimum 20kA nominal discharge current rating.
- .5 100 kAIC short circuit current rating.
- .6 L-N, L-G, N-G, L-L protection modes (for 3-phase wye-connected systems)
- .7 EEMAC 1 surface-mount enclosure with front-mounted display unit.
- .8 LED status indicator for each phase.
- .9 5-year warranty.
- .10 CSA approved.

- 2.19.6 TSS

Add clause 2.19.6:

Contactors for electrical service kiosks shall be Cutler-Hammer "Freedom" series (or approved equal) as follows:

- .1 System voltage, phases, ampacity, contacts: As shown on drawings.
- .2 NEMA-rated magnetic contactor
- .3 120VAC coil

- 2.19.7 TSS

Add clause 2.19.7:

Selector switches for electrical service kiosks shall be

- .1 Allen-Bradley "Bulletin 800T" series.
- .2 Idec "TWTD" series
- .3 Siemens "Class 52 Black Max Corrosion Resistant " series

Selector switches shall be as follows:

- .1 2 or 3 position as shown on drawings
- .2 Fits 30.5mm cutout
- .3 Standard knob operator
- .4 EEMAC 4 & 13 rating
- .5 Nameplate as shown on drawings

- 2.19.8 TSS

Add clause 2.19.8:

Wireless control modules for electrical service kiosks shall be Hubbell Building Automation Inc. "wiHUBB In-fixture Module" series, Cat. #WIH-IM-2RD-1277:

- .1 120-277VAC input, 10A max., 60hz.
- .2 2 x SPST 120VAC relay outputs.
- .3 1 x 0-10VDC dimming output, 30mA max.
- .4 902-928 Mhz wireless communications, peer-to-peer self-organizing self-healing mesh network. Spread-spectrum frequency-hopping with AES-128 security. +20 dBm output power, -118 dBm receive sensitivity (~100m range between devices). Antenna not included.
- .5 -40°C to +90°C operating with temperature, 0-95% relative humidity.
- .6 CSA certified and Industry Canada approved.
- .7 5-year limited warranty
- .8 One control module required per kiosk.

- 2.19.9 TSS

Add clause 2.19.9:

RF surge arresters / bulkhead connectors for electrical service kiosks shall be Terrawave Solutions cat. #TW-LP-RPSMA-P-BHJ:

- .1 Gas-discharge surge arrester with 50Ω characteristic impedance, 90VDC discharge voltage.
- .2 0-6 Ghz frequency range with <0.7 db insertion loss
- .3 10 x 20 kA (8/20 μS) wave impulse discharge rating
- .4 RP-SMA plug to RP-SMA jack.
- .5 -40°C to +85°C operating temperature.

- 2.19.10 TSS

Add clause 2.19.10:

Coaxial cable for electrical service kiosks shall be Times Microwave Systems type LMR-200:

- .1 50Ω characteristic impedance.
- .2 32.6 dB/100m attenuation at 900 Mhz.
- .3 4.95mm diameter, UV-resistant polyethylene jacket designed for 20-year outdoor service use. 13mm installation bending radius.

- .4 -40°C to +85°C installation & operating temperature.
- .5 Times Microwave Systems type RP-SMA and N connectors to suit.

- 2.19.11 TSS

Add clause 2.19.11:

Antennas for electrical service kiosks shall be Laird Technologies cat. #TRAB9023NP:

- .1 902-928 Mhz frequency range.
- .2 3 dB-MEG gain.
- .3 Vandal-resistant, 2.7" high, black ABS housing suitable for direct surface mounting.
- .4 N-female connector.

- 2.19.12 TSS

Add clause 2.19.12:

Shop drawings and Manufacturer's data sheets required for electrical service kiosks and components.

3.0 EXECUTION

3.5 Underground Conduit

- 3.5.6 TSS

Add clause 3.5.6:

Conduits to avoid tree roots.

3.8 Wiring

- 3.8.1 TSS

Delete 3.8.1 and substitute the following:

Install wiring in pole handholes as shown on Standard Detail Drawings E7.11 and E7.12 and as shown in the Tsawwassen First Nations Supplementary Detail Drawings.

3.10 Luminaires and Photocells

Rename section 3.10 "Luminaires, Photocells and Control Equipment".

- 3.10.4 TSS

Add clause 3.8.4:

Install and connect wireless control modules in accordance with manufacturer's instructions. Ensure that the module's MAC address is clearly visible with the pole handhole cover removed. Install the additional MAC address label on the outside of the pole, directly above the handhole cover. Immediately following installation, provide Tsawwassen First Nations with a listing of the installed streetlights and the MAC addresses of the associated

wireless control modules.

- 3.10.5 TSS

Add clause 3.8.5:

Install antennas, RF surge protectors, coaxial cables, and coaxial cable connectors in accordance with manufacturers' instructions. Perform DC continuity test on completed coaxial cable assemblies prior to final connection. Install and terminate ground wire on RF surge protector. Following installation, assist engineer in confirming RF signal quality and adjust antenna orientations as directed by engineer.

**3.13 Pole Finish
Application**

- 3.13.1 TSS

Delete 3.8.1 and substitute the following:

Pole Finish: Hot dip galvanized and powder coated.

**3.14 Electrical Service
Kiosk and
Components**

Add section 3.14 "Electrical Service Kiosk and Components".

- 3.14.1 TSS

Add clause 3.14.1:

- .1 Mount equipment in kiosk. Configure and test all equipment prior to shipment to site.
- .2 Mount kiosk on concrete pad. The kiosk shall be seismically-anchored to the concrete pad.

- 3.14.2 TSS

Add clause 3.14.2:

Install and connect wireless control modules in accordance with manufacturer's instructions. Ensure that the module's MAC address is clearly visible. Install the additional MAC address label on the inside of the kiosk. Immediately following installation, provide Tsawwassen First Nations with a listing of the installed kiosk and the MAC addresses of the associated wireless control modules.

- 3.14.3 TSS

Add clause 3.14.3:

Install antennas, RF surge protectors, coaxial cables, and coaxial cable connectors in accordance with manufacturers' instructions. Perform DC continuity test on completed coaxial cable assemblies prior to final connection. Install and terminate ground wire on RF surge protector. Following installation, assist engineer in

confirming RF signal quality and adjust antenna orientations as directed by engineer.

<u>Section:</u>	<u>Description:</u>
------------------------	----------------------------

1.3 Source Quality Control

- | | |
|-------------|---|
| - 1.3.2 TSS | <p>Delete clause 1.3.2 and substitute the following:</p> <p>Contractor is responsible to provide to Contract Administrator a soils test commissioned by the contractor specifically for this project. Soils analyses commissioned by the soils manufacturer will not be accepted. The Contract Administrator will designate the soil testing laboratory. Contractor is responsible for arrangement and payment for soil analysis and amendments to growing medium as determined. Contractor shall instruct soil testing laboratory to submit results directly to the Contract Administrator prior to commencement of work. The recommendations of the laboratory will be the basis of requirements for soil acceptance and soil amendments.</p> |
| - 1.3.3 TSS | <p>Add clause 1.3.3:</p> <p>Growing medium shall meet BCSLA/BCLNA Landscape Standard, latest edition, unless otherwise specified.</p> |
| - 1.3.4 TSS | <p>Add clause 1.3.4:</p> <p>Contractor is responsible to provide to Contract Administrator a soils test commissioned by the contractor specifically for this project. Soils analyses commissioned by the soils manufacturer will not be accepted. The Contract Administrator will designate the soil testing laboratory. Contractor is responsible for arrangement and payment for soil analysis and amendments to growing medium as determined. Contractor shall instruct soil testing laboratory to submit results directly to the Contract Administrator prior to commencement of work. The recommendations of the laboratory will be the basis of requirements for soil acceptance and soil amendments.</p> |
| - 1.3.5 TSS | <p>Add clause 1.3.5:</p> <p>Contractor to provide separate soils test(s) for all soil deliveries over 30 days apart. See testing requirements above (1.3.4)</p> |
| - 1.3.6 TSS | <p>Add clause 1.3.6:</p> <p>The Contractor shall guarantee that the growing medium submitted for laboratory analysis will be a representative sample of the growing</p> |

medium delivered to the site. The Contractor shall provide receipts upon request of the Contract Administrator.

- 1.3.7 TSS Add clause 1.3.7:

Imported soils to be free of a weed. Contractor will be responsible for the removal and replacement of approved soils at no cost to the owner.

- 1.3.8 TSS Add clause 1.3.8:

At the discretion of the project Contract Administrator submit up to two additional samples at intervals outlined by the Contract Administrator of growing medium taken from material delivered to site. Samples shall be taken from three (3) random locations and mixed to create a single uniform sample for review.

- 1.3.9 TSS Add clause 1.3.9:

Failure to have the growing medium tested as indicated above may result in the removal of substandard soils at the Contractor's expense.

1.4 Measurement and Payment

- 1.4.4 TSS Add clause 1.4.4:

Contractor to account for additional growing medium required as a result of settlement.

END OF SECTION

Section:

Description:

1.2 References

- 1.2.1 TSS Delete clause 1.2.1 and replace with the following:
Current Edition of British Columbia Landscape Standard

1.6 Samples

- 1.6.2 TSS Add clause 1.6.2:
Contractor to provide cut sheets and seed analysis of approved mixes prior to delivery to site

2.1 Grass Seed

- 2.1.3 TSS Delete clause 2.1.3 and replace with the following:
Seed to have a minimum germination rate of 80% and minimum purity of 97% except where otherwise required by professional selecting seed mixture.

END OF SECTION

Section:

Description:

1.2 References

- 1.2.1 TSS Delete clause 1.2.1 and replace with the following:
Current Edition of British Columbia Landscape Standard

1.6 Samples

- 1.6.2 TSS Add clause 1.6.2:
Contractor to provide cut sheets and seed analysis of approved mixes prior to delivery to site

1.9 Inspection and Testing

- 1.9.2 TSS Add clause 1.9.2:
Finished grade to be approved prior to seeding, refer to section 31 22 01 Site Grading

2.1 Grass Seed

- 2.1.3 TSS Delete clause 2.1.3 and replace with the following:
Seed to have a minimum germination rate of 80% and minimum purity of 97% except where otherwise required by professional selecting seed mixture.

END OF SECTION

Section:

Description:

**1.4 Handling
and Storage**

- 1.4.3 TSS Delete clause 1.4.3 and replace with the following:

No storage of unused sod overnight during growing season

1.6 Samples

- 1.6.2 TSS Delete clause 1.6.1 and replace with the following:

Contractor to provide name of supplier and seed analysis for approval
a min. of 48 hours prior to delivery to site

2.1 Sod

- 2.1.2 TSS Delete clause 2.1.2 and replace with the following:

Sod to be suitable for high traffic areas, offer good wear tolerance,
shall be grown on sand or sandy loam based medium and shall be un-
netted from approved supplier, see section 1.6.2 above.

.1 Sod cut size typical unless stated otherwise in contract
documents, such as areas where large roll applications are
desired

END OF SECTION

Section:

Description:

1.3 Source Quality Control

- 1.3.1 TSS Delete clause 1.3.1 and replace with the following:
- Obtain approval from Contract Administrator of plant material at source prior to shipping. Acceptance of plant material at its source does not prevent rejection on site prior to or after planting operations.
- 1.3.3 TSS Add clause 1.3.3:
- All materials and execution to conform to the latest edition of the BCLNA (BC Landscape and Nursery Association) and BCSLA Landscape Standard
- 1.3.4 TSS Add clause 1.3.4:
- Trees delivered to site to be from nursery with current certification for Phytophthora.
- 1.3.5 TSS Add clause 1.3.5:
- All root balls to be free of invasive and weed species. Contractor responsible for removal and replacement at their cost of all plant stock and effected soil to be found contaminated
- 1.3.6 TSS Add clause 1.3.6:
- Plant substitutions require a minimum of 2 months notice in writing for all Tree, Shrub, and Groundcover Species. All subs to be approved by project Contract Administrator
- 1.3.7 TSS Add clause 1.3.7:
- Plant specimen search to extend a minimum area to extend to BC, Washington and Oregon States

1.4 Scheduling

- 1.4.3 TSS Delete clause 1.6.1 and replace with the following:
- Plan, schedule and execute work to ensure a continuous supply of water for landscape purposes in adequate amounts and at adequate

pressures for satisfactory irrigation of all plants from time of delivery until total performance if not responsible for maintenance thereafter.

1.5 Handling and Storage

- 1.5.5 TSS Add clause 1.5.5:

Immediately store and protect plant material that will not be installed within 2 hour after arrival.

- 1.5.6 TSS Add clause 1.5.6:

Protect stored plant material from frost, wind and sun and as follows:

- .1 For bare root plant material preserve moisture around roots by heeling-in or burying roots in topsoil and watering to full depth of root zone.
- .2 For pots and containers maintain moisture level in containers. Heel-in fibre pots.
- .3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

1.8 Site Examination

- 1.8.2 TSS Add clause 1.8.2:

Verify existence and location of any on-site utilities. Contact the contract administrator immediately for directions as to procedure should any piping or utilities be encountered during excavation.

1.10 Inspection and Testing

- 1.10.2 TSS Add clause 1.10.2:

Notify Contract Administrator when plants are available for inspection. All plants are subject to inspection and may be rejected for failure to comply with this specification at any time until total performance. Remove and replace rejected material at no cost to owner

- 1.10.3 TSS Add clause 1.10.3:

Tagged plant material selected and tagged at nursery to remain tagged until plants have been inspected onsite and approved by project Contract Administrator

- 1.10.4 TSS Add clause 1.10.4:

Subsequent site inspections to review transplanted and supplied materials will be performed over the duration of the contract

- 1.10.5 TSS

Add clause 1.10.5:

Final inspection to be made at the end of warranty period as specified. For release from contract all material must be alive and in a healthy growing condition at the time of the inspection.

- 1.10.6 TSS

Add clause 1.10.6:

Project Contract Administrator may waive one or more inspections at their discretion, such actions will not impair the right of the project Contract Administrator to inspect work or materials which have been damaged or in any way do not conform to contract documents.

END OF SECTION

<u>Section</u>	<u>Description</u>
2.0 PRODUCTS	
2.1 General	
- 2.1.1 TSS	Delete clause 2.1.1 and substitute the following: Refer to the approved products list for pipe material.
2.2 Pipe, Joints and Fittings	
- 2.2.4 TSS	Delete 2.2.4 and substitute the following: Refer to the approved products list for pipe joints.
- 2.2.4 TSS	Delete 2.2.4 and substitute the following Refer to the approved products list for pipe fittings.
2.3 Valves and Valve Boxes	
- 2.3.2.7 TSS	Add clause 2.3.2.7 Valves require Tyton Joint gaskets or approved equal, when a flanged connection is not used.
- 2.3.2.8 TSS	Add clause 2.3.2.8 Flange connections to be used for valve installation with HDPE pipe.
- 2.3.2.9 TSS	Add clause 2.3.2.9 For valves that are normally closed (indicated on construction drawings), the underside of the valve box lid shall be painted orange. Also, a tag labelled "normally closed" shall be securely glued on the underside of the valve box lid.

3.0 EXECUTION

3.14 Corrosion Protection

- 3.14.2 TSS Add clause 3.14.2

Where specified, provide corrosion protection measures per
Section 26 42 13 - Cathodic Protection

- 3.14.3 TSS Add clause 3.14.3

The Contractor shall test the conductivity of all cathodic protection
in the presence of the Contract Administrator prior to backfill.

- 3.14.4 TSS Add clause 3.14.4

Field coating of all fittings, valves, air release valve, bolts, tie rods,
clamps, etc. and repair to damage coated areas on fittings shall
be done with a minimum of (1) one coat of Coal Tar Mastic
Polyguard CA-14, Royston Roskote A-51 Mastic or Tapecoat
Canada Inc. T.C. Mastic.

- 3.14.5 TSS Add clause 3.14.5

The anode material shall be magnesium high potential, pre-
packed in a backfill consisting typically of 75% gypsum, 20%
bentonite and 5% sodium sulphate. The nominal composition of
the anode is 98.9% Mg, 0.01% Al, 0.1% Mn, other 0.09%. Each
anode shall have a three (3) metre length of No. 8 TWU insulated
copper wire brazed to the anode core and sealed.

Anodes may be obtained from any of the following (or approved
equal):

- .1 B.H. Levelton & Associates Ltd.
- .2 Commonwealth Seager Group.
- .3 United Corrosion Consultants.
- .4 D.W. Lemmon & Associates Ltd.
- .5 Thomco Supply Ltd.

The anode sizes to be used shall be eight (8) kg or as shown on
the drawings.

END OF SECTION

<u>Section</u>	<u>Description</u>
2.0 PRODUCTS	
2.1 General	
- 2.1.3 TSS	Add clause 2.1.3 Refer to the approved products list.
2.2 Plastic Pipe, Mainline Smooth Profile	
- 2.2.6 TSS	Add clause 2.2.6 Pipe joints shall be restrained non-metallic joints, Cobra Lock or approved equal
3.0 EXECUTION	
3.21 Corrosion Protection	
- 3.21.1 TSS	Add clause 3.21.1 Where specified, provide corrosion protection measures per <u>Section 26 42 13 - Cathodic Protection</u>
- 3.21.2 TSS	Add clause 3.21.2 The Contractor shall test the conductivity of all cathodic protection in the presence of the Contract Administrator prior to backfill.
- 3.21.3 TSS	Add clause 3.21.3 Field coating of all fittings, valves, air release valve, bolts, tie rods, clamps, etc. and repair to damage coated areas on fittings shall be done with a minimum of (1) one coat of Coal Tar Mastic Polyguard CA-14, Royston Roskote A-51 Mastic or Tapecoat Canada Inc. T.C. Mastic.
- 3. 21.4 TSS	Add clause 3.21.4 The anode material shall be magnesium high potential, pre-packed in a backfill consisting typically of 75% gypsum, 20% bentonite and 5% sodium sulphate. The nominal composition of the anode is 98.9% Mg, 0.01% Al, 0.1% Mn, other 0.09%. Each anode shall have a three (3) metre length of No. 8 TWU insulated

copper wire brazed to the anode core and sealed.

Anodes may be obtained from any of the following (or approved equal):

- .1 B.H. Levelton & Associates Ltd.
- .2 Commonwealth Seager Group.
- .3 United Corrosion Consultants.
- .4 D.W. Lemmon & Associates Ltd.
- .5 Thomco Supply Ltd.

The anode sizes to be used shall be eight (8) kg or as shown on the drawings.

END OF SECTION

<u>Section</u>	<u>Description</u>
2.0 PRODUCTS	
2.1 General	
- 2.1.3 TSS	Add clause 2.1.3 Refer to the approved products list for pipe material.
2.2 Pipe, Joints and Fittings	
- 2.2.3 TSS	Delete 2.2.3 and substitute the following: Refer to the approved products list for pipe joints.
- 2.2.5 TSS	Delete 2.2.5 and substitute the following Refer to the approved products list for pipe fittings.
2.3 Valves and Valve Boxes	
- 2.3.2.7 TSS	Add clause 2.3.2.7 Valves require Tyton Joint gaskets or approved equal, when a flanged connection is not used.
- 2.3.2.8 TSS	Add clause 2.3.2.8 Flange connections to be used for valve installation with HDPE pipe.
- 2.3.2.9 TSS	Add clause 2.3.2.9 For valves that are normally closed (indicated on construction drawings), the underside of the valve box lid shall be painted orange. Also, a tag labelled "normally closed" shall be securely glued on the underside of the valve box lid.
2.7 Pigging Chambers	
- 2.7.1 TSS	Add clause 2.7.1 Materials and installation for Pre-Cast Manhole to <u>Section 33 44 01</u> - Manholes and Catchbasins. Manhole concrete base should not be used. Instead use a minimum 300mm thick drain rock base to allow the groundwater to drain freely in chamber.

- 2.7.2 TSS

Add clause 2.7.2

Materials and installation for forcemain piping to pigging chamber to Section 33 34 01.

- 2.7.3 TSS

Add clause 2.7.3

Male quick connect coupling in chamber shall be flanged c/w cap. Coupling to be non-metallic, Watts or approved equal.

3.0 EXECUTION

3.10 Corrosion Protection

- 3.10.2 TSS

Add clause 3.10.2

Where specified, provide corrosion protection measures per Section 26 42 13 - Cathodic Protection

- 3.10.3 TSS

Add clause 3.10.3

The Contractor shall test the conductivity of all cathodic protection in the presence of the Contract Administrator prior to backfill.

- 3.10.4 TSS

Add clause 3.10.4

Field coating of all fittings, valves, air release valve, bolts, tie rods, clamps, etc. and repair to damage coated areas on fittings shall be done with a minimum of (1) one coat of Coal Tar Mastic Polyguard CA-14, Royston Roskote A-51 Mastic or Tapecoat Canada Inc. T.C. Mastic.

- 3.10.5 TSS

Add clause 3.10.5

The anode material shall be magnesium high potential, pre-packed in a backfill consisting typically of 75% gypsum, 20% bentonite and 5% sodium sulphate. The nominal composition of the anode is 98.9% Mg, 0.01% Al, 0.1% Mn, other 0.09%. Each anode shall have a three (3) metre length of No. 8 TWU insulated copper wire brazed to the anode core and sealed.

Anodes may be obtained from any of the following (or approved equal):

- .1 B.H. Levelton & Associates Ltd.
- .2 Commonwealth Seager Group.
- .3 United Corrosion Consultants.
- .4 D.W. Lemmon & Associates Ltd.
- .5 Thomco Supply Ltd.

The anode sizes to be used shall be eight (8) kg or as shown on the drawings.

END OF SECTION

Section

Description

1.0 GENERAL

- 1.0.1 TSS

Add clause 1.0.1

This section refers to those portions of the Work that are unique to the supply and installation of prefabricated submersible sewage lift stations. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

1.1 Related Work

- 1.1.1 TSS

Add clause 1.1.1

Excavating, Trenching, and Backfilling	Section 31 23 01
Aggregates and Granular Materials	Section 31 05 17
Sanitary Sewers	Section 33 30 01
Sewage Force Mains	Section 33 34 01
Concrete Reinforcement	Section 03 20 01
Cast-in-Place Concrete	Section 03 30 53

1.3 Shop Drawings and Data Sheets

- 1.3.1 TSS

Add clause 1.3.1

Five copies of shop drawings prepared under the seal of Professional Engineer(s) registered in the Province of British Columbia three weeks prior to fabrication for:
lift station complete
power supply and control panel

- 1.3.2 TSS

Before fabrication, the Contractor shall submit to the Contract Administrator for review five copies of station layout drawings and pump performance curves.

- 1.3.3 TSS

All drawings and data sheets required for review as indicated on the Contract Drawings.

1.4 Requests for Approved Equal

- 1.4.1 TSS

Add clause 1.4.1

Any requests for approved equal shall contain sufficient documentation regarding the service organization which is available to back up the tendered pumping units. In particular, the

service organization shall:

- have been in existence a sufficient length of time to have established a reputation which can be backed up with references;
- have a number of qualified employees whose major commitment is to carry out service calls; and
- have a well-equipped local maintenance shop.

- 1.4.2 TSS

Add clause 1.4.2

The Contractor shall also be prepared to demonstrate the availability of commonly required spare parts. If these are not kept in stock locally, the anticipated delivery period must be clearly indicated in the Form of Tender.

2.0 EXECUTION

2.1 Excavation and Backfilling

- 2.1.1 TSS

Add clause 2.1.1

To requirements of Section 31 23 01 Excavation, Trenching, and Backfilling.

- 2.1.2 TSS

Add clause 2.1.2

Start backfilling only after the concrete has acquired a suitable degree of strength and only after obtaining written permission from the Contract Administrator. No backfilling of walls shall take place before the slabs have been cast and have reached a minimum of 75% design strength.

- 2.1.3 TSS

Add clause 2.1.3

Make all fills and embankments to elevations, contours, and slopes shown on the drawings.

- 2.1.4 TSS

Add clause 2.1.4

Grade top layer carefully to smooth regular surface, with a minimum thickness of 50 mm of 19 mm minus crushed gravel, or asphalt as designated. Swale to be sodded as per specifications for swale construction.

- 2.1.5 TSS

Add clause 2.1.5

Allow for any settlement which may occur in order that the finished embankments will be to the final grades as shown on the drawings.

- 2.1.6 TSS

Add clause 2.1.6

Excavate and remove all materials whatever their nature and condition to depths and dimensions necessary for the construction of the structure and piping. Native materials can be used to establish 4H:1V fill slopes as long as structural fill is placed at minimum 2H:1V slopes, subject to verification by a Geotechnical Engineer.

- 2.1.7 TSS

Add clause 2.1.7

Furnish all equipment for construction, temporary supports including shoring, bracing, cribs, coffer dams, etc. and for de-watering.

- 2.1.8 TSS

Add clause 2.1.8

Carry out excavations from the natural ground surface. Do not use crawler tractors or large equipment at the bottom of the excavation without written consent of the Contract Administrator.

- 2.1.9 TSS

Add clause 2.1.9

All equipment used for de-watering and excavation shall be of a suitable and rugged type to assure continuous operation.

- 2.1.10 TSS

Add clause 2.1.10

Make special provisions to relieve the water pressure and prevent flotation or damage to parts of the works in case of accidental stoppage of de-watering equipment.

- 2.1.11 TSS

Add clause 2.1.11

Fill with specified sub-base or lean concrete as directed by the Contract Administrator, at no cost to the Owner when any over-excavation has been carried out without prior written approval from the Contract Administrator or the sub-grade has deteriorated due to traffic and lack of drainage.

- 2.1.12 TSS

Add clause 2.1.12

Notify the Contract Administrator for inspection and approval after the excavation is completed.

- 2.1.13 TSS

Add clause 2.1.13

Do not place any concrete until the Contract Administrator has approved the depth of excavation and the character of the foundation material. The contractor is responsible for contacting the Geotechnical Engineer at least 24 hours prior to need for inspection.

2.2 Accessibility

- 2.2.1 TSS

Add clause 2.2.1

Locate all equipment which must be serviced, operated or maintained in fully accessible positions, with minimum interference and maximum useable space. Make minor deviations from drawings to allow for better accessibility, but obtain prior approval for changes of magnitude or changes involving extra cost.

2.4 Pipe Installation

- 2.4.1 TSS

Add clause 2.4.1

Pipe shall be adequately supported on adjustable pipe saddle supports or from pipe hangers or brackets during construction and completion to prevent abnormal stresses being imposed on items of equipment such as pump flanges.

- 2.4.2 TSS

Add clause 2.4.2

Inaccuracies in pipe fabrication causing stresses to be imposed on the equipment will not be permitted. The Contract Administrator reserves the right if he deems it desirable, to have flanged joints unbolted at the equipment flanges to determine if there is any misalignment. Unsatisfactory workmanship shall be corrected by readjustment of supports, anchor points, or re-fabrication.

- 2.4.3 TSS

Add clause 2.4.3

Valves shall be installed in accordance with the manufacturer's recommendations.

- 2.4.4 TSS

Add clause 2.4.4

Before installing bolted connections, pipe ends, and gaskets shall be absolutely clean. Gaskets shall be lubricated with soapy water and bolts with thread lubricant. Bolts shall be tightened progressively by the crossover method and not in rotation around

the joint. Bolts shall be torqued to the manufacturer's requirements. Wrenches used for tightening bolts shall be in good condition and properly sized to prevent rounding of nuts and bolt heads.

- 2.4.5 TSS

Add clause 2.4.5

During all stages of construction, piping shall be protected from damage from any cause. Openings in the piping system shall be securely covered, capped, or plugged to prevent collection of dirt, debris, or other extraneous matter during the entire construction.

- 2.4.6 TSS

Add clause 2.4.6

Damaged work shall be removed and replaced with new material to the satisfaction of the Contract Administrator.

**2.5 Pumps and
Accessories**

- 2.5.1 TSS

Add clause 2.5.1

Locate and discharge elbows on the sump floor at exact locations required so that guide rails which connect from them to the access frame will be in perfect alignment.

- 2.5.2 TSS

Add clause 2.5.2

Firmly anchor discharge elbows to the floor at their proper location.

- 2.5.3 TSS

Add clause 2.5.3

Install guide rails.

- 2.5.4 TSS

Add clause 2.5.4

Lower pumps on guide rail system until contact is made with discharge elbows. Ensure that system functions to give leak-tight connection.

2.6 Start-Up

- 2.6.1 TSS

Add clause 2.6.1

Lift station shall be completed, including work of other sections, before start-up.

- 2.6.2 TSS

Add clause 2.6.2

Start-up of equipment to take place in the presence of a trained representative of the Equipment Supplier. Three copies of draft Operation and Maintenance Manuals shall be provided to the Contract Administrator at least two (2) weeks in advance of start-up. Six copies of final Operation and Maintenance Manuals shall be provided to the Contract Administrator no longer than one (1) week following successful commission of lift station. The Contract Administrator may refuse to issue Completion Certificate until final O&M Manuals are submitted.

- 2.6.3 TSS

Add clause 2.6.3

Set level and align all equipment to the complete satisfaction of the manufacturer's representative. The services of the manufacturer's representative are of an advisory nature and nothing related to those services relieves the Contractor of the necessity of providing his own supervisory personnel. Ensure that the manufacturer's representative receives sufficient advance notice of his requirement to be on-site so as to avoid delaying the construction schedule.

- 2.6.4 TSS

Add clause 2.6.4

Carefully check the operation and controls of the equipment.

- 2.6.5 TSS

Add clause 2.6.5

Notify the Contract Administrator when the operation and controls of the equipment are satisfactory.

- 2.6.6 TSS

Add clause 2.6.6

Provide the necessary facilities for the Contract Administrator to check the operation of the equipment.

- 2.6.7 TSS

Add clause 2.6.7

The Contractor shall make provisions for adequate supply of water to the wet well and force main for testing purposes. Testing will include checking performance of all pumps, floats, and controls. At minimum the following tests will be conducted.

- 2.6.7.1 TSS

Add clause 2.6.7.1

Pump Condition – i.e., pump body, impeller running free, quick disconnect connection, cable connections, gaskets and oil level.

- 2.6.7.2 TSS

Add clause 2.6.7.2

Wet Well Condition – i.e., pump sliding free on guide rails, pump cable with sufficient slack, floats suitably positioned and will not snarl, Ultra Sonic sensor properly positioned and calibrated, no cable splices or junction box in the wet well, well clean.

- 2.6.7.3 TSS

Add clause 2.6.7.3

Control Panel Condition – i.e., components including motor overloads correctly rated for the pumps. Record over-load settings on schematic, date and sign.

- 2.6.7.4 TSS

Add clause 2.6.7.4

Start-Up Operation – i.e., supply voltage suitable, pump rotation correct, operation of pumps – by float switches – HOA selectors – lead pump selector – overloads isolate associated control, alarm float.

- 2.6.7.5 TSS

Add clause 2.6.7.5

Pump Load Checks – i.e., load current on all phases for single and parallel pump operation, supply voltage under load. Confirm pumping rate and operating head.

- 2.6.7.6 TSS

Add clause 2.6.7.6

Liaise with the Contract Administrator to ensure that the Contract Administrator, the Owner's representative, the Contractor, and the Equipment Supplier are present for the start-up and testing program.

- 2.6.7.7 TSS

Add clause 2.6.7.7

The Owner will not take over operation and maintenance of any equipment until the work of all related sections has been completed in the area in which the equipment is located and all equipment has operated in its intended manner to the satisfaction of the Contract Administrator.

- 2.6.7.8 TSS

Add clause 2.6.7.8

Cost of any temporary power costs for the start-up procedure shall be the responsibility of the Contractor.

2.7 Protection

- 2.7.1 TSS

Add clause 2.7.1

Protect the work and material of all other sections from damage and make good all damage thus caused, to the satisfaction of the Contract Administrator.

- 2.7.2 TSS

Add clause 2.7.2

Be responsible for work and equipment until finally inspected, tested, and accepted, protect work against theft, injury, or damage, and carefully store material and equipment received on site which are not immediately installed. Close open ends of work with temporary covers and plugs during construction to prevent entry of obstructing materials.

2.8 Cleaning

- 2.8.1 TSS

Add clause 2.8.1

Any dirt rubbish, or grease on walls, floors, or fixtures for which the Contractor is responsible must be removed and the premises left in first class condition in every respect.

- 2.8.2 TSS

Add clause 2.8.2

De-water station wet well and remove all dirt and grit from bottom of station.

2.9 Operation and Maintenance Manual

- 2.9.1 TSS

Add clause 2.9.1

Supply six copies, hardbacked bound manuals with all the information required for maintenance, operation, parts catalogue and lubrication. The following information shall be included in the manual:

- a) List of Contents
- b) Section 1 – Introduction (information to be inserted by the Contract Administrator)
- c) Section 2 – Design Description (information to be inserted by the Contract Administrator)
- d) Section 3 – Commissioning
 - Commissioning Procedure and Record Sheet (information to be inserted by the Contract Administrator)

Administrator)

- e) Section 4 – Mechanical
 - Description of mechanical equipment and its operation
 - Equipment manufacturer's data and service manuals
- f) Section 5 – Electrical and Controls
 - Description of electrical and controls equipment and the systems operation
 - Level and Alarm Settings
 - Data sheets c/w programmed for all options for electronic instruments
 - Test Certificates or Reports and Approval Certificates of Tests
 - PLC Ladder Logic Printout
 - Equipment manufacturer's data and service manuals
 - Alarm dialer program and phone number call outs
- g) Section 6 – Maintenance Program
 - Listing of equipment with associated warranty schedule,
 - recommended spare parts,
 - nearest service centre,
 - Names, addresses and telephone numbers of all major Subcontractors and Suppliers
 - Emergency operating procedures.
- h) Appendix A – Construction Record Drawings (information to be inserted by the Contract Administrator)
- i) Appendix B – Approved Shop Drawings

Each section shall be separated from the preceding section with a plasticized divider with a tab denoting contents of the section.

- 2.9.2 TSS

Add clause 2.9.2

Review all of these instructions with Tsawwassen personnel before the commencement of this maintenance period. A training session shall be organized by the Contractor for the Tsawwassen designated operations and maintenance worker(s). The Contract Administrator must be informed 72 hours in advance of the training session to allow for attendance. The Contractor shall be sure that suitable trained operator(s) are retained to lead the training. The Operations and Maintenance Manual must be thoroughly reviewed at the lift station site with demonstration of all regular and emergency operating techniques.

- 2.9.3 TSS

Add clause 2.9.3

General catalogues will not be accepted and bulletins must deal specifically with the equipment provided. Printed on the centres of the covers shall be the words "Tsawwassen First Nation - Sewage Pump Station No. ____." In the lower left-hand corner, the supplier's name, address, and phone and fax numbers.

2.10 Spare Parts

- 2.10.1 TSS

Add clause 2.10.1

A spare impeller will be supplied with the lift station.

2.11 Warranty

- 2.11.1 TSS

Add clause 2.11.1

All equipment shall be CSA approved, and be warranted for one (1) year from the date of Substantial Completion.

END OF SECTION

Section

Description

1.0 GENERAL

1.1 TSS

Add clause 1.1

Section 33 34 03 TSS refers to those portions of the Work that are unique to the supply and installation of Fibreglass Reinforced Plastic Pipe and Fittings. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

1.2 Related Work

- 1.2.1 TSS

Add clause 1.2.1

Excavating, Trenching and Backfilling
Aggregates and Granular Materials
Sanitary Sewers
Sewage Forcemains

Section 31 23 01
Section 31 05 17
Section 33 30 01
Section 33 34 01

2.0 MATERIALS

2.1 Resin

- 2.1.1 TSS

Add clause 2.1.1

The resin used shall be of a commercial grade and shall be evaluated as a laminate by test, or known from previous services to be acceptable for the environment. Unless otherwise specified, the same resin will be used throughout the laminate.

For sanitary sewage applications the resin shall be Ashland Aropol K1903 isophthalic resin or approved equal.

- 2.1.2 TSS

Add clause 2.1.2

When resin has been supplied by the manufacturer with an optimal monomer content for normal use, styrene or other monomer shall not be added except for minor adjustments of viscosity. Such additions shall not be more than 5% by weight and shall be consistent with the resin manufacturer's recommendations.

- 2.1.3 TSS

Add clause 2.1.3

The resin may contain thixotropic agents as required for viscosity control to a maximum of 3% by weight.

- 2.1.4 TSS

Add clause 2.1.4

Antimony compounds or other fire retardant agents may be added as required for improved fire resistance.

- 2.1.5 TSS

Add clause 2.1.5

The resin shall be suitable for service at temperatures specified in the Contract Documents or on the Contract drawings

**2.2 Glass Fibre
Reinforcing Materials**

- 2.2.1 TSS

Add clause 2.2.1

All glass fibre used as reinforcing materials, except the surfacing veil, shall be commercial Grade E glass. Glass fibre made from other glass will only be acceptable if physical and chemical properties are equal to or better than Grade E glass.

- 2.2.2 TSS

Add clause 2.2.2

Surfacing veil used on surfaces exposed to chemical attack shall be commercial Grade 'C' glass.

- 2.2.3 TSS

Add clause 2.2.3

All glass fibres shall have received a chemical surface treatment immediately after they were formed. The sizing agent for this surface treatment shall be compatible with the resin to be used. The diameter of the glass fibres shall be selected by the manufacturer for imparting optimum properties to the F.R.P. laminates.

- 2.2.4 TSS

Add clause 2.2.4

Continuous rovings, woven rovings and chopped strand mat shall be selected by the manufacturer to provide the physical strength requirements described herein.

2.3 F.R.P. Laminate

- 2.3.1 TSS

Add clause 2.3.1

The laminate shall consist of the following:

- Primary chemical-resistant surface
- Internal anti-wicking barrier
- Additional reinforcing layers as required
- Exterior surface.

- 2.3.2 TSS

Add clause 2.3.2

The primary chemical-resistant surface shall be between .25 and .50 millimetres thick. This surface shall be a resin rich surface containing less than 20 percent of reinforcing material.

- 2.3.3 TSS

Add clause 2.3.3

The internal anti-wicking barrier shall have a minimum thickness of 3.0mm and shall be reinforced with more than 20% and less than 30% by weight of chopped strand mat.

- 2.3.4 TSS

Add clause 2.3.4

Additional reinforcing layers shall be built up for providing sufficient strength to meet the mechanical requirements. This additional thickness may be constructed either by hand lay-up or by filament winding.

-2.3.4.1 TSS

Add clause 2.3.4.1

Hand Lay-Up Construction

- For hand lay-up laminate alternate layers of chopped strand mat and woven roving shall be added until the required number of layers have been applied or the required wall thickness has been obtained. The exterior of all hand lay-up laminates shall consist of a chopped strand mat. Mat and woven rovings shall be lapped at least 50 millimetres. All overlaps shall be offset from those in previous layers.
- Reinforcing materials shall be placed into a layer of liquid resin applied to the mold or to the laminate already on the mold. The resin shall then be worked through the material from below to the outer surface.
- Glass content shall be between 30% and 50% by weight.

- Laminates shall meet the mechanical properties of Table 1, based on total thickness of laminate, including liner. A factor of safety of 10 shall be applied for calculating allowable working stresses.

Table 1: Requirements for Properties of Newly Fabricated Reinforced-Polyester Laminates

Property at 73.4°F (23°C)	Thickness (mm)				Test Method
	5 or less	6	8	10 and Up	
	MPa	MPa	MPa	MPa	
Ultimate tensile strength, min.	6	8	10	10	ASTM D638
Flexural strength, minimum	10.7	12.7	13.3	14.7	ASTM D790
Flexural modulus of elasticity (tangent), minimum	467	533	600	667	ASTM D790

-2.3.4.2 TSS

Add clause 2.3.4.2

Filament Wound Construction

- Filament wound structural laminates shall be constructed by saturating continuous rovings in a resin bath and then winding the rovings in a controlled pattern on a suitable mold. Each cover, or bi-directional layer, shall consist of two complete layers of continuous rovings. Rovings of each layer shall be placed parallel and close together touching each other. Each layer shall be placed at equal but opposite angles to the axis of the mold. The rovings of these layers shall be interwoven at uniform intervals not exceeding 2.0 metres. The winding pattern shall be regular and shall produce a dense laminate without unreinforced resin pockets.
- Filament wound structural laminates shall consist of not less than two covers. Each cover shall consist of two layers of rovings.
- Glass content shall be between 60% and 70% by weight.
- Winding angles shall be between 45° and 70° off the horizontal axis.
- Laminates shall meet the mechanical properties of Table 1.

2.4 F.R.P. Pipe

- 2.4.1 TSS

Add clause 2.4.1

F.R.P. pipe shall be produced to uniform lengths, either flanged or plain ended.

- 2.4.2 TSS

Add clause 2.4.2

Flanges will be to Sub-section 2.5.

- 2.4.3 TSS

Add clause 2.4.3

Minimum pipe wall thicknesses shall be as per Table 2 (hand layup) or Table 3 (filament wound). Thickness may be varied to accommodate higher temperatures. Working temperatures will be as outlined in the Contract Documents or on the Contract Drawings.

- 2.4.4 TSS

Add clause 2.4.4

Plain ended pipe shall have the pipe face machined flat and square.

2.5 Flanges

- 2.5.1 TSS

Add clause 2.5.1

Flanges shall be constructed to dimensions as per Drawing No. B515-15-A as an integral part of a stub or fitting.

- 2.5.2 TSS

Add clause 2.5.2

The inner liner shall extend across the face of the flanges.

- 2.5.3 TSS

Add clause 2.5.3

Flange faces shall not be machined.

- 2.5.4 TSS

Add clause 2.5.4

Each flanged stub or fitting shall have a minimum of 2 layers of 815 g/m² woven rovings extending without a break into the flange

The first layer of roving shall be close to the inner liner of the pipe. The last layer shall be on the outside, covered by one layer of mat. Flange thickness 'W' shall be made up of alternate layers of mat and woven roving. As many of these composite layers as permitted by neck dimensions 'X' shall taper out in shear section "4W" or in layup 'K', see Drawing No. B515-15-A. The longest

layers shall be placed towards the outside.

- 2.5.5 TSS

Add clause 2.5.5

Minimum glass content in flange and flange neck shall be 40% by weight.

- 2.5.6 TSS

Add clause 2.5.6

Flanges for 690 KPa and higher pressure ratings shall have a built-up FRP ring of thickness 'F' when specified in Drawing No. B515-15-A. This ring shall reinforce the flange and provide sufficient seating surface for bolts and washers. It shall be constructed after flange and stub are cured.

Table 2: Reinforced Polyester Pipe – Minimum Wall Thickness (Hand-Layup)

Normal Pipe Diameter (mm)	Pressure Rating – KPa (PSI)					
	345 (50)		690 (100)		1035 (150)	
	Layers: Mat/Roving	'T' mm	Layers: Mat/Roving	'T' mm	Layers: Mat/Roving	'T' mm
50	Mat. Only	5.0	Mat. Only	5.0	Mat. Only	5.0
75	Mat. Only	5.0	Mat. Only	5.0	2/1	6.5
100	2/1	6.5	2/1	6.5	2/1	6.5
150	2/1	6.5	2/1	6.5	4/3	9.5
200	2/1	6.5	3/2	8.0	5.4	11.0
250	2/1	6.5	4/3	9.5	6.5	13.0
300	2/1	6.5	5/4	11.0	7/6	14.5
350	3/2	8.0	6/5	13.0	8/7	16.0
400	3/2	8.0	7/6	14.5	9/8	17.5
450	4/3	9.5	7/6	14.5	10/9	19.0
500	4/3	9.5	8/7	16.0	11/10	20.5
600	5/4	11.0	9/8	17.5	13/12	22.0
750	6/5	13.0	11/10	20.5	15/14	25.5

- 2.5.7 TSS

Add clause 2.5.7

The ring laminate shall be constructed from alternate layers of chopped strand mat and woven rovings, either parallel or normal to flange face, or it may be wound with uni-directional filaments, provided washers will have a smooth seating surface and filaments are well wetted out. The bond between stub and ring shall be broken by applying a suitable parting agent under the ring up to the bolt circle.

- 2.5.8 TSS

Add clause 2.5.8

Flanges may be laminated onto pipes or fittings as per Drawing No. B515-15-A.

Pipe or fitting ends shall be cut true and square to the centreline. At the end, the structural wall shall be bevelled approximately 30° exposing the liner. The liner of the flange face shall be laid up on a flange mold and pushed onto the pipe or fitting end while still soft. After the liner has cured, complete the flange laminate as per paragraph 2.5.4.

Table 3: Reinforced Polyester Pipe – Minimum Wall Thickness (Filament Wound)

Normal Pipe Diameter (mm)	Pressure Rating – KPa (PSI)					
	345 (50)		690 (100)		1035 (150)	
	Covers	'T' mm	Covers	'T' mm	Covers	'T' mm
50	2	5.3	2	5.3	2	5.3
75	2	5.3	2	5.3	3	6.6
100	3	6.6	3	6.6	3	6.6
150	3	6.6	3	6.6	5	9.1
200	3	6.6	4	7.9	7	11.1
250	3	6.6	5	9.1	8	13.0
300	3	6.6	7	11.1	9	14.2
350	4	7.9	8	13.0	11	16.8
400	4	7.9	9	14.2	12	18.0
450	5	9.1	9	14.2	14	20.6
500	5	9.1	11	16.8	14	20.6
600	7	11.7	12	18.0	15	21.8
750	8	13.0	14	20.6	18	25.4

- 2.5.9 TSS

Add clause 2.5.9

Flange tolerances shall be:

Flange thickness: ± 2 mm

Flatness of Flange Face: ± 1 mm

Flatness of Flange Back: ± 3 mm of inside pipe diameter.

Alignment: perpendicular to $\frac{1}{2}^\circ$ to axis of stub or fitting

- 2.5.10 TSS Add clause 2.5.10
- Full face flange diameters and drilling of flange and back-up flanges shall conform to the following standards:
- 50 mm up to 600 mm sizes -
ANSI B16.5 for 150 lb. Steel Flanges
- 650 mm up to 1200 mm sizes -
ANSI B16.1 for 125 lb. Cast Iron Flanges.
- 2.5.11 TSS Add clause 2.5.11
- Bolt holes in flanges shall be drilled.
- 2.5.12 TSS Add clause 2.5.12
- Inside of bolt holes and outside edge of flanges shall be brush coated with resin. Bolt holes shall be drilled oversize to allow for thickness of resin.

2.6 Fittings

2.6.1 Elbows

- 2.6.1.1 TSS Add clause 2.6.1.1
- Structural laminate shall have 1.5 times the number of mat and woven rovings specified for hand lay-up pressure pipe in Table 2.
- 2.6.1.2 TSS Add clause 2.6.1.2
- Flanges shall be constructed as per Drawing No. B515-15-A as an integral part of the fitting laminate. Butt ends shall be tapered at approximately 10:1 to the minimum wall thickness given in Table 2.

2.6.2 Reducers

- 2.6.2.1 TSS Add clause 2.6.2.1
- Structural laminate shall be equal to those specified in Table 2 for pipe size equal to large end diameter.
- 2.6.2.2 TSS Add clause 2.6.2.2
- Flanges shall be constructed as per Drawing No. B515-15-A as an integral part of the fitting.
- 2.6.2.3 TSS Add clause 2.6.2.3

Butt ends shall be fabricated sufficiently long to allow for field installation as per Sub-section 3.0.

2.6.3 Molded Tees

- 2.6.3.1 TSS

Add clause 2.6.3.1

Liner and structural laminate shall be constructed on suitable mold with rounded transition between branch and run. Radius of the transition shall be equal to 1/3 of the inside diameter of the branch or 100 mm maximum.

- 2.6.3.2 TSS

Add clause 2.6.3.2

Structural laminate shall have 1.5 times the number of mat and woven rovings specified in Table 2 for pipe of equal diameter and pressure rating to the run of tee.

- 2.6.3.3 TSS

Add clause 2.6.3.3

Taper butt ends at 10:1 to the nominal wall thickness in Table 2.

- 2.6.3.4 TSS

Add clause 2.6.3.4

Flanges shall be full-face type.

- 2.6.3.5 TSS

Add clause 2.6.3.5

Molded tees for design pressure over 517 KPa shall be reinforced with bands of continuous filament rovings wound at uniform tension diagonally across main run and circular around branch.

Width of bands shall be 1/3 inside diameter of branch, up to 100 mm maximum width. Thickness of bands shall be 1/3 of wall thickness of tee but not less than 3 mm. Bands shall taper to feather edges.

- 2.6.3.6 TSS

Add clause 2.6.3.6

A filler laminate equal to wall thickness of the tee shall be placed centered under crossing of the bands. The filler laminate shall taper to a feather edge at a radial distance of ½ of the main run diameter.

3.0 INSTALLATION

3.1 Trench Excavation and Backfill

Add clause 3.1

Trench excavation and backfill as per Sub-section 5.2.

3.2 F.R.P. Field Joints

3.2.1 Protection of Working Areas

- 3.2.1.1 TSS

Add clause 3.2.1.1

The cure of FRP laminates and their bond to existing laminates is affected by temperature and humidity.

- 3.2.1.2 TSS

Add clause 3.2.1.2

Whenever possible, field joints shall be made in heated and ventilated buildings.

- 3.2.1.3 TSS

Add clause 3.2.1.3

If field joints have to be made outside, they shall be made under suitable covers to provide shade during sunny periods and to protect the work against possible rain showers.

- 3.2.1.4 TSS

Add clause 3.2.1.4

When the relative humidity is more than 70%, or when the air temperature is less than 15° (60°F), field joints shall be made inside a protective enclosure. This enclosure shall be heated until the relative humidity has decreased to 60% or less. The minimum temperature in the enclosure shall be 15°C (60°F).

- 3.2.1.5 TSS

Add clause 3.2.1.5

Excavations for field joints on underground pipe lines shall be kept free of standing water. the bottom of the excavation inside the protective enclosure shall be covered with polyethylene, if evaporating moisture raises the relative humidity above those stated in clause 3.2.1.4.

- 3.2.1.6 TSS

Add clause 3.2.1.6

When working inside buildings, the contractor shall avoid spreading grinding dust onto equipment or other working areas.

- 3.2.1.7 TSS

Add clause 3.2.1.7

Glass reinforcing material shall be protected from moisture at all times. They shall be kept in their polyethylene bags until used for layups.

3.2.2 Preparation of Pipe Ends

- 3.2.2.1 TSS

Add clause 3.2.2.1

Pipe ends shall be fitted to each other with a maximum gap of 6mm. After fitting, exposed glass fibres on the edges shall be brush coated with hot resin (see clause 3.2.3).

- 3.2.2.2 TSS

Add clause 3.2.2.2

Thin wall pipe 500 (20") or larger shall be aligned with each other and fixed in place by inserting a suitable expandable device. This alignment device shall hold the inside diameters concentric and provide a backing for the gap between the pipe ends all around the circumference.

- 3.2.2.3 TSS

Add clause 3.2.2.3

Pipe 450 (18") or smaller and heavy wall pipe may be held in place by external means or may be secured with hot patches (see paragraph 3.2.3.12).

- 3.2.2.4 TSS

Add clause 3.2.2.4

Pipe ends shall be cleaned by grinding with a coarse disc (#16 grit) in a power grinder for the width of the joint layup plus 150 (6") equally spaced on either side of the gap. This grinding operation shall remove all contamination and unreinforced resin from the surface and shall expose the glass reinforcing of the pipe laminate. High edges caused by differences in wall thickness shall be ground off to a 10:1 slope. (See also paragraph 3.2.2.7).

- 3.2.2.5 TSS

Add clause 3.2.2.5

Pipe ends may be ground in advance of fitting and installing the pipes, provided the ends can be kept dry. During storage all preground pipe ends shall be covered with plastic bags secured with masking tape. The maximum permissible interval between pregrinding and layup of the field joint depends on the prevailing weather conditions. It should not exceed 24 hours unless permitted by the Engineer.

- 3.2.2.6 TSS

Add clause 3.2.2.6

When pipes are cleaned and secured in place the gap between ends shall be cleaned of grinding dust with a clean and dry brush. Do not use compressed air. The clean gap shall be filled with resin paste containing short glass fibre and silica powder. The paste shall remain sufficiently liquid for bonding to surfaces but shall not flow out of vertical or overhead crevices. A small amount of talc or

similar substance may be added to improve workability.

- 3.2.2.7 TSS

Add clause 3.2.2.7

Resin paste shall not be used as filler when wall thicknesses differ. All fillers between pipe and joint shall consist of laminates, reinforced with chopped strand mat. The only permitted exceptions are 15 (1/2") radius putty fillers in the root of three-way fittings. These filler laminates shall have cured and the exotherms shall have dissipated before the joint laminate may be applied.

3.2.3 Lay-Up of Field Joints

- 3.2.3.1 TSS

Add clause 3.2.3.1

After the resin paste is cured and immediately before commencing the layup of the joint laminate, the pipe ends shall be cleaned again by lightly grinding the entire joint area. This grinding shall remove all resin smears, finger marks, soil stains or other contaminations from the pipe walls. Wiping with acetone is not permitted.

- 3.2.3.2 TSS

Add clause 3.2.3.2

The grinding dust shall be brushed off with a clean dry brush. Do not blow dust off with compressed air. The grinding dust shall be completely dry and fall off the brush while brushing. If a damp pipe surface or high humidity causes the dust to cake and to cling to the bristles, the joint layup work shall be terminated. (See paragraph 3.2.1.4).

- 3.2.3.3 TSS

Add clause 3.2.3.3

The cleaned joint area shall be brush coated with a thin layer of resin for 150 (6") either side of the gap and the first layup of the joint shall then be applied.

- 3.2.3.4 TSS

Add clause 3.2.3.4

Joint laminates shall be started by applying two mats centered over the gap between the pipe ends. These mats shall be well wetted out with resin and thoroughly rolled out with grooved steel rollers. When all air bubbles within the mats and between pipe and mats have been removed, the balance of the laminate shall be applied in alternate layers of woven roving and mat, ending with a layer of mat. Woven roving shall never be in contact with pipe or cured laminates. The technique of applying the laminates depends on the preference of the contractor, providing the resulting joint is of acceptable quality. However, if a joint consists of a single layup only, all mat and roving layers shall be applied to the pipe one

layer at a time with all ends staggered.

- 3.2.3.5 TSS

Add clause 3.2.3.5

The joint laminate shall be uniformly wetted out without dry spots or resin rich areas. It shall be shaped smoothly, be of uniform thickness and contain 30-50% glass reinforcing and 70-50% resin, by weight. Air bubbles within the laminate or between pipe and laminate are not permitted. Joints in the glass reinforcing shall overlap approximately 150 (6") and shall be staggered.

- 3.2.3.6 TSS

Add clause 3.2.3.6

Each layup shall consist of a minimum of 4 mats and 3 woven rovings. The maximum thickness per layup shall be 7 mats and 4 rovings. The first layup shall have a minimum of 5 mats and 3 rovings. The total number of mat and rovings to be used for the various pipe sizes and pressure rating are listed in Tables A and B. Field joint kits supplied by vendors of FRP pipe shall be adjusted to suit this tabulation, if necessary.

- 3.2.3.7 TSS

Add clause 3.2.3.7

After the first layup is cured and the exotherms (heat produced while resin is curing) have dissipated, the other layups shall be completed in a similar manner as the first one. Before each new layup, unreinforced resin smears and other contaminants shall be removed by touch-up grinding, grinding dust shall be brushed off, all ground surfaces of pipe and the previous layup shall be brush coated with resin. Grinding of the first layup is not required if its surface is clean and smooth, well cured and the second layup is started within one hour after the first one was cured. the joint shall then be completed in the sequences and to the dimension shown on Table B, Field Joint Layup Details.

- 3.2.3.8 TSS

Add clause 3.2.3.8

If it seems likely that the next layup of a joint cannot be started within the next 2 hours, the fresh laminate may be wrapped tightly with cellophane or similar material for preventing contamination and air inhibition of the surface resin. Before commencing the next layup, the surface gloss, gross irregularities, and unreinforced resin smears on each side of the laminates shall be removed by grinding.

- 3.2.3.9 TSS

Add clause 3.2.3.9

Field joints, and all ground areas near the joints shall be brush

coated with waxed resin during the initial cure of last laminate.

- 3.2.3.10 TSS

Add clause 3.2.3.10

An inside layup shall be completed on all joints for pipe diameters of 750 mm (30") and larger and on all accessible joints of smaller pipes. Inside layups shall be wax-coated.

- 3.2.3.11 TSS

Add clause 3.2.3.11

The pot life of resin for field joints shall be between 25 and 35 minutes. Pot life is the time the resin remains usable after adding the catalyst. The pot life shall be adjusted by varying the ratio of resin and curing chemicals as required by prevailing temperatures in accordance with recommendations by the resin manufacturer. The recommended minimum ratio of catalyst shall be maintained at all times. If the pot life is still too short at the minimum catalyst ratio, the contractor shall obtain advice from the fabricator of the FRP pipe or from the Engineer.

- 3.2.3.12 TSS

Add clause 3.2.3.12

Resin for brush coating exposed cut edges or for hot patches shall have a pot life of 5-10 minutes.

- 3.2.3.13 TSS

Add clause 3.2.3.13

Laminates which cannot be completed and properly rolled out with grooved steel rollers, within the pot life of the resin, shall be removed from the pipes while the resin is still soft. The pipes shall then be cleaned and prepared again as noted in paragraph 3.2.2.4 and a new layup shall be made. Layups with less than the numbers of glass reinforcements specified shall not be permitted.

- 3.2.3.14 TSS

Add clause 3.2.3.14

If resin in a laminate does not gel within 60 minutes, or its cure is not substantially complete within 2 hours of adding the catalyst, the contractor shall apply heat. The laminate shall be kept heated until its cure is completed. Laminates not cured satisfactorily after 25 hours shall be removed from the pipe and remade.

- 3.2.3.15 TSS

Add clause 3.2.3.15

Laminates which have been cured with excessive exotherms and show evidence of brittleness or pinholes shall be removed and remade.

- 3.2.3.16 TSS

Add clause 3.2.3.16

The cost of remedial work under 3.2.3.13, 3.2.3.14 and 3.2.3.15,

including the cost of new materials, shall be to the Contractor's account.

- 3.2.3.17 TSS

Add clause 3.2.3.17

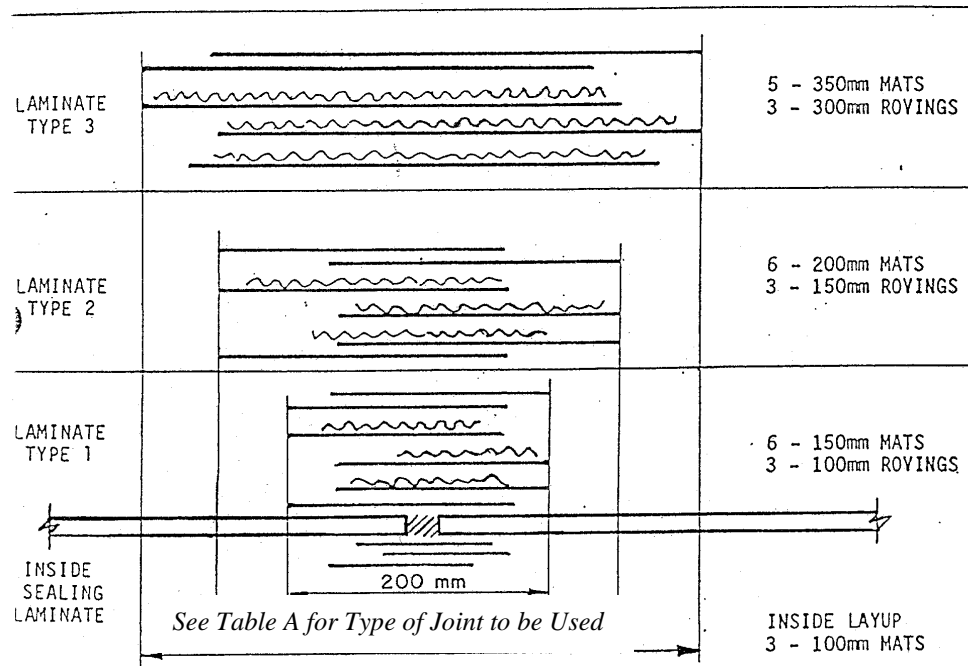
The Engineer may at any time ask the Contractor to remove a completed or partially completed field joint from the pipe. If the bond between the pipe and joint is satisfactory, and if the joint laminate is of an acceptable quality, the contractor will be reimbursed for the cost of removing the joint and replacing it. If either the bond or the quality of the laminate is not acceptable, the Contractor shall remove additional joints as instructed by the Engineer. The cost of all remedial work shall then be to the Contractor's account.

Table A: Type of Field Joints for Diameter and Pressure Rating

See Table B for layup details

Pressure Rating				
Diameter	Gravity	345 kPa (50PSI)	690 kPa (100PSI)	1035 kPa (150 PSI)
50mm	Type 1	Type 1	Type 1	Type 1
75mm	1	1	1	1
100mm	1	1	1	1
150mm	1	1	1+2	1+2
200mm	2	1+2	1+2	1+2
250mm	2	1+2	2+3	2+3
300mm	2	2+3	2+3	2+3
350mm	2+3	2+3	2+3	2+3
400mm	2+3	2+3	2+3	1+2+3
450mm	2+3	2+3	2+3	1+2+3
500mm	2+3	2+3	2+3	1+2+3
550mm	2+3	2+3	1+2+3	1+2+3
600mm	2+3	2+3	1+2+3	Type 1+2+3
750mm	2+3	2+3	1+2+3	
900mm	2+3	2+3	Type 1+2+3	
1050mm	2+3	2+3		
1200mm	Type 2+3	Type 1+2+3		

Table B: Field Joint Layup Details



4.0 TESTING

4.1 Testing Procedure

- 4.1.1 TSS

Add clause 4.1.1

The Contractor shall provide all labour, materials and equipment necessary to carry out the tests. Testing shall be performed in a manner satisfactory to and in the presence of the Engineer.

- 4.1.2 TSS

Add clause 4.1.2

Testing shall be carried out after completion of backfilling with all service connections and laterals in place.

- 4.1.3 TSS

Add clause 4.1.3

Cost incurred for witnessing unsuccessful tests shall be borne by the Contractor.

4.2 Testing Fibreglass Air Header

- 4.2.1 TSS

Add clause 4.2.1

Fibreglass air header systems shall be pressure tested at 140 kPa

for thirty minutes.

- 4.2.2 TSS

Add clause 4.2.2

No drop of pressure within thirty minutes shall constitute a successful test.

**4.3 Testing Fibreglass
Pipe Gravity Flow
Systems**

Add clause 4.3.1

- 4.3.1 TSS

Open ends shall be plugged so as to be airtight. Air shall be slowly supplied until the air pressure reaches 20.7 kPa. At least two minutes shall be allowed for pressure stabilization before proceeding. The time in minutes for the pressure to drop from 20.7 kPa (3.0 PSI) to 17.2 kPa (2.5 PSI) shall not be less than the following:

Pipe Size	100mm	150mm	200mm	250mm	300mm	350mm	375mm
Maximum Air Pressure Loss Time	2 min 32 sec	3 min 50 sec	5 min 06 sec	6 min 22 sec	7 min 39 sec	8 min 56 sec	9 min 30 sec

- 4.3.2 TSS

Add clause 4.3.2

For pipe sizes of over 375 mm, the time in minutes for the pressure to drop shall not be less than 0.0256 times the pipe diameter in millimeters.

**4.4 Testing Fibreglass
Pipe Forcemain**

- 4.4.1 TSS

Add clause 4.4.1

Pipe shall be filled with water and all air expelled.

- 4.4.2 TSS

Add clause 4.4.2

Using water, pipe shall be pressurized to 1.5 times working pressure unless specified otherwise in the Contract Documents or on the Contract Drawings.

- 4.4.3 TSS

Add clause 4.4.3

No pressure drop over thirty minutes shall constitute a successful test.

4.5 Cleaning

- 4.5.1 TSS

Add clause 4.5.1

Air headers shall have all debris removed from line. Lines shall be given final cleaning by drawing a damp polyurethane pig through line. Cleaning may be done in stages to accommodate varying pipe diameters.

- 4.5.2 TSS

Add clause 4.5.2

Gravity flow and pressure systems may be cleaned by flushing.

5.0 EXECUTION

5.1 Internal Piping

- 5.1.1 TSS

Add clause 5.1.1

To requirements of Contract Documents and Contract Drawings.

5.2 External Piping

- 5.2.1 TSS

Add clause 5.2.1

To requirements of:

Excavating, Trenching and Backfilling

Section 31 23 01

Sanitary Sewers

Section 33 30 01

Sewage Force mains

Section 33 34 01

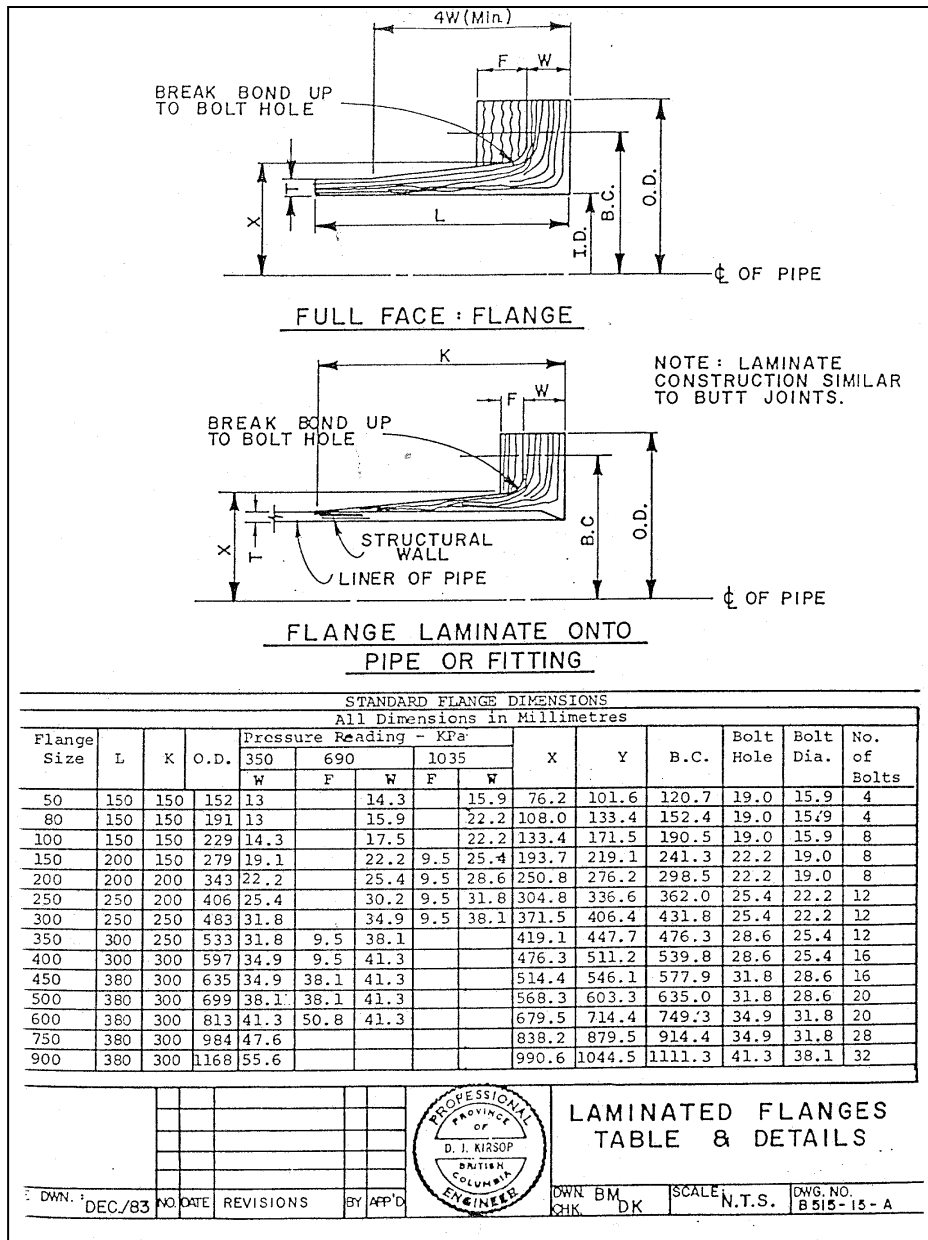
And to the requirements of contract drawings.

- 5.2.2 TSS

Add clause 5.2.2

Pipe trench to be in accordance with contract drawings. All bedding and pipe surround material to be in accordance with Granular Pipe Bedding and Surround Material (19mm minus), as defined in Aggregates and Granular Materials Section 31 05 17.

5.0 SUPPLEMENTAL DRAWING



END OF SECTION

APPENDIX I
List of Approved Materials

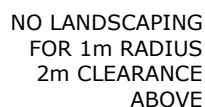
MMCD Ref (2009 Platinum)	Product	Approved Material/Type	Approved Product	Restrictions/ and Additional Specifications
33 11 01	Waterworks			
	Mainline Pipe, Joints and Fittings	<ul style="list-style-type: none"> · Restrained PVC (except in dyke); or · HDPE where no residential service connections exist · HDPE within dyke 	Cobralock or approved equal Sclairpipe or approved equal	<ul style="list-style-type: none"> · All PVC pipe to be restrained non-metallic joints
	Hydrants		Terminal City C71P or approved equal, 4" Threaded Pumper Port	No drain plugs. Paint red with white port caps.
	Main line valves	Gate valves	Mueller Co. or Toyo Valve Co.	Supply cut sheets
	Backflow preventers	Double Check backflow preventers	Watts DCVA, Model 007 or as requested and approved by TFN	Engineer to provide detailed drawings and shop drawings as required
33 11 02 TSS	Water Meters			
	Domestic Water Meters	Neptune meters	See Table 1 in TSS 33 11 02	Design Engineer to provide sizing calculation
	Residential, Commercial and Industrial Metres greater than 50mm diameter	Neptune meters only	<ul style="list-style-type: none"> · Domestic to be metred · Fire line to be equipped with detector check valve 	<ul style="list-style-type: none"> · Engineer to provide sizing calculations · Engineer to provide detailed drawings and shop drawings as required · Developer to supply and install
33 30 01	Sanitary Sewers			
	Plastic Pipe, Mainline Smooth Profile	<ul style="list-style-type: none"> · PVC (except in dyke) · HDPE within dyke 		

33 34 01	Sewage Forcemains			
	Pipe, Joints and Fittings	<ul style="list-style-type: none"> · Restrained PVC · HDPE 	Cobralock or approved equal Sclairpipe or approved equal	All PVC pipe to be restrained non-metallic joints
	Sanitary Air Valve	Combination air valve	ARI for wastewater. Model selection subject to TFN approval.	Engineer to provide detailed drawings and shop drawings as required
	Sanitary Flow Measurement	Magnetic flow meter	ABB or Siemens. Model subject to TFN approval	Engineer to provide detailed drawings and shop drawings as required
	Forcemain valves	Gate valves	Mueller Co. or Toyo Valve Co.	Provide cut sheets
	Forcemain check vales	Ball check valves	AVK Series	Engineer to provide detailed drawings and shop drawings as required
33 34 02 TSS	Pump Stations			
	Pump Stations	As shown in supplementary design specifications	<ul style="list-style-type: none"> · In accordance with the TFN Bulk Water and Sewer Trunk Master Plan 	<ul style="list-style-type: none"> · All pump stations to come equipped with VFD
	Sewage pumps	Submersible sewage pumps	Flygt pumps	<ul style="list-style-type: none"> · Engineer to provide detailed drawings and shop drawings as required
	Pump VFD		Mitsubishi Electric	<ul style="list-style-type: none"> · Semiconductor technology
	Pump station controls		Rockwell Automation	<ul style="list-style-type: none"> · PLC based semiconductor technology
	PS odour control	Carbon filter	TRICAN	<ul style="list-style-type: none"> · Engineer to provide detailed drawings and shop drawings as required

	H2S sensor and transmitter	Sensor	Honeywell	.
	LEL sensor and transmitter	Sensor	Honeywell	.
	PS manlift mount		North Safety Amount FP6662/00	. Engineer to provide detailed drawings and shop drawings as required
	PS manlift davit		Uni-hoist Model US 101	. Engineer to provide detailed drawings and shop drawings as required
	Kiosk	PS control kiosk	Valid Manufacturing	. Model KXXA7511740-17089 . Enclosure type 3R . Control panel nearest to wet well.
	Kiosk task lights		Haztex handlamp – LED bulb	. Supply cut sheets
	Kiosk shock absorbers		Manufacturer: Faucher Product :7777727 Gas spring-free type, 8mm rod, 18mm tube w.polyamide end fitting M6 X1 190.5 MM STR X 457 MM EXT - 142 N BLACK TUBE - QPQ ROD, 30 LBS	. Supply cut sheets
	Kiosk straps		Ericksom 1300 lbs straps	. Supply cut sheets
32 80 00 TSS	Irrigation			Shop drawings to be provided prior to construction.
	Central Controller		Baseline	
	Standalone Controller		Rain Bird ESPLXME	
	Valves		Hunter ICV	

	Sprinklers: Spray Head		Rain Bird 18XX PRS (SAM)	
	Sprinklers: Rotors		Rain Bird 3504 Rain Bird 5004 Rain Bird 6504 Rain Bird 8005	
	Drip Line		Toro DL 2000	
	Drip Emitters		Rain Bird Xeribug Emitters	
	Root Watering System		Rain Bird Root Watering System	
	Pressure Regulating Filters		PRB-QKCHK-100	
	Isolation Valves		1" to 2": Red White Valve #280 2 1/5": Mueller 2360	


TFN SUPPLEMENTARY DETAIL DRAWINGS

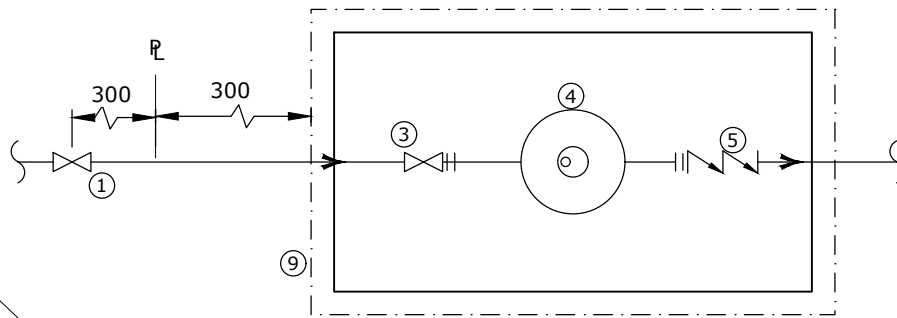


- ① METER NUT
- ② METER SETTER (CAMBRIDGE BRASS SERIES 6032 WITH 18" EXTENSION OR APPROVED EQUAL)
- ③ INLET BALL VALVE (PART OF SETTER)
- ④ WATER METER
- ⑤ DUAL CHECK VALVE (PART OF SETTER)
- ⑥ RIGID FOAM INSULATION CUT TO FIT METER BOX OPENING.
- ⑦ TOUCH PAD, 45Ø OPENING FOR REMOTE METER SENSOR PLUGGED UNTIL METER IS INSTALLED.
- ⑧ LID PER SPECIFICATIONS
- ⑨ BROOK #37 OR EQUAL
- ⑩ 19mm CLEAR CRUSHED DRAIN ROCK
- ⑪ COMPRESSION FITTINGS
- ⑫ MAIN VALVE (CURB STOP C/W RISER)
- ⑬ CONCRETE BRICKS (4 TOTAL, SHALL NOT BE PLACED DIRECTLY ABOVE PIPE AND/OR FITTINGS)

NOTES:

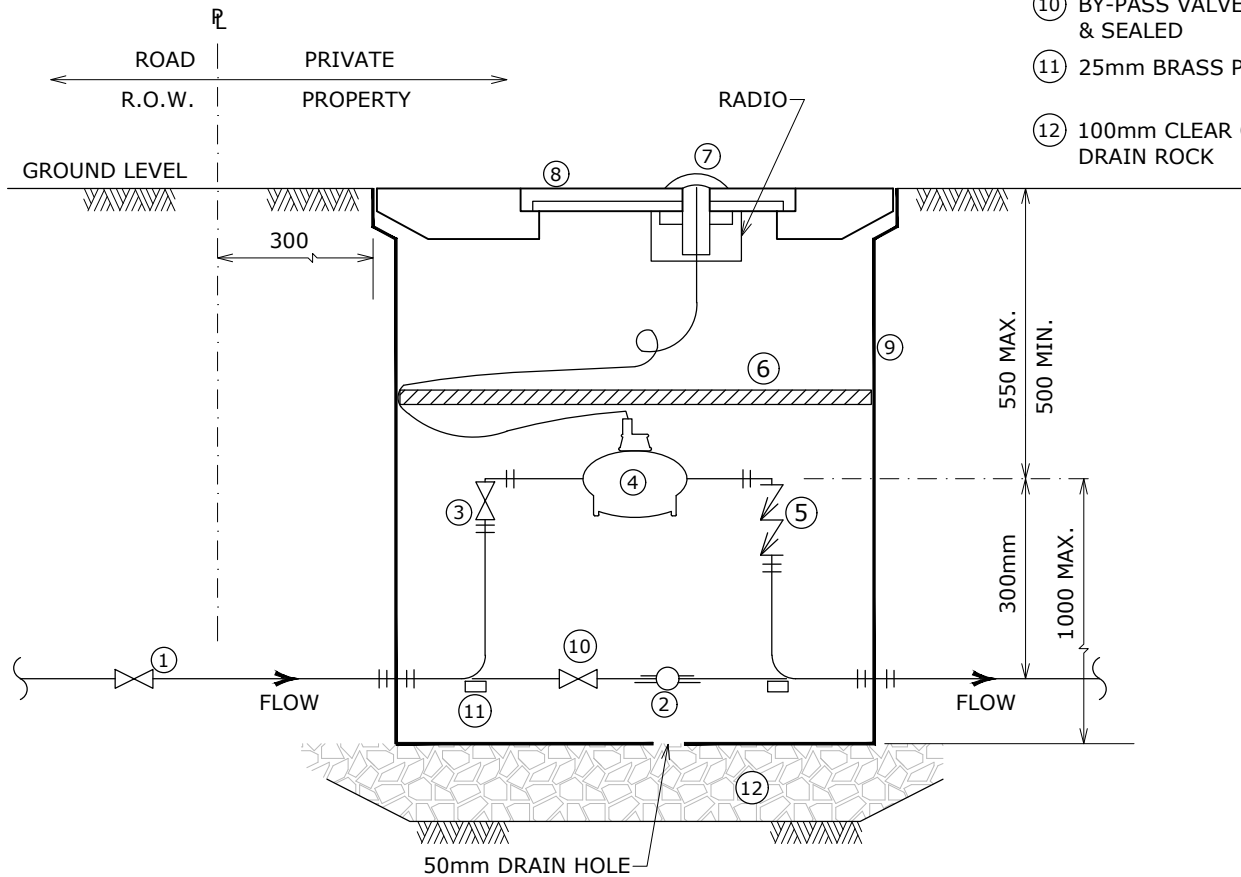
1. THIS DRAWING SHOULD BE REVIEWED IN CONJUNCTION WITH THE DOCUMENT, "WATER METER DESIGN CRITERIA MANUAL AND SUPPLEMENTARY SPECIFICATIONS."
2. METER AND METER SETTER ARE TO BE FULL PORT.

3	JUNE 2020	All Dimensions Shown In Millimetres, Unless Otherwise Noted
2	JANUARY 2014	
1	OCTOBER 2011	Title METER CHAMBER INSTALLATION FOR METERS 25mm DIAMETER AND SMALLER
	Revision Date Approved	
 <p>scəwəðən məsteyəx™ TŨSŨ WADŨN FİRST NALŨN</p> <p>WATER METER INSTALLATION STANDARDS</p>		Approved TFN
		Date JUNE 2020
		DRAWING NUMBER TSSD-W1



PLAN VIEW

- ① MAIN VALVE (CURB STOP C/W RISER)
- ② METER SETTER (FORD 70 SERIES, OR APPROVED EQUAL)
- ③ INLET BALL VALVE (PART OF SETTER)
- ④ WATER METER WITH RADIO TRANSMITTER
- ⑤ OUTLET DUAL CHECK VALVE (PART OF SETTER)
- ⑥ RIGID FOAM INSULATION CUT TO FIT METER BOX OPENING.
- ⑦ TOUCH PAD 45Ø OPENING FOR REMOTE METER SENSOR PLUGGED UNTIL METER IS INSTALLED.
- ⑧ LID PER SPECIFICATIONS
- ⑨ SERVICE CHAMBER PER SPECIFICATIONS
- ⑩ BY-PASS VALVE CLOSED & SEALED
- ⑪ 25mm BRASS PIPE (TYP)
- ⑫ 100mm CLEAR CRUSHED DRAIN ROCK




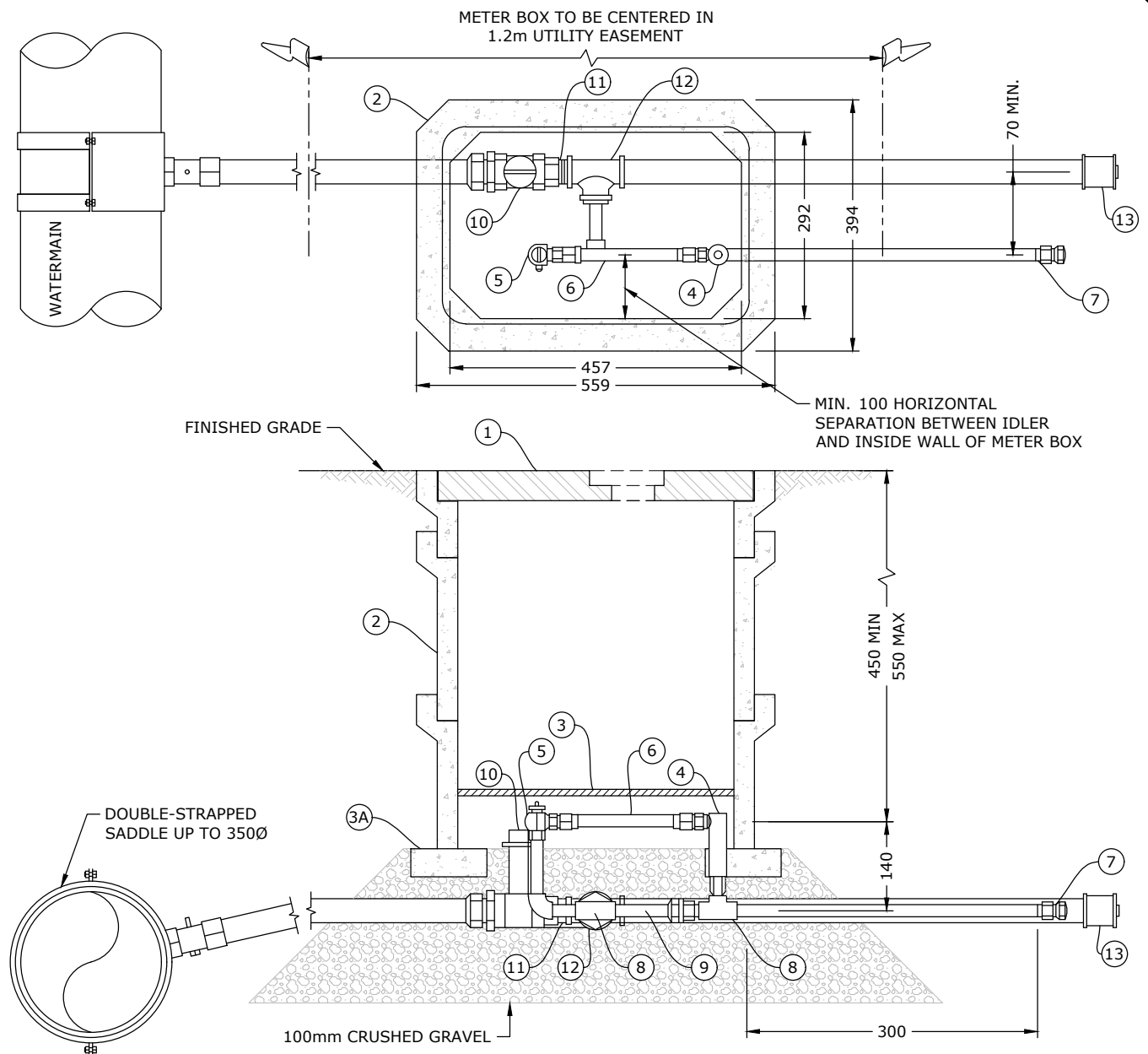
SECTION VIEW

NOTES:

1. THIS DRAWING SHOULD BE REVIEWED IN CONJUNCTION WITH THE DOCUMENT, "WATER METER DESIGN CRITERIA MANUAL AND SUPPLEMENTARY SPECIFICATIONS."

BY-PASS VALVE CLOSED & SEALED

3	JUNE 2020	All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2	JANUARY 2014		
1	OCTOBER 2011	Title METER CHAMBER INSTALLATION FOR METERS 38mm & 50mm DIAMETER POSITIVE DISPLACEMENT	
	Revision Date		
	Approved	DRAWING NUMBER TSSD-W2	
 <p>WATER METER INSTALLATION STANDARDS</p>		Approved	TFN
		Date	JUNE 2020



METER BOX

- ① DUCTILE IRON LID c/w B937 RECESSED OFFSET 50mm HOLE TO ACCOMMODATE NEPTUNE R900i ANTENNA PAD (DOBNEY OR APPROVED EQUAL)
- ② PRECAST CONCRETE B937 METER BOX (ARMTEC OR APPROVED EQUAL) HEIGHT AND NUMBER OF BOXES TO SUIT
- ③ RIGID FOAM INSULATION (CUT TO FIT METER BOX OPENING)
- ③A CONCRETE BRICKS (4 TOTAL, SHALL NOT BE PLACED DIRECTLY ABOVE THE PIPES AND/OR FITTINGS)

NOTE:

ALL PIPE MATERIALS ARE BRASS OR COPPER

19mmØ METER

- ④ 19mmØ ANGLE DUAL CHECK VALVE (LOCK NUT x F.I.P. OUTLET)
- ⑤ 19mmØ ANGLE CURB STOP WITH LOCKWING C/W SHUTOFF HANDLE
- ⑥ IDLER BAR (IN PLACE OF FUTURE METER)
- ⑦ 19mmØ COMPRESSION COUPLING
- ⑧ 19mmØ X 19mmØ x 19mmØ TEE
- ⑨ 19mm SOLID BAR (BRASS)

38mmØ FIRE SERVICE

- ⑩ 38mmØ CURB STOP COMPRESSION x F.I.P.
- ⑪ 38mmØ THREADED PIPE NIPPLE (CLOSE)
- ⑫ 38mmØ X 38mmØ x 19mmØ TEE F.I.P.
- ⑬ 38mm MIP C/W F.I.P. PLASTIC END CAP

6	JUNE 2020
5	FEBRUARY 2020
4	MAY 2019
	Revision Date
	Approved

All Dimensions Shown In Millimetres,
Unless Otherwise Noted

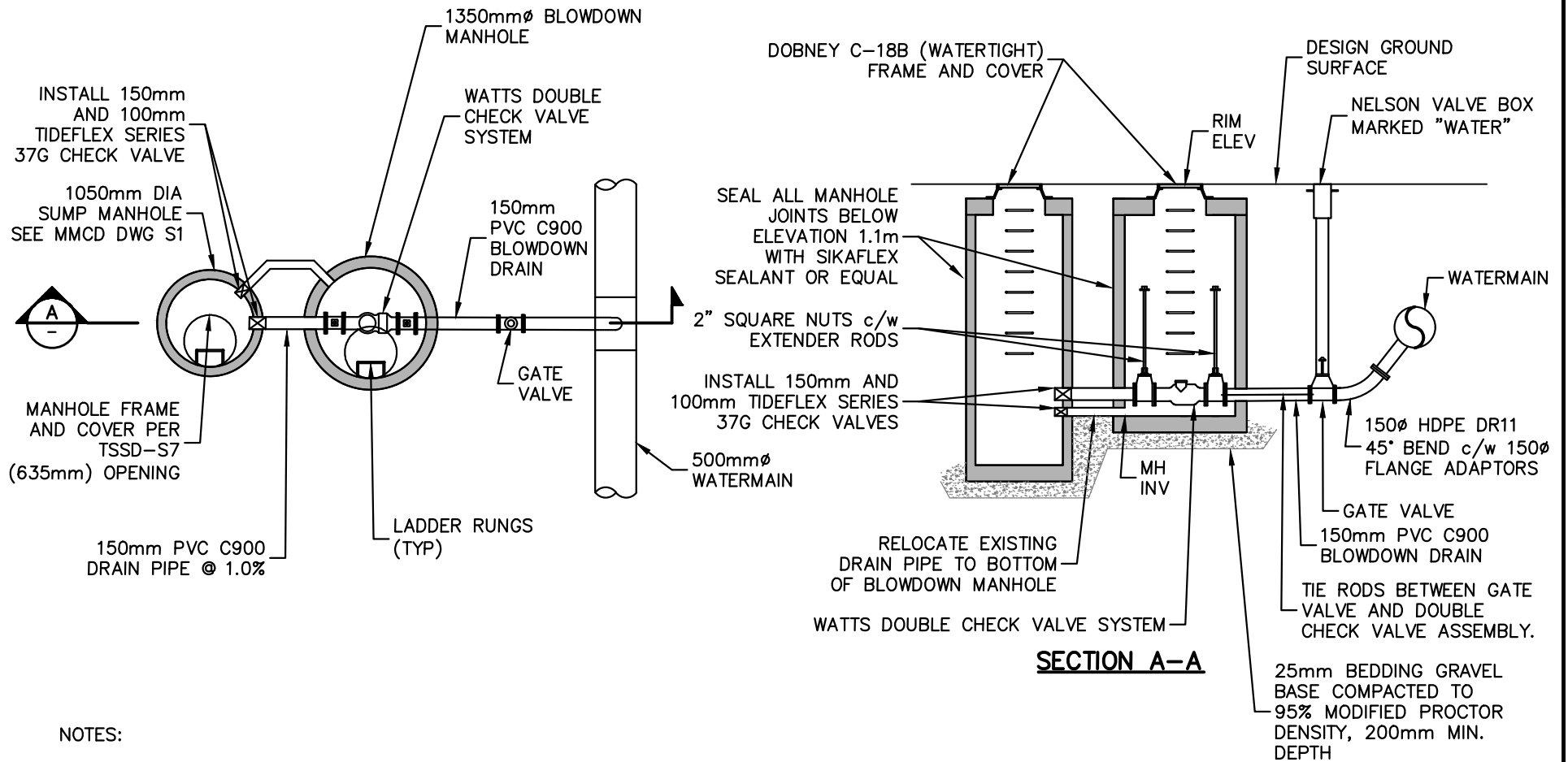
Title
**19mmØ METER SETTER
& 38mmØ FIRE SERVICE**



**WATER METER
INSTALLATION
STANDARDS**

Approved TFN
Date JUNE 2020


DRAWING NUMBER
TSSD-W3



NOTES:

1. TEST DOUBLE CHECK VALVE TO MANUFACTURER'S TESTING PROCEDURES.
2. PIPES TYPE TO BE APPROVED BY TFN.

0 0.5 1:75 1.75m

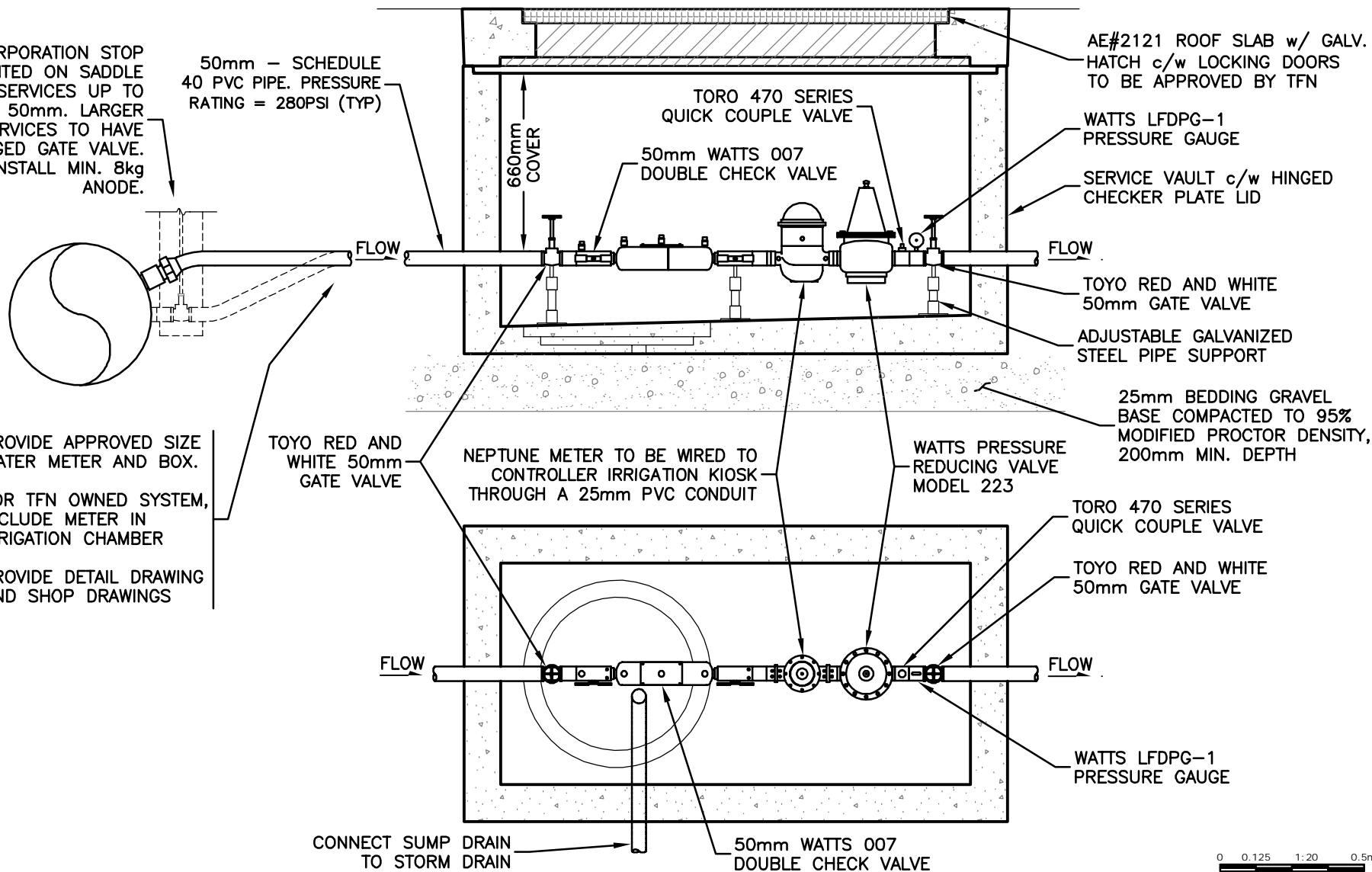
3	JUNE 2020	All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2	MARCH 2019			
1	FEBRUARY 2019	Title TYPICAL BLOW DOWN CHAMBER		
	Revision Date Approved			
<div><div>scəwəθən məsteyəx™ TRAN WARDEN FIRST NATION</div></div> <div>WATERMAIN INSTALLATION STANDARDS</div>		ApprovedTFN		DRAWING NUMBER TSSD-W4
		DateJUNE 2020		


\\sls.urban-systems.com\projects\Projects_VAN\217700\701\0-Drafting-Design-Analyst\CADD\CURRENT\PRODUCTION\New Standards 2019\Water\TSSD-W5 - Irrigation Vault.dwg, TSSD-W5, 2020/05/26 09:23 am foster

CORPORATION STOP
MOUNTED ON SADDLE
FOR SERVICES UP TO
50mm. LARGER
SERVICES TO HAVE
FLANGED GATE VALVE.
INSTALL MIN. 8kg
ANODE.

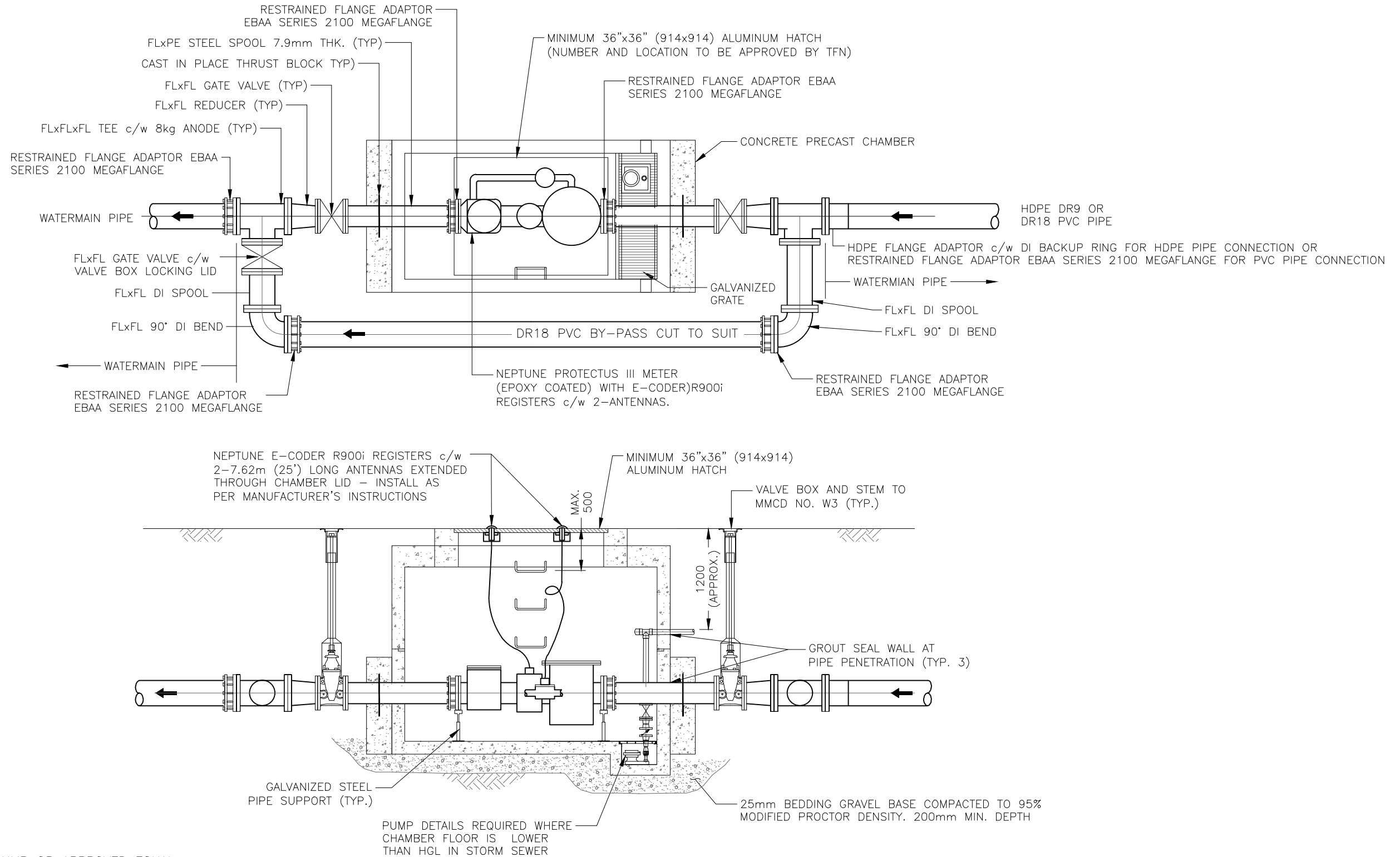
50mm - SCHEDULE
40 PVC PIPE. PRESSURE
RATING = 280PSI (TYP)

- PROVIDE APPROVED SIZE
WATER METER AND BOX.
- FOR TFN OWNED SYSTEM,
INCLUDE METER IN
IRRIGATION CHAMBER
- PROVIDE DETAIL DRAWING
AND SHOP DRAWINGS



3	MAY 2020	All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2	MARCH 2019		
1	FEBRUARY 2019		
	Revision Date	Approved	Title IRRIGATION VAULT FOR TFN WATER SERVICE
 WATERMAIN INSTALLATION STANDARDS		Approved TFN	DRAWING NUMBER TSSD-W5
		Date MAY 2020	

2019-00-1353.dwg
U:\Projects_VAN2\7700\7010\Drafting-Design-Analysis\CADD CURRENT\PRODUCTION\New Standards 2019\Water\TSSD-W6 - Water Meter Chamber.dwg, TSSD-W6, 2019/03/21 08:45 pm, larry




PUMP DETAILS:

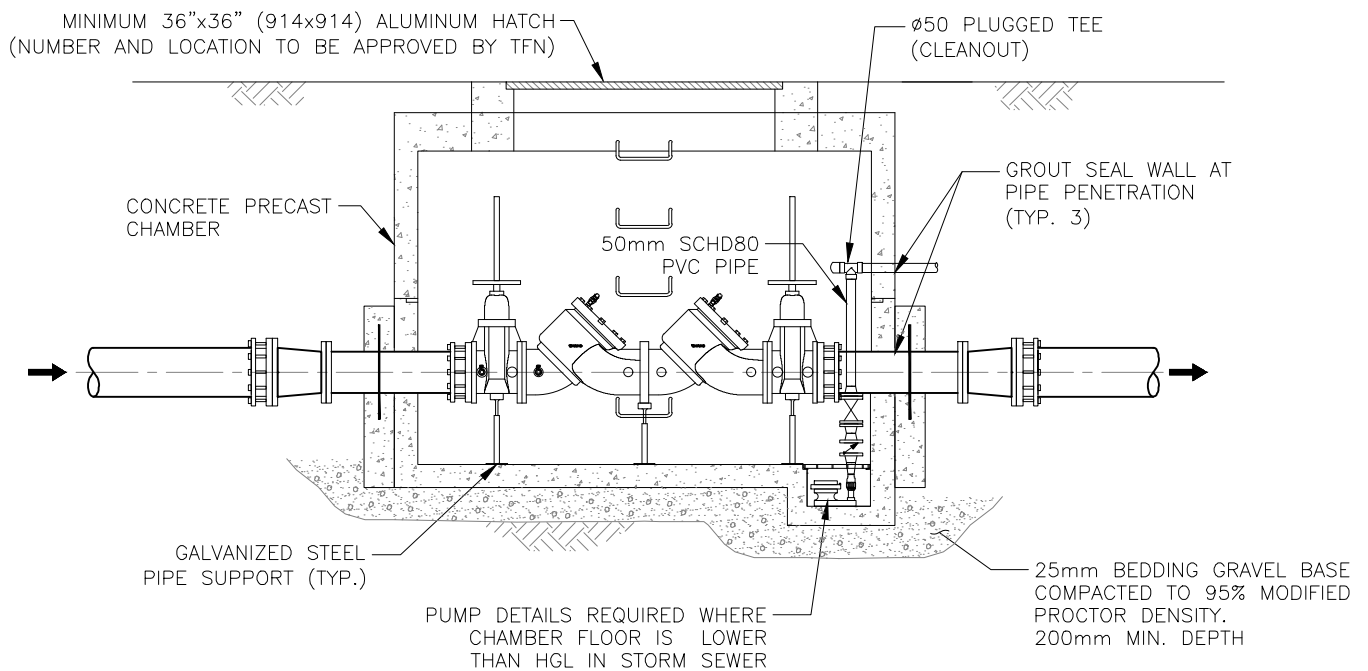
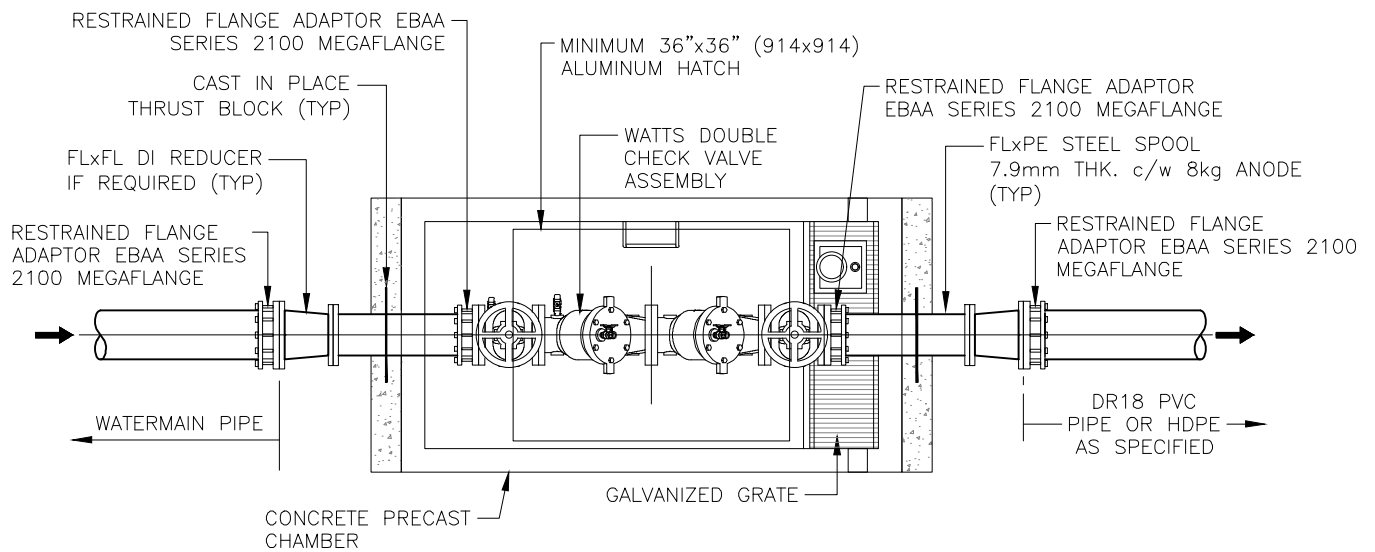
1. CRANE SUBMERSIBLE PUMP OR APPROVED EQUAL.
2. SUMP PUMP PIPING COMPLETE WITH CLEAN OUTS AT ALL DIRECTIONAL CHANGES.

WATER WORKS NOTES:

1. REFER TO TFN SUPPLEMENTARY SPECIFICATION CLAUSE 3.14.4 FOR DETAILS OF COATINGS TO ALL BURIED NUTS, BOLTS, TRANSITION COUPLINGS, RESTRAINERS AND METAL FITTINGS.
2. MAX DEPTH TO FIRST LADDER RUNG IS 500mm.
3. ENGINEER TO PROVIDE METER SIZING CALCULATIONS FOR TFN APPROVAL.
4. SHOP DRAWINGS TO BE PROVIDED FOR TFN APPROVAL
5. PIPE TYPE AND CHAMBER SIZE TO BE APPROVED BY TFN.
6. DESIGN ENGINEER TO PROVIDE DETAIL DRAWING.

0 0.25 1:50 1.25m

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted				
2	MARCH 2019					
1	FEBRUARY 2019	Title				
	Revision Date	Approved	WATER METER CHAMBER FOR WATERMAIN 100mm AND LARGER			
 sawabon masteyax™ TSANWASHAN FIRST NATION		WATERMAIN INSTALLATION STANDARDS		Approved	TFN	DRAWING NUMBER TSSD-W6
				Date	MARCH 2019	




PUMP DETAILS:

1. CRANE SUBMERSIBLE PUMP OR APPROVED EQUAL.
2. SUMP PUMP PIPING COMPLETE WITH CLEAN OUTS AT ALL DIRECTIONAL CHANGES.

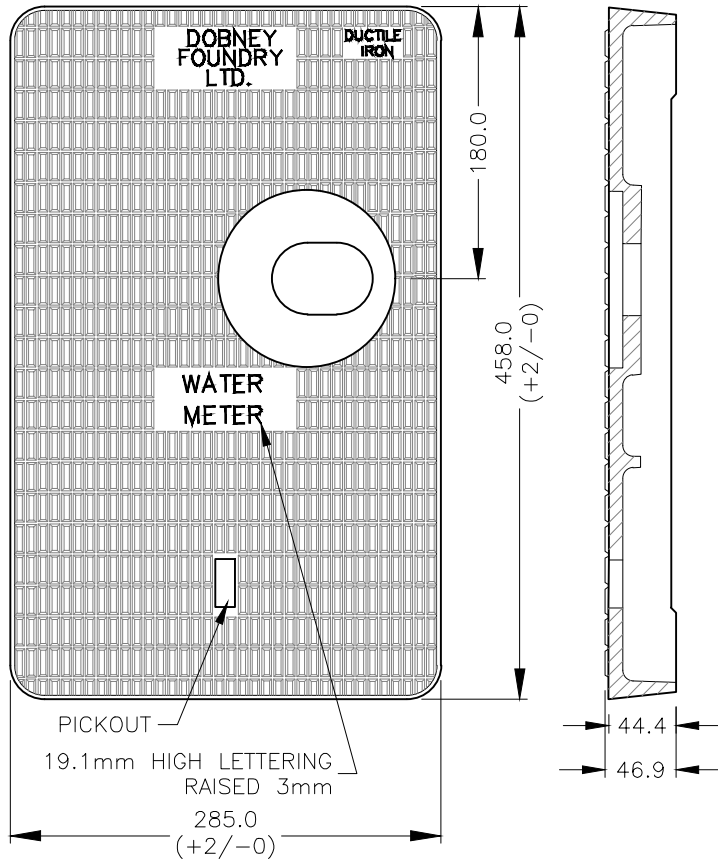
WATER WORKS NOTES:

1. REFER TO TFN SUPPLEMENTARY SPECIFICATION CLAUSE 3.14.4 FOR DETAILS OF COATINGS TO ALL BURIED NUTS, BOLTS, TRANSITION COUPLINGS, RESTRAINERS AND METAL FITTINGS.
2. MAX DEPTH TO FIRST LADDER RUNG IS 500mm.
3. ENGINEER TO PROVIDE METER SIZING CALCULATIONS FOR TFN APPROVAL.
4. SHOP DRAWINGS TO BE PROVIDED FOR TFN APPROVAL
5. PIPE TYPE TO BE APPROVED BY TFN.
6. HATCH SIZE AND LOCATION TO ALLOW FOR DCVA REMOVAL.
7. DESIGN ENGINEER TO PROVIDE DETAIL DRAWING.

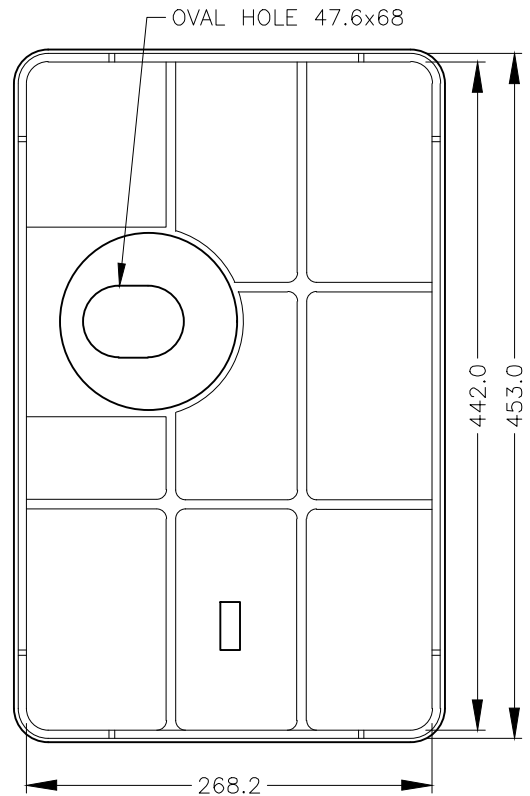
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3		All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2	MARCH 2019	Title BACKFLOW PREVENTER DETAIL FOR WATERMAIN 100mm AND LARGER		
1	FEBRUARY 2019			
	Revision Date	Approved	DRAWING NUMBER	
			Approved	TFN
			Date	MARCH 2019
 <p>WATERMAIN INSTALLATION STANDARDS</p>		TSSD-W7		

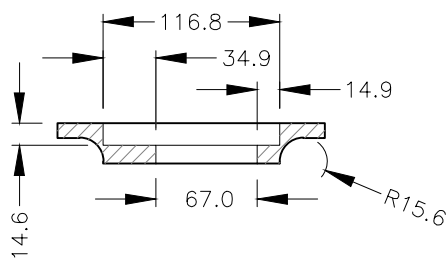
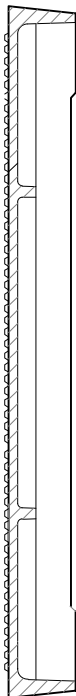
PLAN - COVER



PLAN - COVER U/S REINF.



RIB DETAIL



HOLE DETAIL


RIB DETAIL

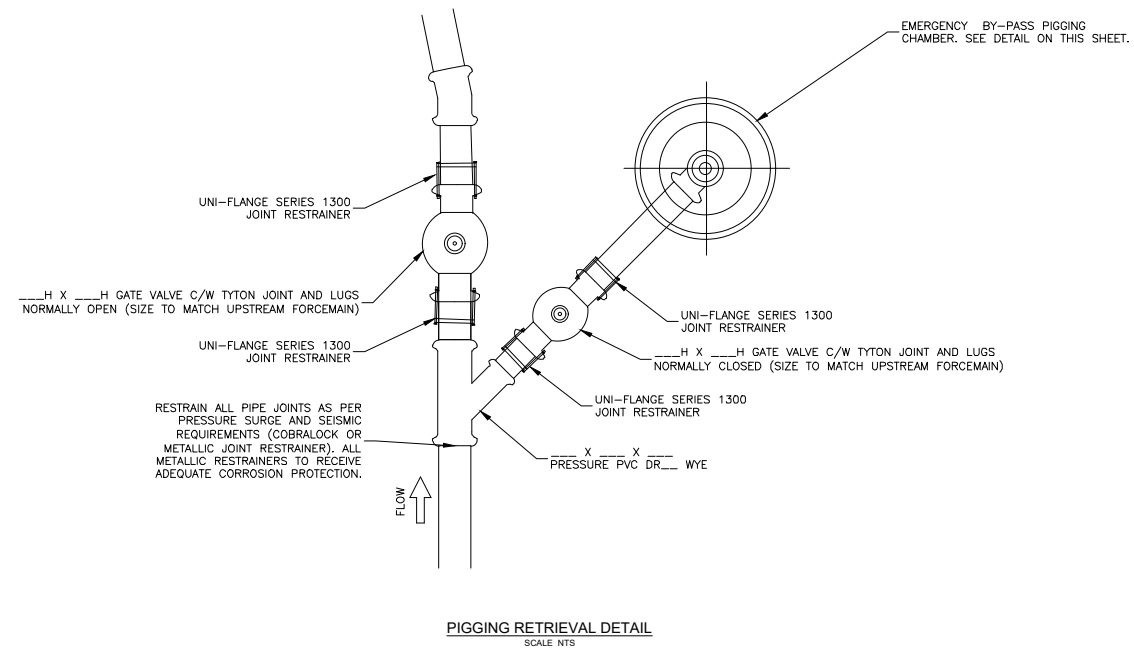
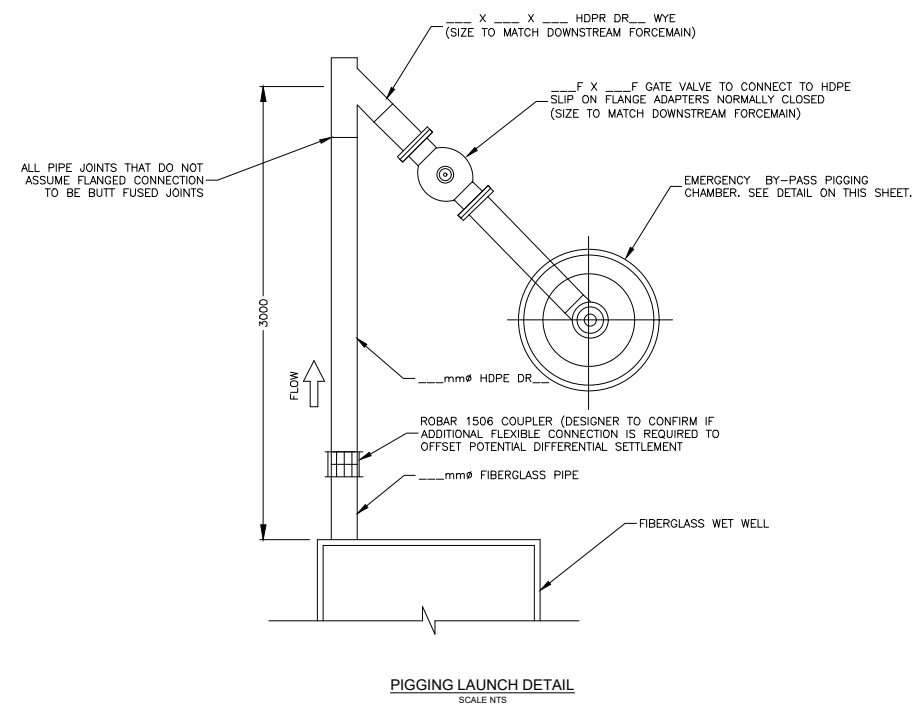
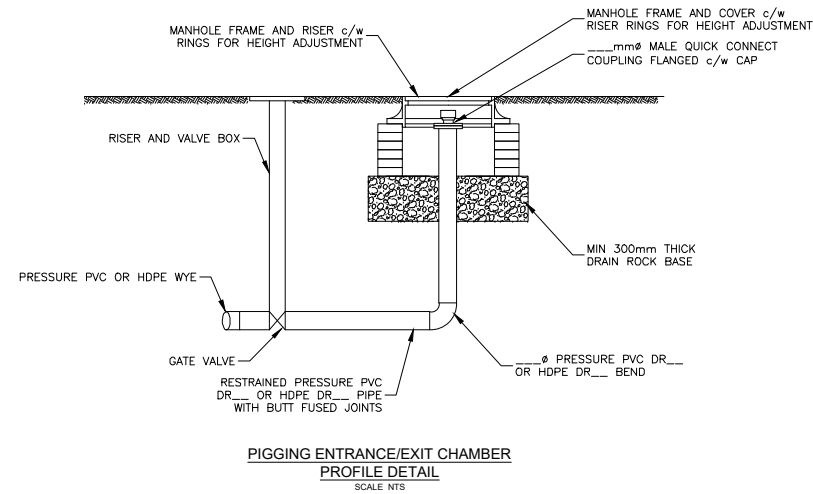


MATERIAL:
65-45-12 DUCTILE IRON


APPROX. WEIGHT: 20 LBS.

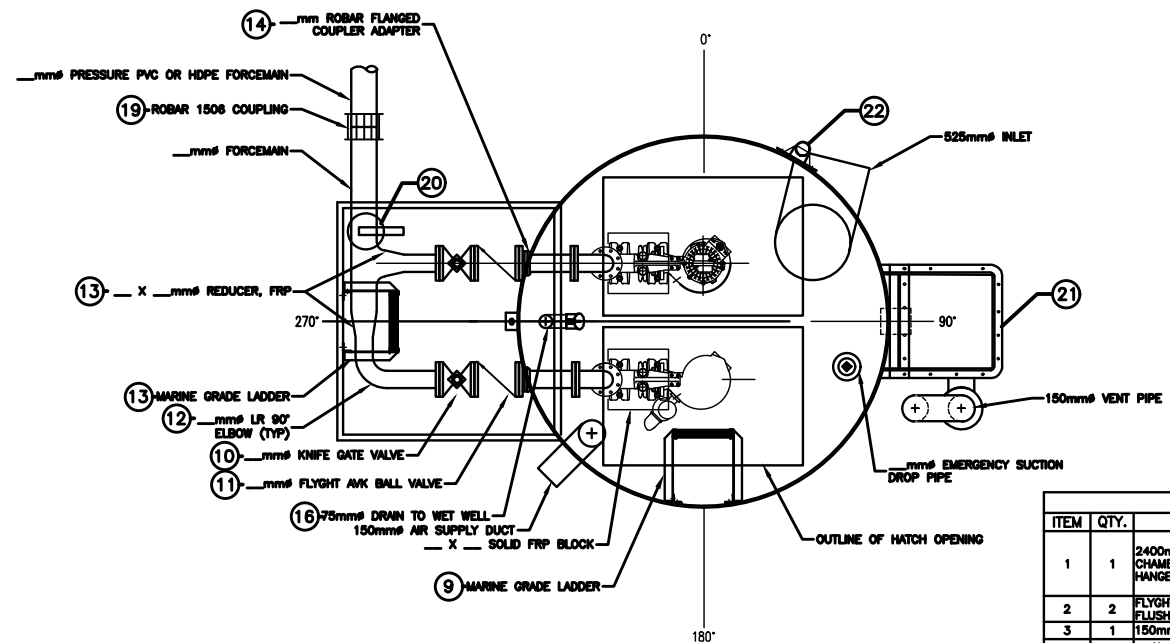
LID BY: DOBNEY FOUNDRY LTD. #37LTR0H

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2				
1	MARCH 2019	Title TFN RECESS PIT LID DETAIL		
	Revision Date			
	Approved	Approved	TFN	DRAWING NUMBER TSSD-W8
		Date	MARCH 2019	
 <p>sc̓aw̓aθ̓an məsteyax™ TSAWWASSEN FIRST NATION</p>		WATER INSTALLATION STANDARDS		

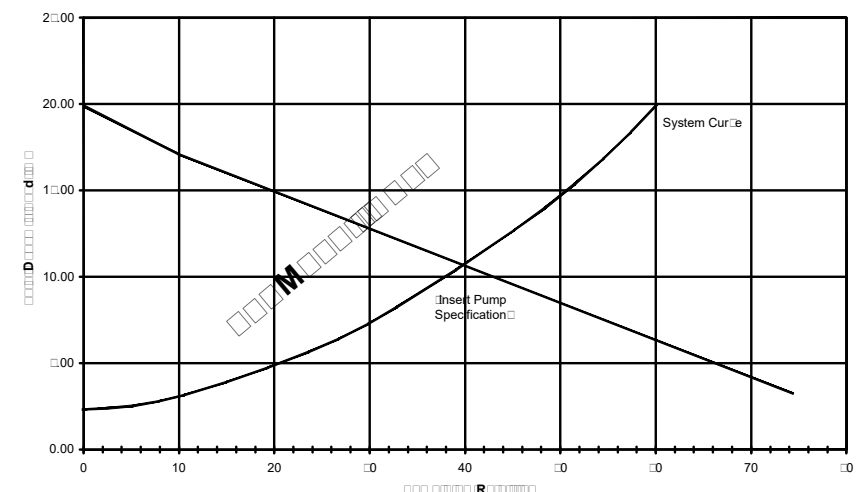



NOTE:
PIPE DETAILS SHOWN ON PIGGING LAUNCH AND RETRIEVAL CONNECTIONS VARY BETWEEN HDPE AND PVC PRESSURE PIPE OPTION IN ORDER TO SPECIFY CONNECTION DETAILS FOR BOTH OPTIONS.

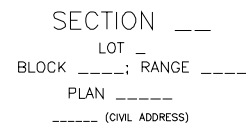
3		All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2				
1	OCTOBER 2011	Title	TYPICAL PIGGING CHAMBER DETAIL	
	Revision Date	Approved		
 tsnawāḥan mōsteyax™ TSNAWAHSEN FIRST NATION		Approved	TFN	DRAWING NUMBER TSSD-S1
		Date	OCTOBER 2011	



LIST OF MATERIALS		
ITEM	QTY.	DESCRIPTION
1	1	2400mm ϕ (8.0') x ____ m FIBREGLASS WET WELL c/w ____ X ____ X ____ m VALVE CHAMBER, TOP BOTTOM BENCHING, EXPLOSION PROOF LIGHT, LEVEL FLOAT AND HANGER, FRP COATED ALUMINIUM PLATFORM AND ACCESS LADDERS
2	2	FLYIGHT SUBMERSIBLE PUMP, MODEL NP ____ HP, ____ mm IMPELLER, ONE WITH FLUSH VALVE
3	1	150mm ϕ VENT PIPE WITH GALVANIZED MESH SCREEN (MAX. 6mm OPENING)
4	1	c/w CLEAR OPENING FRP HATCH c/w PADLOCK HASPS WITH A GS BOX ENCLOSURE
5	1	c/w CLEAR OPENING ALUMINIUM SAFE-HATCH c/w PADLOCK HASPS WITH A GS BOX ENCLOSURE
6	2	____ mm GALVANIZED GUIDE RAILS
7	2	____ mm GALVANIZED UPPER GUIDE BAR SUPPORT
8	1	m FRP COATED ALUMINIUM LADDER c/w BILCO LADDER UP
9	1	m FRP COATED ALUMINIUM LADDER c/w BILCO LADDER UP
10	2	mm ϕ KNIFE GATE VALVE
11	2	mm ϕ AVK BALL CHECK VALVE - SERIES 53-100-53
12	1	mm ϕ LONG RADIUS FRP 90 $^{\circ}$ ELBOW
13	2	mm x ____ mm ϕ FRP REDUCER
14	2	ROBAR FLANGED COUPLER ADAPTER
15	1	MILLITRONICS MODEL XPS-15 ULTRASONIC TRANSDUCER (SEE ELECTRICAL DRAWINGS FOR DETAILS)
16	1	75mm ϕ DRAIN TO WET WELL c/w S-TRAP
17	1	150mm ϕ FORCED AIR INLET c/w 150mm ϕ MH DRAIN INLET
18	2	mm ϕ FRP RISER PIPE
19	1	ROBAR 1508 COUPLER
20	1	ARJ COMBINATION AIR RELEASE VALVE (D-025 STAINLESS STEEL CONSTRUCTION) c/w 50mm BRASS OR BRONZE BALL VALVE, 2 THREDOLETS AND 2 THREADED SPOOL PIECES (IF REQUIRED)
21	1	CARBON FILTER BOX
22	1	NORTH SAFETY DWT ASSEMBLY FP8680 COMPLETE, c/w WALL MOUNT SOCKET, FP8662

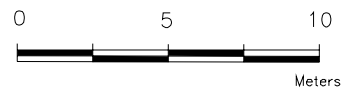


3	FEBRUARY 2019	All Dimensions Shown In Millimetres, Unless Otherwise Noted
2	JANUARY 2014	
1	OCTOBER 2011	Title TYPICAL PUMP STATION INSTALLATION DETAILS
	Revision Date Approved	
 <div style="display: inline-block; vertical-align: middle; text-align: center;"> <p>SANITARY INSTALLATION STANDARDS</p> </div>		Approved TFN
		Date FEBRUARY 2019
		DRAWING NUMBER <div style="font-size: 24pt; font-weight: bold;">TSSD-S2</div>


[illegible]

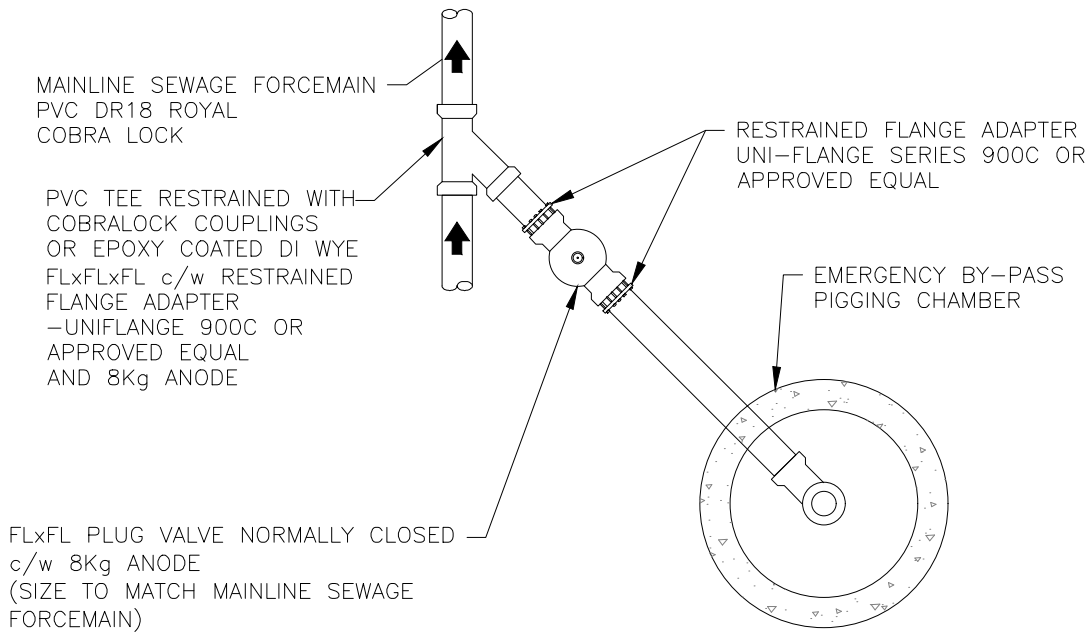
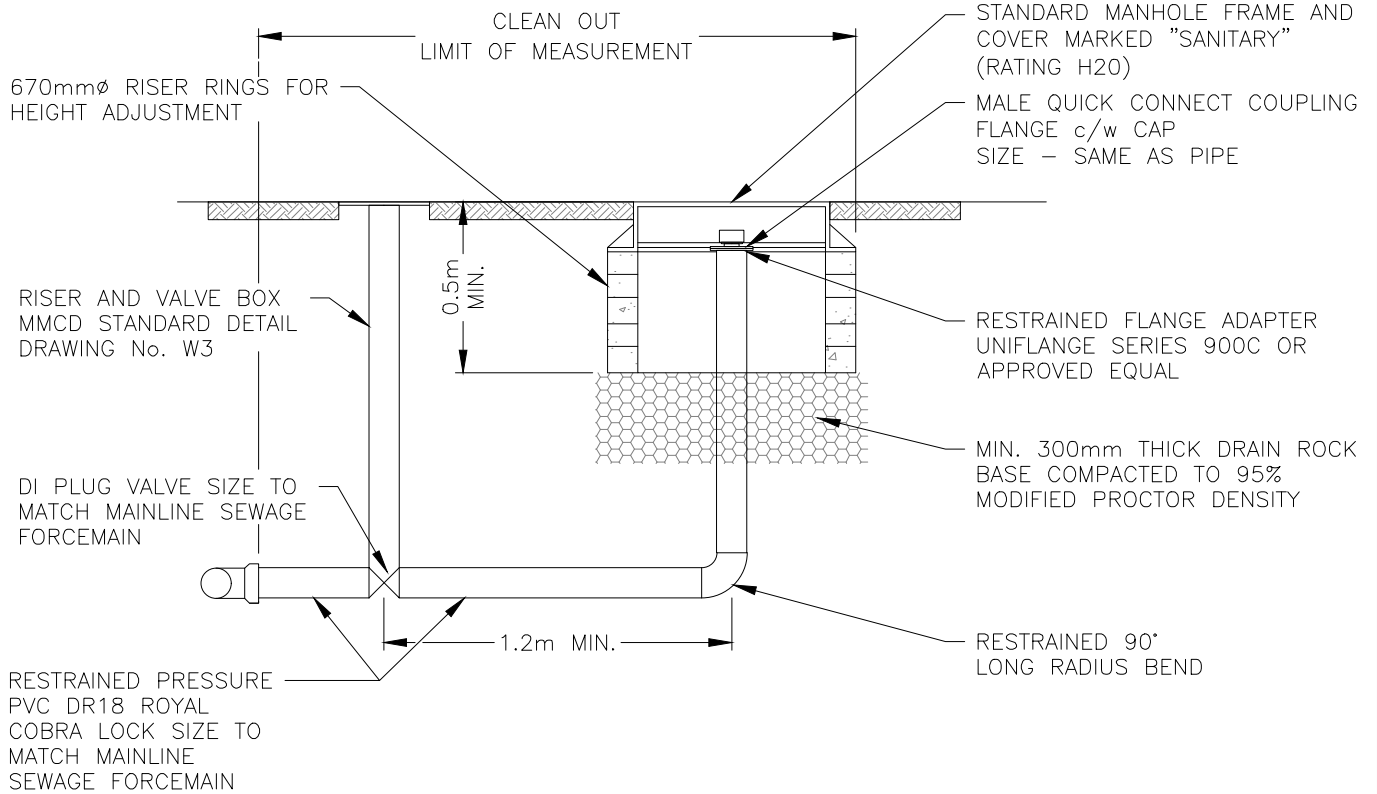
(INSERT ROAD NAME)

SECTION ____
BLOCK ____; RANGE ____
LOT ____
REM PCL ____
REF PLAN ____
PLAN ____
____ (CIVIL ADDRESS)




14. PANEL CONTROL SIDE KIOSK DOORS TO BE NEAREST TO THE WET WELL.

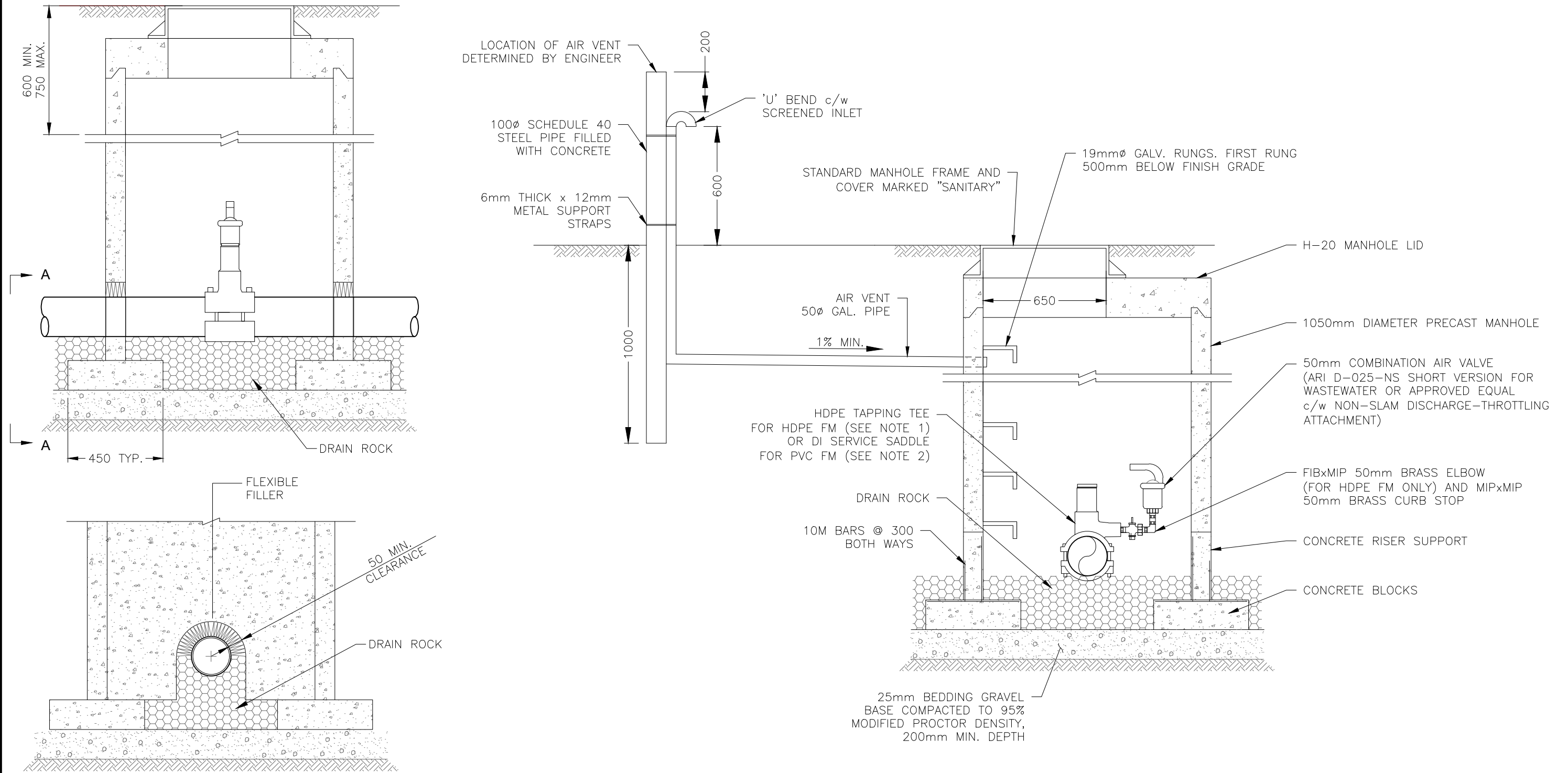
3	MAY 2020	
2	FEBRUARY 2019	
1	OCTOBER 2011	Title TYPICAL PUMP STATION PLAN LAYOUT
	Revision Date Approved	
 <p>საბუნებრივ რესურსთა და გარემოს დაცვის სამინისტრო TRAPNARDEN FURT NATURE</p>		Approved TFN
		Date MAY 2020
		DRAWING NUMBER TSSD-S3



0 0.1 1:25 1 0.625m

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2	MARCH 2019		
1	FEBRUARY 2019	Title SANITARY CLEANOUT DETAIL	
	Revision Date		
	Approved	Approved	TFN
		Date	MARCH 2019
 səwəθən məsteyax™ TSARWAAN FIRST NATION		DRAWING NUMBER	
		TSSD-S4	
SANITARY INSTALLATION STANDARDS			

U:\Projects_VAN2\77004701\01\Drafting-Design-Analysis\CADD CURRENT\PRODUCTION\New Standards 2019\Sanitary\TSSD-S5 - 50mm Combination Air Valve.dwg, TSSD-S5, 2019/03/21 03:45 pm dbarry




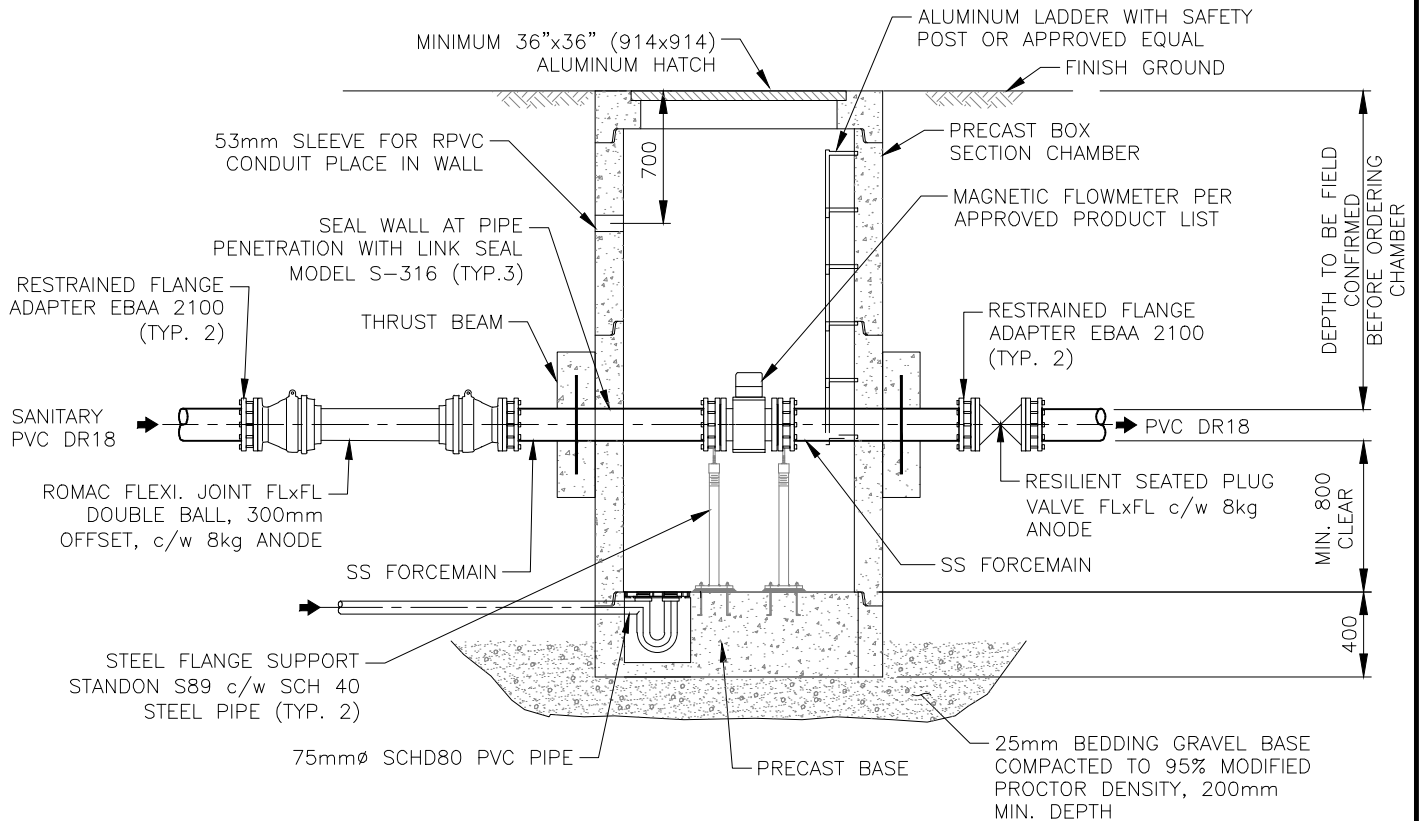
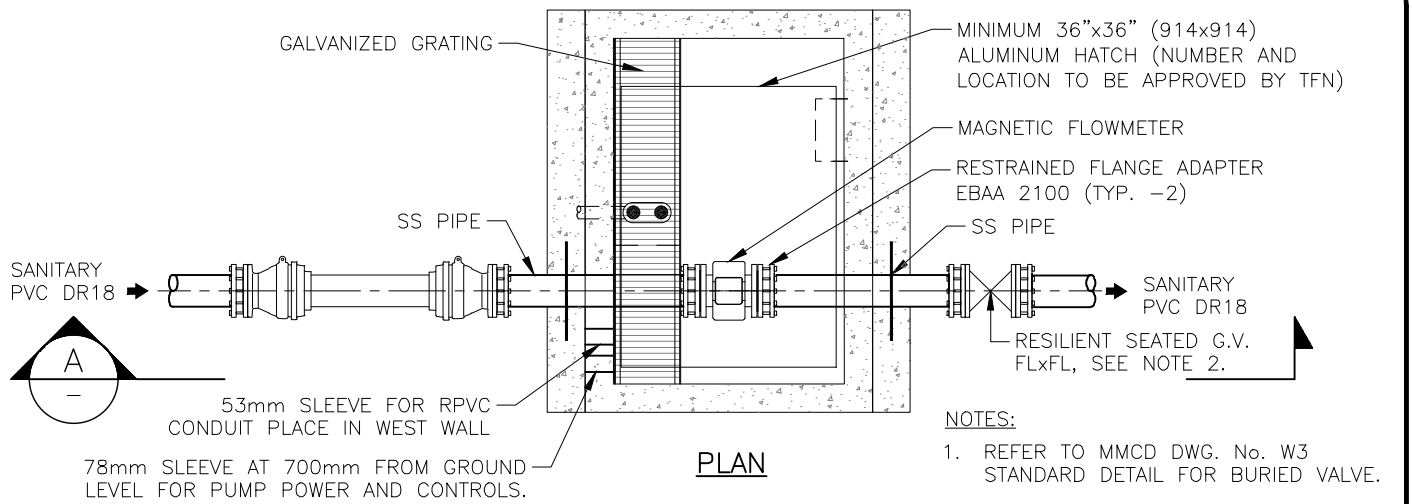
SECTION A-A

0 0.125 1:20 0.5m

NOTES:

1. SHOP DRAWINGS TO BE PROVIDED FOR TFN APPROVAL
2. PIPE TYPE TO BE APPROVED BY TFN.


3		All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2	MARCH 2019			
1	FEBRUARY 2019	Title 50mm COMBINATION AIR VALVE		
	Revision Date Approved			
<div> scaʷaθən məsteyax™ TSAWWASSEN FIRST NATION</div> <div>SANITARY INSTALLATION STANDARDS</div>		Approved TFN		DRAWING NUMBER TSSD-S5
		Date MARCH 2019		

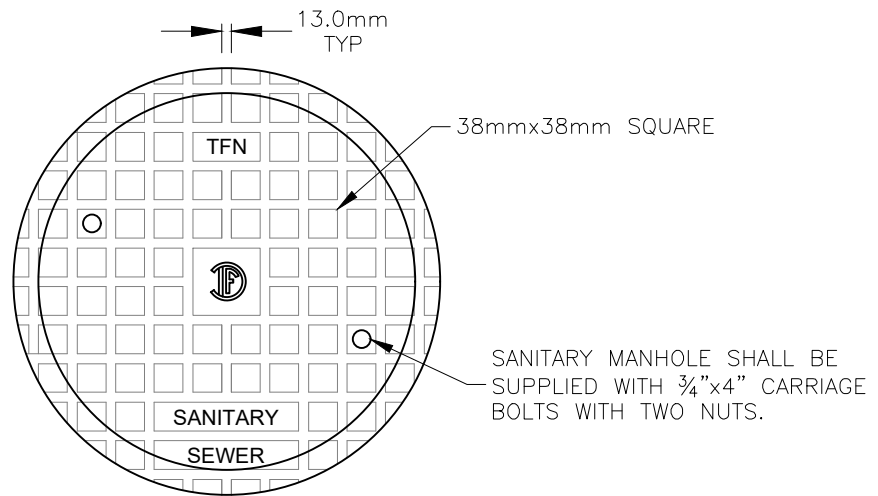


NOTES:

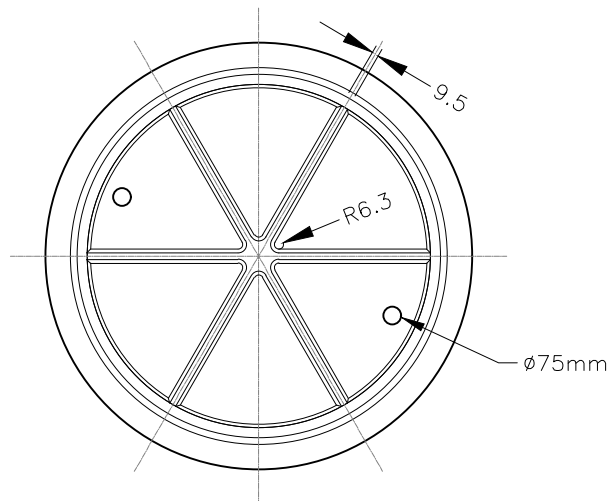
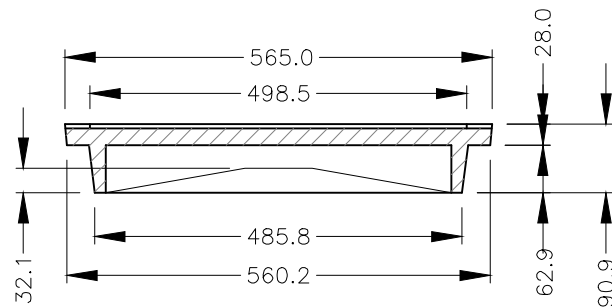
1. SUPPLY SPARE 150Ø DUCTILE IRON SPOOL PIECE FOR FUTURE TEMPORARY OPERATION OF FORCEMAIN WITHOUT FLOW METER.
2. ALL BOLTS, NUTS AND WASHERS STAINLESS STEEL (TYP.).
3. STEEL FLANGE SUPPORT c/w SCH 40 STEEL PIPE TO BE GALVANIZED.
4. SHOP DRAWINGS TO BE PROVIDED FOR TFN APPROVAL.
5. PIPE TYPE TO BE APPROVED BY TFN.

0 0.25 1:40 1m

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2	MARCH 2019			
1	FEBRUARY 2019	Title SANITARY FORCEMAIN METERING CHAMBER		
	Revision Date <div>Approved</div>			
<div><div>sc̣ẉạḅạṇ ṃạṣṭẹỵạx̣^w ṢANṢṢṢ</div></div>				



PLAN – COVER




PLAN – COVER U/S REINF.

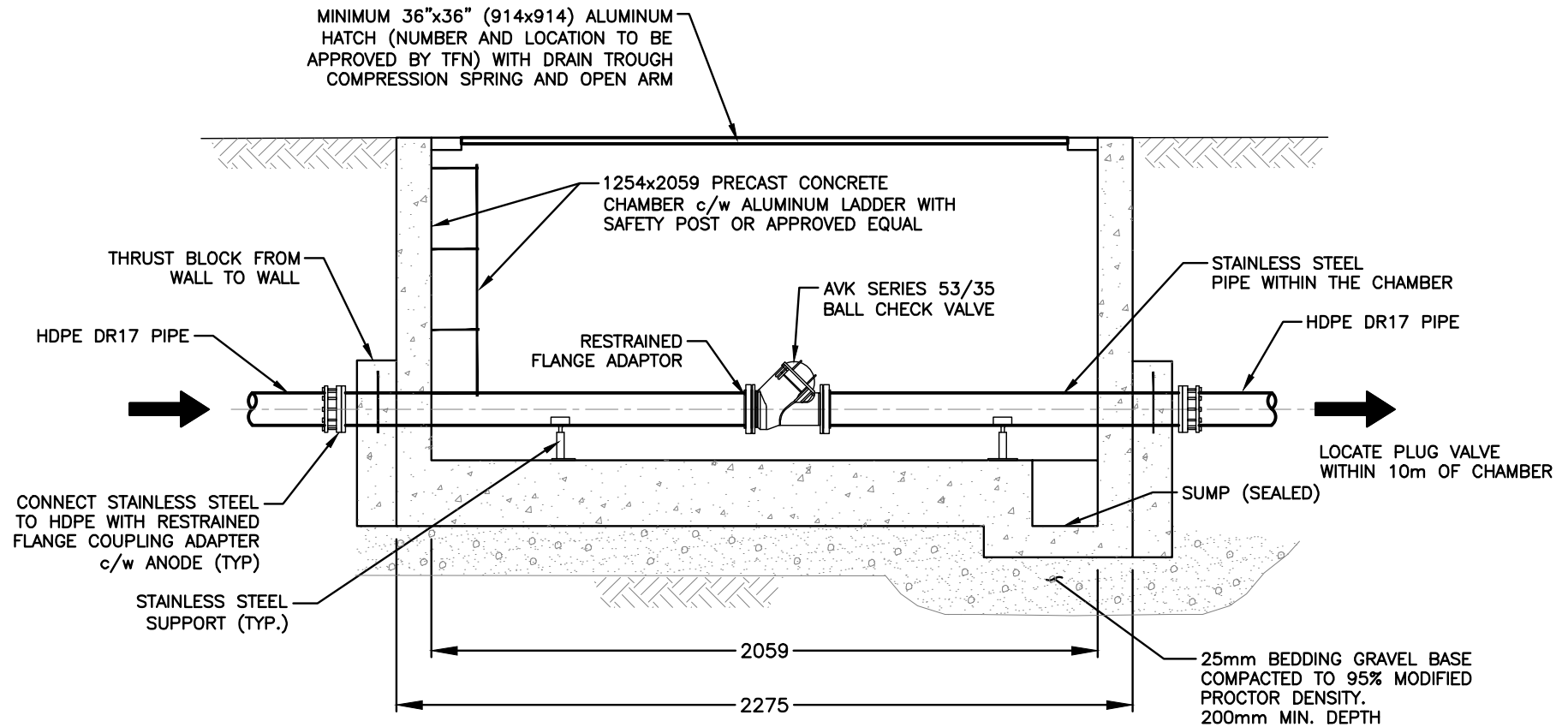
NOTE:

COVER TO BE MARKED
APPROPRIATELY FOR SANITARY,
STORM OR WATER

0 0.05 1:10 0.25m

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2	MARCH 2019		
1	FEBRUARY 2019	Title TFN MANHOLE LID	
	Revision Date Approved		
<div> scaʷaḁan mästayax™ <small>TSARWADHAN FIRST NATION</small></div> <div>SANITARY INSTALLATION STANDARDS</div>		Approved TFN	DRAWING NUMBER TSSD-S7
		Date MARCH 2019	


U:\Projects_VAN\217\04701\1D-Drafting-Design-Analysis\CADD\CURRENT\PRODUCTION\New Standards 2019\Sanitary\TSSD-S8 - Ball Check Valve for San FM.dwg TSSD-S8, 2019/03/21 03:46 pm dbarry



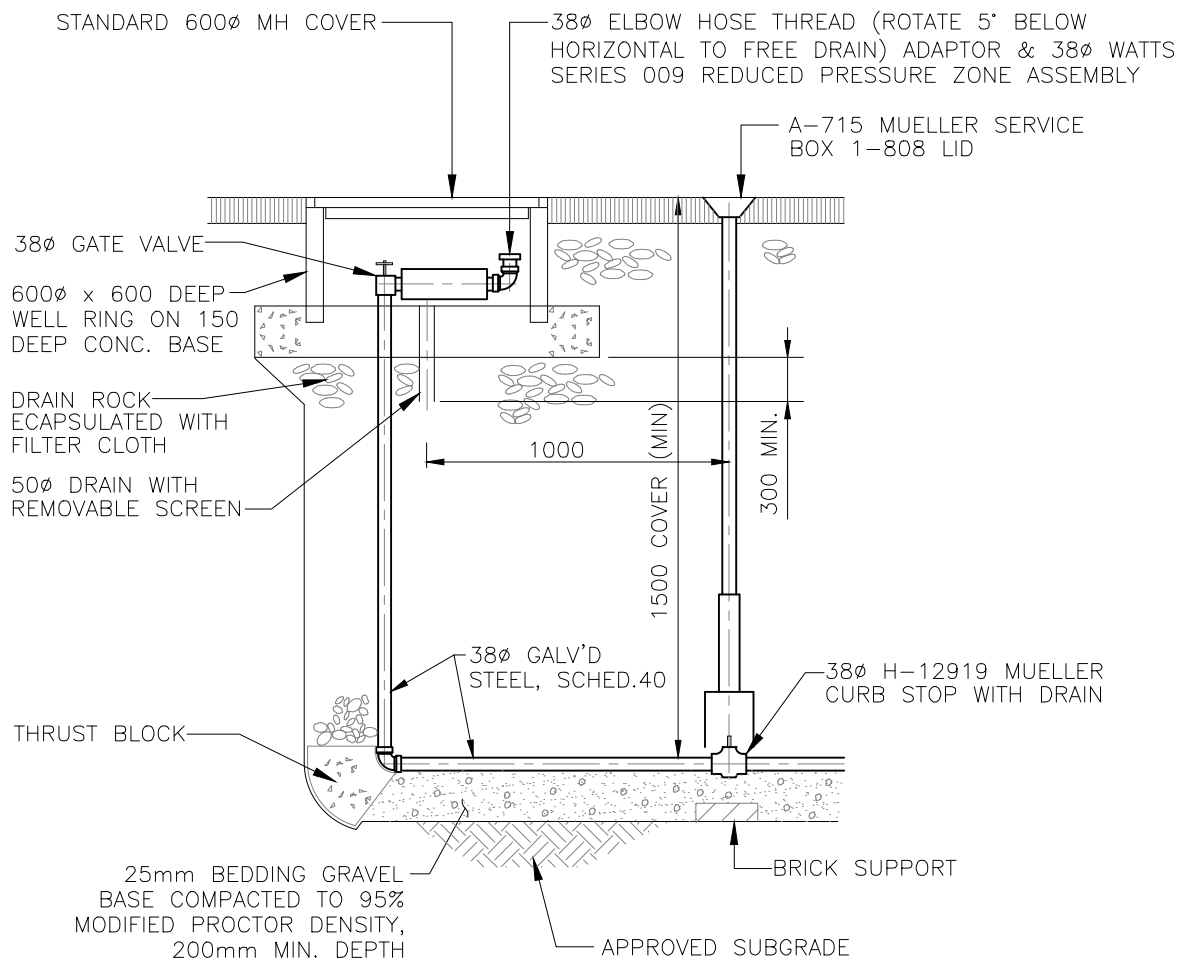
NOTE

1. SUPPLY SPARE 150Ø DUCTILE IRON SPOOL PIECE FOR FUTURE TEMPORARY OPERATION OF FORCEMAIN WITHOUT FLOW METER.
2. ALL BOLTS, NUTS AND WASHERS STAINLESS STEEL (TYP.).
3. STEEL FLANGE SUPPORT c/w SCH 40 STEEL PIPE TO BE GALVANIZED.
4. SHOP DRAWINGS TO BE PROVIDED FOR TFN APPROVAL.
5. PIPE TYPE TO BE APPROVED BY TFN.


0 0.125 1:20 0.5m

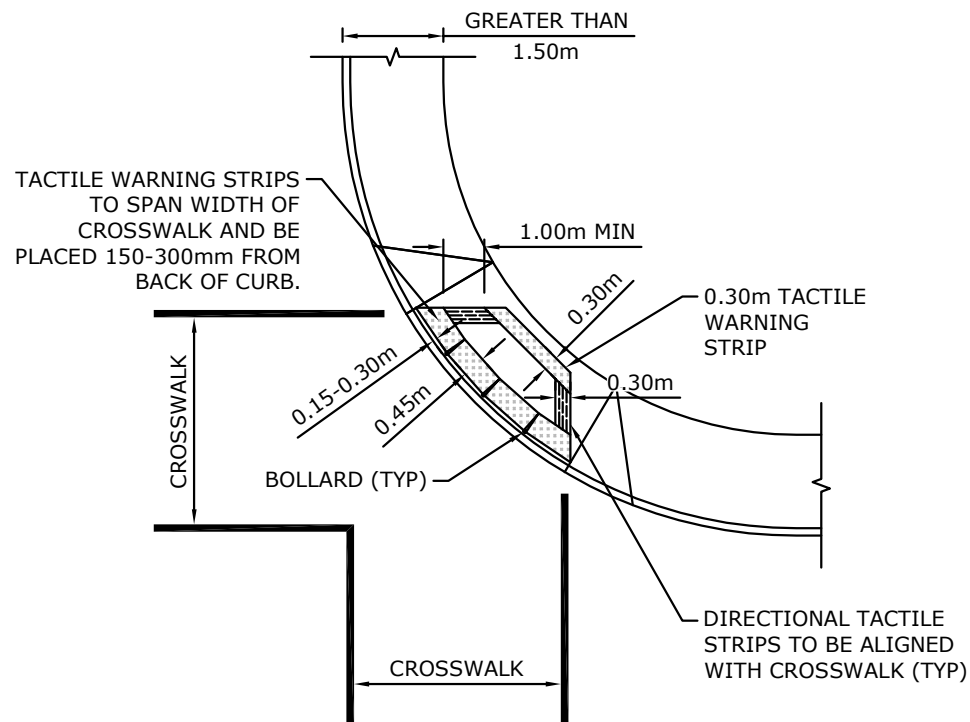
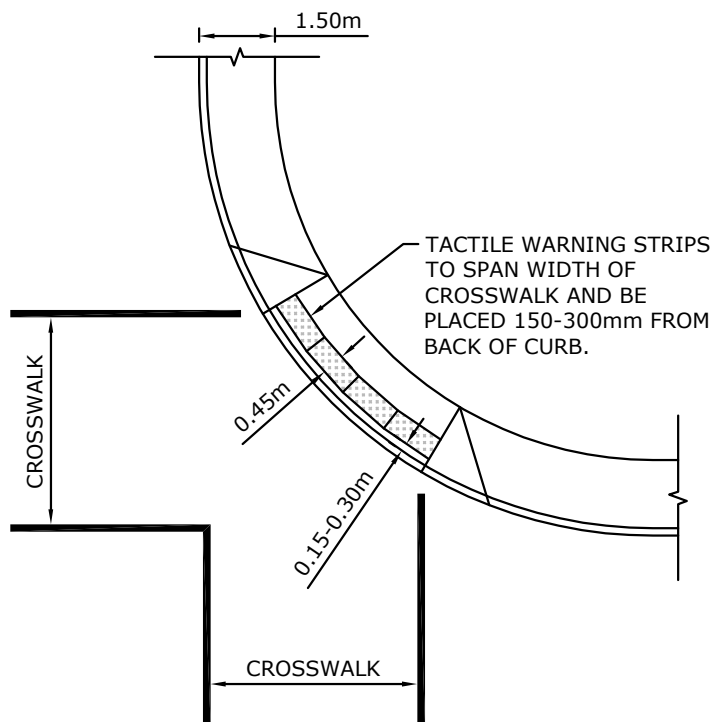
3		All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2	MARCH 2019			
1	FEBRUARY 2019	Title CHECK VALVE ASSEMBLY FOR SANITARY FORCEMAIN DETAIL		
	Revision Date			
	Approved	Approved TFN Date MARCH 2019		
				DRAWING NUMBER TSSD-S8

U:\Projects_VAN\2177004701\DDrilling-Design-Analysis\CADD\CURRENT PRODUCTION\New Standards 2019\Sanitary\TSSD-S9 - San Wash Down Chamber.dwg, TSSD-S9, 2019/03/21 03:46 pm dbarry



0 0.1 1:25 1 0.625m


3		All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2	MARCH 2019		
1	FEBRUARY 2019	Title SANITARY WASH-DOWN CHAMBER DETAIL	
	Revision Date		
	Approved	Approved	TFN
		Date	MARCH 2019
 scəwəθən məsteyəx™ TSAWWASSEN FIRST NATION		DRAWING NUMBER	
		TSSD-S9	
WATER INSTALLATION STANDARDS			

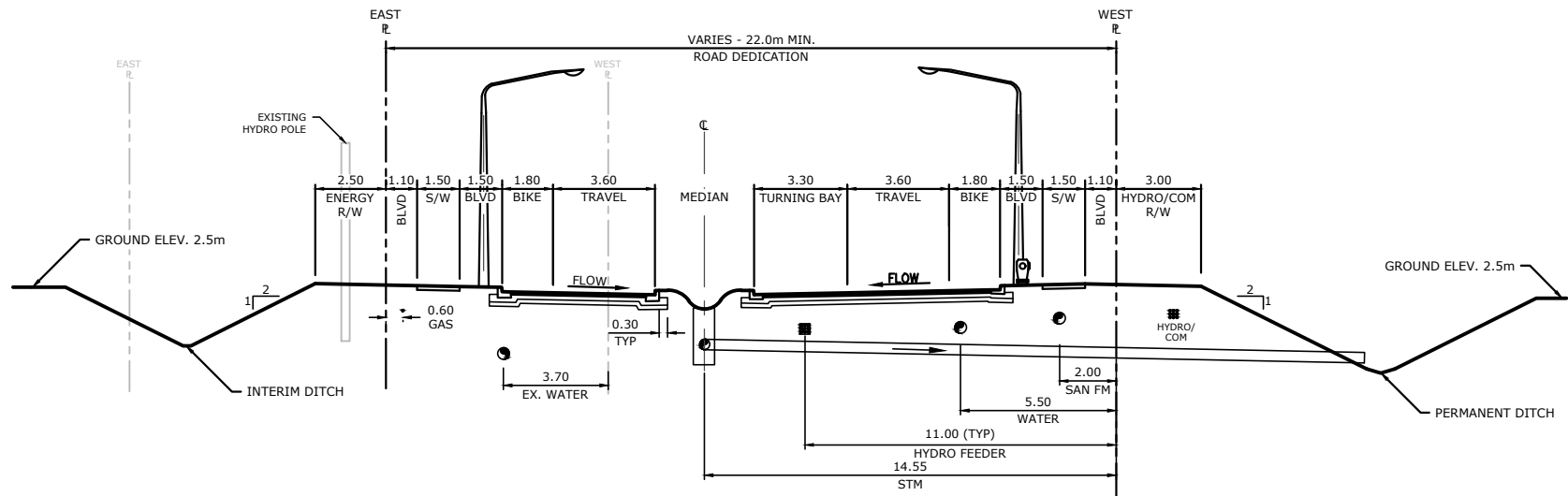



NOTE:

TACTILE TILE PRODUCTS SHALL BE PRE-APPROVED BY TSAWWASSEN FIRST NATION ACCESSIBILITY COMMITTEE AND/OR:

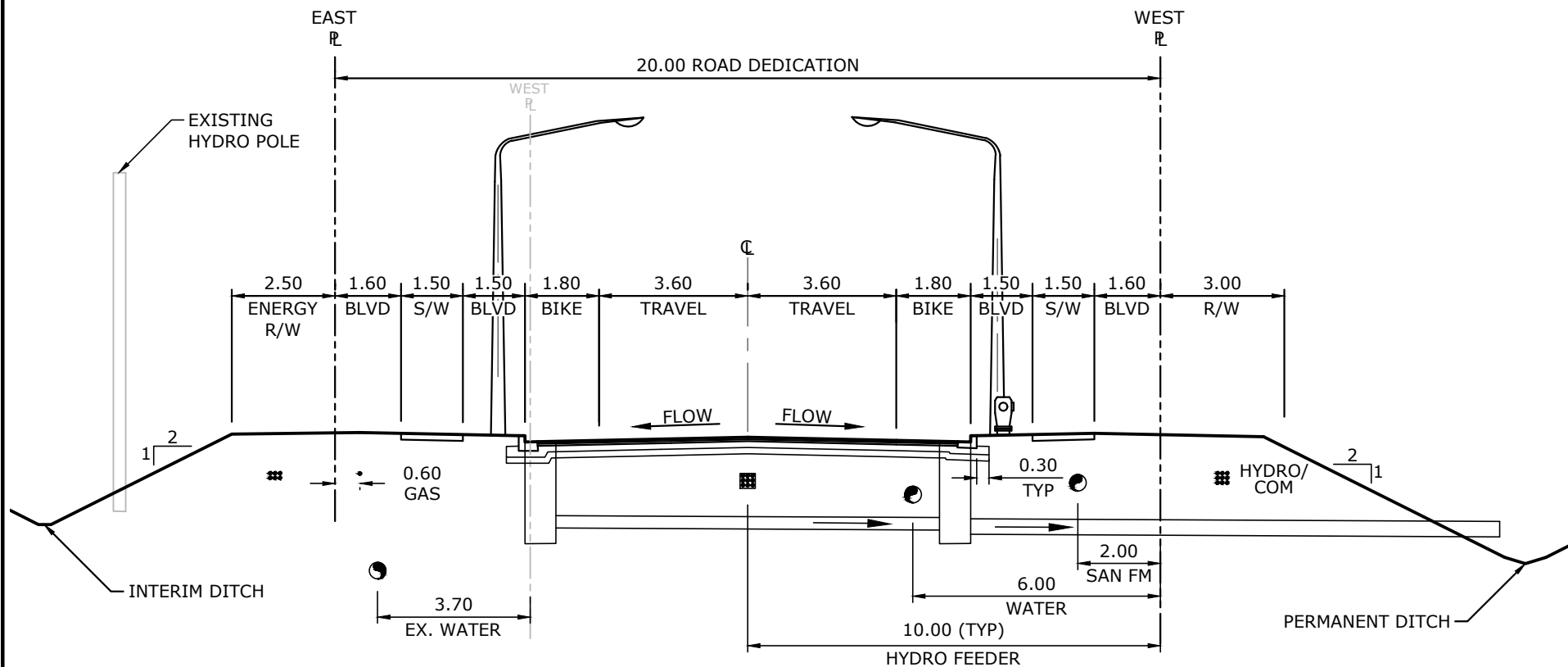
- TACTILE TILES SHALL BE CAST IN PLACE AND SHALL BE MADE OF VITRIFIED POLYMER COMPOSITE (VPC). THE TILES SHALL BE AN EPOXY POLYMER COMPOSITION WITH ULTRA VIOLET STABILIZED COATING EMPLOYING ALUMINIUM OXIDE PARTICLES IN THE TRUNCATED DOMES. TO ACHIEVE THE DESIRED STRUCTURAL INTEGRITY THE COMPOSITE MUST CONTAIN A MINIMUM OF THREE FULL SHEETS OF OF FIBREGLASS AND ONE WOVEN SHEET. THE TILE SHALL INCORPORATE AN IN-LINE DOME PATTERN OF TRUNCATED DOMES 5.1mm (0.2") IN HEIGHT, 22.9mm (0.9") DIAMETER AT THE BASE AND 10.2mm (0.4") DIAMETER AT TOP OF DOME SPACED 59.7mm (2.35") NOMINAL AS MEASURED ON A DIAGONAL AND 43.2mm (1.70") NOMINAL AS MEASURED SIDE BY SIDE. FOR WHEELCHAIR SAFETY THE FIELD AREAS SHALL CONSIST OF A NON-SLIP SURFACE WITH A MINIMUM OF 40-90° RAISED POINTS 1.1mm (0.045") HIGH PER SQUARE INCH. THE TILES SHALL BE SOUND AMPLIFYING AND COLOURS BRIGHT YELLOW (US FEDERAL CODE 33538).
- INSTALLATION OF TACTILE DETECTABLE WARNING SHALL BE BY MANUFACTURER TRAINED AND CERTIFIED INDIVIDUALS. THE CONTRACTOR SHALL UPON REQUEST PROVIDE THE ENGINEER WITH COPIES OF THESE CERTIFICATES PRIOR TO BEGINNING WORK. INSTALLATIONS SHALL HAVE A FIVE (5) YEAR WARRANTY FROM THE CONTRACTOR.


3				
2				
1	JULY 2012	Title		
	Revision Date	Approved	TACTILE STRIP PLACEMENT	
<div><p>scəwəθən məsteyəxʷ TSAWWASSEN FIRST NATION</p></div> <div>ROADWAY STANDARDS</div>		Approved	TFN	DRAWING NUMBER TSSD-C1
		Date	JULY 2012	

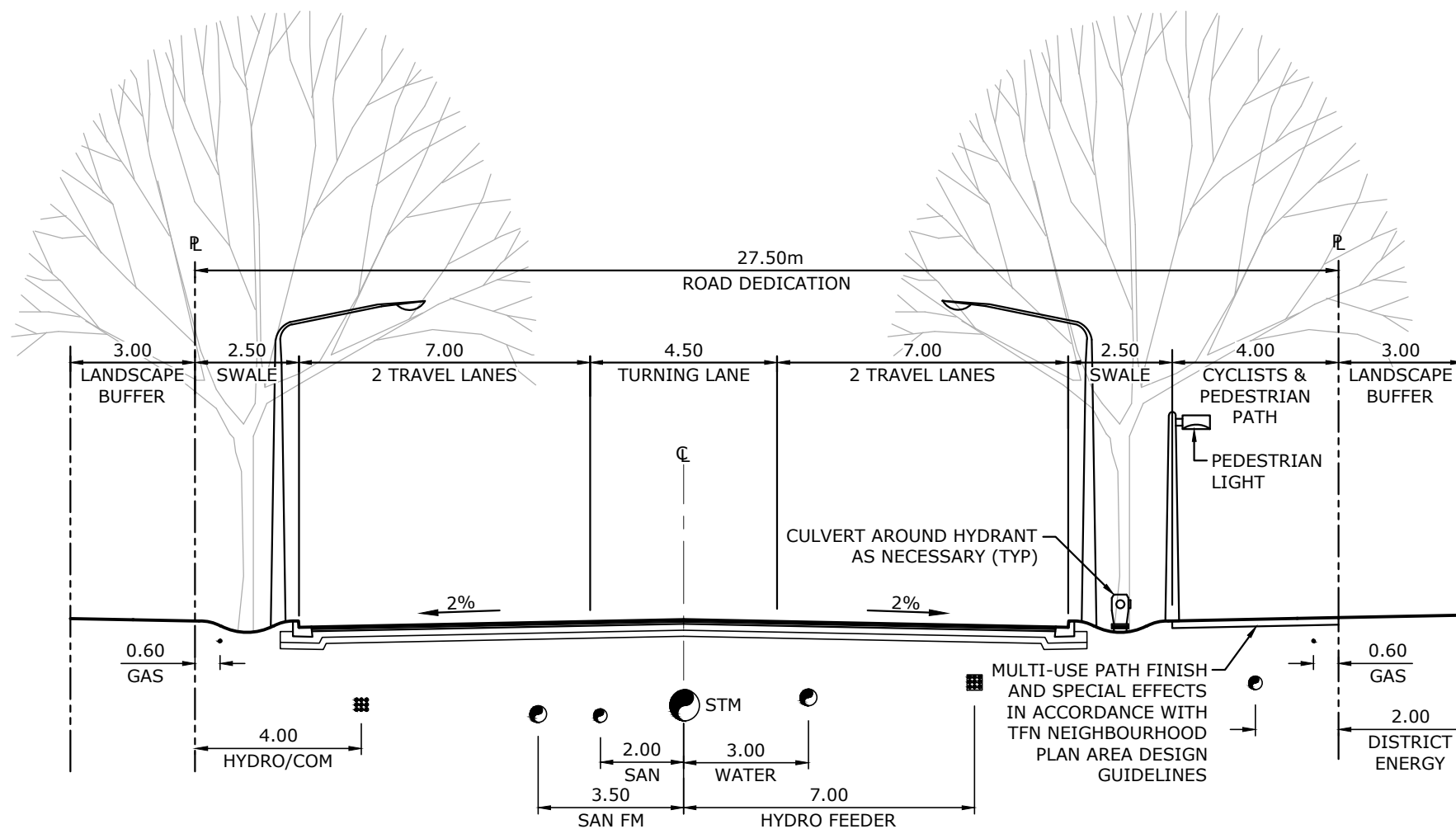


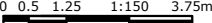

Classification: Industrial Divided		<div>011:2506m</div>		
3		All Dimensions Shown In Metres, Unless Otherwise Noted		
2	JUNE 2012			
1	DECEMBER 2011			
	Revision Date	Approved	Title 41B STREET AT INTERSECTION OF 27B AVENUE	
<div> scəwətsən məsteyəxʷ TSAWWSSEN FIRST NATION</div> <div>TYPICAL SECTIONS</div>			ApprovedTFN	DRAWING NUMBER TSSD-R1
			DateDECEMBER 2011	


U:\Projects_VAN\177\0047\01\0-Drafting-Design-Analysis\CADD\CURRENT\PRODUCTION\Standards-2019\TSSD-R1-R15.dwg [R2] 2019-04-29 2:04:30 PM




Classification: Industrial Undivided		0 0.5 1.25 1:150 3.75m		
3		All Dimensions Shown In Metres, Unless Otherwise Noted		
2	JUNE 2012			
1	DECEMBER 2011			
	Revision Date	Approved	Title 41B STREET SOUTH OF 27B AVENUE	
 TYPICAL SECTIONS		Approved	TFN	DRAWING NUMBER TSSD-R2
		Date	DECEMBER 2011	

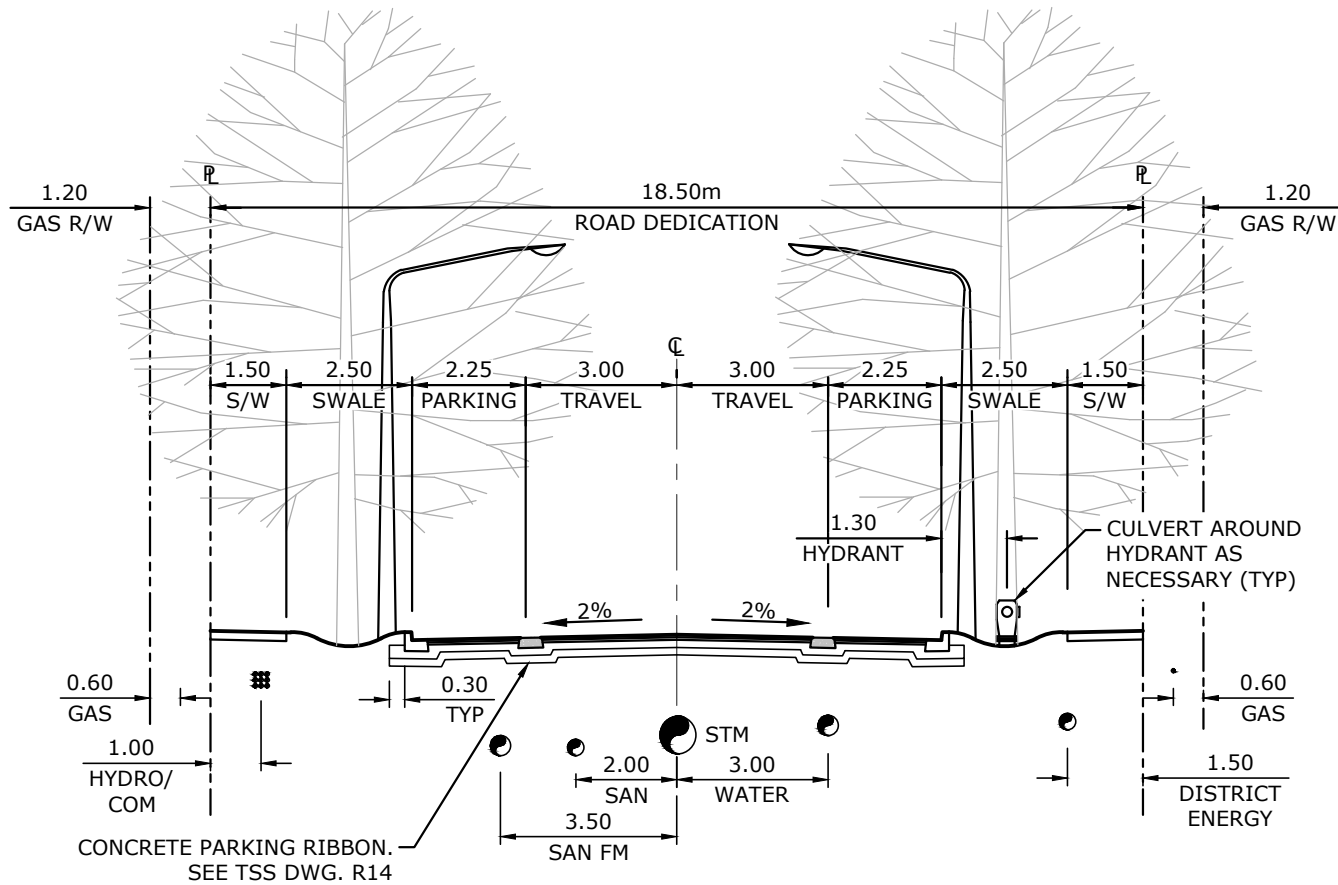


Classification: Collector 4 Lane			
3		All Dimensions Shown In Metres, Unless Otherwise Noted	
2	JUNE 2012		
1	DECEMBER 2011	Title 41B STREET AT INTERSECTION OF 27B AVENUE	
	Revision Date Approved		
 TYPICAL SECTIONS		Approved TFN	DRAWING NUMBER TSSD-R4
		Date DECEMBER 2011	

Classification: Local Greenway		<div>00.51.251:1503.75m</div>			
3		All Dimensions Shown In Metres, Unless Otherwise Noted			
2	JUNE 2012				
1	DECEMBER 2011				
	Revision Date	Approved	Title LOCAL ROAD W/ GREENWAY		
<div><div><div>sc̓awāḡḡon m̓asteyāx™ TOWN OF WABIGOON</div></div><div>TYPICAL SECTIONS</div></div>			Approved	TFN	DRAWING NUMBER TSSD-R6
			Date	DECEMBER 2011	

Classification: Local Road A		0 0.5 1.25 1:150 3.75m	
3		All Dimensions Shown In Metres, Unless Otherwise Noted	
2			
1	JUNE 2012	Title	
	Revision Date	ROAD A	
Approved		DRAWING NUMBER	
 TYPICAL SECTIONS		Approved	TFN
		Date	FEBRUARY 2012
		TSSD-R6-S	

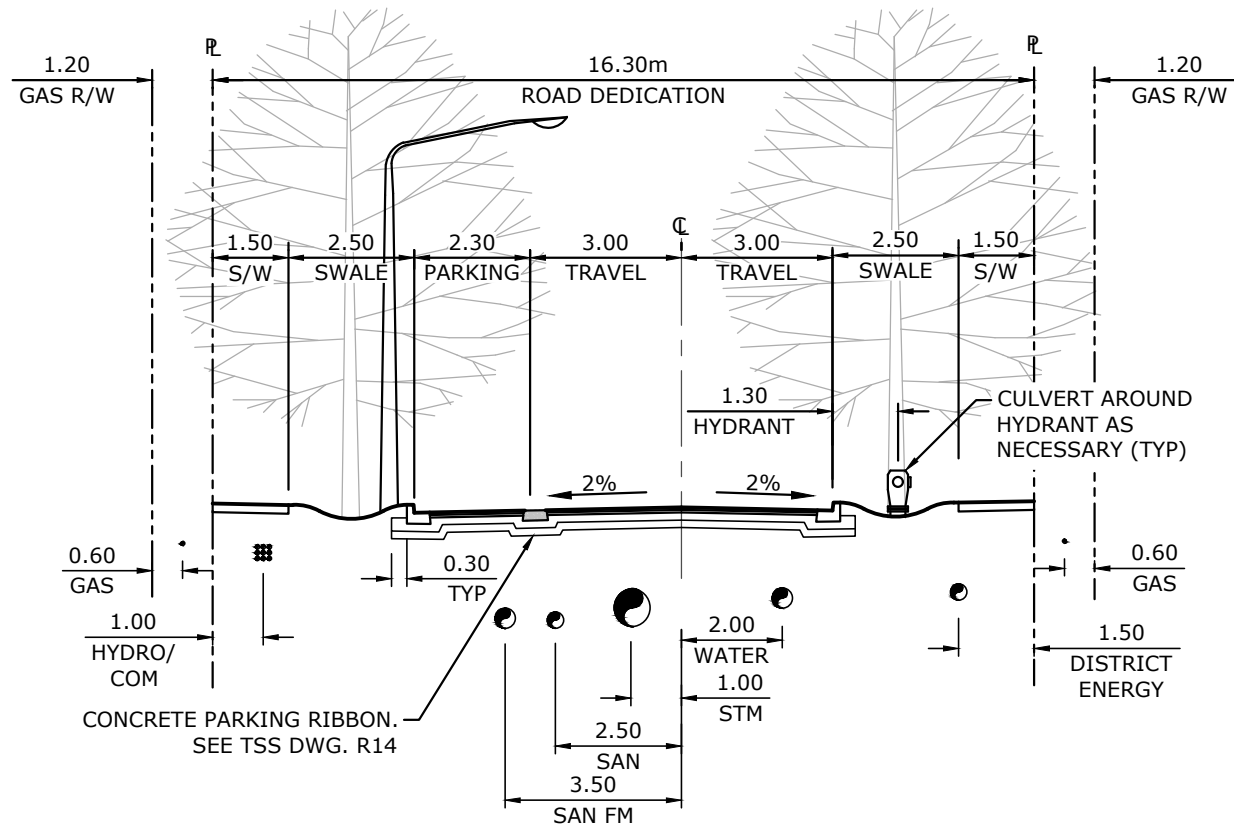
U:\Projects_VAN\17\10047\01\10-Drafting-Design-Analysis\CADD\CURRENT\PRODUCTION\11-Standards-2019\TSSD-R1-R15.dwg [R7] 2019-04-29 2:04:32 PM



Classification:
Local w/ Parking Both Sides


3		All Dimensions Shown In Metres, Unless Otherwise Noted			
2	JUNE 2012				
1	DECEMBER 2011				
	Revision Date	Approved	Title LOCAL ROAD - 1		
<div></div> <div>TYPICAL SECTIONS</div>					
			Approved	TFN	DRAWING NUMBER TSSD-R7
			Date	DECEMBER 2011	

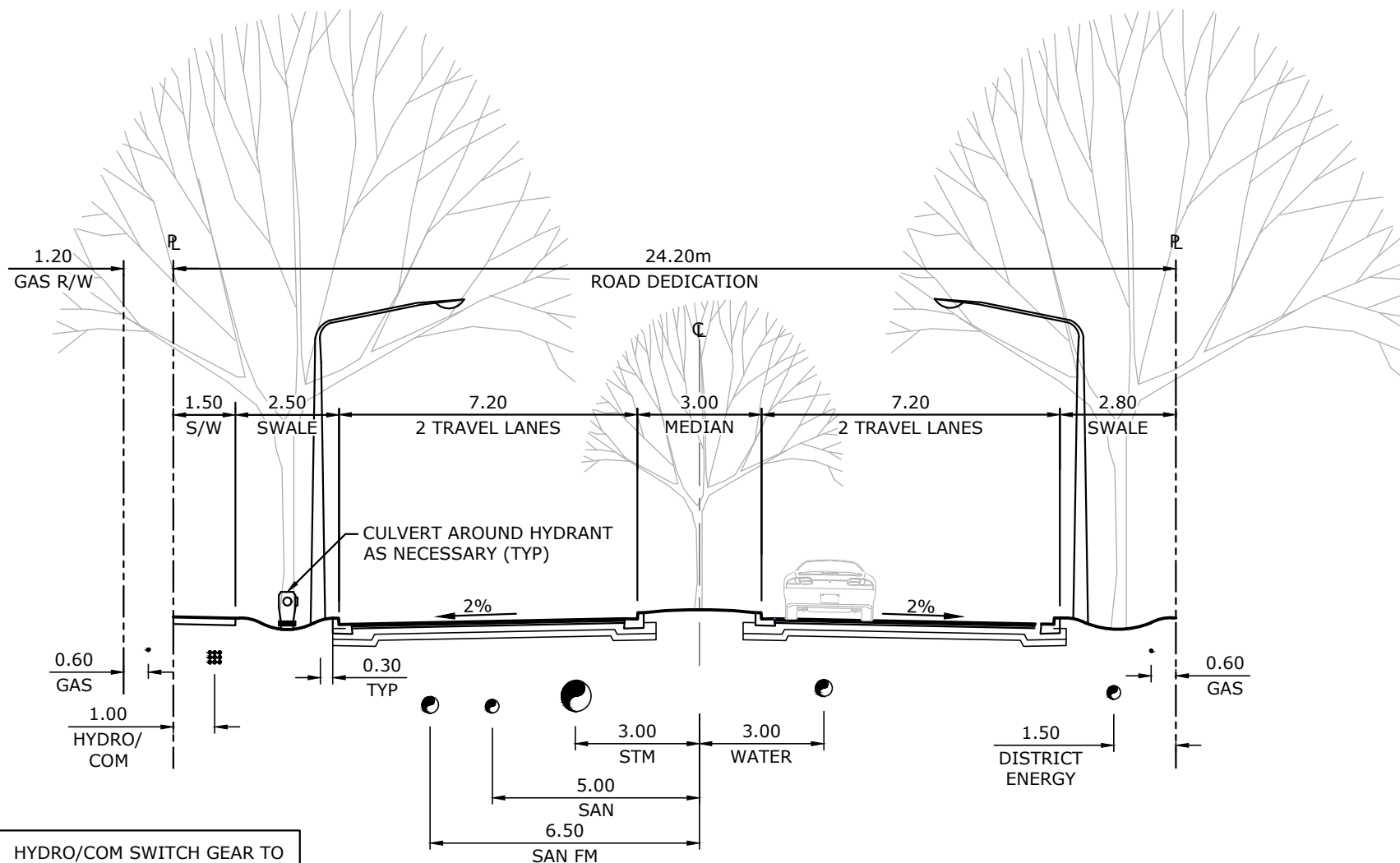
U:\Projects_VAN\177\0047\01\0-Drafting-Design-Analysis\CADD\CURRENT\PRODUCTION\All-Standards-2019\TSSD-R1-R15.dwg [R8] 2019-04-29 2:04:33 PM



Classification:
Local w/ Parking One Side

0 0.5 1.25 1:150 3.75m


3		All Dimensions Shown In Metres, Unless Otherwise Noted			
2	JUNE 2012				
1	DECEMBER 2011				
	Revision Date	Approved	Title	LOCAL ROAD - 2	
<div><div>TYPICAL SECTIONS</div></div>			Approved		TFN
			Date	DECEMBER 2011	




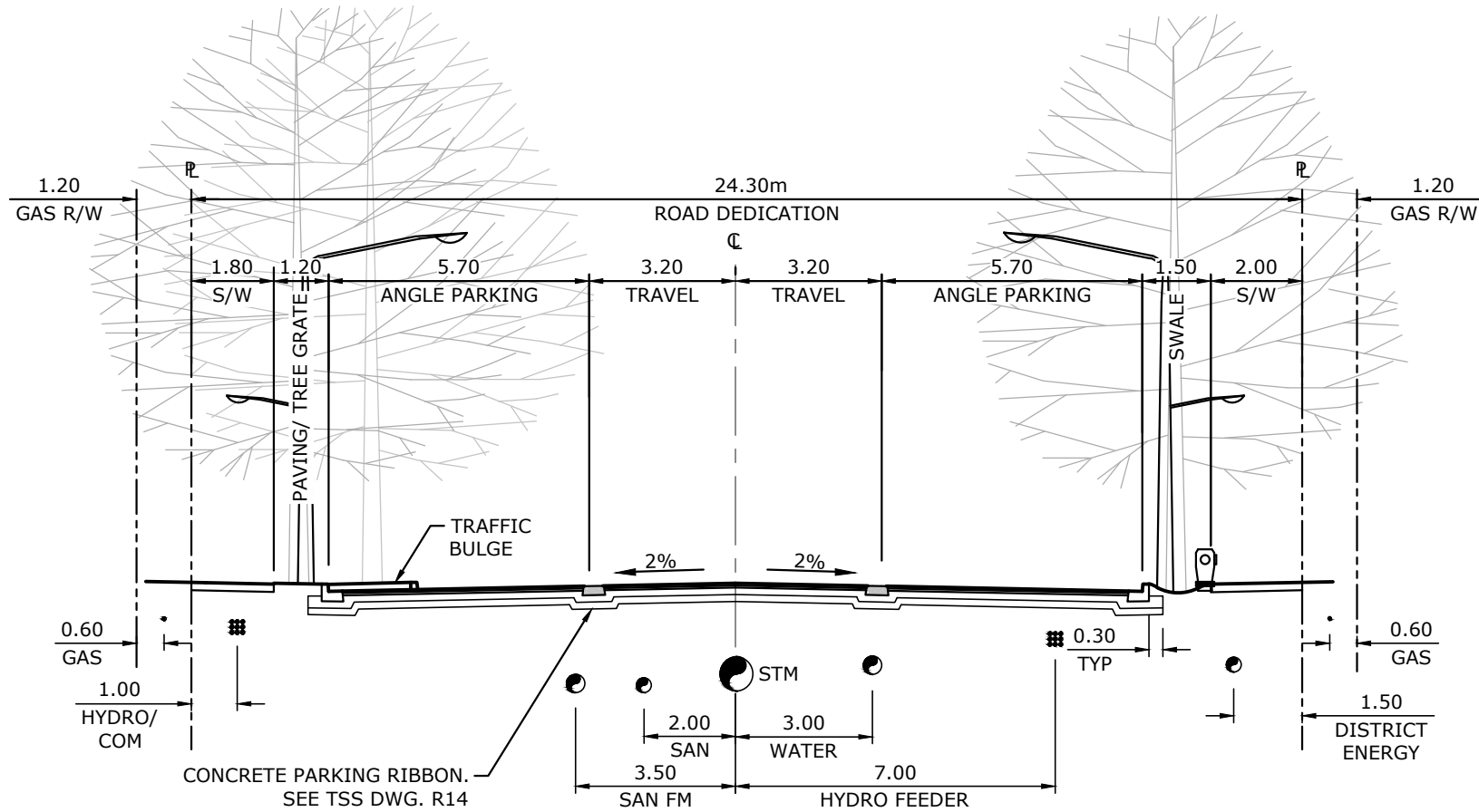
HYDRO/COM SWITCH GEAR TO
BE LOCATED WITHIN A ROW
ADJACENT GAS ROW (TYP)

Classification:
Divided Collector

0 0.5 1.25 1:150 3.75m


3		All Dimensions Shown In Metres, Unless Otherwise Noted
2	JUNE 2012	
1	DECEMBER 2011	Title ENTRANCE BOULEVARD
	Revision Date Approved	
 scəwəθən məsteyəx™ TSAWWSHEN FIRST NATION		Approved TFN
		Date DECEMBER 2011
		DRAWING NUMBER TSSD-R9

3		All Dimensions Shown In Metres, Unless Otherwise Noted	
2	JUNE 2012		
1	DECEMBER 2011	Title COLLECTOR ROAD	
	Revision Date Approved		
<div> scəwəθən məsteyən™ TSAWWASSEN FIRST NATION</div> <div>TYPICAL SECTIONS</div>		Approved TFN	DRAWING NUMBER TSSD-R10
		Date DECEMBER 2011	

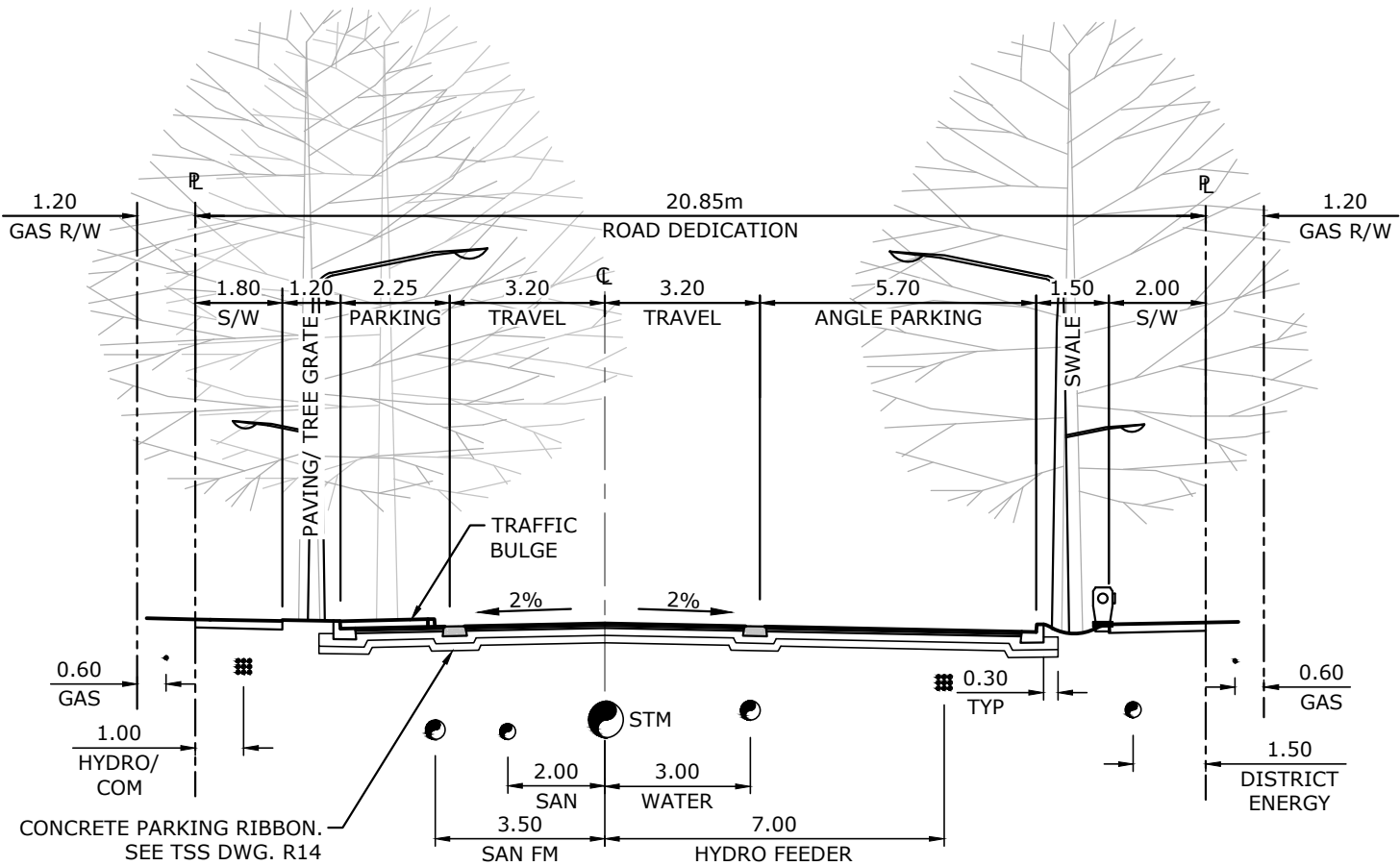


Classification:
Collector 2 Lane w/ Angle & Parallel Parking

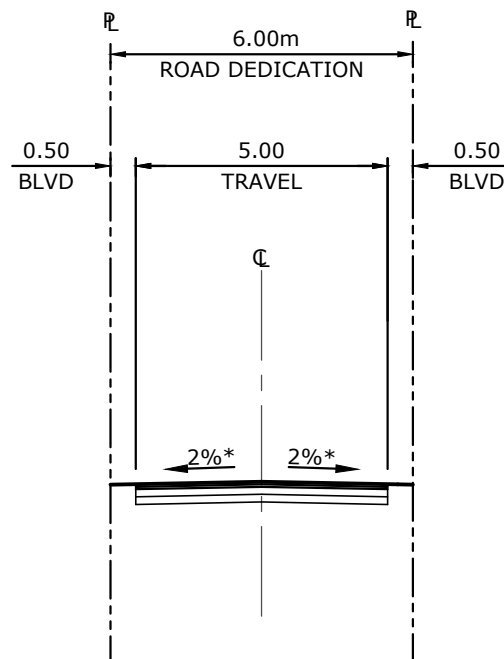
0 0.5 1.25 1:150 3.75m

3		All Dimensions Shown In Metres, Unless Otherwise Noted			
2	JUNE 2012				
1	DECEMBER 2011				
	Revision Date	Approved	Title	VILLAGE CENTRE 1	
<div><div>TYPICAL SECTIONS</div></div>			Approved		TFN
			Date	DECEMBER 2011	TSSD-R11

TYPICAL
SECTIONS




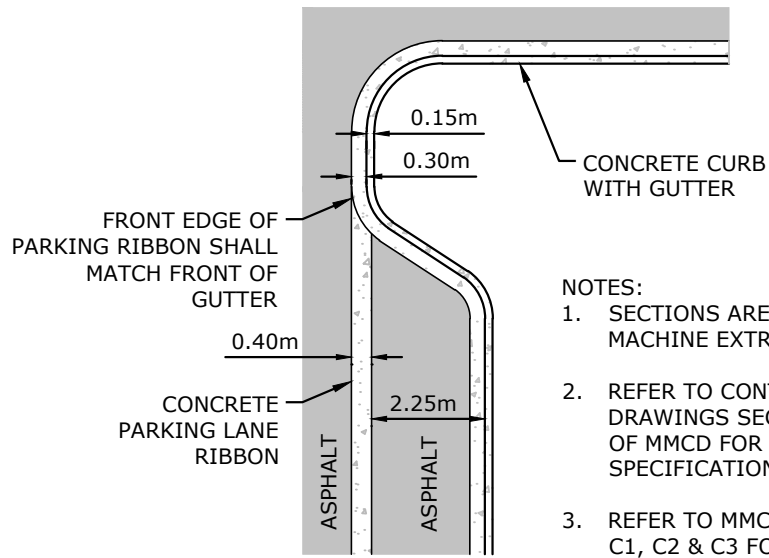
Classification: Collector 2 Lane w/ One Side Angle & One Side Parallel Parking			
3		All Dimensions Shown In Metres, Unless Otherwise Noted	
2			
1	JUNE 2012	Title	
	Revision Date	VILLAGE CENTRE 2	
	Approved		
		Approved	TFN
		Date	JUNE 2012
TYPICAL SECTIONS		DRAWING NUMBER TSSD-R12	



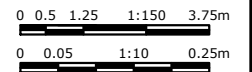
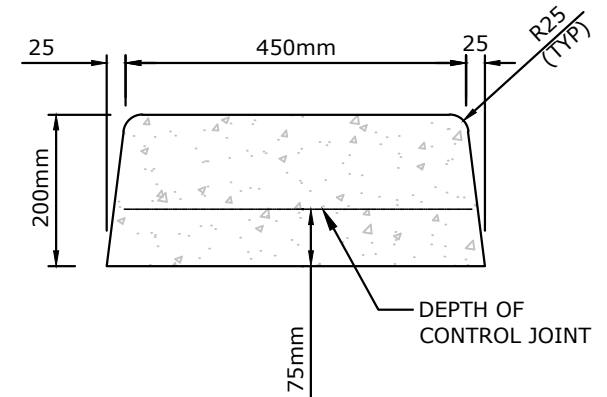
* CROSSFALL AND DRAINAGE CONFIGURATION
CAN BE MODIFIED TO SUIT SITE SPECIFIC
CONDITIONS SUBJECT TO APPROVAL BY TFN.


0 0.5 1.25 1:150 3.75m


3		All Dimensions Shown In Metres, Unless Otherwise Noted	
2	JUNE 2012		
1	DECEMBER 2011	Title REAR LANE	
	Revision Date Approved		
<div><div>TYPICAL SECTIONS</div></div>		Approved TFN	DRAWING NUMBER TSSD-R13
		Date DECEMBER 2011	



- NOTES:
1. SECTIONS ARE SHOWN FOR MACHINE EXTRUDED CURB
 2. REFER TO CONTRACT DRAWINGS SECTION 03 30 20 OF MMCD FOR DETAILED SPECIFICATIONS
 3. REFER TO MMCD STD. DWG. C1, C2 & C3 FOR INSTALLATION DETAILS.



3		All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2			
1	JUNE 2012	Title CONCRETE PARKING LANE RIBBON	
	Revision Date		
	Approved	Approved TFN Date JUNE 2012	
 ROADWAY STANDARDS		DRAWING NUMBER TSSD-R14	

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted
2	FEBRUARY 2019	
1	JULY 2012	Title BIOSWALE, SUMP & DRAIN DETAIL
	Revision Date Approved	
 sc̓awəθən məsteyəx™ <small>TSAWWASSEN FIRST NATION</small> ROADWAY STANDARDS		Approved TFN
		Date FEBRUARY 2019
		DRAWING NUMBER TSSD-R15

U:\Projects_VAN\17\1047\1047\10-Drafting-Design-Analysis\CADD\CURRENT\PRODUCTION\Standards-2019\TSSD-R1-R15.dwg [R16] 2019-04-29 2:04:36 PM

OPTION 1

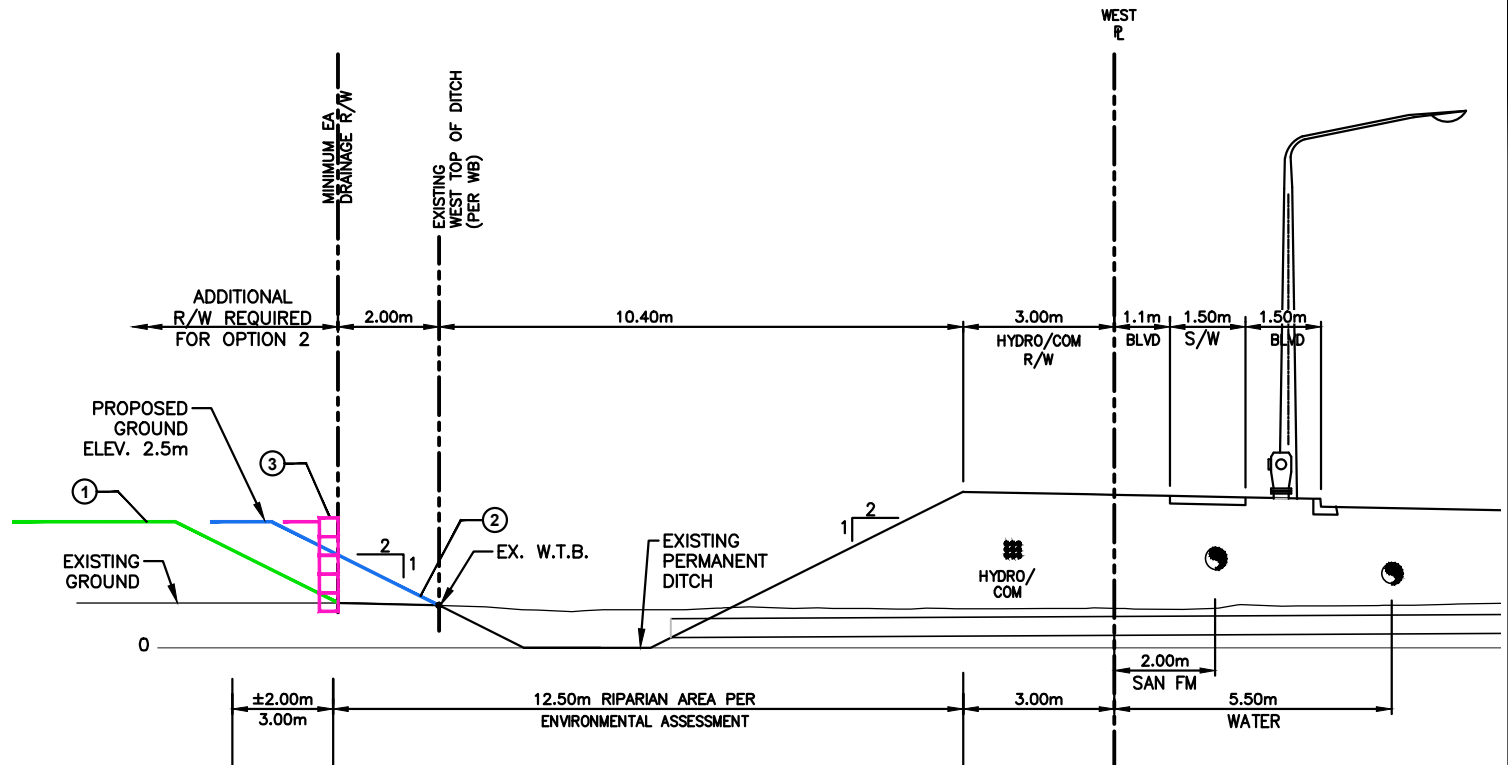
GRADE SLOPE UP TO LOT ELEVATION NOT ENCROACHING ON MINIMUM ENVIRONMENTAL ASSESSMENT SETBACKS. SLOPE ANGLE TO BE BASED ON DEVELOPER GEOTECHNICAL INPUT AND SHALL BE NO STEEPER THAN 2(HOR):1(VERT). RIGHT OF WAY FOR DRAINAGE STAYS AS ILLUSTRATED. APPROVED ENVIRONMENTAL PLANTINGS REQUIRED TO LIMIT OF RIGHT OF WAY.

OPTION 2

EXTEND EXISTING SLOPE AT A GRADE NO STEEPER THAN 2(HOR):1(VERT). SLOPE ANGLE TO BE BASED ON DEVELOPER GEOTECHNICAL INPUT. ADDITIONAL RIGHT OF WAY FOR DRAINAGE REQUIRED TO 2 METRES BEYOND TOP OF DITCH SLOPE. APPROVED ENVIRONMENTAL PLANTINGS REQUIRED TO LIMIT OF NEW RIGHT OF WAY.

OPTION 3

RETAIN GRADE WHILE NOT ENCROACHING ON MINIMUM ENVIRONMENTAL ASSESSMENT SETBACKS AND RIGHT OF WAY. GEOTECHNICAL AND/OR STRUCTURAL DESIGN FOR WALL REQUIRED FROM DEVELOPER. STYLE OF WALL TO THE SATISFACTION OF THE DIRECTOR OF LANDS. RIGHT OF WAY FOR DRAINAGE STAYS AS ILLUSTRATED. APPROVED ENVIRONMENTAL PLANTINGS REQUIRED TO LIMIT OF RIGHT OF WAY.




OPTIONS	
—	OPTION 1
—	OPTION 2
—	OPTION 3

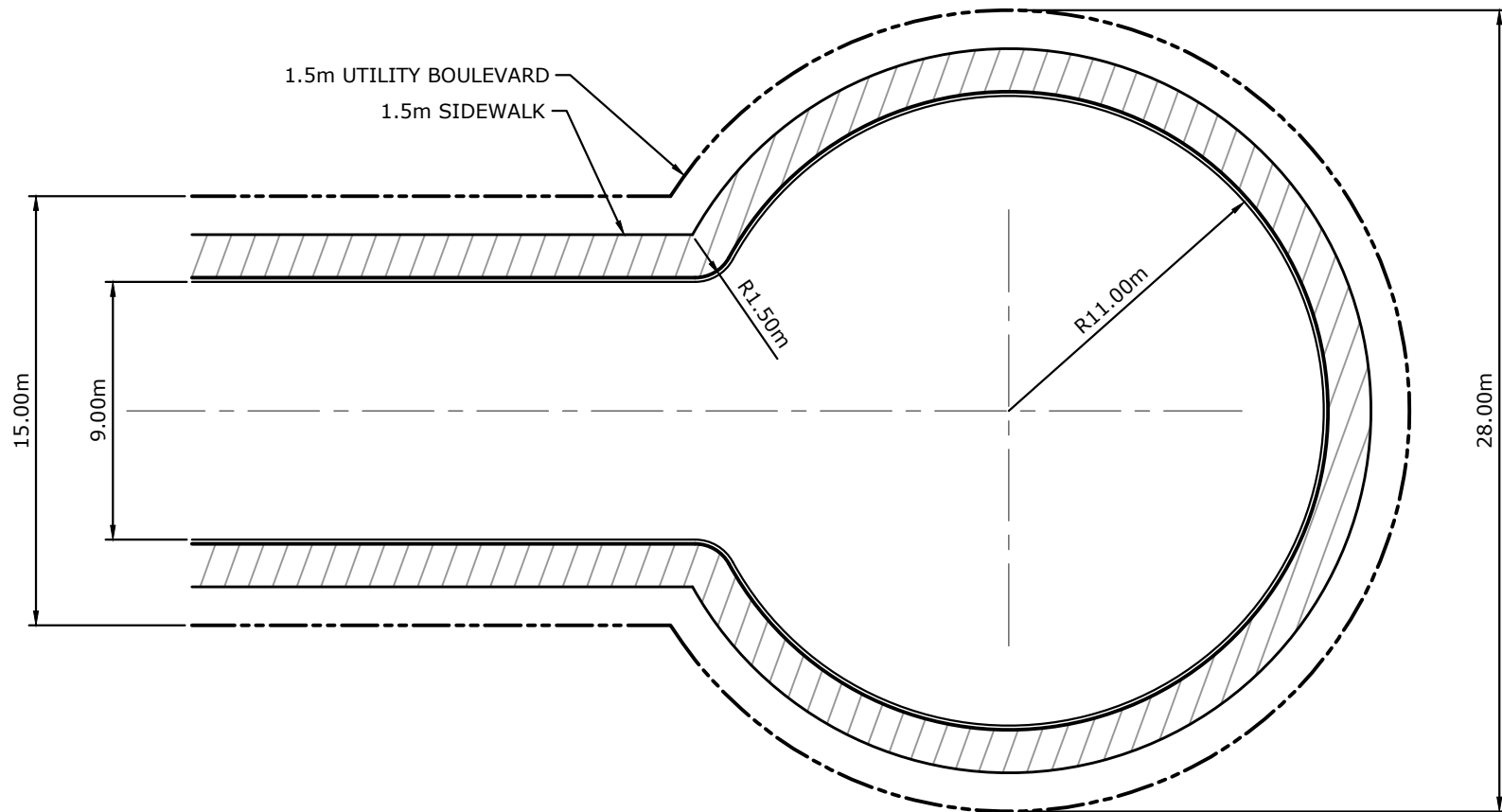
TYPICAL SECTION OPTIONS FOR INDUSTRIAL LANDS

SCALE 1:150

0 0.5 1.25 1:150 3.75m


3		All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2	MARCH 2019			
1	MAY 2013	Title TYPICAL SECTION OPTIONS FOR INDUSTRIAL LANDS		
	Revision Date			Approved
<div><p>scəwəθən məsteyəx'w TSAN'WATS'EN FIRST NATION</p></div> <div>ROADWAY STANDARDS</div>		Approved	TFN	DRAWING NUMBER TSSD-R16
		Date	MARCH 2019	

U:\Projects_VAN\17\1047\01\10-Drafting-Design-Analysis\CADD\CURRENT\PRODUCTION\All-Standards-2019\TSSD-R17 - CUL-DE-SAC.dwg [R17] 2019-04-29 2:04:39 PM

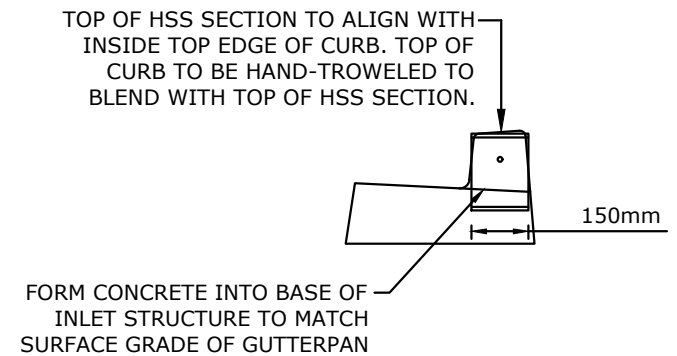
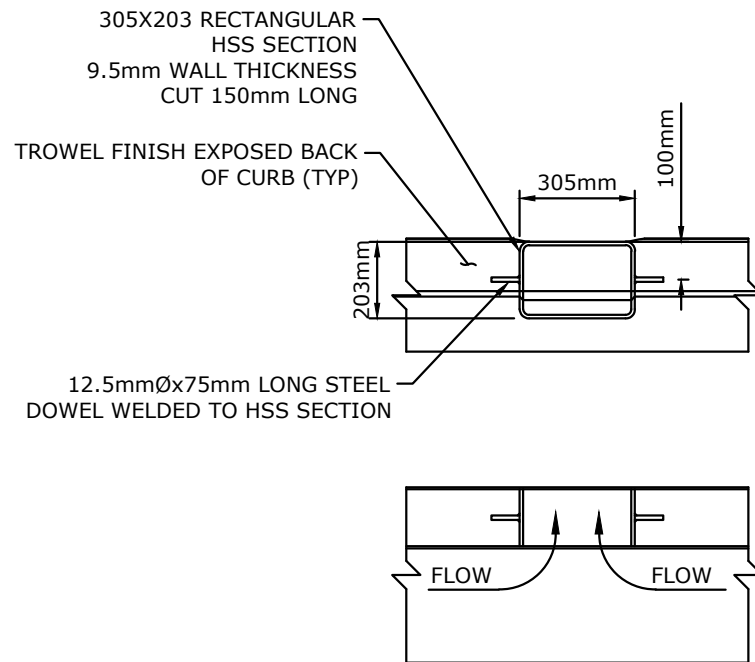


CUL-DE-SAC BULB DETAIL
SCALE 1:250

0 1 1:250 6m

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted		
2	MARCH 2019			
1	APRIL 2014	Title CUL-DE-SAC DETAIL		
	Revision Date			
	Approved	Approved TFN Date MARCH 2019		
 ROADWAY STANDARDS				DRAWING NUMBER TSSD-R17


U:\Projects_VAN\17\1047\1047\101\10-Drafting-Design-Analysis\CADD\CURRENT\PRODUCTION\Standards-2019\TSSD-R1-R15.dwg [R.18] 2019-04-29 2:04:42 PM



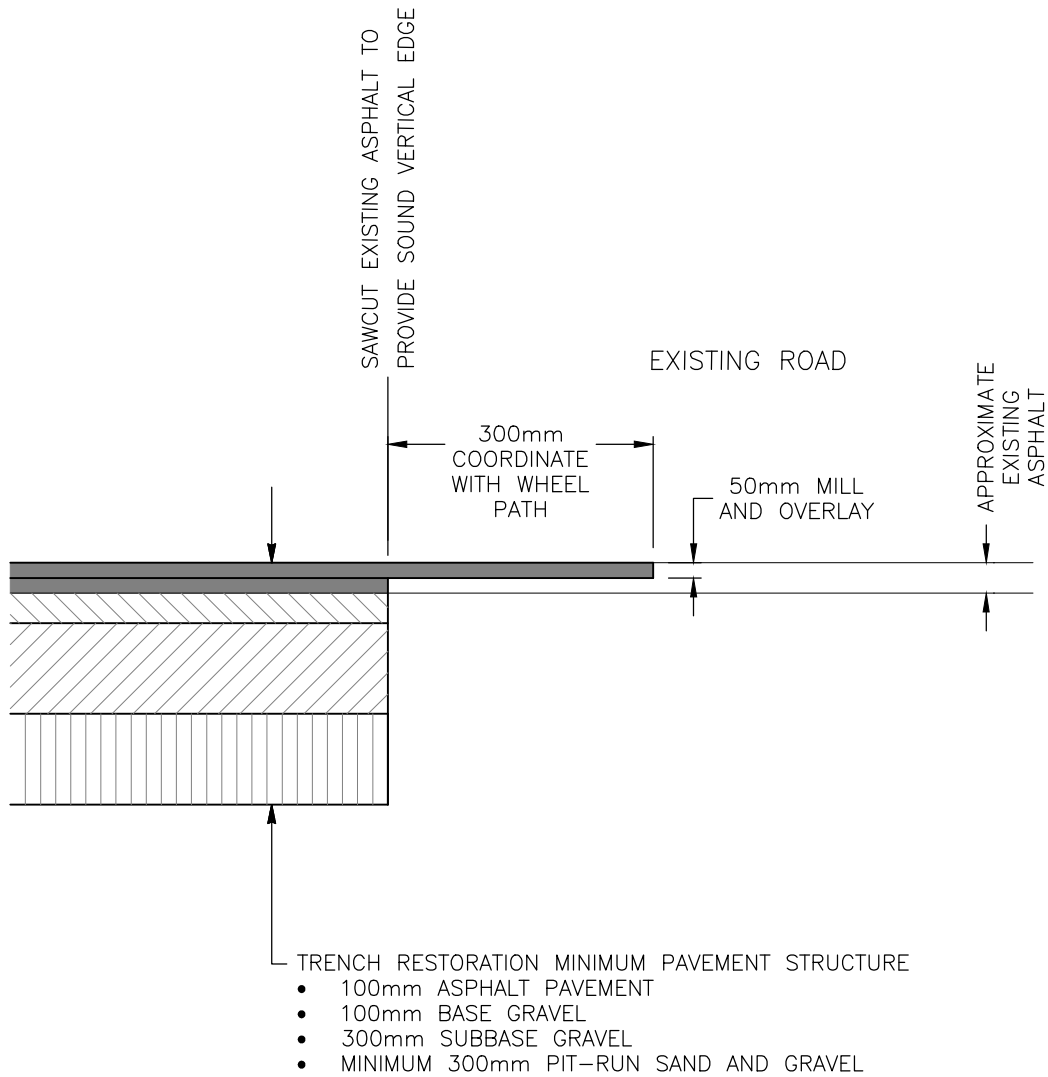
NOTES:

1. COMPLETE STEEL MEMBER TO BE HOT-DIP GALVANIZED AFTER FABRICATION
2. HAND FORM ALL CURB SURFACES IN VICINITY OF INLET STRUCTURE TO ENSURE A SMOOTH TRANSITION AND AN EFFICIENT WATER FLOW PATH INTO THE INLET


0 0.125 1:20 0.5m

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2			
1	FEBRUARY 2019	Title CURB INLET STRUCTURE DETAIL	
	Revision Date		
	Approved	Approved	TFN
		Date	FEBRUARY 2019
 ROADWAY STANDARDS		DRAWING NUMBER	
		TSSD-R18	

U:\Projects_VAN21770047010-Drafting-Design-Analysis\CADD\CURRENT\PRODUCTION\TSSD-R19 - Tie-in Exist Asphalt Surface.dwg, TSSD-R19, 2019/04/29 02:04 pm bnychuk



PROVIDE SOUND VERTICAL EDGE

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2	MARCH 2019		
1	FEBRUARY 2019	Title TIE-IN EXISTING ASPHALT SURFACE	
	Revision Date Approved		
<div><p>scəwəθən məsteyəx™ TSAWWASSEN FIRST NATION</p></div> <div>ROADWORKS INSTALLATION STANDARDS</div>		Approved TFN	DRAWING NUMBER TSSD-R19
		Date MARCH 2019	



Top blade

32" x 10"



Bottom blade

32' x 8.5"


SPECIFICATIONS:

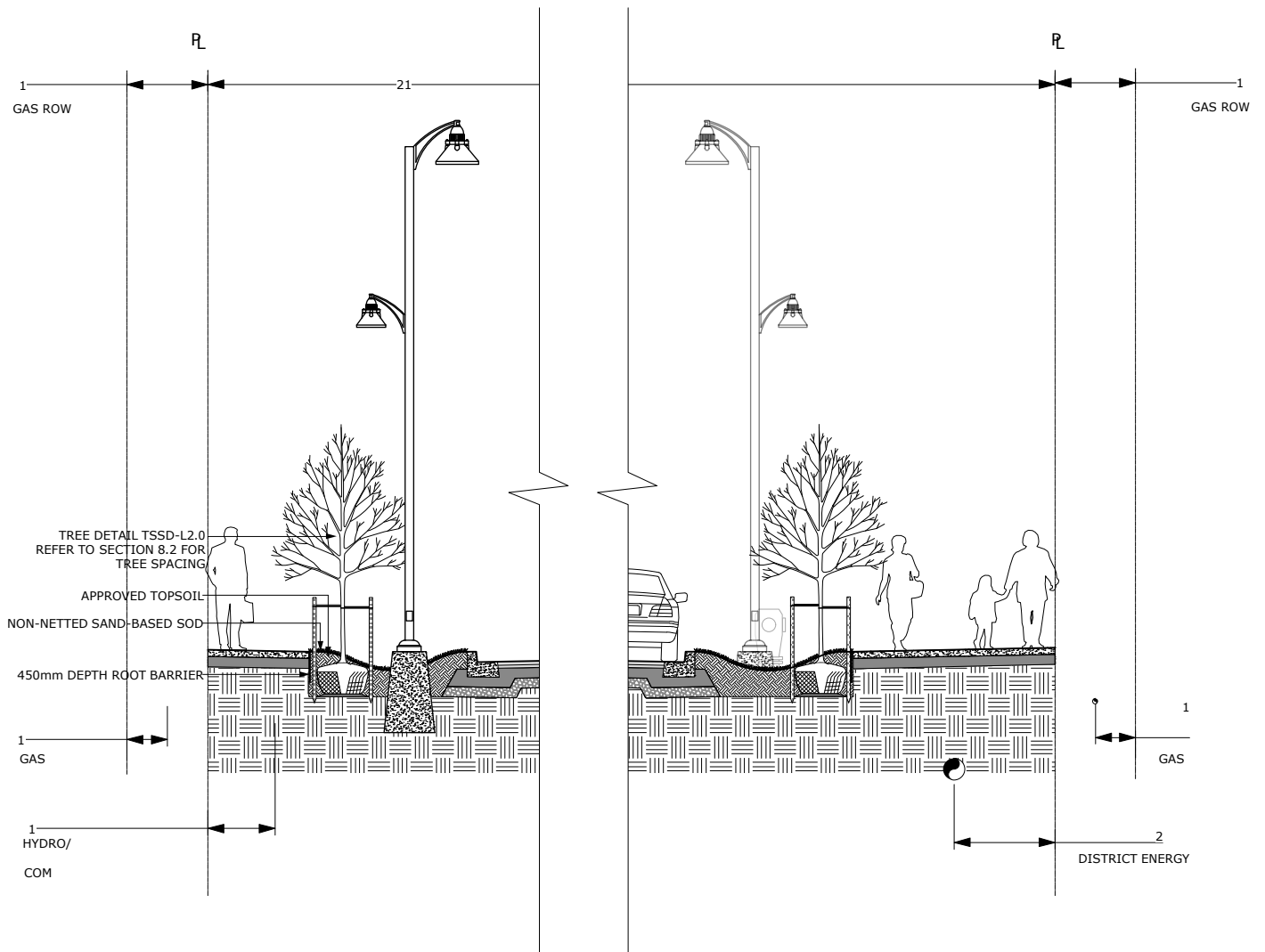
DOUBLE-SIDED ALUMINUM "BUBBLE-TOP" STYLE BILINGUAL STREET BLADES,
COMES WITH BLUE 2975 BORDER, BLACK & GREY EAGLE AND BLACK TEXT
DIGITALLY PRINTED ON A WHITE ENGINEER GRADE BKG.


CONTACT TFN FOR COLOUR SCHEME

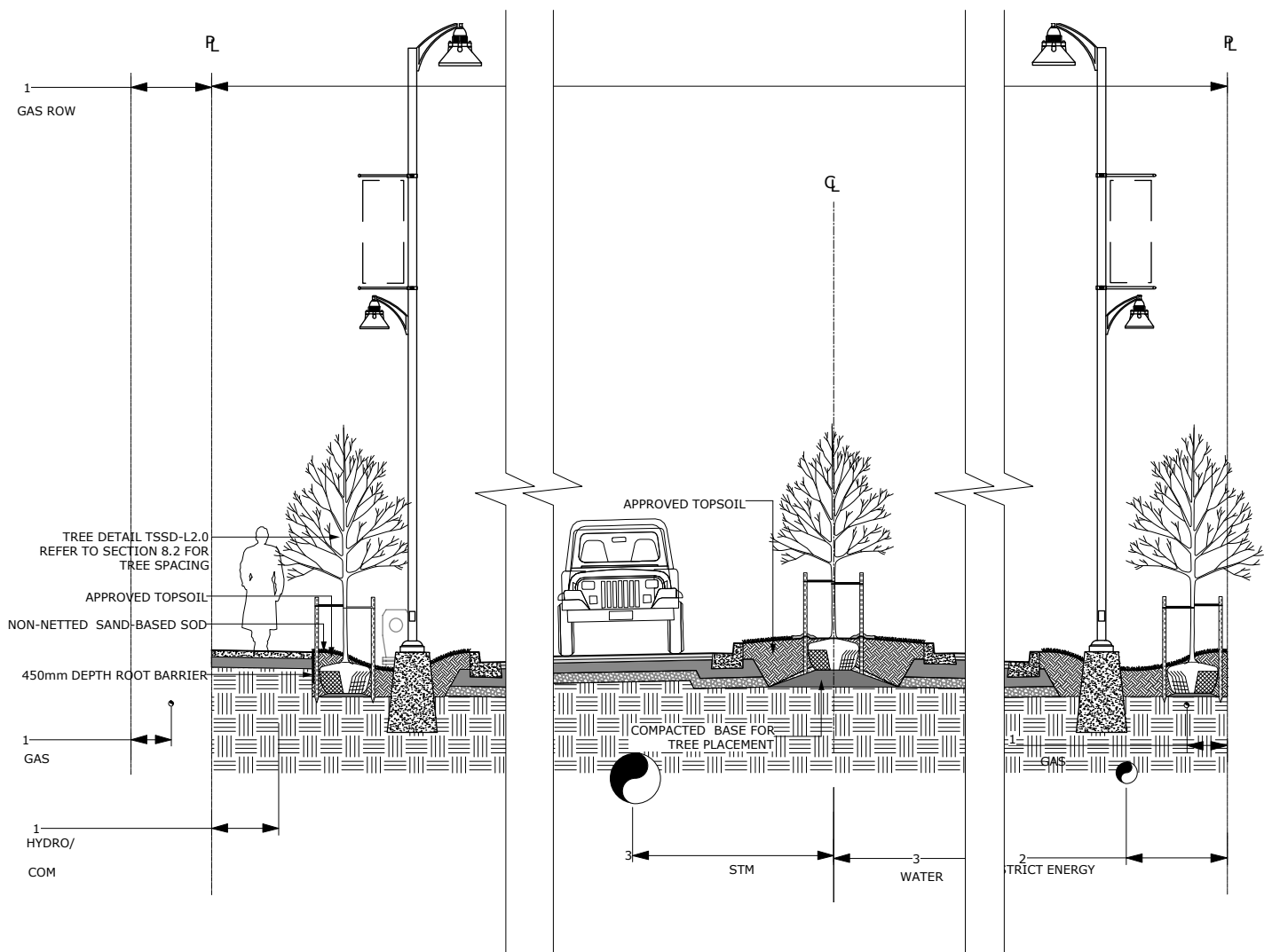
NOTES:

1. PROOFS TO BE PROVIDED TO TFN FOR APPROVAL.

3		All Dimensions Shown In Millimetres, Unless Otherwise Noted	
2	MARCH 2019		
1	FEBRUARY 2019	Title TSAWWASSEN FIRST NATION STREET NAME SIGN DETAIL	
	Revision Date		
	Approved	 ROADWORKS INSTALLATION STANDARDS	
		Approved	TFN
		Date	MARCH 2019
		DRAWING NUMBER TSSD-R20	



3		All Dimensions Shown In Metres, Unless Otherwise Noted		
2	JANUARY 2014			
1	MAY 2012	Title TYPICAL SECTION COLLECTOR ROAD		
	Revision Date Approved			
 TSAWWASSEN FIRST NATION st̓aw̓aθən məsteyax™		Approved TFN		DRAWING NUMBER TSSD-L1.0
		Date JANUARY 2014		



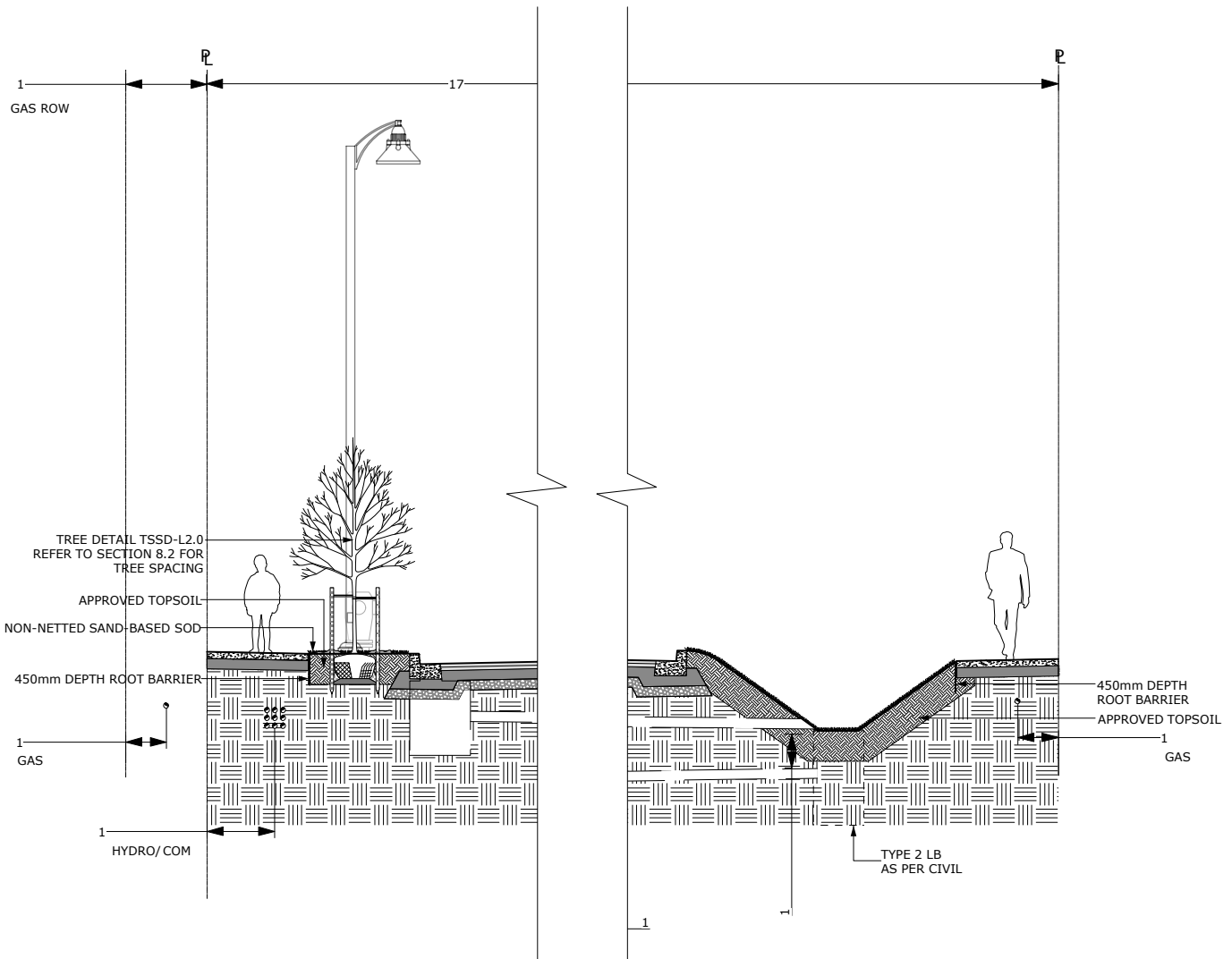
3	
2	JANUARY 2014
1	MAY 2012
	Revision Date Approved


All Dimensions Shown In Metres, Unless Otherwise Noted	
Title TYPICAL SECTION ENTRANCE BOULEVARD	

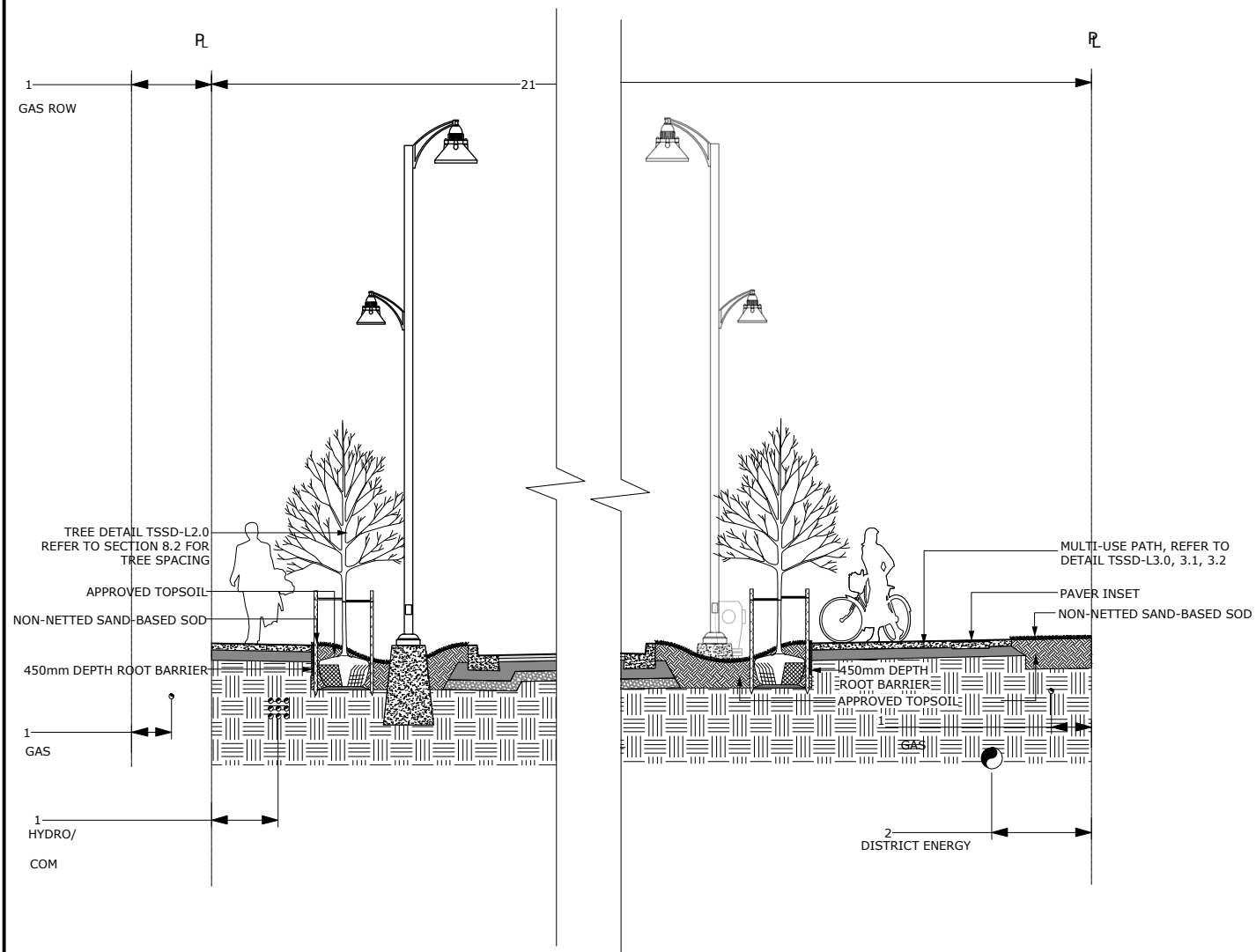



TSAWWASSEN FIRST NATION
s̓c̓awaθ̓ən məsteyax™

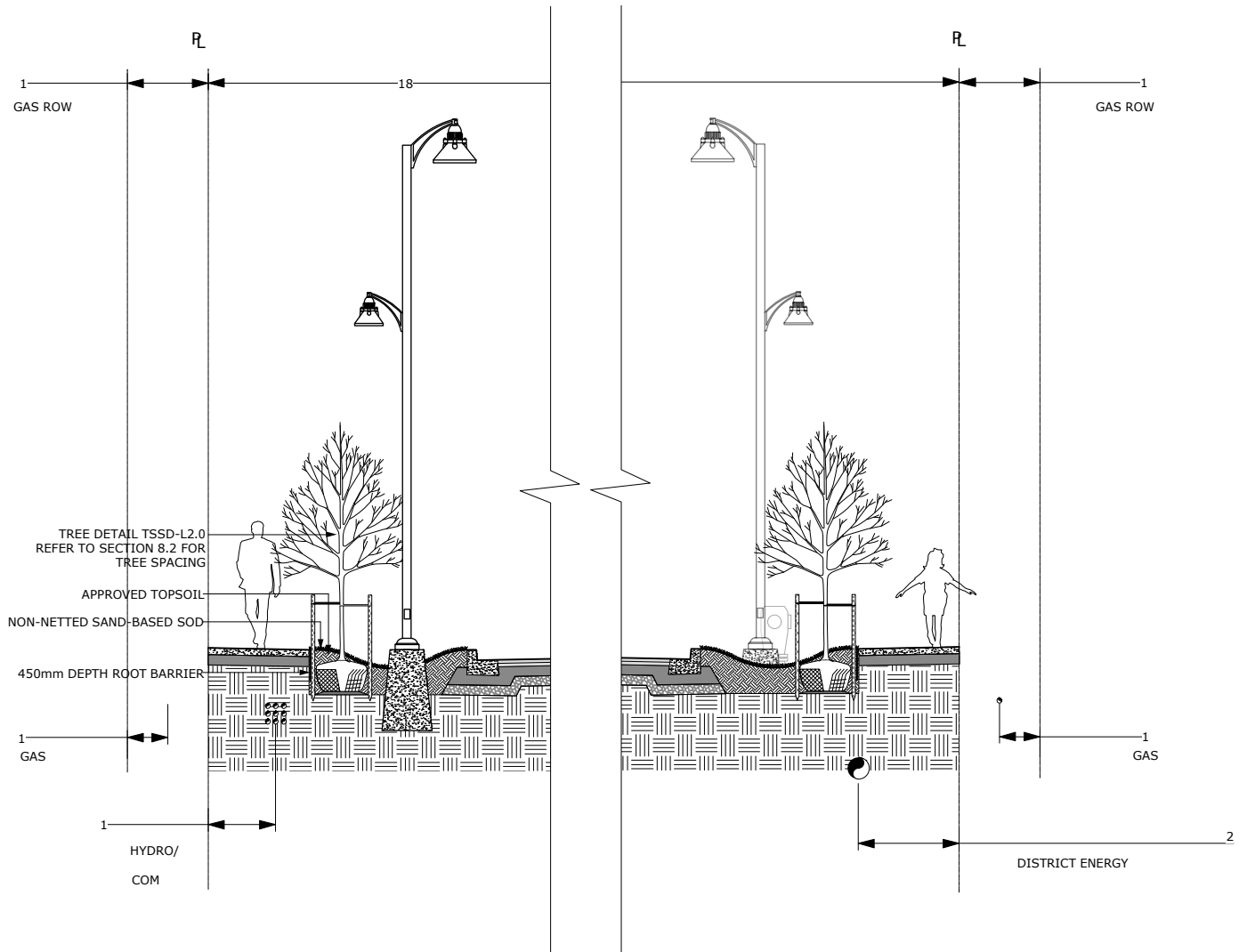
Approved	TFN	DRAWING NUMBER TSSD-L1.1
Date	JANUARY 2014	




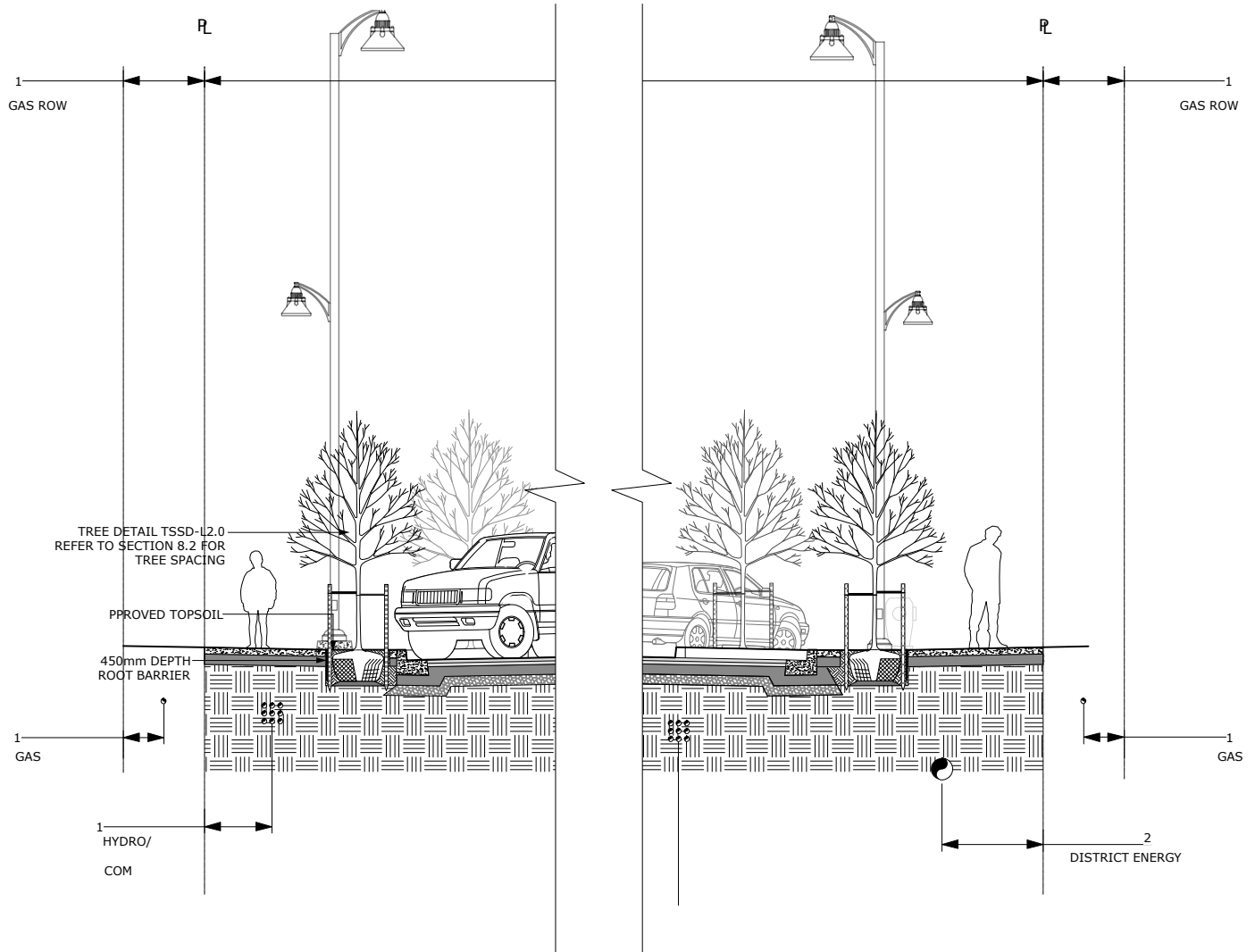
3		All Dimensions Shown In Metres, Unless Otherwise Noted	
2	JANUARY 2014		
1	MAY 2012	Title TYPICAL SECTION LOCAL ROAD W/ 3.5M BIOSWALE	
	Revision Date Approved		
 TSAWWASSEN FIRST NATION sčawaθən məsteyəx™		Approved TFN	DRAWING NUMBER TSSD-L1.2
		Date JANUARY 2014	




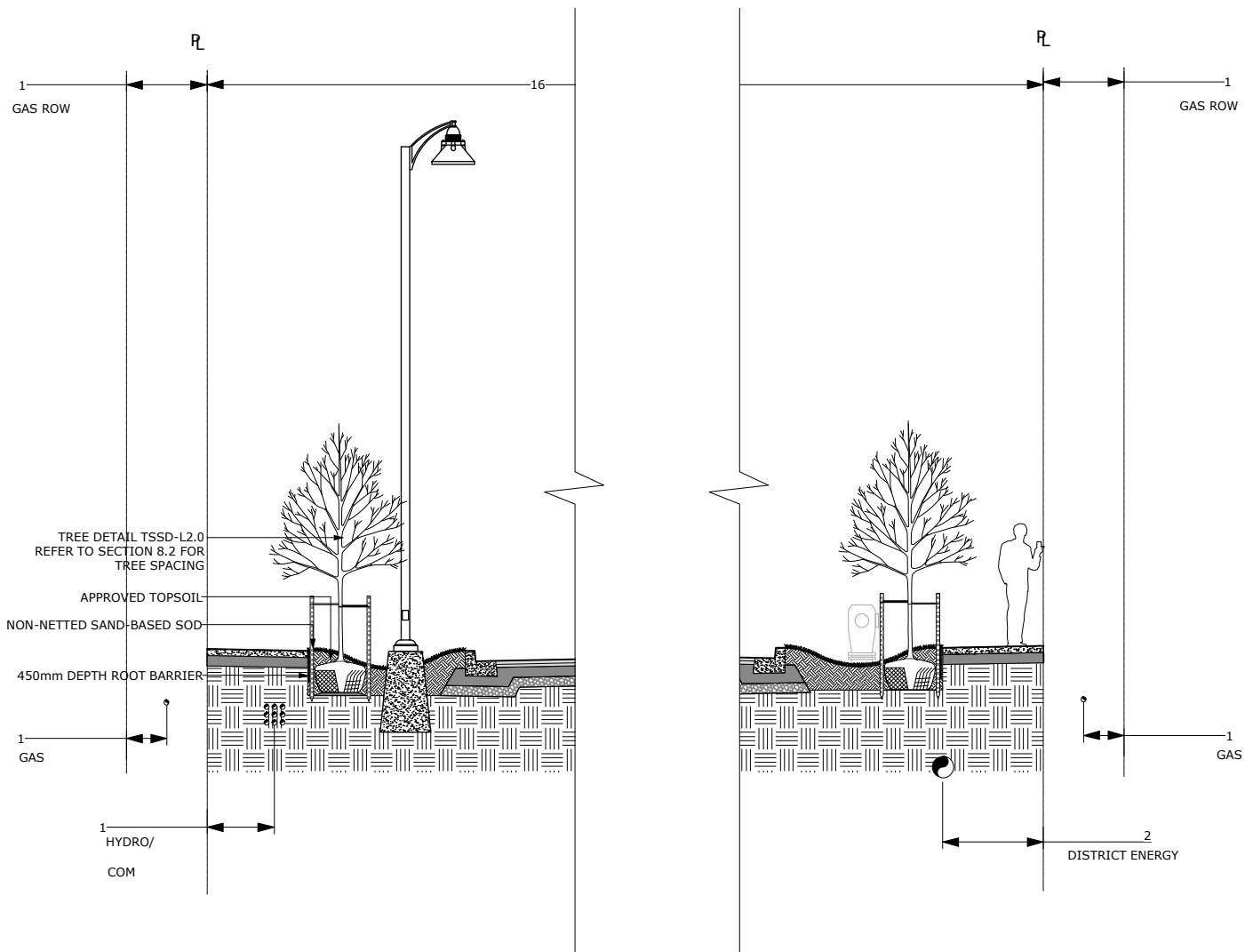
3		All Dimensions Shown In Metres, Unless Otherwise Noted	
2	JANUARY 2014		
1	MAY 2012	Title TYPICAL SECTION LOCAL ROAD W/ GREENWAY	
	Revision Date		
 TSAWASSEN FIRST NATION s̓c̓awaθ̓ən məsteyax̓		Approved	TFN
		Date	JANUARY 2014
		DRAWING NUMBER TSSD-L1.3	




3		All Dimensions Shown In Metres, Unless Otherwise Noted		
2	JANUARY 2014			
1	MAY 2012	Title TYPICAL SECTION LOCAL ROAD - 1		
	Revision Date Approved			
 TSAWWASSEN FIRST NATION stawaashan maweyax™		Approved TFN		DRAWING NUMBER TSSD-L1.4
		Date JANUARY 2014		



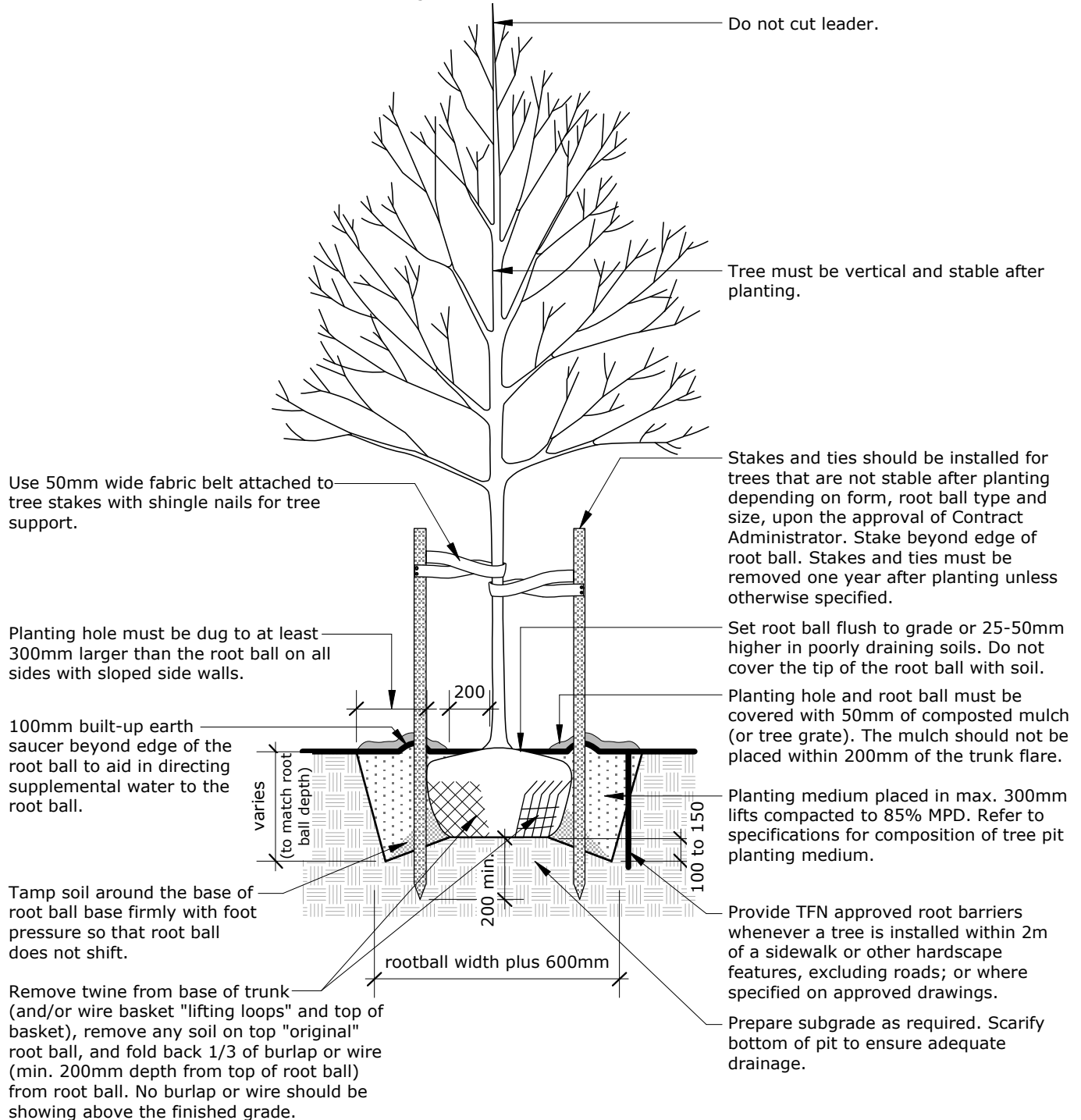
3		All Dimensions Shown In Metres, Unless Otherwise Noted		
2	JANUARY 2014			
1	MAY 2012	Title TYPICAL SECTION VILLAGE CENTER		
	Revision Date Approved			
 TSAWWASSEN FIRST NATION sc̓əwəṣən məsteyəxʷ		Approved TFN		DRAWING NUMBER TSSD-L1.5
		Date JANUARY 2014		




3		All Dimensions Shown In Metres, Unless Otherwise Noted	
2	JANUARY 2014		
1	MAY 2012	Title TYPICAL SECTION LOCAL ROAD - 2	
	Revision Date		
 TSAWWASSEN FIRST NATION sčawaθən məsteyax™		Approved	TFN
		Date	JANUARY 2014
			DRAWING NUMBER TSSD-L1.6

1. Site preparation must include provision for soil placement, replacement or enhancement to meet TFN Supplementary Specifications.

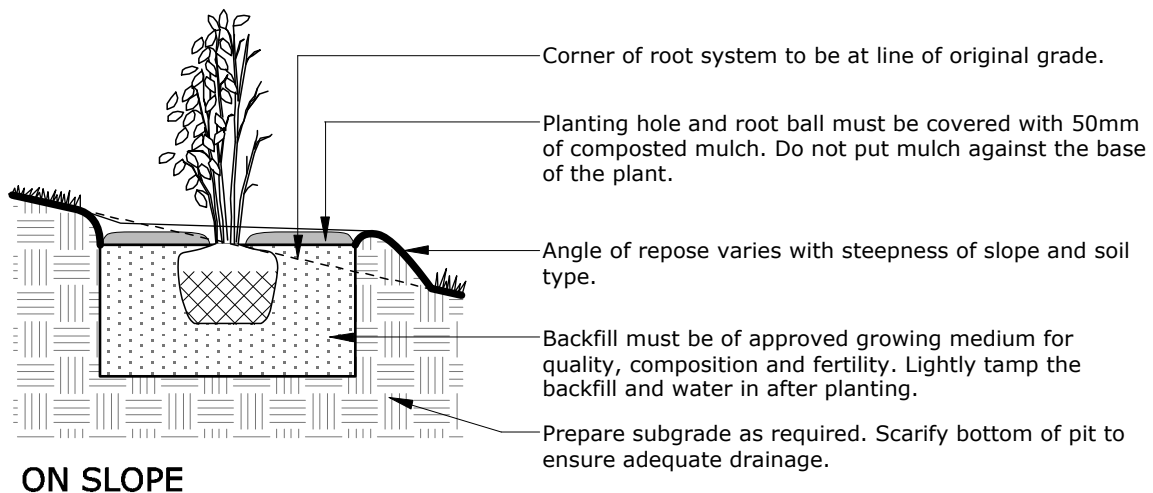
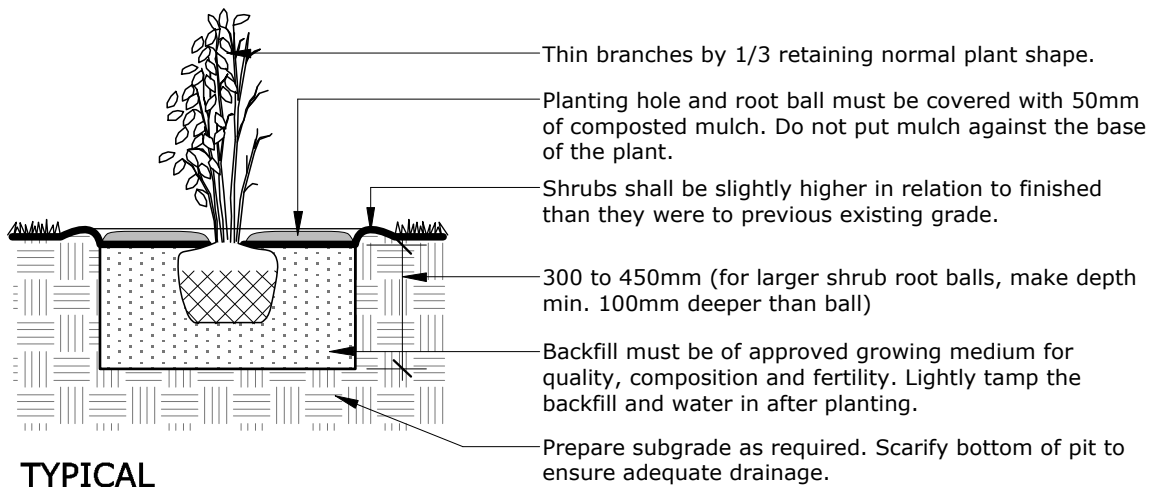
3. Maintain minimum clearances of 2.5m between street trees and any underground utilities.




3		All Dimensions Shown In millimetres, Unless Otherwise Noted		
2	January, 2014			
1	July, 2012	Title Tree Planting Detail		
	Revision Date <div>Approved</div>			
<div><div>TSAW WASHEN FIRST NATION st̓awəwəṇ məstevəx̣w̓</div></div> <div>Planting Details</div>		Approved	TFN	DRAWING NUMBER TSSD-L2.0
		Date	January, 2014	
		Drawn By	TFN	

NOTES:

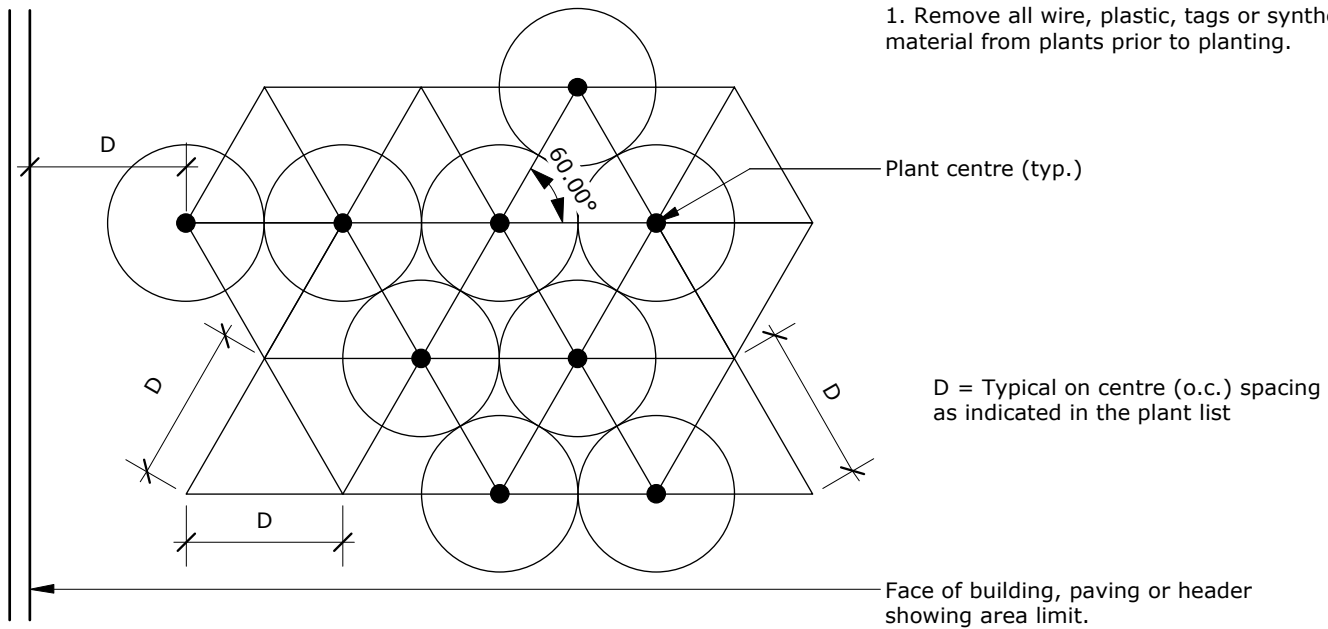
1. Min. root spread to be in accordance with "Canadian Standards for Nursery Stock."
2. For container-grown shrubs, use fingers or small hand tools to pull the roots out of the outer layer of potting soil; then cut or pull apart any roots that circle the perimeter of the container. Prune all damaged, diseased, or weak limbs and roots.
3. Cleanly prune all damaged root ends.
4. Fold burlap from top of root ball down into ground set top of ball flush with finish grade.
5. Do not allow roots to dry out during installation process.
6. Soak roots in water overnight before planting.



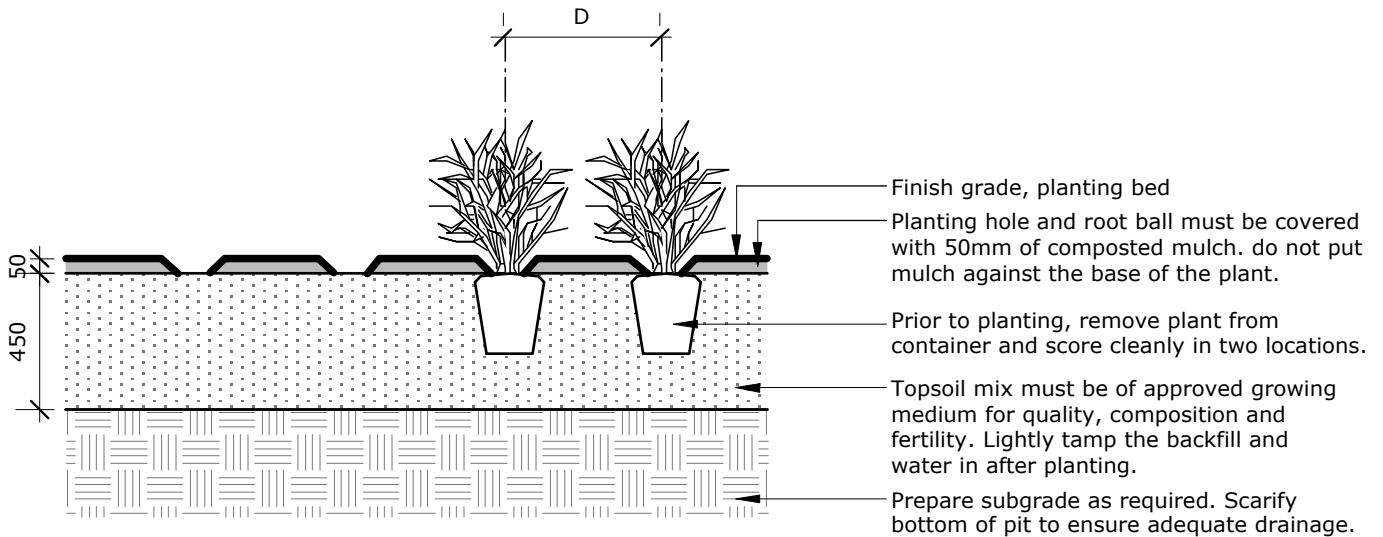
3		All Dimensions Shown In millimetres, Unless Otherwise Noted		
2				
1	January, 2014	Title Shrub Planting Detail		
	Revision Date Approved			
<div> TSAWWASSEN FIRST NATION sc̓awəwəṣən məsteyəxʷ</div> <div>Planting Details</div>		Approved	TFN	DRAWING NUMBER TSSD-L2.1
		Date	January, 2014	
		Drawn By	TFN	

NOTE:


1. Remove all wire, plastic, tags or synthetic material from plants prior to planting.

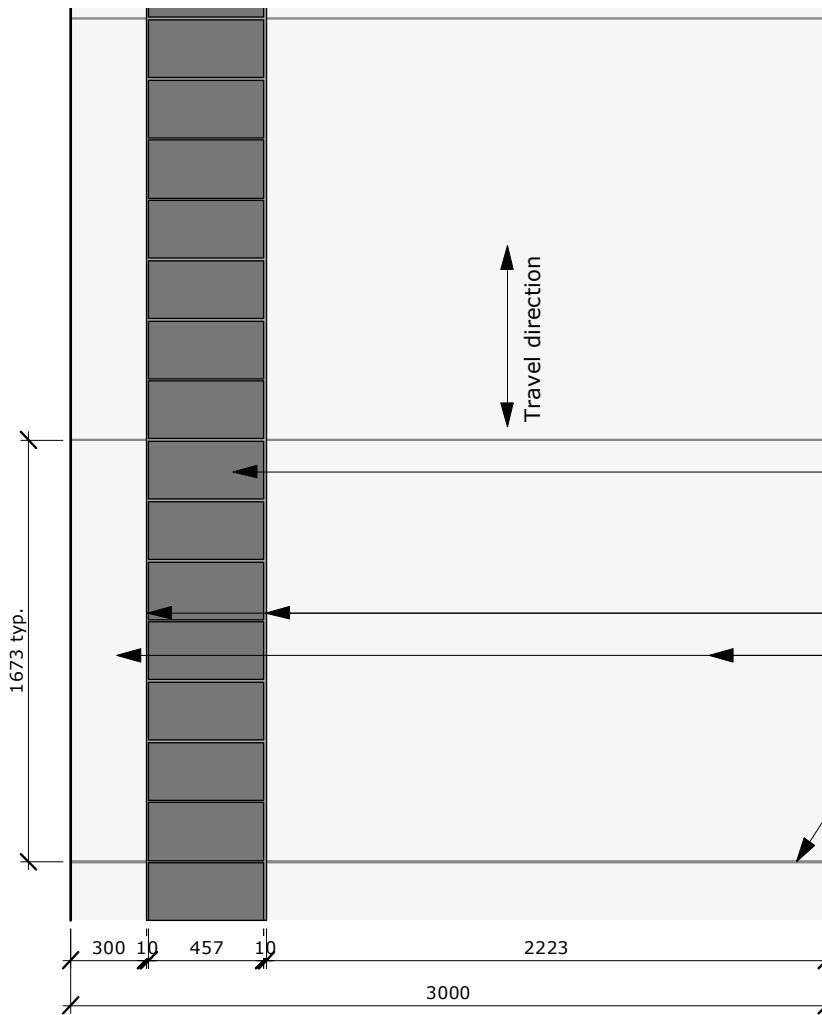


PLAN



SECTION

3		All Dimensions Shown In millimetres, Unless Otherwise Noted		
2				
1	January, 2014	Title Groundcover Planting Detail		
	Revision Date Approved			
<div> TSAWWASSEN FIRST NATION sc̓awabən məsteyəxʷ</div> <div>Planting Details</div>		Approved	TFN	DRAWING NUMBER TSSD-L2.2
		Date	January, 2014	
		Drawn By	TFN	



PLAN VIEW

Note to Contractor: Provide a sample area of light-medium sandblast finish for review and approval by Contract Administrator.

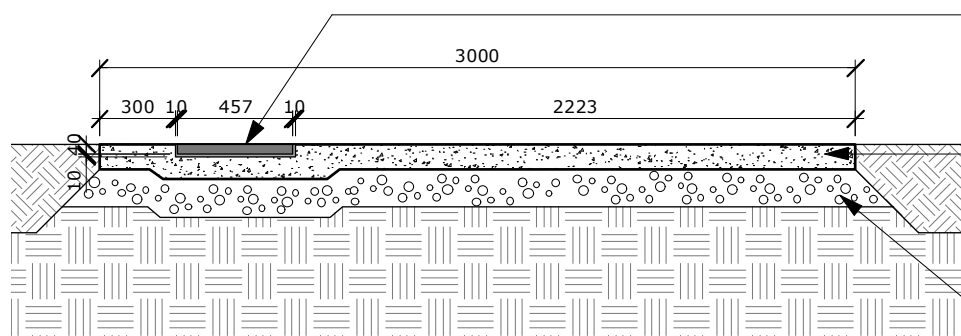
To curb

457x229x40mm thick Hydrapressed Slab pavers from Abbotsford Concrete or equivalent, mortared in place, Texada finish, charcoal colour. Band to be on the farther side from curb.

10mm mortar joint each side

CIP concrete with light-medium sandblast finish. Medium sandblast finish to be non slip, consistently applied over the surface with no aggregate showing.

Control joints to be sawcut, 5x12mm. Control joints to be provided at 1673mm o.c. typical, to line up with paver coursing. Expansion joints to be provided max. 9m o.c.




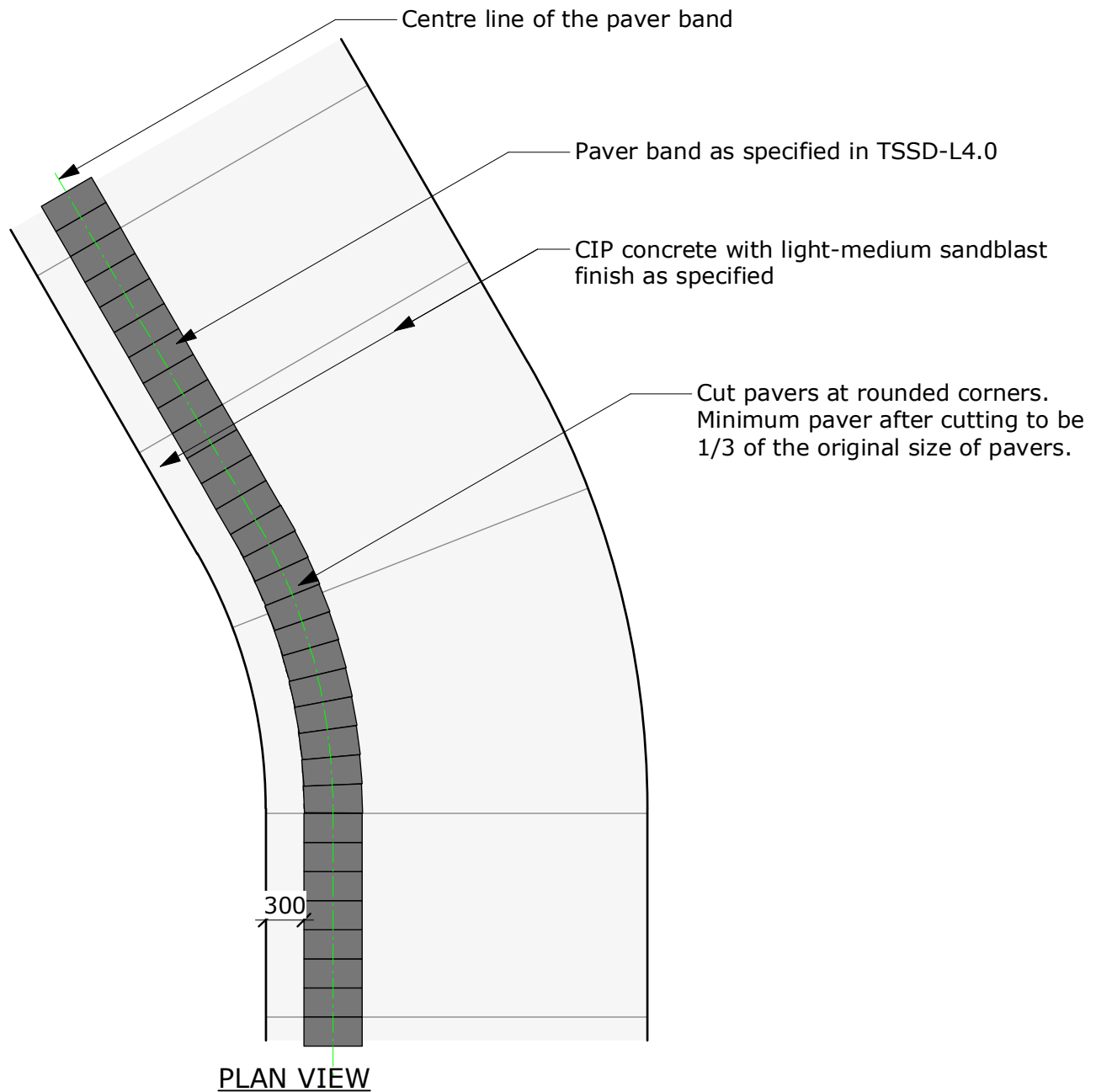
SECTION VIEW


457x229x40mm thick Hydrapressed Slab pavers from Abbotsford Concrete or equivalent, mortared in place on all sides and bottom.

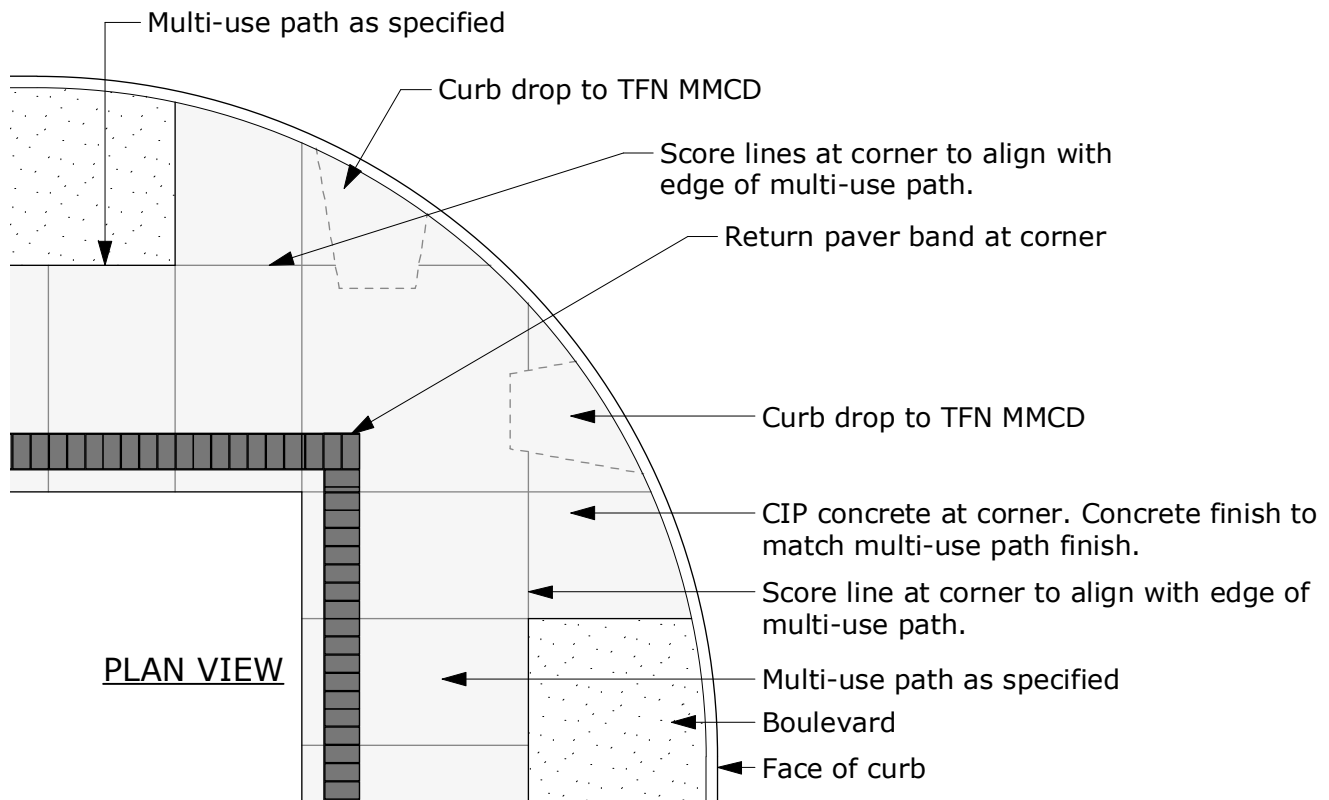
100mm thick CIP concrete with light-medium sandblast finish. Sandblast finish to be non slip, consistently applied over the surface with no aggregate showing.

Base course as per engineer over approved compacted subgrade

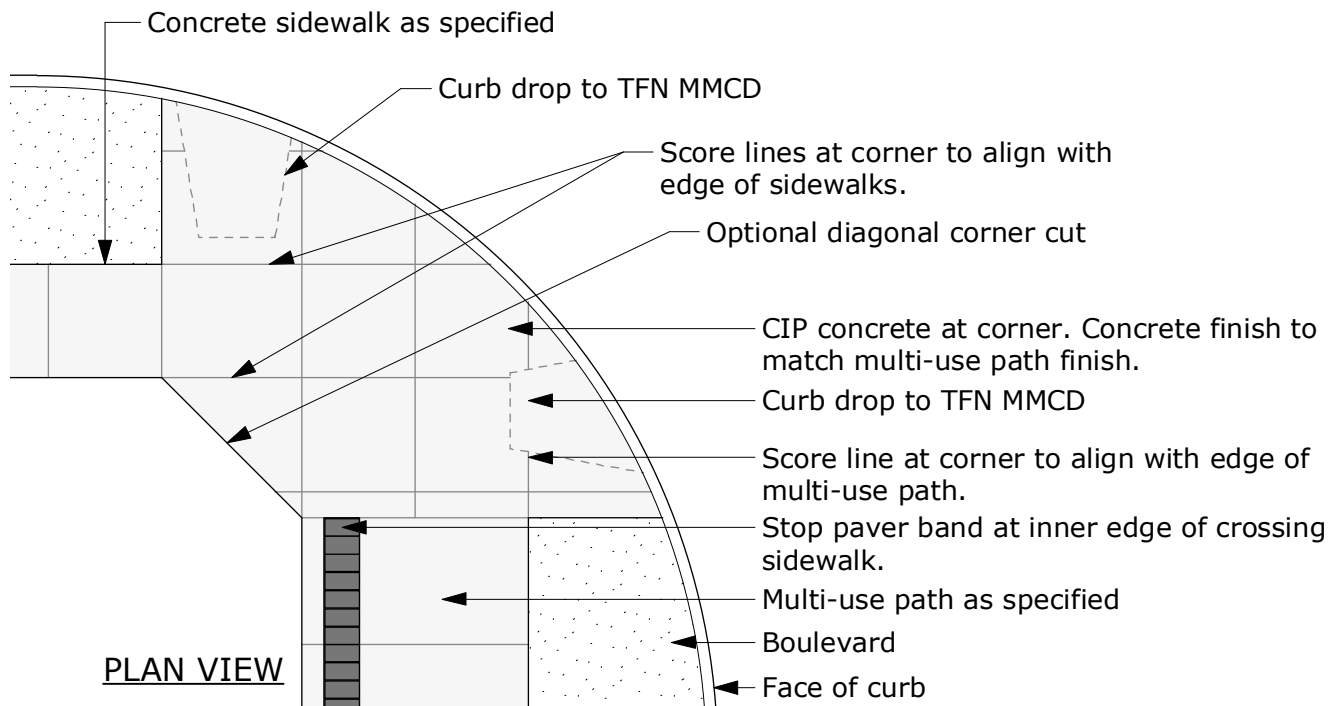
3		All Dimensions Shown In millimetres, Unless Otherwise Noted	
2			
1	January, 2013	Title Special Paving at Multi-Use Paths	
	Revision Date		
	Approved	Approved	TFN
		Date	January, 2013
		Drawn By	TFN
 TSAW WASSEN FIRST NATION sc̓awaθən məsteyax [™]		DRAWING NUMBER	
		TSSD-L3.0	
Boulevard Areas Hard Landscape Standards			




3		All Dimensions Shown In millimetres, Unless Otherwise Noted		
2				
1	January, 2013	Title Special Paving at Multi-Use Paths - Curved Condition		
	Revision Date Approved			
<div><p>TSAWWASSEN FIRST NATION sc̓awaθən məsteyəxʷ</p></div> <div>Boulevard Areas Hard Landscape Standards</div>		Approved TFN		DRAWING NUMBER TSSD-L3.1
		Date January, 2013		
		Drawn By TFN		

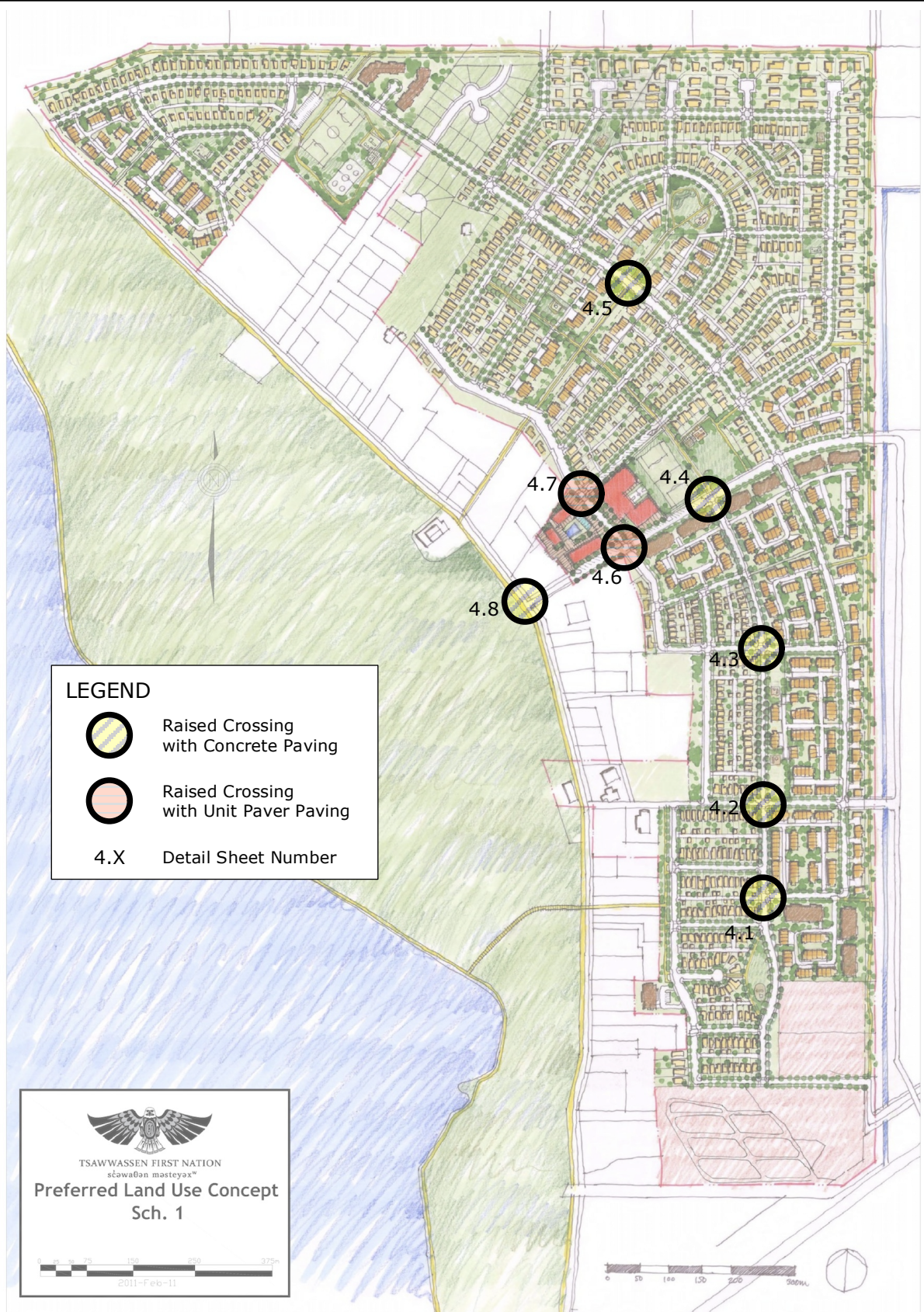



a) Corner with two multi-use paths




b) Corner with a multi-use path and a concrete sidewalk

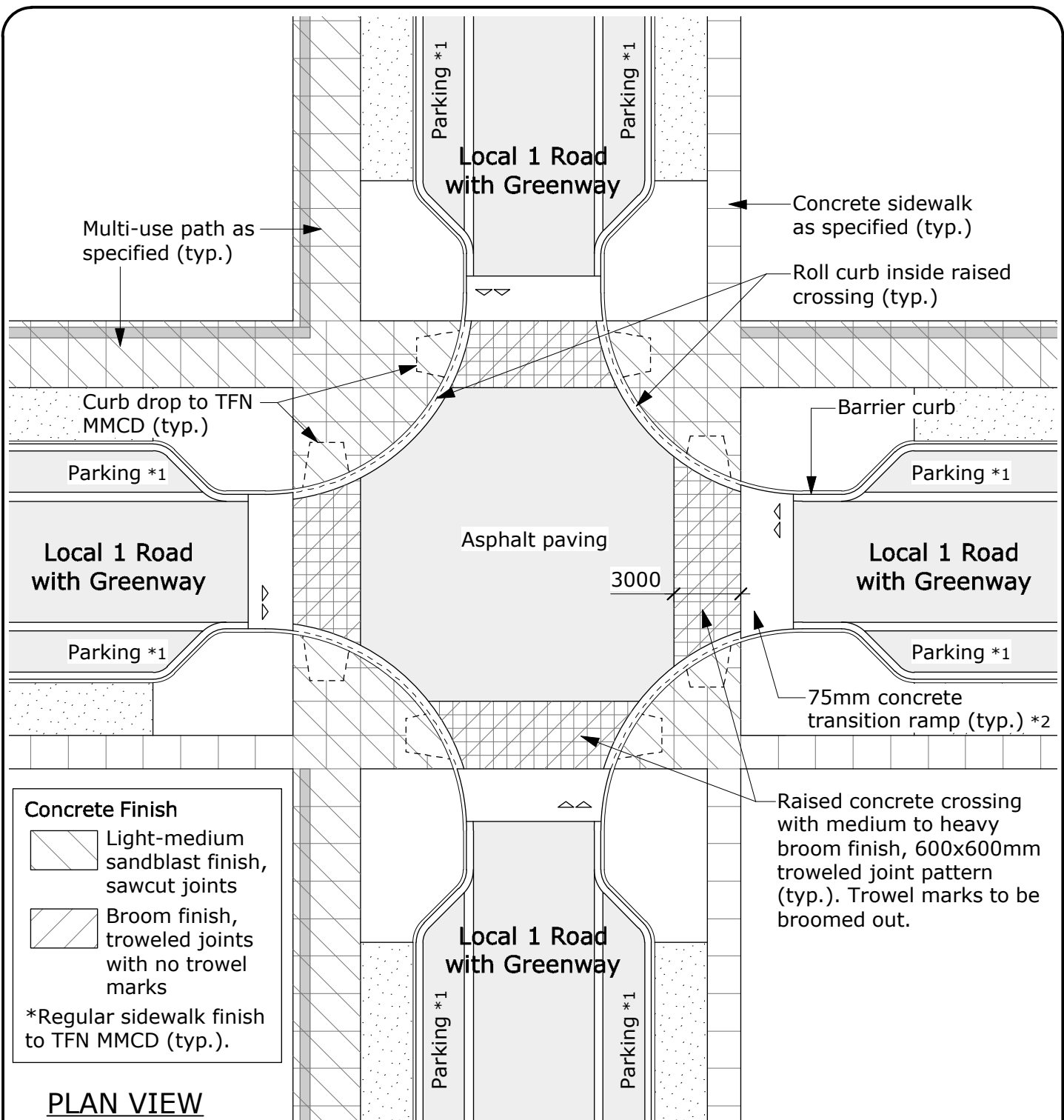
3		All Dimensions Shown In millimetres, Unless Otherwise Noted	
2	February, 2013		
1	January, 2013	Title Special Paving at Multi-Use Paths - Corner Condition	
	Revision Date		
	Approved	Approved	TFN
		Date	February, 2013
		Drawn By	TFN
 TSAW WASSEN FIRST NATION sc̓awəθən məsteyəxʷ		DRAWING NUMBER	
		TSSD-L3.2	
Boulevard Areas Hard Landscape Standards			



3		All Dimensions Shown In millimetres, Unless Otherwise Noted		
2				
1	January, 2013	Title Raised Crossing Location Map		
	Revision Date Approved			
 TSAWWASSEN FIRST NATION sc̓awaθən məsteyax™ Boulevard Areas Hard Landscape Standards		Approved	TFN	DRAWING NUMBER TSSD-L4.0
		Date	January, 2013	
		Drawn By	TFN	

- pending -

3		All Dimensions Shown In millimetres, Unless Otherwise Noted		
2				
1	January, 2013	Title Raised Crossing Details - Intersection of Local 1 Rd w/Greenway and Local Rd		
	Revision Date Approved			
<div><p>TSAWWASSEN FIRST NATION sc̓awaθən məsteyəx™</p></div> <div>Boulevard Areas Hard Landscape Standards</div>		Approved	TFN	DRAWING NUMBER TSSD-L4.1
		Date	January, 2013	
		Drawn By	TFN	



PLAN VIEW

NOTES:

*1: Actual parking setback distance shall be calculated by the Engineer using TAC Turn Templates to confirm the site specific distance.

*2: Actual proportion of transition ramp shall be specified by the Engineer.

3		All Dimensions Shown In millimetres, Unless Otherwise Noted		
2	February, 2013			
1	January, 2013	Title Raised Crossing Details - Intersection of Local 1 Roads w/Greenway		
	Revision Date			
	Approved	Approved	TFN	DRAWING NUMBER TSSD-L4.2
		Date	February, 2013	
		Drawn By	TFN	



TSAWWASSEN FIRST NATION
sc̓awəθən məsteyəxʷ

Boulevard Areas
Hard Landscape
Standards