Bremner Area Project

Design and Construction Standards Supporting Document Final Draft

Prepared for:
Strathcona County

Prepared by:
Stantec Consulting Ltd.

March 27, 2019

Table of Contents

1 INTRODUCTION – VISION & PRINCIPLES

The Bremner ACP follows a Complete Street concept, where streets are considered as a network for users of all ages, modes, and abilities. Details about the overarching Transportation Vision, Transportation Network Principles, and the goals/objectives for Bremner can be found in the following documents:

- Strathcona County Municipal Development Plan Bylaw 20-2017: Forwarding our Future. Together (2017)
- Strathcona County Transportation Integrated Transportation Master Plan (2012)
- Bremner ACP
- Bremner Transportation Plan

The Bremner Design and Construction Standards (DCS) outline the design requirements for streets in Bremner in support of the Bremner Area Concept Plan (ACP), Transportation Plan, and Utilities Plan. The Bremner DCS are supplemental to the Strathcona County Design and Construction Standards (Dec 2011) and are used to support the Visions and Principles set out for Bremner. Different street classifications from the rest of Strathcona County are defined along with associated design elements and requirements (e.g., intersections, access management, utilities). Geometric considerations align with the 2017 Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (TAC GDG).

1.1 Vision and Principles

The Transportation Vision for Bremner is:

Bremner has an accessible, connected, and integrated multimodal transportation system that provides mobility, access for goods and services, safety for all users, and links to local and regional destinations.

The Bremner Transportation Network Principles direct how the transportation network functions. The Transportation Network Principles are:

Access, Mobility, and Connectivity – The transportation network provides access in all seasons to residents and businesses by all modes of transportation within Bremner, Strathcona County, and the Edmonton Metropolitan Region.

Demographics – The transportation network supports users of all ages, abilities, and income levels.

Safety & Health – The transportation network is designed to help achieve a vision of no one being seriously or fatally injured while using it, regardless of mode. The network provides active transportation and recreation opportunities that promote healthy lifestyles.

Integration – The transportation network is context sensitive, supported by complementary land uses and quality multimodal infrastructure that provides proximity to services and integrated mobility options for travel between origins and destinations.

Winter Design – The transportation network is useable and accessible to users of all modes in all seasons.

Green Infrastructure – The transportation network is integrated with open spaces, including storm water systems, public infrastructure, and natural habitats.

Smart City –The transportation network is adaptable to community needs and the changing future.

The Transportation Network Principles are further supplemented by the Street Principles which direct how streets are designed, built, and operated in Bremner. The Street Principles are:

Streets are for Everyone

- Streets are equitable and inclusive.
- Streets are comfortable and safe for children and older adults.

Streets are Multimodal

- Streets are designed to prioritize active transportation and transit.
- Streets provide a network for goods and commuter movements that connect to local and regional destinations.

Streets are Safe

- Streets are safe and comfortable for all users in all seasons.
- Streets are designed to prioritize the safety of active transportation users, recognizing their vulnerability.
- Streets are appropriately lit and landscaped and provide a high level of personal security.

Streets are Healthy

- Streets support healthy environments and lifestyle choices.
- Streets support active transportation.
- Streets support positive mental health. (Streets are safe, green, and quiet).

Streets are Public Spaces

- Streets are places, not just links.
- Streets are designed for recreation, cultural expression, social interaction, and celebration.

Streets Create Value

- Streets encourage activity and provide multimodal access, generating value for residents and businesses.
- Streets incorporate public utilities to support development and growth.

Streets are Flexible

- Streets can transition over time and as land use context changes along a corridor.

Streets to support Ecosystems

- Streets incorporate green infrastructure and low impact design to improve biodiversity and quality of the environment in all seasons.
- Streets design is informed by natural resources and the local climate.

1.2 How to use the Bremner DCS

The Bremner DCS provides specific design requirements for Bremner and the Local Employment Area (referred to as Bremner in the remainder of the document) and are to be used in conjunction with Strathcona County Design and Construction Standards for the design of all streets, intersections, off-street paths, and utilities in Bremner. It provides direction on how to prioritize transportation modes for different types of streets and identifies the principles which direct that priority. In certain cases, the designer may have to refer to other design guidance which could include:

- Design and Construction Standards, Strathcona County
- Geometric Design Guidelines for Canadian Roads, Transportation Association of Canada (TAC GDG)
- Manual of Traffic Control Devices for Canada (MUTCD-C), TAC
- Bikeway Traffic Control Guidelines for Canada, Transportation Association of Canada
- Canadian Guide to Neighbourhood Traffic Calming, Transportation Association of Canada
- Canadian Roundabout Design Guide, Transportation Association of Canada
- Alberta Transportation Highway Geometric Design Guide, Alberta Transportation
- Accessible Design for the Built Environment, Canadian Standards Association (CSA)

The standards include cross sections, intersection design guidance, and associated pavement markings and signs. There are a number of Standards and Standard Drawings from the Strathcona County Design and Construction Standards that apply to Bremner. These are referenced where applicable. Refer to the Strathcona County Design and Construction Standards for design requirements not included or specified in this document. For Construction Specifications, refer to the Strathcona County Design and Construction Standards. Where conflicts arise between Bremner Design Standards and another standard, the Bremner Design Standards shall govern.

Streets and intersections shall be reviewed under the process outlined in the Bremner Transportation Impact Assessment Guidelines.

1.2.1 Design Process

Refer to the Strathcona County Design and Construction Standards for Design Process, Approval Process, Drafting Standards, and associated forms.

Section 3.0 of this document outlines the design philosophy directing these guidelines. In general, streets should align with the Cross Sections identified in this document, and exceptions should fall within the recommended range of Design Domain (detailed in Section 2.0). Higher priority modes for a given street should be designed to the upper end of the recommended range, and lower priority modes may accommodate lower end or more basic access.

Where a mode cannot be accommodated on a street within the recommended Design Domain values due to constraints, one approach is to review the broader network to determine if movements by all modes can be adequately facilitated from a network perspective. Where this approach is not feasible or desired, designers will need to justify the use of values outside the recommended Design Domain values through development of a Design Exception.

Design variances may be required to provide a design that is implementable (mitigate community impacts) or where the design variance will result in significantly improved performance or safety. Design variances can be initiated by the designer or requested by Strathcona County. Variances should be discussed with Strathcona County and the approval process for Bremner Design and Construction projects must align with the Strathcona County Design and Construction Standards Approval Process.

1.3 Outline

The Bremner DCS is organized as follows:

Section 1: Introduction – Vision & Principles

This section outlines the intent of the Design and Construction Standards, the Transportation Vision, the Transportation Network Principles, and the Street Principles.

Section 2: Street Type Overview

This section provides a summary of all street types identified in the Bremner Design and Construction Standards for quick reference for users.

Section 3: Design Philosophy

This section identifies the Design Principles, concept of Design Domain, human factors, modal priority based on trip type, Universal Design, considerations for designing for winter, and the Design Exception process.

Section 4: Design Users & Street Types

This section discusses human factors, Design Users and Design Vehicles, and presents the street types to be used for the transportation network in Bremner.

Section 5: Design Requirements

This section identifies the design requirements for the street elements (e.g., lane widths, sidewalks), off-street multi-use trails, intersections, and utilities for Bremner.

Section 6: Standard Drawings & Details

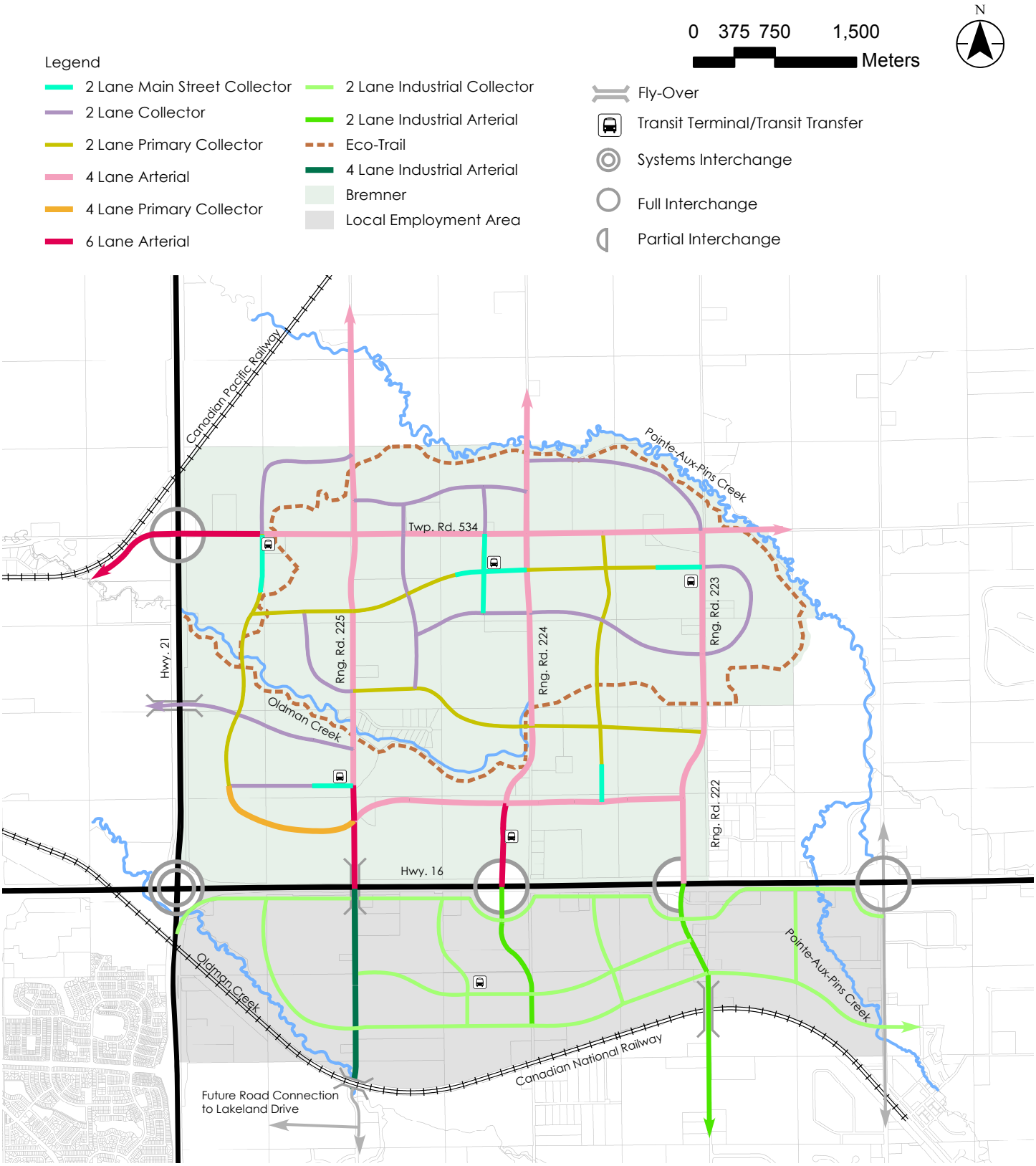
This section presents standard drawings and standard details for the design of streets, intersections, off-street multi-use trails, and utilities in Bremner.

2 STREET TYPE OVERVIEW

Design philosophy, details on design users, street types and design requirements are covered in detail in **Sections 3.0 – 5.0**. A summary of Street Types and their locations in Bremner can be found on the following page on Map 2, from the Bremner Transportation Plan.

MAP 2

ROAD CLASSIFICATION AND NUMBER OF LANES



STRATHCONA COUNTY

Note: This map is conceptual in nature. The exact location and alignment of land uses, facilities, roadways and services will be determined by the future development ASPs subject to Strathcona County's approval.

3 DESIGN PHILOSOPHY

3.1 Design Principles

The Bremner Transportation Plan outlines a plan based on the principles of Safe Systems and Vision Zero. The design of Bremner's streets and intersections will be based on the following 5 Design Principles that emphasize Safe Systems and Vision Zero:

1. Minimize Exposure to Conflicts
2. Reduce Speed at Conflict Points
3. Communicate Right of Way Priority
4. Provide Adequate Sight Distance
5. Minimize Complexity

3.2 Design Domain

Design Domain can be thought of as a range of values that a design element might take such as sidewalk width, lane width, design speed, or horizontal curvature. The Design Domain range has a relationship with the fitness-for-purpose of the design element as illustrated below based on direction in the TAC GDG. For example, utilizing values in the lower regions of the Design Domain for a single design element may result in designs which may be less efficient or less safe, although perhaps less costly to construct. Utilizing values in the upper regions of the Design Domain may result in designs which may be safer in some ways and more efficient in operation, but may cost more and, depending on the element, may be considered less safe for some users.

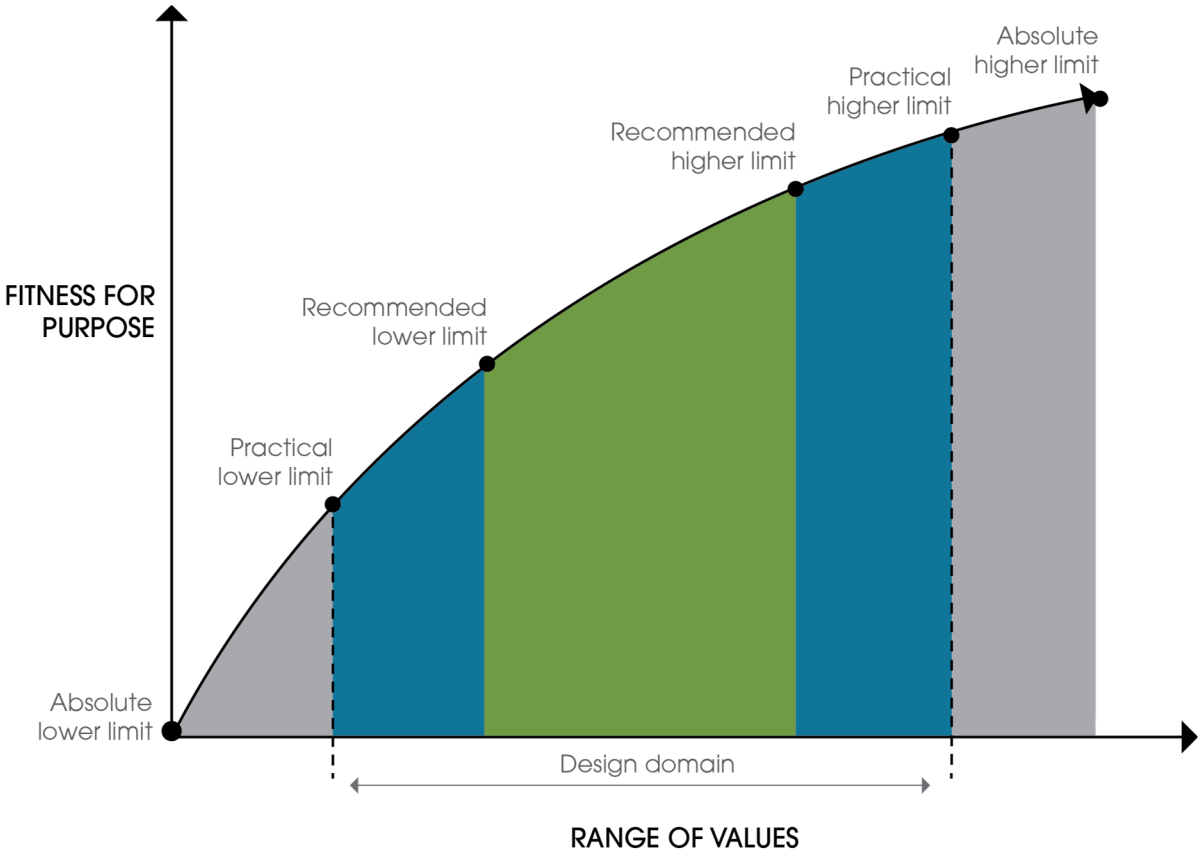


Figure 3.1: The Design Domain Concept

The concept of Design Domain accepts that, for many elements in the transportation right of way, there is no absolute value that is the "correct" design dimension. A designer shall consider the overall impact to make an informed decision that will suit the context and users. Consequences of reducing a value for a design requirement should be understood, particularly regarding safety performance and impacts, but also in terms of costs and other outcomes.

3.3 Human Factors

Streets are built for use by all people including those who are walking, cycling, riding transit, and driving. Consequently, human traits should be considered in design.

There are certain human abilities that determine how far we can see, the limits of our peripheral vision, how quickly we react, the extent of our mobility, and how information is perceived and processed. It is important to remember that these traits vary from person to person and from situation to situation. For example, a numerical value for reaction time should not be thought of as fixed, even though a fixed numerical value is assumed for design purposes. Older adults will often have slower walking speeds, reduced perceptions, and reduced stopping speeds. Those with mobility impairments may require additional time to start a movement, especially when using mobility aids. Street users of all ages and abilities also adapt to perceived and anticipated conditions.

The reason human factors are of significant interest in the street design process is that there is a close link between how streets are built and how people use them. If perceptual clues are clear and consistent, the task of adaptation is made easier and the response of people driving, walking, and cycling will be more appropriate and uniform. For street design this translates into two foundational principles[1]:

- It is important to design a street so that it conforms to what users expect from such a street based on previous experience (e.g., driver expectancy).
- It is important to provide street users with sufficient time to detect, identify, and react to hazards in the street (e.g., driver perception and reaction).

Different street users have different performance capabilities and design needs. Such differences and needs can be categorized in terms of the "type" of user being considered for design purposes. When contemplating design challenges, designers consider different Design Users in the same way they consider different Design Vehicles.

Design Users will include the wide range of multimodal users. They will also represent a range of people, from those who are young and inexperienced, to those who are older, those with challenges resulting from failing sensory and cognitive faculties, and physical disabilities. Their trip purposes may also differ, from those who are driving/cycling/walking for pleasure to those who are commuting, from those who are in a hurry, to those who are not. Perhaps most importantly, Design Users will include those who are familiar and those who are unfamiliar with the street.[2]

More information on Human Factors, as well as the related topic of Design Consistency, can be found in Sections 2.2 and 2.7 of the 2017 TAC GDG.

3.4 Modal Priority & Universal Design

3.4.1 Modal Priority

The Bremner Transportation Plan has identified three main trip types, the priority modes for those trip types (i.e., modal priority), and the associated street types that accommodate those trips. By defining the trip types, priority modes, and street types in this way, the designer can identify the priority mode(s) for a street and prioritize space within the right of way.

Modal priority is a term that refers to the hierarchy for transportation modes along a street (such as walking, cycling, transit, driving, and goods movement) and can vary depending on the street type. For example, if designing a street to prioritize its use by people walking, the level and quality of service of the street will be focused on maximizing the operation for people walking, while still accommodating the flow of other modes of travel at a reasonable level or quality of service. Another example, for prioritizing transit operations, is the use of transit priority measures (e.g. transit signal priority and queue jump lanes) to give transit a "head start" at intersections.

Within a corridor, the highest priority mode will take precedence in the design process and typically will be accommodated through design values in the higher end of the recommended range of the Design Domain. In any trade-off assessment, lower priority modes will be the first to

[1] TAC GDG Section 2.2
[2] TAC GDG Section 2.2.5

be reviewed for the potential for trade-offs. Regardless, the Design Domain concept should be utilized to ensure minimum design requirements are met for all modes needing to be accommodated. Where this cannot occur, the designer may have to look to other adjacent routes in the network to properly provide for the requirements for some users.

For all street types, access for emergency services vehicles is an essential consideration in the street design. All street types shall be designed to accommodate emergency service vehicles when the route has been identified for primary access or staging.

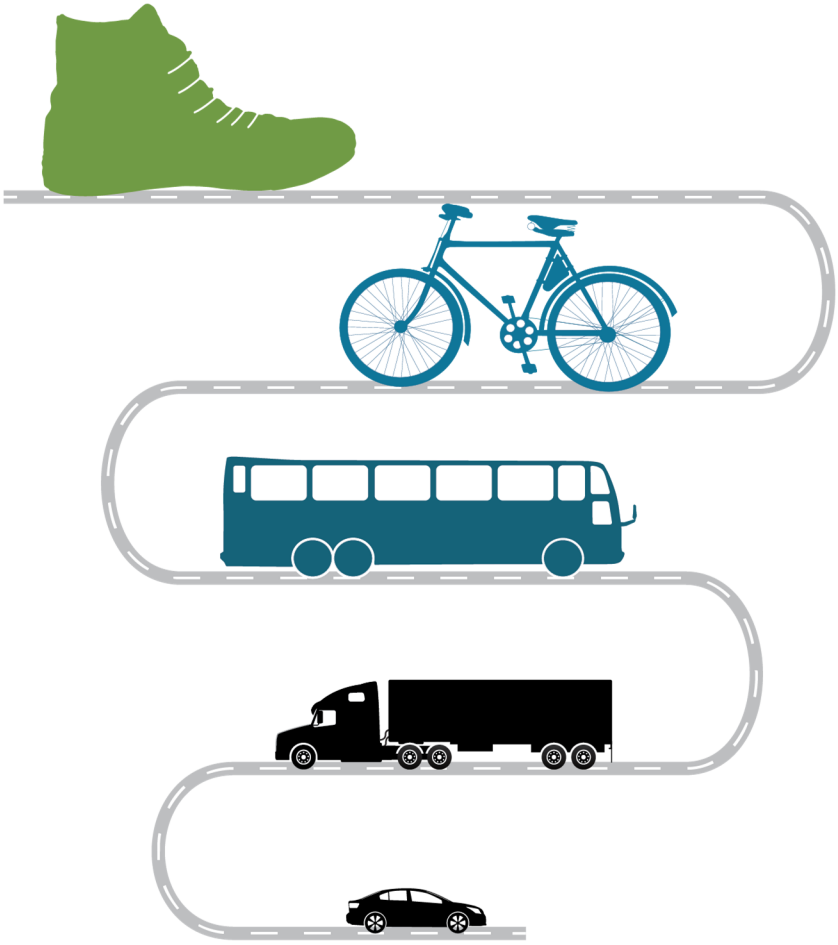


Figure 3.2: Example Modal Priority for a Walkable Main Street

The following summarizes the trip types, priority modes, and street types for Bremner.

Table 3.1: Trip Types, Priority Modes, and Street Types for Bremner

Getting To and From Bremner	• **Prioritize:** Goods Movement, People Riding Transit, People Driving • **Accommodate:** People Walking, People Biking • **Transit:** Edmonton Express Route, Connections to LRT and Sherwood Park, Park and Ride Facility • **Walking and Cycling**: Off-Street Multi-Use Trail • **Street Types**: Arterials, Industrial Arterials • **Typical Destinations**: City of Edmonton, Sherwood Park, Industrial Heartland
Getting Around Bremner	• **Prioritize:** People Biking, People Riding Transit, People Walking, People Driving • **Accommodate:** Goods Movement • **Transit:** Local Transit Routes, Park and Ride Locations, Transit Centres, Ride Sharing, Local Shuttles • **Walking and Cycling:** Multi-Use Trails and Cycle Tracks, Bike Parking • **Street Types:** Off-Street Multi-Use Trails, Collector, Main Street Collectors, Primary Collectors, Industrial Collector • **Typical Destinations:** Town Centre, Community Nodes, Schools, Local Employment Area
Getting Around the Neighbourhood	• **Prioritize:** People Walking, People Biking, People Riding Transit • **Accommodate:** People Driving, Goods Movement • **Transit:** Community Shuttles • **Walking and Cycling:** Sidewalks, Multi-Use Trails, Cycle Tracks • **Street Types:** Laneway, Reverse Housing Laneway, Local, Shared Street, Industrial Local. • **Typical Destinations:** Village Centres, Schools, Transit Stops, Local Commercial Areas

3.4.2 Universal Design

Universal Design is a socially inclusive approach to design that increases the potential for developing a better quality of life for a wider range of individuals. The design process creates an environment that is usable to as many people as possible regardless of age, ability, or situation. While streets will have varying modal priority, every street is to be designed to achieve Universal Design.

To support the Principles of Universal Design[3] the designer should consider the broadest set of Design Users applicable to the context, including:

- Equitable Use: The design is useful and marketable to people with diverse abilities.
- Flexibility in Use: The design accommodates a wide range of individual preferences and abilities.
- Simple and Intuitive Use: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
- Perceptible Information: The design communicates necessary information effectively to the user, regardless of ambient conditions of the user's sensory abilities.
- Tolerance for Error: The design minimizes hazards and the adverse consequences of accidental or unintended actions.
- Low Physical Effort: The design can be used efficiently and comfortably and with a minimum of fatigue.
- Size and Space for Approach and Use: Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

Universal Design Principles are supportive and complementary to the Design Principles, Safe Systems, and Vision Zero.

[3] The Center for Universal Design, 1997

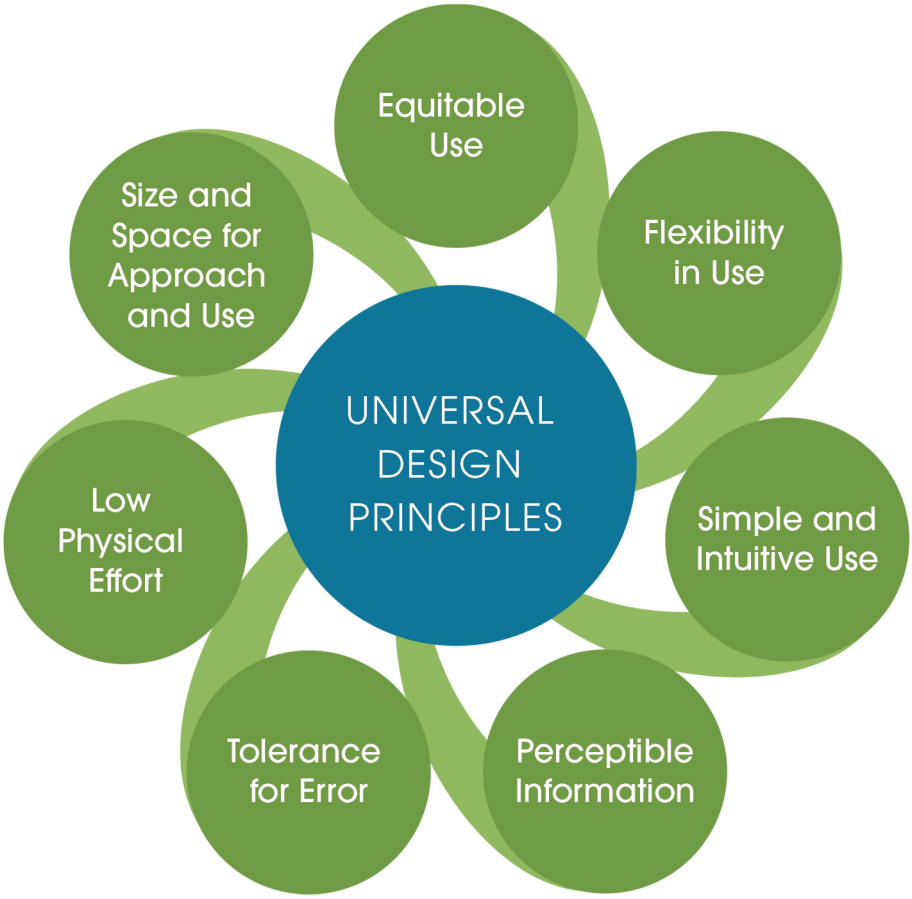


Figure 3.3: Universal Design Principles (Adapted from the Center for Universal Design)

3.4.3 Designing for Winter

Winter city design means designing facilities with consideration to the maintenance and operations that occur due to the impacts of snow accumulation and snow clearing. Bremner is a northern, winter community and the impact of winter needs to be considered in the design process.

Designing for winter requires designing with a winter perspective at the beginning of the design process. There are five main principles that apply to designing for winter:

- Design and provide infrastructure that supports desired winter life and improves comfort in cold weather (this includes allowances for snow clearing, storage, and removal);
- Create visual interest with light and vegetation;
- Incorporate design strategies to block wind;
- Maximize exposure to sunshine; and
- Use colour to enliven the winterscape.

Experience shows that when a street is designed with winter in mind, it will be comfortable for all users in all seasons.

3.4.4 Low Impact Development

Low Impact Development (LID) is a more holistic approach to storm water management than traditional end-of-pipe designs. LID promotes infiltration and filtration of stormwater and seeks to maintain the existing hydrology of the site after development while improving water quality. LID facilities can be designed for quantity reduction, quality treatment or both.

In addition to volume/peak flow rate reduction and water quality improvements, LID has many other benefits such as increasing biodiversity, addition of green space in communities, providing recreation opportunities, reducing heat island effect, and improving air quality. LID facilities have proven valuable in reducing flooding as they slow down and infiltrate storm water, shifting the peak flows from the catchment they serve to later in the storm. This shifting of peak flow timing often means the downstream infrastructure has capacity to handle larger storms.

LID is most effective during small, frequent rain events, which typically comprise about 90% of the rainfall events during a typical year. During these events, LID absorbs a significant portion of the runoff and treat the first flush. While LID does not remove the need for downstream infrastructure (e.g., wetlands and retention ponds), there are clear benefits in water quality treatment and increased infiltration. Important considerations when selecting appropriate LID treatments include land use application and suitability, cold climate suitability, land availability, maintenance, groundwater elevations, in situ soil conditions, and effectiveness in reducing quantity and improving quality of storm water. LID is covered in more detail in **Section 5.5.2.**

4 DESIGN USERS & STREET TYPES

4.1 Design Users & Design Vehicles

Designing streets requires an understanding of the dynamics and functional requirements of people and their various modes of transportation. The following information is used to define the Design Users and Design Vehicles to be used in the design of Bremner's streets. Their requirements have been incorporated in the Design Domains for the street elements and facilities described later in Section 4.

4.1.1 Design Users & Vehicles for Walking

Walking is the most universal form of travel. When we consider walking to include people using mobility aids, including wheelchairs, it is also the most equitable form of travel, though it represents the most vulnerable street users.

The Design Domain for operating envelopes for people walking and wheeling are outlined below. They shall be used to design walking facilities within street and other public rights of way and should also be used for the design of walking access within private property.

Table 4.1: Design Domain for Walking

Design Domain: Operating Envelope Walking (in m)	**Recommended Values**	
	Horizontal Operating Envelope	Vertical Operating Envelope
Person Walking	0.75	2.10
Manual Wheelchair or Scooter	0.90	2.10
Person Walking with Child / Person Walking with Service Animal / Two People Walking / Two Wheelchair Users Passing	1.80	2.10

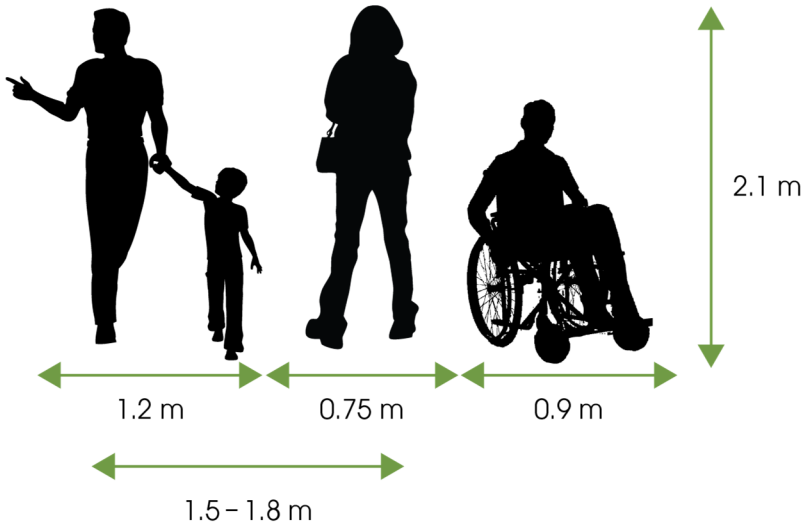


Figure 4.1: Operating Envelopes for Walking

4.1.2 Design User & Vehicles for Cycling

Consistent with TAC's GDG Section 5.1.2.2, the Bremner DCS are designed to recognize the needs for the full range of user ages and abilities of people who may ride a bike. This group of people are sometimes referred to as the "Interested but Concerned" or "Casual and Less Confident," and embodies the widest practical range of ages and abilities.

The Design Domain for the operating envelopes for people cycling is presented below and shall be used for the design of on- and off-street bicycle facilities as well as bicycle parking.

Table 4.2: Design Domain for Cycling

Design Domain: Operating Envelope Cycling (in m)	**Recommended Values**	
	Minimum Recommended Value	Maximum Recommended Value
Horizontal Operating Envelope	1.2	1.5
Lengthwise Operating Envelope	1.8	3.0
Vertical Operating Envelope	2.5	N/A

The higher ends of the horizontal operating envelope are most appropriate for steep grades.

In addition to the horizontal operating envelope, the following horizontal clearances shall be provided:

- The width of the gutter pan is not considered part of the horizontal operating envelope. The minimum clearance from the face of curb shall be 0.25 m for a 250 mm gutter pan or 0.50 m where there is a 500 mm gutter pan;

- Minimum horizontal clearance of 0.2 m is required from vertical obstructions of 100 mm to 750 mm in height;
- Minimum horizontal clearance of 0.5 m is required for vertical obstructions greater than 750 mm in height; and
- Horizontal clearance of 0.2 m shall be provided to accommodate passing maneuvers, either for oncoming or overtaking movements.

The recommended maximum radius for bicycle facilities is 10.0 m. The minimum radius for bicycle facilities is 5.0 m. For turns less than 5.0 m, operating speed reduces to less than 12 km/h which is the speed where stability is significantly impacted.

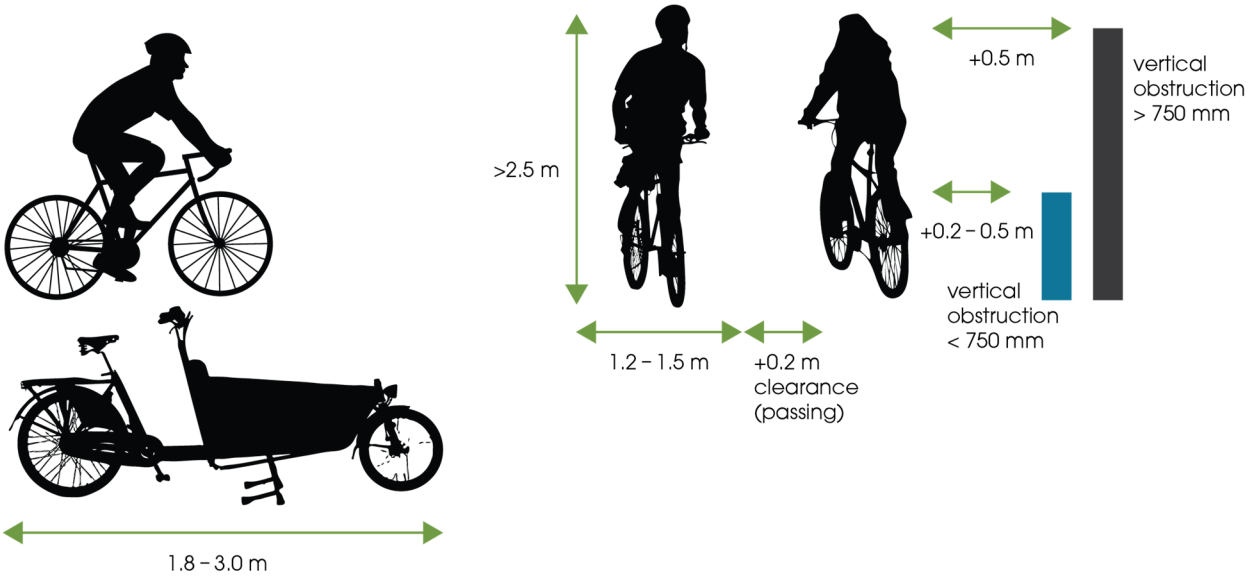


Figure 4.2: Operating Envelopes for Cycling

4.1.3 Design Vehicle for Driving, Transit, and Goods/Services

The physical characteristics of the vehicles using a street define many geometric design elements including intersections, site access configurations, horizontal curvature, and vertical clearance. As part of the design process, it is necessary to identify all vehicle types using a street and then to select representative vehicles whose turning dimensions (i.e., dimensions affecting tracking or turning behaviour[21]) and other characteristics (e.g., height of eye, overall length, and performance characteristics) are then used to establish the relevant vehicle parameters for geometric design.

The **Design Vehicle** is typically the vehicle with the largest turning radius frequently required to maneuver a turn at the intersection and, as such, turns should be made with relative ease. The Design Vehicle also assists in establishing the width of elements within the Travelled Way and Ancillary Zone.

Control Vehicles are typically the largest vehicle occasionally required to maneuver a turn at an intersection corner but are infrequent and may have less available space to maneuver. The space needed for maneuvering by Control Vehicles may occur by turning into non-curbside travel lanes or encroaching into opposing lanes (provided measures are taken to manage the conflicts).

Three general classes of Design Vehicles have been established based on research commissioned by TAC:

- Passenger cars – includes compacts and subcompacts, all light vehicles, and all light delivery trucks (e.g., vans and pickups);
- Trucks – includes single-unit trucks, truck tractor-semitrailer combinations, and trucks or truck tractors with semitrailers in combination with full trailers; and,
- Buses – includes single unit buses, articulated buses, double decker, and intercity buses.

For the design of Bremner streets, designers are to consider both Design Vehicles and Control Vehicles.[4]

The following table outlines the Design Domain values for width, length, and minimum turning radius for Design and Control Vehicles.

[4] TAC GDG Section 2.4

Table 4.3: Design Domain for Driving & Operating Vehicles

Design Domain: Width, Length, & Turning Radius for Design & Control Vehicles (in m)	**Recommended Values**		
	Recommended Width	Recommended Length	Recommended Minimum Turning Radius
Passenger Car	2.0	5.6	6.3
Medium Single Unit (MSU) Truck	2.6	10.0	11.1
Standard Single Unit Bus (B-12)	2.6 3.15 w/ mirrors	12.2	12.9
Waste Truck	2.6 3.15 w/ mirrors	12.4	12.8
Fire Truck	2.6	15.1	12.8
Tractor Semi-Trailer (WB-21)	2.6	25.0	12.8
Turnpike Double (WB-36)	2.6	38.0	17.3
Nova Bus	2.6	12.2	12.44

Typical vertical heights of trucks range from 4.15 to 4.25 m which can be used in the assessment of vertical clearance. The recommended minimum vertical clearance measured from the highest point of the Travelled Way on the cross section to the lowest point of the underside of a structure above is 5.4 m. For further information and details on the above Design Vehicles and other potential Design Vehicles, refer to TAC GDG Section 2.4 (e.g., articulated buses).

4.2 Street Types

For each street type, the Design Vehicle and Control Vehicle(s) are noted.[5] Should a designer select a Design or Control Vehicle that is different than those listed below, a Design Exception is required.

[5] PC = Passenger Car, MSU = Medium Single Unit, WT = Waste Truck, FT = Fire Truck, B-12 = City Bus, WB-21 = Tractor Semi-Trailer, WB-36 = Turnpike Double

Table 4.4: Design & Control Vehicles by Street Type

Street Type	Design Vehicle	Control Vehicle	Control Vehicle Allowable Encroachments
Off-Street Multi-Use Trail	Bicycle	FT[6,7]	Must maneuver within the hard-surfaced areas with 0.3 m clearance to pavement edge and any vertical obstacles.
Laneway			
Laneway	PC	WT	Must maneuver within the hard-surfaced areas with 0.3 m clearance to pavement edge and any vertical obstacles.
Reverse Housing Laneway	PC	WT, FT	Must maneuver within the hard-surfaced areas with 0.3 m clearance to pavement edge and any vertical obstacles.
Local			
Local	PC	WT, FT, MSU	Must maneuver within the hard-surfaced areas with 0.3 m clearance to pavement edge and any vertical obstacles.
Shared Street	PC	WT, FT, MSU	Must maneuver within the hard-surfaced areas with 0.3 m clearance to pavement edge and any vertical obstacles.
Collectors			
Collector	B-12	WT, FT	Maneuver within hard surfaced areas with 0.5 m clearance to pavement edge and any vertical obstacles.
Primary Collector	B-12	WB-21	Encroachment into adjacent lanes in same direction at major intersections (opposing lanes at minor intersections)
Main Street Collector	MSU	B-12	Encroachment into adjacent lanes in same direction and into opposing lanes
Arterials			
Arterial	WB-21	WB-36	Encroachment into adjacent lanes in same direction permitted at major intersections (opposing lanes at minor intersections)
Industrial Areas			
Industrial Local	WB-21	WB-36	Encroachment into opposing lanes permitted at intersections (local/collector)
Industrial Collector	WB-21	WB-36	Encroachment into opposing lanes permitted at intersections (local/collector)
Industrial Arterial	WB-21	WB-36	Encroachment into adjacent lanes in same direction permitted at major intersections (opposing lanes at minor intersections)

[6] Fire Truck is Control Vehicle for off-street paths if used for emergency access. If this is not the case, a passenger vehicle should be used as the Control Vehicle to reflect access for maintenance vehicles.
[7] Minimum 6.0 m clear width required to accommodate FT operations. This must be provided where FT is a Control Vehicle and can be accommodated by including the width of opposing lanes, as well as parking lanes on local streets.

5 DESIGN REQUIREMENTS

5.1 Design Speeds

Travel speeds have a significant impact on the safety and efficiency of the transportation system. Inconsistencies between the Operating Speed, Design Speed, and the Posted Speed can create unsafe conditions.

Operating Speed refers to the actual travel speed of vehicles at a time when traffic volumes are low, and drivers are free to choose the speed at which they travel without reductions due to congested conditions. In general, the intended Operating Speed should be equal to or less than the Design Speed.

There is evidence that design treatments, such as narrow lanes, traffic calming measures, on-street parking, street-oriented buildings, and trees located closer to the street result in drivers traveling at lower Operating Speeds.

Design Speed ranges are typically based on aspects such as land use context, building orientation in relationship to the street, functional classification of the street, types of interactions that can occur between street users, and mobility goals of the street section. While higher speed of travel for people operating vehicles, transit users, and goods movement will result in shorter travel times, the detrimental influence this higher speed can have on other street users, the built environment, and collision severity must be considered.

Research has shown the probability of fatalities increases significantly when impact speeds are above 50 km/h (see figure below). To mitigate these negative impacts, streets in areas with buildings oriented to the street should be designed for slower, walking-compatible motor vehicle travel speeds as a response to higher levels of people walking. These speeds should be kept at or below 50 km/h wherever possible.

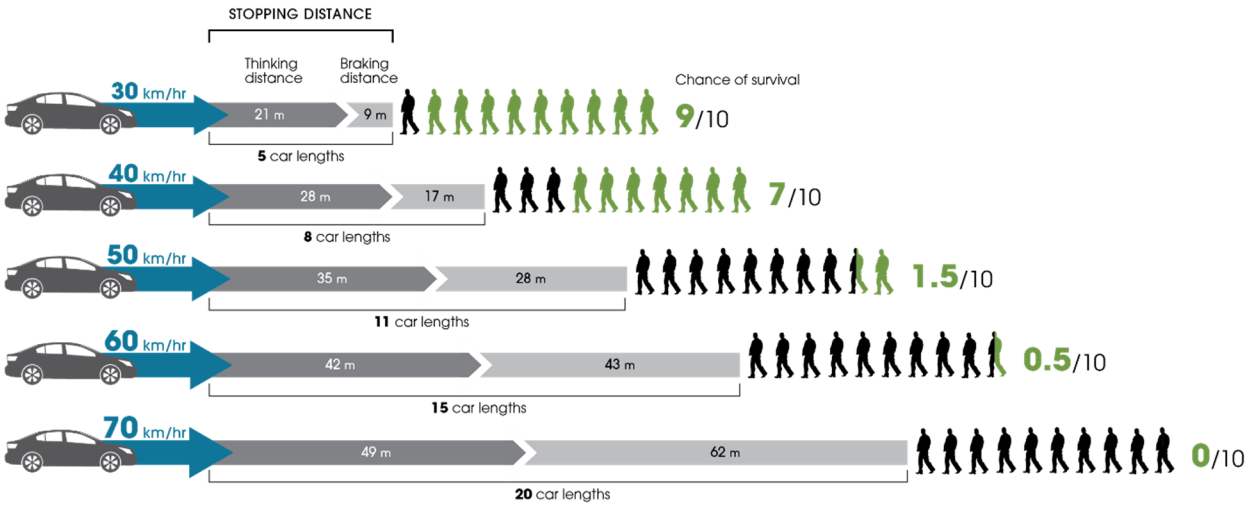


Figure 5.1: Vehicle Speed, Stopping Distances, and Chance of Survival (Adapted from World Health Organization, 2008, Speed Management: a road and safety manual for decision-makers and practitioners)

Off-street multi-use trails and bike paths and on-street bicycle facilities (cycle tracks, shared lanes/bicycle boulevards) should have a Design Speed that is at least as high as the preferred speed of the faster users of the facility and consider the expectations of other users of a facility, including those with mobility issues.

For all Bremner streets, **DESIGN SPEED EQUALS THE POSTED SPEED**. The following table provides the Design Domain for Design Speeds for each street type and for off-street and on-street active transportation facilities and the Target Value that has been used for the Standard Drawings.

Table 5.1: Design Domain for Design Speed

Design Domain: Design Speed by Street Type / Active Transportation Facility Type (in km/h)	**Design Domain Recommended Range**		**Target Value**
	Recommended Lower Limit	Recommended Upper Limit	Design Speed
Off-Street Multi-Use Trails	10	30	30
Bike Path, On-street Bicycle Facilities	20	50	30
Laneways, Reverse Housing Laneways	5	20	15
Local Streets	30	40	30
Shared Streets	5	20	15
Collector Streets	30	50	40
Main Street Collectors	30	50	30
Primary Collector Streets	40	50	50
Arterial Streets (4-lane)	40	50	50
Arterial Streets (6-lane)	50	70	60
Industrial Local Streets	30	50	50
Industrial Collector Streets	50	60	50
Industrial Arterial Streets	50	70	60

5.2 Streets

Streets are a collection of different design elements that allow for movement of people and goods and use of the space as a public amenity. Street right of way can be defined as separate design zones as illustrated in the figure below.

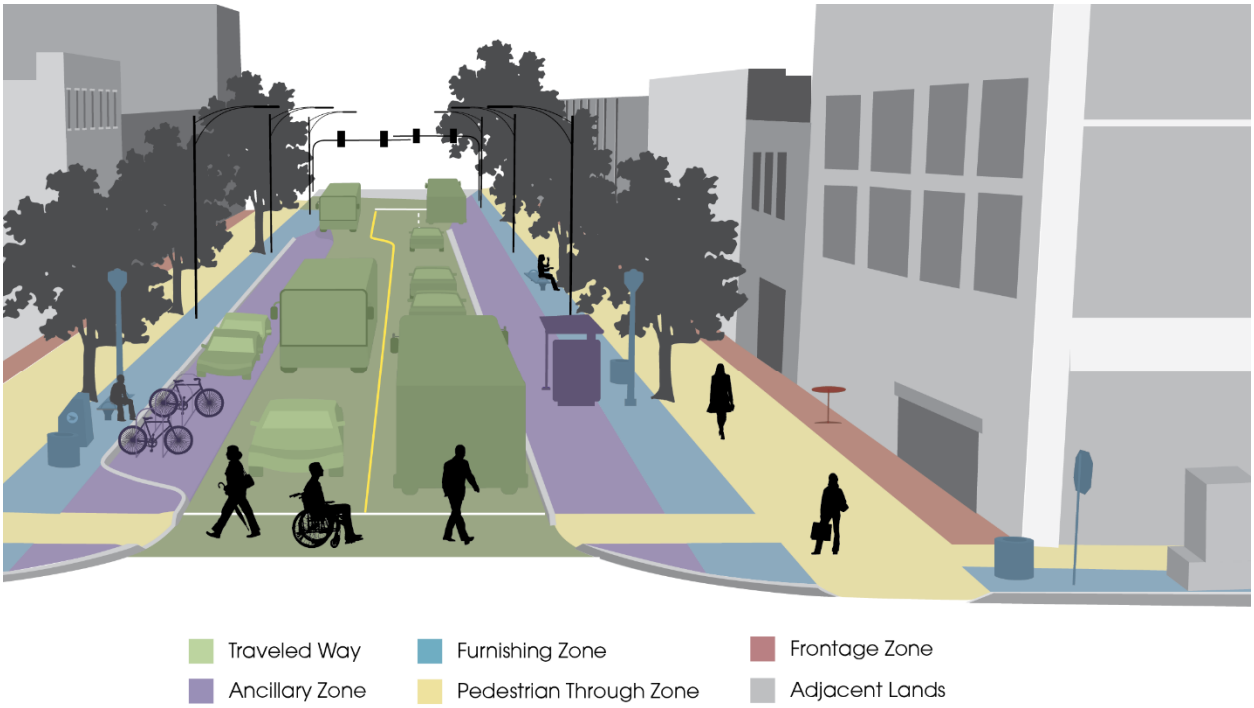


Figure 5.2: Design Zones for Street Rights of Way

The remainder of this sub-section outlines design requirements for each Design Zone.

5.2.1 Adjacent Lands

Adjacent Lands are the land uses that abut the street right of way. Adjacent Lands have a significant influence on the context, characteristics, and potential users of the street. Likewise, the design of the street can have a significant influence on the type of land uses and their orientation. Taken together, the Adjacent Lands and the Street, form the built environment.

The following table identifies the land use types, street orientation, and trip purposes for each street type. This information was used to inform the Design Domain and associated Standard Drawings. Design guidance for development parcels, buildings, and associated lands are provided through the Zoning Bylaw and ASP-level Site and Building Design Guidelines.

Table 5.2: Street Orientation of Adjacent Lands

Street Type	Typical Land Uses	Street Orientation of Buildings	Trip Purposes for Street Users
Off-Street Multi-Use Trail	Park, Environmental Reserve, Residential	Street oriented, Non-street oriented	Getting Around Bremner
Laneway			
Laneway	Residential	Non-street oriented	Getting Around the Neighbourhood
Reverse Housing Laneway	Residential	Non-street oriented	Getting Around the Neighbourhood
Local			
Local	Residential	Street oriented	Getting Around Neighbourhoods
Shared Street	Commercial, Employment, Mixed-use	Street oriented	Getting Around Neighbourhoods
Collectors			
Collector	Residential, Commercial, Employment, Schools, Parks	Street oriented, Non-street oriented	Getting Around Bremner
Primary Collector	Residential, Commercial, Employment, Schools, Parks	Street oriented, Non-street oriented	Getting Around Bremner
Main Street Collector	Commercial, Mixed-use	Street oriented	Getting Around Bremner
Arterials			
Arterial	Residential, Commercial, Employment, Schools, Parks	Non-street oriented	Getting To and From Bremner
Industrial Areas			
Industrial Local	Industrial Employment	Non-street oriented	Getting Around the Neighbourhood
Industrial Collector	Industrial Employment	Non-street oriented	Getting Around Bremner
Industrial Arterial	Industrial Employment	Non-street oriented	Getting To and From Bremner

5.2.2 Frontage Zone

Figure 5.3: Frontage Zone

Immediately adjacent to buildings or private property, the Frontage Zone in street-oriented contexts (e.g., Main Streets) is a space used as a support and/or extension of the land uses along the street. Uses of the Frontage Zone can include ground floor retail displays, café seating, temporary signage, queuing areas, and other activities to support active use of the street by people and businesses. For local streets and non-street-oriented contexts, the frontage zone is typically landscaped and a passive space that can include space between the Pedestrian Through Zone and the property line for underground utilities or noise attenuation devices such as a barrier wall.

The following table summarizes the Design Domain for Frontage Zone width and identifies target values for Main Streets.

Table 5.3: Design Domain for Frontage Zone Width

Design Domain: Width, Frontage Zone (in m)	**Design Domain Recommended Range**		**Target Value**
	Recommended Lower Limit	Recommended Upper Limit	
Non-Main Streets	0.2	4.5	N/A
Main Street Collectors			1.0

NOTES:
1. Laneways do not have Frontage Zones.
2. Frontage Zones for Industrial Areas and along Arterial Streets may exceed the recommended upper limit if berms are constructed for noise attenuation. Refer to the Strathcona County Design and Construction Standards for requirements for berms.

The target values for Main Streets are based on accommodating advertising and small tables/displays along Main Street Collectors.

The edge of buildings are commonly used for positioning by people with visual impairments. Frontage Zones may be filled with people, furniture and other objects and shall be designed with tactile guidance detectable under foot and a long cane. Acceptable forms of tactile guidance include tactile walking surface directional indicators and rough edge, small paver stones. The separation between the Frontage Zone and the Pedestrian Through Zone shall be of high visual contrasting colours.

5.2.3 Pedestrian Through Zone

Figure 5.4: Pedestrian Through Zone

Located between the Frontage and Furnishing Zones, the Pedestrian Through Zone provides an area for active transportation mobility for people of all ages and abilities to access the land uses along the street and to interact with one another. This zone is typically used by people walking but, in the case of multi-use trails, can be shared by those cycling.

To ensure that the design of the walking environment accommodates the greatest possible number and range of people, the following guidelines should be adhered to:

- Allow a clear path of travel, free of obstructions;
- Provide a firm, non-slip, and glare-free surface (typically concrete for sidewalks, asphalt for multi-use trails);
- Ensure gradients along the path of travel are gradual to allow access by all and that landings are added if grades are greater than 6%; and
- Limit motor vehicle driveways across the Pedestrian Through Zone to minimize disruption and improve safety.

Boulevard sidewalks are required in Bremner wherever sidewalks are provided to support a safe and comfortable walking environment and efficient maintenance and operations in winter. The following table summarizes the walking facility requirements by street type.

Table 5.4: Walking Facility Requirements

Walking Facility Requirements by Street Type	Walking Facility
Laneways and Reverse Housing	Shared Travelled Way
Local Streets	Boulevard Sidewalk or monowalk both sides
Shared Streets	Shared Travelled Way plus Pedestrian Through Zone (i.e., Comfort Zone) on one or both sides
Collector Streets	Boulevard Sidewalk one side, Multi-Use Trail one side
Main Street Collector, Primary Collector	Boulevard Sidewalks both sides
Arterial Streets	Multi-Use Trail both sides
Industrial Local, Industrial Collector Streets	Multi-Use Trail one side
Industrial Arterial Streets	Multi-Use Trail both sides

5.2.3.1 Sidewalk & Walkway Widths

The following Design Domain widths for walking facilities required in Bremner are summarized in the following table.

Table 5.5: Design Domain for Sidewalk & Walkway Widths

Design Domain: Sidewalk & Walkway Widths by Street Type (in m)	Design Domain Recommended Range	
	Recommended Lower Limit	Recommended Upper Limit
Local Street, Collector Street, Off-street Walkway	1.80	N/A
Shared Streets (Comfort Zone)	2.00	N/A
Main Street Collectors, Primary Collectors	2.00	N/A
Arterial Streets	3.0 Multi-use Trail	N/A
NOTES: 1. For Design Domain widths of Multi-Use Trails, see Section 5.2.6.2.		

5.2.3.2 Pedestrian Through Zone at Driveways

Any ramps for motor vehicle access at driveways to transition from the Travelled Way or Ancillary Zone elevation to the elevation of the Pedestrian Through Zone shall occur entirely within the Furnishing and/or Ancillary Zone(s). The Pedestrian Through Zone grades shall be continuous and not sloped at driveway accesses to be used as part of the driveway ramp.

The cross fall on sidewalks and walkways across driveways shall remain consistent with the Standard Design Detail. Grade transitions to/from the Travelled Way and the Adjacent Lands shall occur within the Furnishing and/or Ancillary Zones.

5.2.4 Furnishing Zone

Figure 5.5: Furnishing Zone

Located adjacent to the Pedestrian Through Zone, the Furnishing Zone provides an area for signs, streetlight poles, street trees or landscaping, transit stops, benches, bicycle parking, public art, underground and surface utilities, low impact development (LID), snow storage, and concrete curb along urban streets or overland drainage for rural cross sections.

Along Local, Collector, Arterial, and Industrial Arterial Streets, the Furnishing Zone is typically landscaped.

Along Main Street Collectors and Shared Streets, a hardscaped Furnishing Zone shall be used due to their street oriented commercial context and the level of activity within the Ancillary Zone with people accessing and exiting parked vehicles and/or cycle tracks. Hardscaped Furnishing

Zones can be in the form of acceptable concrete, paver stones, brick, or another hard surface. Using a different surface material from the Pedestrian Through Zone can assist with Universal Design and detectability under foot or with a long cane.

5.2.4.1 Furnishing Zone Widths

The Design Domain for Furnishing Zone width is summarized below. The recommended lower limit is the minimum width required to support the growth and health of mature street trees and accommodate the concrete curb.

When warranted by mitigating circumstances at the discretion of the County, Furnishing Zone widths less than the recommended lower limit may be utilized, but will require alternative landscape treatments such as shrubs or hardscaping and submission of a Variance. Narrower Furnishing Zones shall also consider impacts to utilities.

Table 5.6: Design Domain for Furnishing Zone Widths

Design Domain: Furnishing Zone Widths (in m)	**Design Domain Recommended Range**	
	Recommended Lower Limit	Recommended Upper Limit
Furnishing Zone Width	1.85	5.00

NOTES:
1. For Industrial Area streets, the Furnishing Zone consists of a ditched cross section to accommodate overland drainage. The widths of the Furnishing Zone for rural cross sections includes the side slope, drainage channel, and back slope. See the Standard Drawings for the recommended widths of Industrial Local, Industrial Collector, and Industrial Arterial Streets.
2. For Laneways, the Furnishing Zone varies from 0.5 m to 1.0 m. See the Standard Drawings for more details.
3. For Laneways and Reverse Housing Laneways, the Travelled Way extends the entire width of the right of way. As such, the Furnishing Zone width is 0 m.

5.2.4.2 Street Trees & Landscaping

Street trees and landscaping are critical elements of urban streets and should be prioritized accordingly due to their contributions to an urban space; providing climate control (micro-climates) from heat, wind, and rain; reducing traffic speeds; improving pedestrian safety; and adding value to adjacent properties.

Adequate tree spacing, and soil volume is required for healthy tree growth and is dependent on tree species. The soil volume can be located under a combination of the Furnishing Zone, Pedestrian Through Zone, and Ancillary Zone or Travelled Way through the use of soil cells. Refer to the Strathcona County Design and Construction Standards for information pertaining to tree selection, soil volume, spacing, and landscaping requirements.

The location of trees may obscure sightlines and visibility at intersections and mid-block crosswalks. Trees shall be adequately set back from curbs, signs, and utilities. The following table summarizes tree set back requirements.

Table 5.7: Tree Set Back/Offset Requirements

Tree Set Back/Offset Requirements by Street Element	Minimum Set Back/Offset Distance
Face of Curb along: Local Streets, Collector Streets, Main Street Collectors, Primary Collectors	1.25
Face of Curb along: Arterial Streets	2.00
Street lights	3.50
Street Corners, Intersections, Traffic Signals	15.00
Driveways	2.00
Sidewalks, Walkways, Multi-Use Trails, Cycle Tracks	1.00
NOTES: 1. Distances are measured from centre of tree trunk to edge of linear street element (e.g., sidewalks, curbs) or centre line for utilities and other appurtenances (e.g., signs, hydrants). 2. For elements not listed above, refer to the Strathcona County Design & Construction Standards. 3. Bus pads should be clear of trees and trees should be setback 1.0 m from bus pads. 4. If horizontal clearance from sidewalk to trees is less than 1.0m, tree type suitability must be reviewed to minimize disturbance to the adjacent infrastructure at tree's full growth.	

5.2.4.3 Street Lighting

Street lighting is used to illuminate the public right of way for its various users and contributes to safety and personal security and shall be provided along all Bremner streets and at all intersections to illuminate the crossings and ensure adequate visibility of people walking. Refer to the Strathcona County Design and Construction Standards and the TAC Guide for the Design of Roadway Lighting for street lighting requirements.

Human-scaled lighting, commonly referred to as "pedestrian oriented lighting," with increased spacing and luminaires at lower elevations shall be used in street-oriented contexts including along Main Street Collectors, and Shared Streets. Human-scaled lighting shall be placed with spacing of 30 m between poles and luminaires at approximately 5 m above the height of the Pedestrian Through Zone. This infrastructure is not currently reflected in the standard cross-section drawings (Section 6) until details of location, power supply, and specifications have been determined. Consideration also needs to be given the effects of artificial lighting on wildlife and vegetation, not just humans. For this reason, no artificial lighting is to be located in natural areas.

Street light setback and offset requirements are presented in the following table.

Table 5.8: Street Light Set Back/Offset Requirements

Street Light Set Back/Offset Requirements by Street Element	**Minimum Set Back/Offset Distance**
Face of Curb along: Local Streets, Collector Streets, Main Street Collectors, Primary Collectors	1.00
Face of Curb along: Arterials	2.00
Edge of Shoulder along: Industrial Arterial Streets	4.00
Trees	See Tree Set Back/Offset Requirements (Table 5.7)
Street Corners, Intersections, Traffic Signals	1.00
Driveways (Residential)	1.00
Driveways/Accesses (Commercial/Industrial)	1.50
Sidewalks, Walkways, Multi-Use Trails, Cycle Tracks	0.65
Bus Stops	1.00

NOTES:

1. Distances are measured from centre of street light pole to edge of linear street element (e.g., sidewalks, curbs) or centre line for utilities and other appurtenances (e.g., signs, hydrants, trees).
2. Street light poles are to be place at the same offset as trees from the face of curb or closer to allow for visibility of any signs that may be affixed to the poles.
3. For Street Light set backs on rural cross sections, refer to the Strathcona County Design and Construction Standards.
4. For elements not listed above, refer to the Strathcona County Design & Construction Standards.

The City of Edmonton is currently completing work (2019) on their Light Efficient Community Guidelines with the intent of reducing light waste, trespassing, glare, and pollution as there are human health impacts of light pollution. This will be a useful resource for Bremner once completed.

5.2.4.4 Hydrants

Hydrants shall be located within the Furnishing Zone of most streets. Hydrants shall be located 1.25m from active transportation facilities, intersections, driveways, Ancillary Zone uses, and the face of curb of all streets.

Refer to the Strathcona County Design and Construction Standards for all other requirements for fire hydrants.

5.2.4.5 Street Furniture

Street furniture includes functional and decorative elements that support the function and use of the street. Street furniture can include poles for traffic signals and lighting, benches, bicycle parking, flower pots, waste receptacles, bollards, banners, tables and chairs, advertising boards, signal boxes and traffic controllers, fire hydrants, pay parking stations, newspaper boxes, electric vehicle charging stations, wayfinding, sign poles, and public art. Street furniture is to be placed in the Furnishing Zone (and can extend to the Ancillary Zone in some cases).

The Design Domain width for the Furnishing Zone has considered the offsets/setbacks and size of the above noted street furniture. The placement of street furniture shall also consider maintenance and operations including snow clearing, snow storage, street sweeping, and replacement of damaged pieces.

Street furniture shall not be placed to negatively impact the sightlines and visibility at intersections and driveways.

5.2.4.6 Bus Stops

Bus stops are the street interface between transit services and the people they serve. Bus stops shall facilitate people accessing, loading, and unloading from buses and shall also provide a comfortable environment for people to wait for the bus to arrive. Supportive elements for a bus stop include a shelter, bench, waste receptacle, bicycle parking, traveler information for transit services, and wayfinding.

Bus stops shall be located in the Furnishing Zone and will typically extend into the Ancillary Zone. The street furniture associated with bus stops shall not encroach in the Pedestrian Through Zone or restrict this space below the horizontal operating envelope for people walking and cycling. Bus stops are typically located after an intersection to allow the bus to depart immediately after stopping. The placement of bus stops shall consider visibility, safety, transit operations, bus signal priority, intersection operations, parking restrictions, passenger demand, passenger access, and right of way constraints.

The minimum size of a bus pad is 3 m in width by 9 m in length. This size accommodates the loading and unloading for one bus and the installation of a shelter, bench, and other bus stop amenities.

Bus stops along urban streets shall extend into the Ancillary Zone to prioritize transit services and limit delay for bus operations (related to merging back into traffic). Interaction with cycle tracks and access to the bus stop across the bike lane needs to be considered.

Bus stops along rural street types (i.e., in Industrial Areas) shall be located in the Furnishing Zone and require a crossing to be built of the overland drainage ditch for access to the bus stop. Coordinating bus stop locations with industrial site accesses and intersections shall be done to support access to/from the stop and minimize additional construction of ditch crossings. The bus

stop shall be built with curbs to have the stop surface elevated from the Travelled Way to accommodate level boarding.

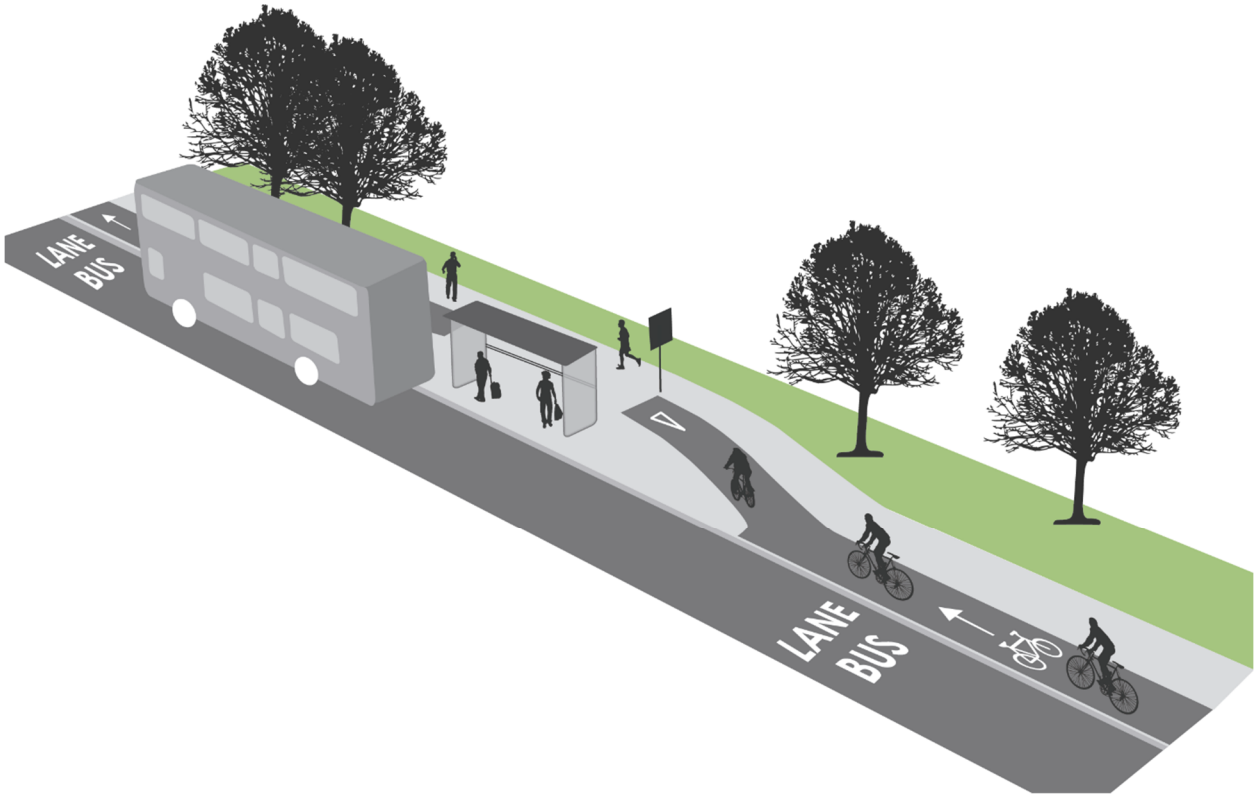


Figure 5.6: Example Bike Lane/Bus Zone Integrated Design

5.2.5 Ancillary Zone

Figure 5.7: Ancillary Zone

Located between the Travelled Way and Furnishing Zone, the Ancillary Zone provides a flexible space with the opportunity for various permanent and temporary street uses depending on the context and characteristics of the street. This area is typically considered "on-street", but it is not designed for through traffic. The use of this flexible space can vary and can include motor vehicle parking, loading or delivery zones, parklets, bicycle parking, curb extensions, public art, and transit stops. This space also includes the concrete gutter along urban streets and can be used for snow storage. In cases where cycle tracks are provided (i.e., part of the Travelled Way), the Ancillary Zone may be located between two parts of the Travelled Way.

Ancillary Zones are typically provided in street-oriented contexts including Local Streets, Collector Streets, Main Street Collectors, Primary Collectors, and Shared Streets.

5.2.5.1 Ancillary Zone Widths

The width of the Ancillary Zone is primarily related to the width of motor vehicle parking/loading, which can vary based on street type, parking utilization and turnover rates, and typical size of delivery vehicles. The Design Domain for the Ancillary Zone is summarized in the following table. The lower end of the recommended range is suitable for lower volume and speed streets such as Local Streets which have a combined Travelled Way and Ancillary Zone of 9 m. Other elements that could be located in the Ancillary Zone, such as parklets, bicycle parking corrals, and patios, shall be sized to fit the Design Domain widths except for Accessible Parking (see Section 5.2.5.3).

Table 5.9: Design Domain for Ancillary Zone Widths

Design Domain: Ancillary Zone Width (in m)	**Design Domain Recommended Range**	
	Recommended Lower Limit	Recommended Upper Limit
Ancillary Zone Width	2.10	2.70
NOTES: 1. Measured from face of curb.		

5.2.5.2 Parking, Loading & Delivery Zones

On-street parking, loading, and delivery zones can be important elements of streets to support the Adjacent Land related to access and goods. These uses of the right of way can also moderate motor vehicle traffic speeds and provide a buffer for people walking and cycling from moving motor vehicle traffic.

Parking, loading, and delivery zones shall be restricted within a minimum of 5 m from the near side of a marked crosswalk, stop sign, yield sign, or projection of the curb or edge of the intersecting street for Local and Collector Street intersections. Parking, loading, and delivery zones shall be restricted up to 20 m from Main Street Collector, Primary Collector intersections due to increased intersection volumes and activity.

5.2.5.3 Accessible Parking

Accessible parking is motor vehicle parking or loading zones that are dedicated through signs and pavement markings for the use by people that have parking placards for persons with disabilities. The Ancillary Zone provides the opportunity for dedicated 24-hour accessible parking, increasing the accessibility of destinations along the street to a broader range of people.

Accessible parking width requirements are wider than motor vehicle parking to accommodate wheelchair access for the driver to get into and out of the vehicle. A total width of 3.7 m shall be provided for accessible parking. Where provided, the additional accessible parking stall width can be achieved by reducing the width of the Furnishing Zone for a short segment.

A curb ramp shall be provided at accessible parking stalls for access and shall be located as to not be negatively impacted by drainage infrastructure (i.e., avoid ramps located at a catch basin or sag location).

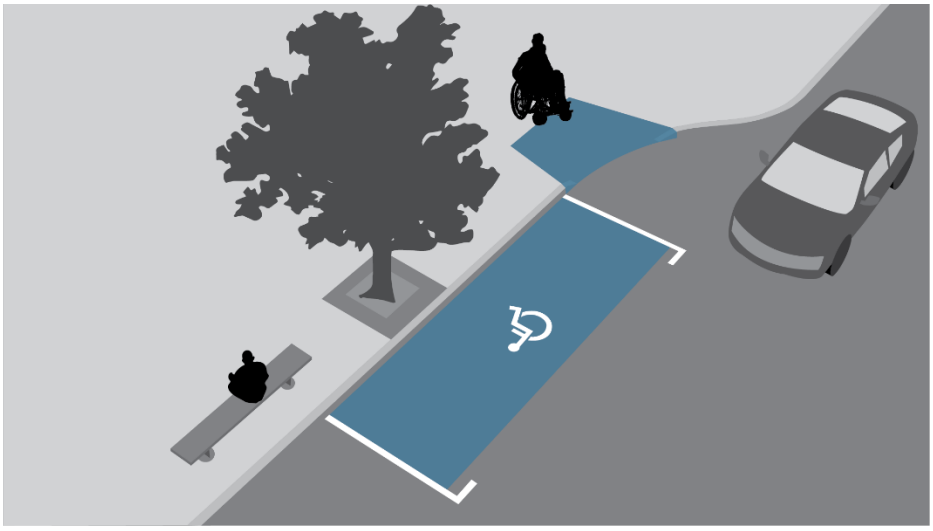


Figure 5.8: Accessible Parking

5.2.5.4 Curb Extensions

Curb extensions shift the curb from the edge of the Ancillary Zone toward the edge of the Travelled Way. They can be used at intersections, mid-block crossings, and traffic calming pinch points (e.g., along Collector Streets) to increase the visibility of people walking and cycling to people driving by shifting the position of people waiting closer to the Travelled Way and restricting parking which may obstruct sightlines Curb extensions have been shown to reduce motor vehicle speeds. Curb extensions can also be used at bus stops to allow for buses to stop within the travel lane. Curb extensions can also be locations for street furniture and low impact development.

Curb extensions are typically 2.0 m to 2.5 m in width and at least 6.0 m in length. A minimum radius of 4.5 m allows street sweeping and snow removal equipment to navigate the inside curves of the curb extension.

Figure 5.9: Curb Extension on an Arterial Street

5.2.5.5 Bus Stops

As discussed in Section 5.2.4.6, bus stops shall be provided such that the infrastructure associated with the stop includes the width of the Ancillary Zone and Furnishing Zone.

5.2.6 Travelled Way

Figure 5.10: Travelled Way

The Travelled Way provides an area for traveling along a street or to access land uses along a street for people traveling by motor vehicle, bicycle, and transit, and for the delivery of goods. The space can include exclusive or shared lanes for bicycles, transit, motorized vehicles ,and goods. Medians or islands, concrete gutters, refuge areas for people walking or cycling, crosswalks and crossrides, and turning lanes are also located within the Travelled Way.

In non-peak hours, some of the Travelled Way may be used as an area for motor vehicle parking or loading zones and, in some cases, can also be closed at time to motor vehicle traffic to host events and festivals. For Shared Streets, the Travelled Way is shared by people walking, cycling, driving, and delivering goods with the priority and right of way given to people walking. The Travelled Way is also the space for underground utilities including water, sanitary sewer, and storm sewer lines.

5.2.6.1 Motor Vehicle Lane Width

Section 4.2 of the TAC GDG discusses the design considerations for lane widths. Topics described include safety, Design Speed (and desirable Operating Speed), vehicle type, multimodal traffic volumes, climatic conditions, utility and streetscaping elements, and land use context.

TAC GDG Section 4.2.2 identifies three links between safety and lane width:

- The wider the lanes, the larger the average separation between vehicles operating in adjacent lanes. This may provide a larger buffer to absorb the small random deviations of vehicles from their intended path. On streets that are identical except for lane widths,

drivers may tend to drive faster and follow the preceding vehicle more closely on a street that has wider lanes. Slower speed limits, when coupled with wider lanes, can also result in poor compliance with the posted speed;

- A wider lane may provide more room for correction in near-collision circumstances. For example, a moment's inattention may cause a vehicle to drift into an adjacent lane. In the same situation, if the driving lane was wider, the driver's moment of inattention may have less serious consequences;
- However, wider lane widths may induce higher operating speeds by creating an open environment with little "side friction". In urban areas, this can be linked to reduced safety performance for people walking and cycling. Higher speeds increase stopping distances and increase the severity of collisions.

A growing consideration for lane widths is the transition to connected and autonomous vehicles that will likely occur over the course of Bremner's construction. It is anticipated lane widths will be able to be narrowed with reduced horizontal variations in travel with automated lane positioning. This consideration has not been incorporated into Bremner street lane widths at this time.

The following tables for the Design Domain for lane widths in Bremner are based on TAC GDG guidance and Bremner Design Principles.

Table 5.10: Design Domain for Lane Widths

Design Domain: Lane Width based on Design Speed (in m)	**Design Domain Recommended Range**	
	Recommended Lower Limit	Recommended Upper Limit
Streets with Design Speed ≤ 50 km/h	3.00	3.50
Streets with Design Speed > 50 km/h	3.30	3.70
Industrial Area Streets	3.50	4.00

NOTES:

1. Lane Width is measured to Lip of Gutter and exclude any gutter pan width.
2. Lane Widths for streets with rural cross sections in Industrial Areas (i.e., south of Highway 16) are wider than streets in urban areas due to the frequency of heavy vehicle traffic. In addition, rural area cross sections include a shoulder ranging in width from 1.0 m to 2.0 m.

Table 5.11: Target Lane Widths

Target (Paved) Lane Width by Street Type (in m)	Target Value
Laneways	5.80 (in a 6.0m right of way)
Reverse Housing Laneways	7.30 (in a 7.5m right of way)
Local Streets (shared travel lane for both directions of travel)	4.50
Shared Streets	VARIES
Collector, Main Street Collector, Primary Collector	3.30
Turn Lanes on Collector, Main Street Collector, Primary Collector	3.00 to 3.30
Arterial Streets, Arterial Street Turn Lanes	3.50
Industrial Local Streets	3.50
Industrial Collector Streets	3.75
Industrial Arterial Streets	3.70
Industrial Area Two-Way Left Turn Lane	5.00
Industrial Arterial Street Turn Lanes	3.50
NOTES: 1. Lane Width is measured to Lip of Gutter and excludes any gutter pan width.	

5.2.6.2 Bicycle Facility Types, Suitability & Widths

Bicycle facilities range in types based on the degree to which people riding bicycles are separated from motor vehicle traffic and people walking. Motor vehicle traffic volumes and speeds are a major deterrent for the cycling Design User[8] (see Section 4.1.2). Creating an environment that is safe and comfortable for all ages and abilities requires increased separation when there are higher motor vehicle volumes or speeds and in locations with higher volumes of heavy vehicles. The following figure illustrates the impact motor vehicle speed and volume has on conflicts with people cycling.

[8] Winters, M., Davidson, G., Kao, D., & Teschke, K. 2011. "Motivators and Deterrents of Bicycling: Comparing influences on Decisions to Ride". *Transportation*, 38, pp. 153-168.

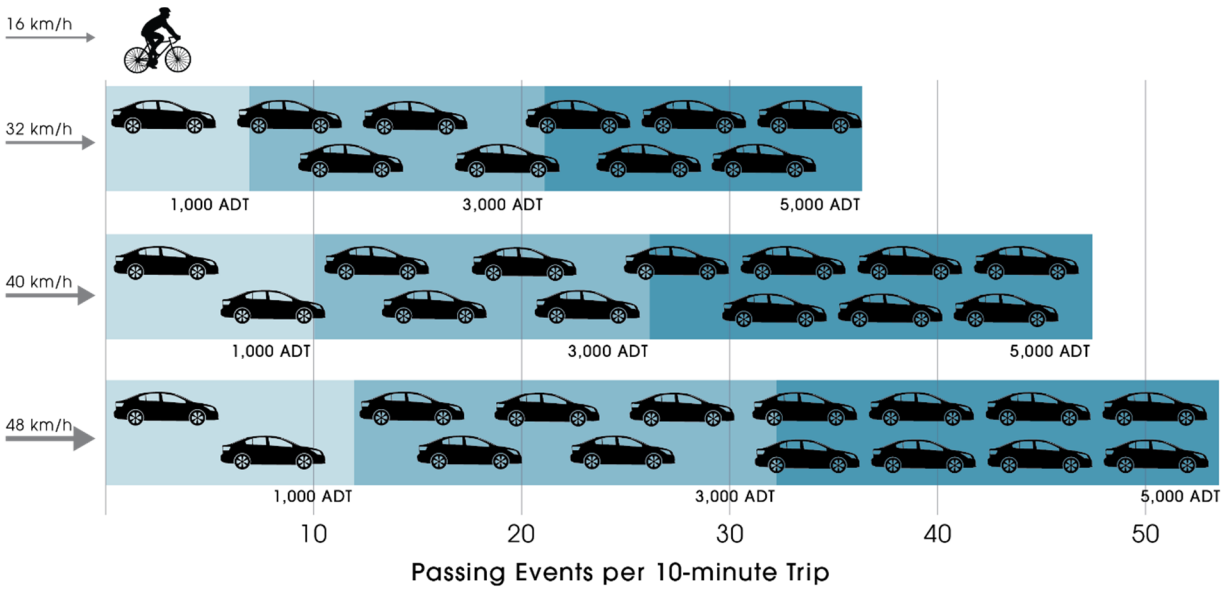


Figure 5.11: Conflicts between Motor Vehicle Traffic and People Cycling[9]

Bicycle facilities types to be used in Bremner are as follows and is based on Design User needs and all-seasons operation and maintenance:

- Multi-Use Trails
- Cycle Tracks[10]
- Bicycle Boulevards[11] and Shared Streets

The following table outlines the Design Domain for bicycle facilities in Bremner (see TAC GDG for additional context) and summarizes the street types where each facility is suitable.

[9] National Association of City Transportation Officials (NACTO). 2017. *Designing for All Ages & Abilities: Contextual Guidance for High-Comfort Bicycle Facilities*. NACTO.
[10] Cycle tracks are bike lanes that are physically separated from motor vehicle travel lanes and parking lanes by a buffer, typically a concrete median, and from people walking, typically by the Furnishing Zone.
[11] As defined in the TAC GDG, Bicycle Boulevards are "a shared roadway that provides a continuous corridor of suitable operating conditions for cyclists, including limiting exposure to motor vehicle traffic and designing for low motor vehicle speeds. Often located on local roads, bicycle boulevards incorporate traffic calming measures to facilitate through-access by bicycles while inhibiting through access by motor vehicles." Traffic calming can include diagonal diverters, bicycle-crossable medians, neighbourhood traffic circles, speed humps, chicanes, and raised intersections or crosswalks.

Table 5.12: Design Domain for Design Speed

Design Domain: Width by Bicycle Facility Type (in m)	Design Domain Recommended Range		Suitable Street Type(s)
	Recommended Lower Limit	Recommended Upper Limit	
Multi-Use Trail	3.0	6.0	Arterial Streets, Industrial Local Streets, Industrial Collector Streets, Industrial Arterial Streets, Collector Streets, Off-street locations (e.g., parks)
Cycle Track	2.1	3.5	Main Street Collectors, Primary Collectors
Bike Path Width (one-direction)	1.8	2.5	
Buffer Width	0.3	1.0	
Bicycle Boulevard, Shared Streets	See Design Domain for Lane Widths for Suitable Street Types		Local Streets, Shared Streets

5.2.6.3 Medians Widths

A median is the portion of the Travelled Way which physically separates the travel lanes of traffic operating in opposing directions and can also separate travel lanes operating in the same direction. Median width is the lateral dimension measured between the face of curbs on either side of the median. Medians are used along Arterials, Primary Collectors, and Industrial Arterial Streets in Bremner. The following table presents the Design Domain for medians in Bremner.

Table 5.13: Design Domain for Median Widths

Design Domain: Median Width (in m)	Design Domain Recommended Range	
	Recommended Lower Limit	Recommended Upper Limit
Centre Medians	4.5	N/A

Left Turn Lane Medians	1.5	N/A

NOTES:

1. Median width is measured from face of curb to face of curb.
2. Medians along multi-lane arterials shall be designed to accommodate refuge for people walking and cycling. A minimum refuge area of 10 m^2 is required for this purpose. A minimum width of 3.0 m is required to accommodate a range of users including people using mobility aids, pushing strollers, and riding bicycles with child trailers.

5.2.6.4 Curb & Gutter Widths and Types

Curbs are raised or vertical elements, located adjacent to a travel lane, parking lane, or cycle track. Concrete gutters are typically used to facilitate longitudinal drainage along urban streets and are often cast integrally with curbs.

There are three types of curb: straight face, mountable, and roll face. Curbs in Bremner will mainly be 150 mm straight face curbs with 250 mm gutters.

Refer to the Strathcona County Design and Construction Standards for Standard Drawings of curb and gutter.

5.2.6.5 Catch Basin Locations

Drainage grates, catch basins, and utility covers are potential hazards for people cycling and walking because they tend to be slippery when wet, may not be flush with the Travelled Way surface, are prime locations for the formation of potholes, a potential trap for bicycle or mobility aid wheels, and a tripping hazard. While this can be mitigated to some extent through the use of appropriate frames and covers, wherever possible, catch basins, manholes, and utility covers shall not be located along a cycle track, multi-use trail, or sidewalk.

Catch basins shall not be located within a curb ramp or curb ramp flare or other locations that are crossing locations for people walking. Catch basins shall be installed to intercept runoff on the uphill side of crosswalks. This supports Universal Design principles for walking and limits pooling of rain or snowmelt in the crosswalk, thereby improving safety and accessibility. Wildlife friendly catch basins are required.

Refer to the Strathcona County Design and Construction Standards for Standard Drawings of catch basins.

5.2.6.6 Intersection Spacing & Access Management

Intersections and driveways are important to provide access to destinations and impact the walkability and accessibility of communities. Intersection spacing, and the management of property accesses/driveways are also important for safety, managing conflicts, and intersection operations. The following table defines the minimum and maximum spacing for intersections and spacing of driveways for Bremner for each street type.

Table 5.14: Minimum Intersection & Driveway Spacing

Intersection & Driveway Spacing (in m)	Design Dimensions		
	Minimum Intersection Spacing (meters)	Maximum Intersection Spacing (meters)	Driveway Spacing (meters)
Off-Street Multi-Use Trails (not adjacent to streets)	N/A	400 (200 preferred for CPTED)	N/A
Laneways	N/A	180	N/A
Local Streets	60	180 (120 for cul de sacs)	N/A
Shared Streets	60	120	Driveways Prohibited
Collector Streets	60	180	No restriction except residential driveways should be a minimum 30m from a major intersection.
Main Streets	60	120	Driveways Prohibited
Primary Collector Streets	120	300	No Residential Driveways, Commercial Accesses designed as intersections and minimum spacing of 60
Arterial Streets, Industrial Arterial Streets	400	800	No Residential Driveways, Commercial Accesses Design as intersections and minimum spacing of 200
Industrial Local & Industrial Collector Streets	200	400	Accesses Design as intersections and minimum spacing of 60

5.2.7 Laneways

Laneways provide a through zone for rear access to the Adjacent Lands for deliveries and parking and can also be a location for utilities. They can also provide opportunities for public art, walking and cycling connections, and placemaking.

Design Domain widths for laneways are provided in Section 5.2.6.1.

5.2.7.1 Other Laneway Requirements

Refer to the Strathcona County Design & Construction Standards for the following requirements:

- Vertical Alignment
- Pavement Structure

5.2.8 Shared Streets

Shared streets are streets designed to limit motor vehicle traffic and limit speeds to those of people walking. By removing the physical distinctions between pedestrian, cycle, and vehicular spaces, shared street treatments force all users to share the street. Treatments can include: flush street surface (no raised curbing), textured pavement material, planters with trees or vegetation, or street furniture. Shared streets are designed primarily for people walking and cycling. Figure 5.12 illustrates a commercial and residential context shared street. Due to the unique characteristics of this street and the multiple options on how to use the street space, there it is challenging to develop a single standard detail for this street type.

Figure 5.12: Commercial and Residential Shared Street (source: nacto.org Urban Street Design Guide)

5.3 Intersections & Driveways

An intersection is defined as the location where two or more public streets or active transportation facilities join or cross at-grade. An entrance or exit from an adjacent property (i.e., driveway) is considered an access and not an intersection.

Intersection design is based on geometric elements including horizontal alignment, vertical alignment, and cross section components. The design of an intersection requires integration of these elements with the physical constraints, multimodal traffic characteristics, and environmental requirements of the intersection, as well as the functional classification of the intersecting streets. Intersection design must balance competing demands to produce a design that provides acceptable levels of service for people walking (including Universal Design), cycling, driving, operating transit, and delivering goods, while prioritizing safety through a Safe Systems approach.

Intersection and driveway design are based on the Design Principles defined in Section 3.1.

For intersection and driveway/access spacing requirements, see Section 5.2.6.6.

5.3.1.1 Horizontal Alignment

The location of intersections on curves is not desirable due to decreased visibility, increased conflict potential for people crossing the major street, and complications with street super-elevation on higher speed streets. Intersecting streets shall meet at or within 10° of a right angle (i.e., between 80° and 100°).

5.3.1.2 Sight Distances & Sightlines

The avoidance of collisions and the efficiency of operation depends on the judgement, capabilities, and responses of each user. Thus, it is important to provide the appropriate reaction and decision time for street users to clearly see the intersection, identify any potential conflict approaching and passing through the intersection, and make the appropriate decision to stop or otherwise avoid the conflict. Intersection design shall provide adequate sight distance for all users of the intersection. Restricting obstructions in areas along the intersection approaches and across corners gives users more time to complete their visual search and ensure that they have sufficient time to react.

The minimum sight distance requirement for people driving vehicles approaching an intersection is the Stopping Sight Distance (SSD), which is based on Design Speed and the stopping distance of the Design Vehicle/User. Minimum SSD requirements and sightline distances are summarized in the following table. Refer to TAC GDG Section 2.5.3 for further information and guidance. See TAC GDG Section 9.9.2 for guidance on the application of clear sight triangles.

Restrictions for parking, loading, and delivery zones to provide adequate sightline distances prior to intersections and driveways/access are included in Section 5.2.5.2.

Table 5.15: Sight Distance Requirements

Sight Distance Requirements by Design Speed (in m)	Minimum Stopping Sight Distance	Minimum Sightline Distance
15 km/h	15	35
20 km/h	20	45
30 km/h	35	65
40 km/h	50	85
50 km/h	65	105
60 km/h	85	130

NOTES:

1. Stopping sight distance for passenger cars based on brake reaction time of 2.5 s, deceleration rate of 3.4 m/s^2, and level grade. Adapted from TAC GDG Tables 2.5.2 and 2.5.3.
2. Sightline distance for passenger car, approach grades ≤ 3%, and for a driver stopped in a vehicle on a minor street approach, such that the person stopped is safely able to depart from the intersection and enter or cross the major street. Design Speed is for the major street. Measurement is taken from 5 m back of the curb line of intersecting street or the location of the stop bar, whichever is further from the motor vehicle travel lane of the intersecting street. See below figure. Adapted from TAC GDG Table 9.9.4.
3. Minimum sightline distance for multi-use trails and cycle tracks is 5 m prior to all intersections, driveways, and accesses.

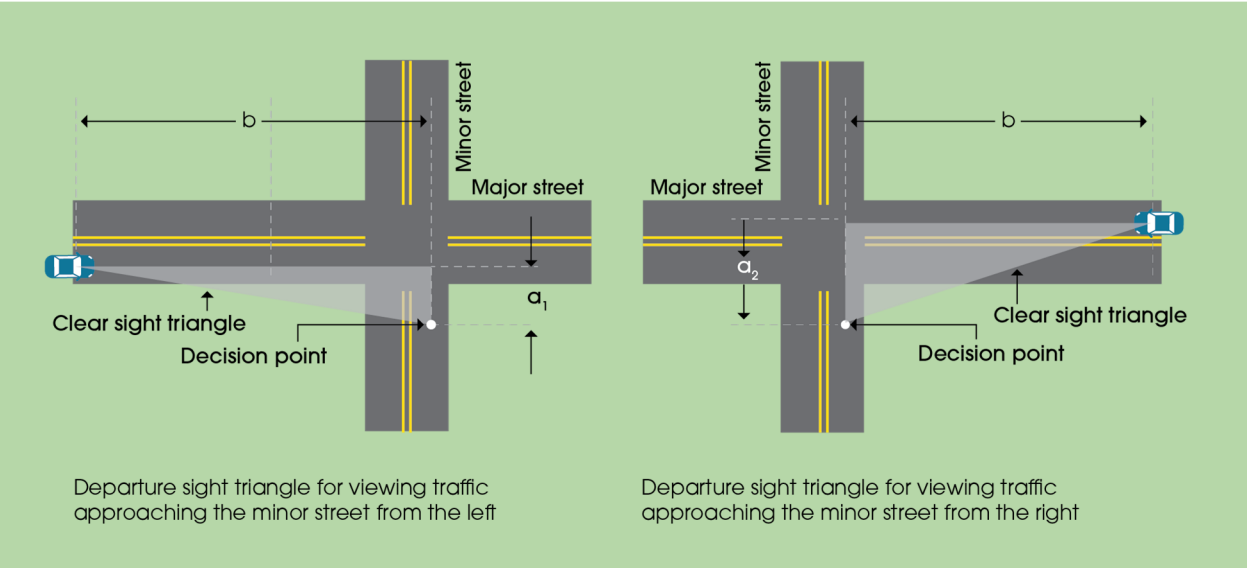


Figure 5.12: Departure Sight Triangle (Adapted from TAC GDG Figure 9.9.2)

5.3.1.3 Right of Way Corner Cuts

Right of way corner cutoff requirements at intersections and right of way tapers for the Adjacent Lands are required to ensure adequate sightlines are provided. Refer to the Strathcona County Design and Construction Standards for cutoff requirements based on intersecting streets.

5.3.1.4 Surface Utility, Street Furniture & Landscaping Offsets

To ensure adequate sightlines and required sight distances, the following requirements for location of utilities, street furniture, and landscaping from intersections and driveways are required:

- Traffic Controller and Signal Cabinets to Intersection: Outside Clear Sight Triangle;
- Transformer/Cubicle Cabinet to Intersection & Driveways/Accesses: 15 m;
- Trees to Intersections & Driveways/Accesses: see Section 5.2.4.2; and
- Street Light & Signal Poles to Intersections & Driveways/Accesses: see Section 5.2.4.3.

5.3.1.5 Corner Radius

The corner radius connects the curb lines of two intersection streets (or shoulder edges for rural cross sections). The design of corner radii is influenced by Design Vehicle(s), street types, lane widths, Travelled Way width, parking lane widths, turning traffic volumes, turning motor vehicle speed, and other considerations.

Corner radii shall be designed using the minimum motor vehicle turning path of the Design Vehicles to promote reduced motor vehicle turn speeds. Smaller corner radii also provide more queuing space for people walking, facilitate a shorter crossing distance, enable straight and direct connections, and increase visibility. To determine appropriate corner radii, the following inputs are to be used:

- Motor vehicle turning speeds of 5 km/h;
- Motor vehicle starting position of a minimum of 0.3 m offset from face of curb/edge of pavement and centre of lane marking;
- Motor vehicle turning movements shall maintain a minimum 0.3 m offset from face of curb/edge of pavement during the turning maneuver;
- Design Vehicles should not cross the centre line of the intersection approach on Arterial Streets but may use multiple receiving lanes with the same travel direction;
- Design Vehicles may encroach partway into opposing traffic lanes on low volume Local and Collector Streets where daily motor vehicle traffic volumes are less than 2,000 vehicles per day. If no painted centre line exists, Design Vehicles may use the entire Travelled Way outside of designated parking zones;

- Emergency vehicles shall be able to physically maneuver between fixed objects and parked vehicles on all corners, but are allowed to use the entire pavement width; and
- When a right turning lane is not adjacent to the curb, the effective turning radius can be greater than the physical corner radius. This can occur along streets with on-street parking and no curb extensions.

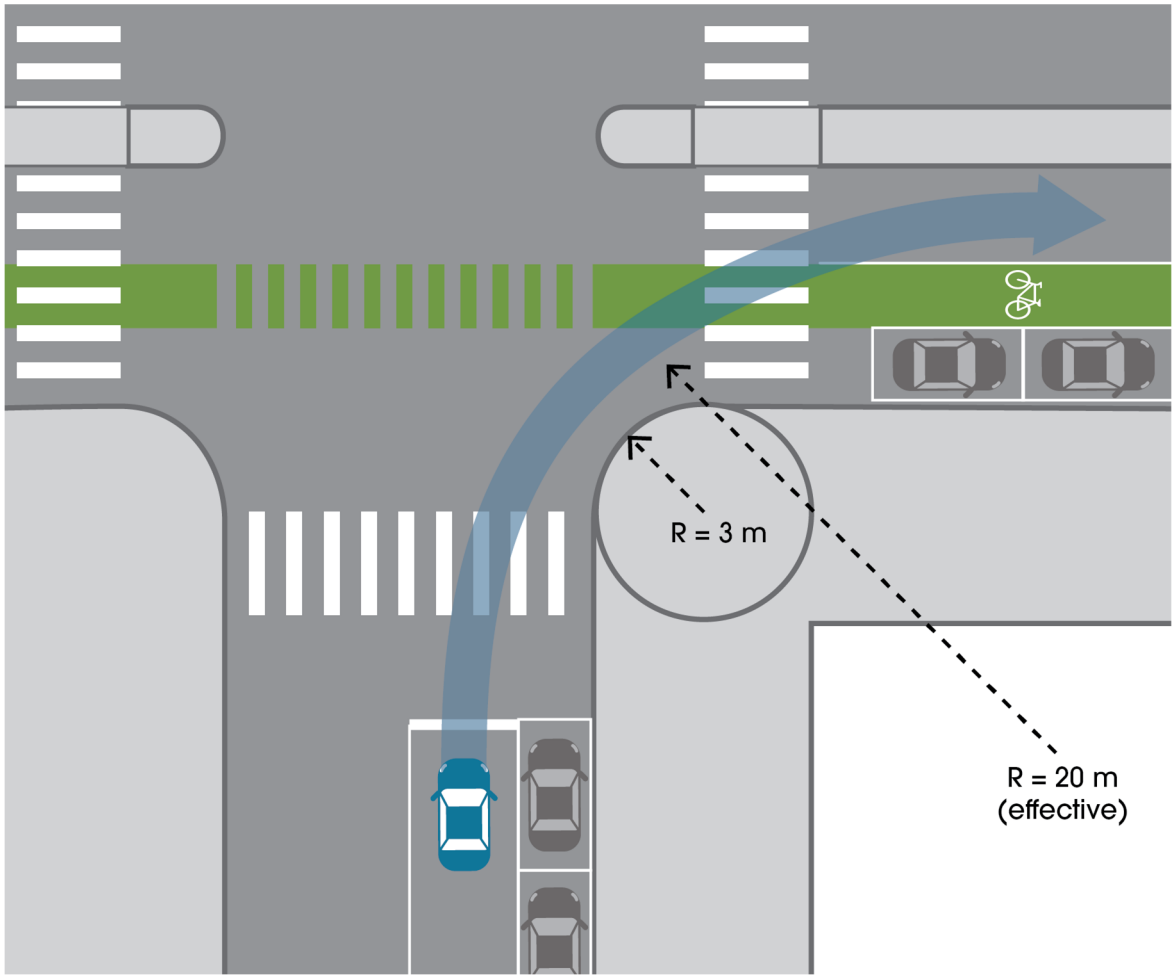


Figure 5.13: Corner Radius (Source: Based on NACTO Global Street Design Guide)

Design Domain requirements for Corner Radii are summarized below for simple radius curves.

Table 5.16: Design Domain for Corner Radius

Design Domain: Corner Radius – Departing Street/Receiving Street (in m)	**Design Vehicle**	**Design Domain Recommended Range**	
		Recommended Lower Limit	Recommended Upper Limit
Arterial Street/Arterial Street	WB-21	Use High Entry Angle channelized right turn design (13.5 m to 15.0 m for simple radius)	
Major Arterial Street/Minor Arterial Street (4 lanes)	B-12	7.5	13.5
Major Arterial Street/Minor ArterialPrimary Collector Street (2 lanes) OR Major Arterial Street/Collector	B-12	10.0	13.5
Primary Collector Street (any lanes)/ Arterial Street OR Primary Collector Street (any lanes)/Primary Collector Street (4 lanes)	B-12	7.5	10.0
Primary Collector Street (any lanes)/Collector Street OR Primary Collector Street (any lanes)/Primary Collector Street (2 lanes)	B-12	10.0	15.0
Collector Street/Primary Collector Street OR Collector Street/Collector Street	B-12	7.5	10.0
Main Street Collector/Any Street OR Any Street/Main Street Collector	MSU	4.5	10.0
Local Street/Any Street OR Any Street/Local Street OR Shared Street/Any Street OR Any Street/Shared Street	PC	4.0	6.0
Any Industrial Street/Any Industrial Street	WB-21	Use mutli-centred curve while minimizing crossing distances for people walking	
NOTES: 1. Designers should use corner radii toward the lower end of the Design Domain. 2. Turning maneuvers shall be confirmed using swept path analysis for the Design and Control Vehicles. 3. The use of two-or three-centred curves may be required based on swept path analysis.			

5.3.1.6 Curb Ramps

A curb ramp is a graded transition between the Pedestrian Through Zone (e.g., sidewalk) and the Travelled Way, linking the Pedestrian Through Zone with the crosswalk and ensuring a smooth transition for all users. A curb ramp consists of several parts that provide smooth transitions,

places of refuge, and tactile guidance for people walking and wheeling. Tactile guidance is a best practice design element that creates a street environment that can be used by everyone regardless of age, ability (physical or mental), or situation. This practice is a Universal Design approach to street design.

Curb ramps shall be provided at all corners except where raised crossings are provided:

- Grade of ≤ 6% (maximum of 6.0%);
- Curb ramp flare of 400 mm for boulevard walk and 1750 mm for monowalk;
- Width of 1.8 m minimum (to match width of sidewalk or multi-use trail);
- Tactile walking surface indicators (TWSIs) are provided;
- A landing of 1.8 m is provided at the top of the ramp (can be accommodated by the sidewalk); and
- Centred in the crosswalk.

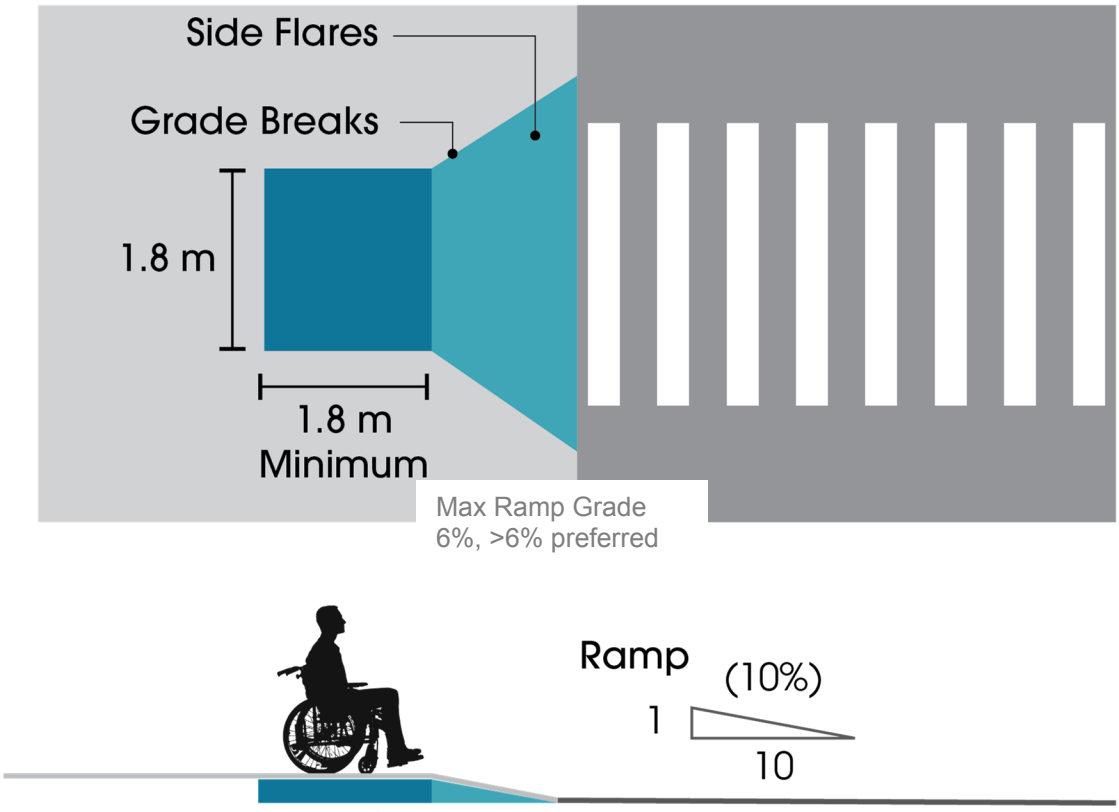


*Figure 5.14: Curb Ramp (**Adapted from** NACTO Global Street Design Guide)*

5.3.1.7 Traffic Calming Features

Traffic calming is the application of mainly physical measures to reduce the negative effects of motor vehicle use, alter driver behaviour, and improve conditions for non-motorized users. Traffic calming has been shown to reduce motor vehicle speeds, discourage through traffic (i.e., shortcutting), minimize conflicts between street users, and improve the neighbourhood environment. Through the use of volume and speed management approaches, motor vehicle traffic volumes and speeds can be achieved that are consistent with the Design Principles for

Bremner. Street designs in Bremner are intended to encourage lower travel speeds, but some locations where high pedestrian and cyclist volumes are present alongside higher traffic volumes, traffic calming may be required.

The TAC Canadian Guide to Neighbourhood Traffic Calming is the primary resource in Canada for application of traffic calming. Traffic calming features that shall be applied in Bremner along Shared Streets, Local Streets Collector Streets, Main Street Collectors, and Primary Collectors Streets include the following:

- Vertical deflection in the form of raised crosswalks, raised intersections, and speed cushions.
- Horizontal deflection in the form of curb extensions, minimized corner radius, chicanes, on-street parking, raised medians, mini roundabouts / neighbourhood traffic circles, and raised medians; and
- Obstructions in the form of directional closures, diverters, and right-in/right-out islands.

Figure 5.15: Diverter (Source: NACTO Global Street Design Guide)

5.3.1.8 Raised Intersections & Crossings

Raised intersections and crossings (including mid-block) are crossings for people walking and/or cycling that are raised to the elevation of the sidewalk, multi-use trail, and/or cycle track. They calm traffic, improve accessibility, and increase visibility for active transportation users.

Raised crossings shall be used across Local Streets that intersect with Collector Streets and at crossings along Main Street Collectors and Primary Collectors. Raised crossings shall also be considered across Collector Streets that intersect Main Street Collectors and Primary Collectors.

Intersections along Main Street Collectors and Primary Collectors may include completely raised intersections and raised crossings may be applied at mid-block crossings of Collector Streets, Main Street Collectors, and Primary Collectors at the discretion of the County.

Figure 5.16: Raised Crossing (Source: NACTO Global Street Design Guide)

5.3.1.9 Cycle Tracks at Intersections & Driveways

Intersections and driveway crossings with cycle tracks shall be carefully designed to promote safety and facilitate turns from and across the cycle track. In addition to TAC GDG, FHWA also provides useful information specifically on cycle tracks at intersections.[12]

Protected intersections shall be used at large intersections with multiple lanes. A protected intersection accommodates bicycle left turn movements in two stages. A protected intersection functions intuitively because it replicates walking movements around the perimeter of the intersection. It is particularly beneficial where two streets with cycle tracks intersect or where a wide buffer or parking lane separate a cycle track.

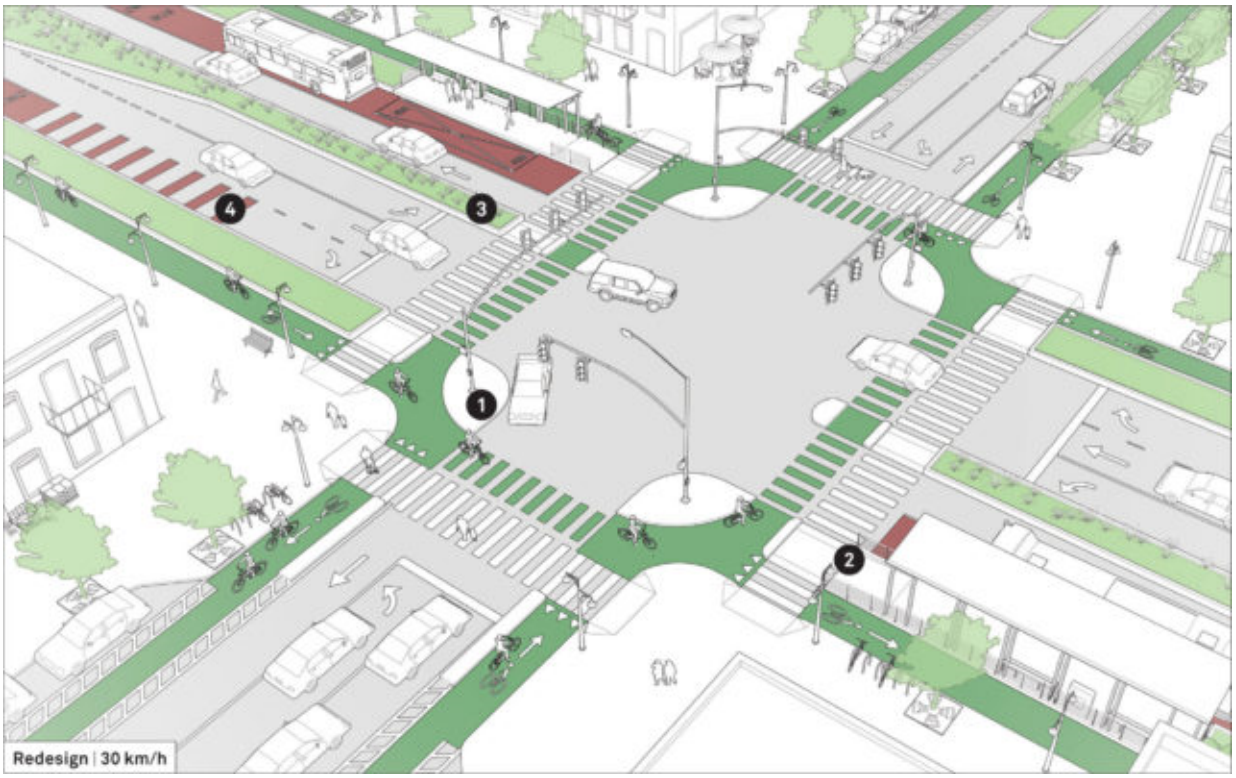


Figure 5.17: Protected Intersection (Source: NACTO Global Street Design Guide)

Within the protected intersection, the setback for the cycle track crossing from the parallel travel lanes shall be 6.0 m. This provides adequate space for a single motor vehicle to queue outside the path of both through vehicle traffic and bicycle traffic. The presence of corner safety islands and crossrides (designated bicycle crossings, see Section 5.6) means that the person cycling is visible to the person driving.

The corner safety island at the far side of the intersection functions as a two-stage turn queue box. The corner radius of the safety island should be as small as feasible to accommodate the Design Vehicle while encouraging slow motor vehicle traffic turning speeds and appropriate

[12] Federal Highway Administration (FHWA). 2015. Separated Bike Lane Planning and Design Guide. Report FHWA-HEP-15-025. McLean, Virginia: Federal Highway Administration.

yielding behaviour. To accommodate Control Vehicles, the corner safety island can include a mountable apron to allow access and provide smaller corner radii.

Protected intersections can also be paired with separate bicycle signal phases and bicycle actuation. The bicycle crossings can also be raised, in conjunction with raised crosswalks, to further alert drivers to the crossing, increase yielding compliance, and manage traffic speeds across the crossride/crosswalk.

The cycle track delineator buffers for a protected intersection shall be designed based on Universal Design. Curb cuts shall be provided through islands where possible to minimize the impact on people crossing. Curb cut treatments through the median shall include provisions of TWSI. Multiple TWSIs shall be used through the medians to identify to people that they have not fully crossed the street.

5.3.1.10 Multi-Use Trails at Intersections & Driveways

At street intersections and driveways, additional design treatments are required to inform people driving that the crossing is not only for people walking, but for multiple types of off-street multi-use trail users. These treatments may include, but are not limited to:

- Including a crossride along with the crosswalk at the multi-use trail crossing to accommodate a larger variety of users;
- Installing regulatory signage for right of way clarity and warning of the crossing (see Section 5.6);
- Incorporating design treatments such as a material change to the street surface;
- Using vertical deflection, such as a raised crossing to increase awareness of the crossing for people driving; and
- Adding a protected signal phase to the intersection crossing, either an advance bike/walk phase or a restricted right/left turn phase, that would eliminate many potential conflicts.

Similar to cycle tracks at intersections, multi-use trail crossings at intersections shall be located such that there is space for one turning motor vehicle to queue between the crossing and the parallel travel lane. This may require a "bend-out" of the multi-use trail prior to the intersection to increase the offset. In some cases, particularly in Industrial areas, the multi-use trail will require a "bend-in" toward the Travelled Way due to the offset of the multi-use trail within the cross section. Research indicates a bending out of the cycle track between 2 m and 5 m can have safety performance benefits[13] while many North American practitioners are using an offset distance of 6 m. An offset distance of 6 m shall be used for multi-use trail crossings in Bremner. The bicycle crossings can also be supplemented by being raised, similar to a raised crosswalk, to provide further safety benefits.[14]

[13] de Groot, R. editor (CROW). 2016. *Design Manual for Bicycle Traffic*. The Netherlands: CROW.
[14] Martinson, R & Golly, T. 2017. *Protected Bikeways Practitioners Guide*. Washington, DC: Institute of Transportation Engineers

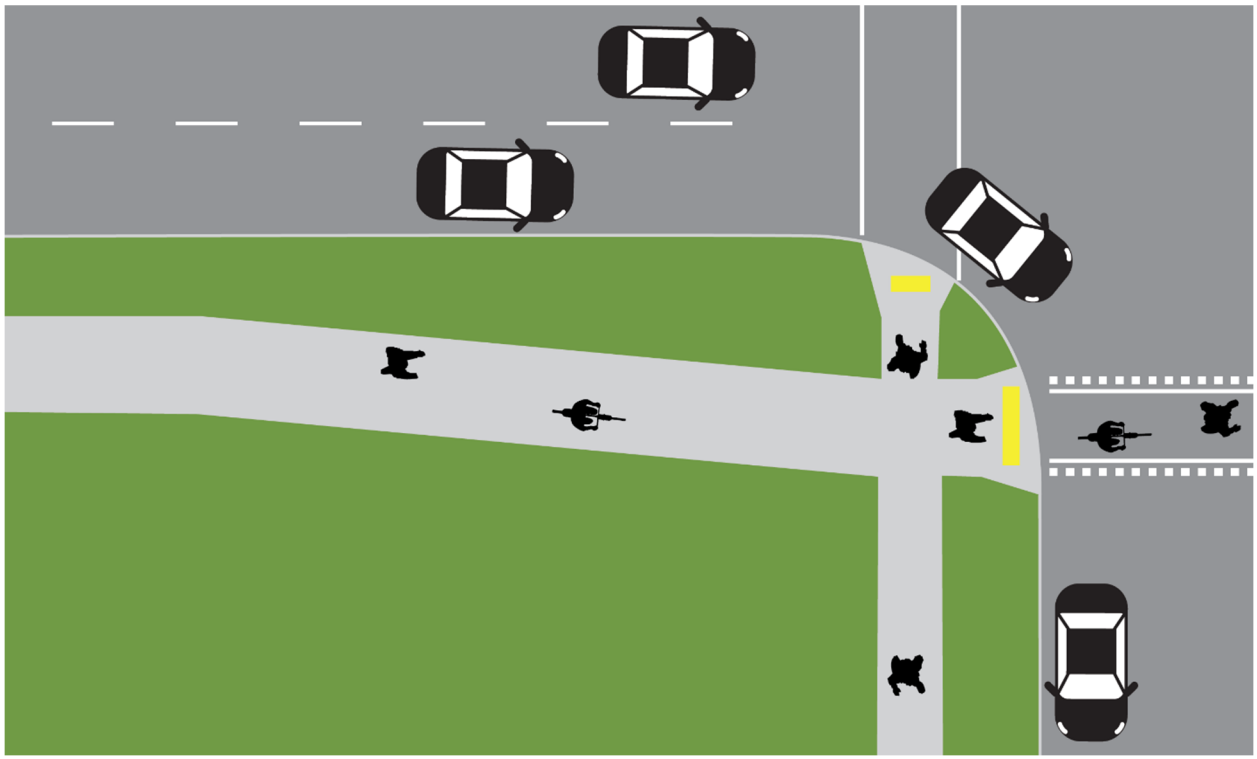


Figure 5.18: Multi-Use Trail at Intersection (Source: Adapted from City of Edmonton)

5.3.1.11 Roundabouts

A roundabout is a type of circular intersection in which vehicles travel counter-clockwise and vehicles entering the roundabout yield to circulating traffic. Roundabouts have specific geometric design and traffic control features as illustrated in the following figure.

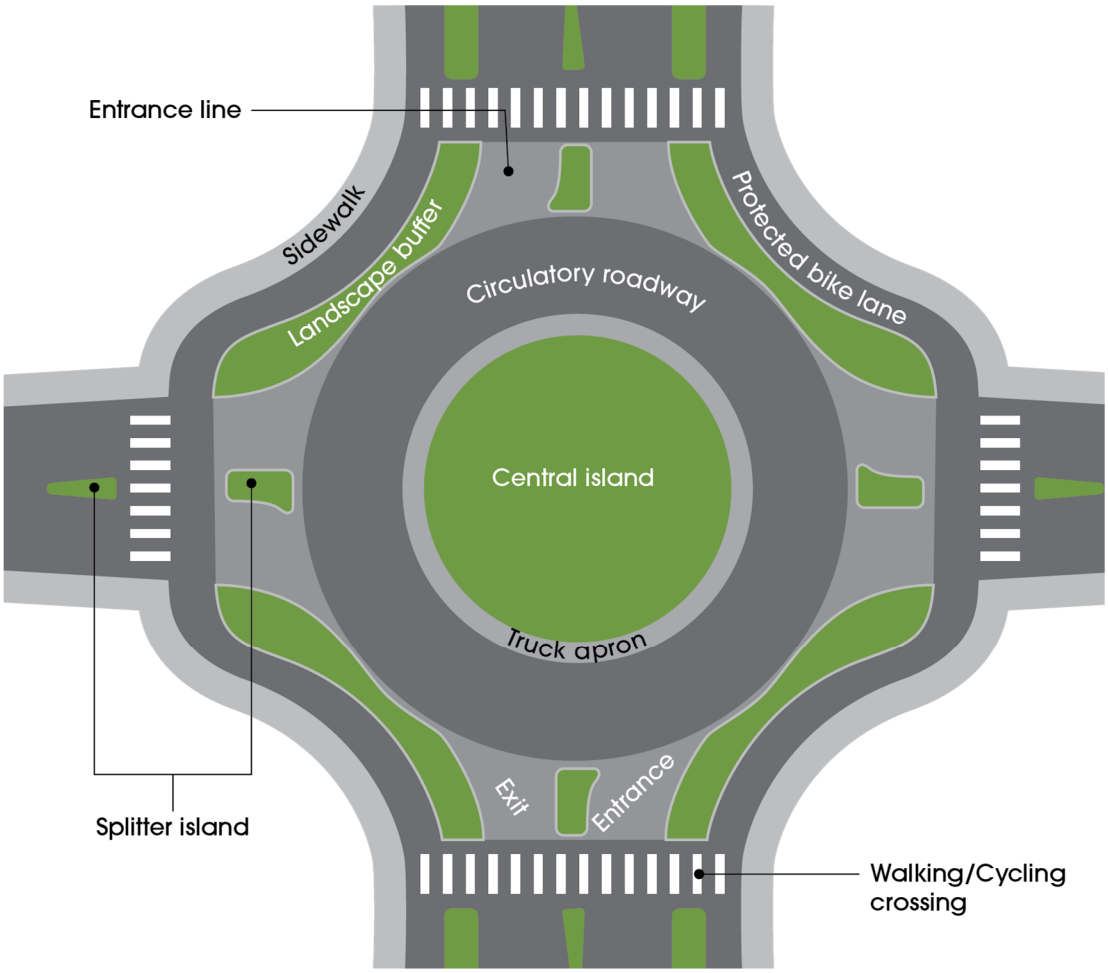


Figure 5.19: Roundabout Components (Source: Adapted from City of Edmonton)

In general, roundabout design shall strive to achieve the same principles as other types of intersections. Specifically, for roundabouts, these principles include:

- For motor vehicle traffic, provide low entry speeds and consistent speeds through the roundabout. This is achieved through the use of low entry and exit deflection angles;
- Provide adequate entry width and circulating width with an appropriate number and assignment of lanes for the roundabout to provide the required traffic capacity;
- Include proper intersection channelization, providing people driving with adequate guidance as to appropriate speed and path, and smooth transitions for entry and exit movements;
- Include facilities and provisions adequate for all intended intersection users including people walking, cycling, driving and delivering goods. Other than neighbourhood traffic circles, roundabouts are not suitable for the Design User for people cycling on the street. A separated, off-street circulating path for people cycling shall be provided;
- Ensure roundabouts can accommodate movements for the appropriate Design Vehicle (swept path analysis may be required to confirm maneuvers during design);
- Ensure that adequate stopping and intersection sight distance and visibility between users is provided for all intended users;

- Include landscaping where possible and where sight distance is maintained. See Chapter 9 of the TAC Canadian Roundabout Design Guide for more direction on landscaping;
- Include adequate lighting of the roundabout, crossings, and public realm. See Chapter 8 of the TAC Canadian Roundabout Design Guide for more direction on illumination; and
- Design the landscape and roundabout elements to support winter operations. See Chapter 10 of the TAC Canadian Roundabout Design Guide for direction on winter control maintenance.

For Bremner, roundabouts can be used as an alternative for the following intersections:

- Neighbourhood Traffic Circles: at Local Street/Local Street intersections for traffic calming; and
- Roundabouts: at Collector Street/Collector Street intersections or Collector Street/Primary Collector Street(2 Lane) intersections where motor vehicle traffic flows on each leg of the intersection are approximately balanced.

More information on roundabouts can be found in the TAC Canadian Roundabout Design Guide.

5.4 Off-Street Paths

Facilities for people walking and cycling include multi-use trails that are off-street located through parks, utility corridors/rights of way, and storm water facilities. The environments in these public places shall be designed to allow safe and convenient access by all active transportation traffic and shall accommodate appropriate maintenance vehicles as necessary. Where off-street paths are located in naturalized areas, lighting will not be considered, with the exception of intersections and other critical access locations. Walkways are also provided through Public Utility Lots (PULs). The Design Domain for multi-use trails is provided in Section 5.2.6.2. The Design Domain for walkways is provided in Section 5.2.3.1.

Figure 5.20: Multi-Use Trail Located Off-Street

Refer to Strathcona County Design and Construction Standards for design and construction details.

5.5 Utilities

This section provides design and construction guideline for utilities that vary for the Bremner ACP from the Strathcona Design and Construction Standards. The conceptual designs of water, wastewater and stormwater drainage systems are presented in the Bremner ACP Utilities Master Plan report. For system design parameters, please refer to the utilities master plan. In order to mitigate impact of development on natural water courses and to meet sustainable design objectives, low impact development/drainage (LID) features have been encouraged for Bremner ACP and a list features have been included in this section for subsequent future design considerations.

5.5.1 Utility Locations

The Bremner ACP is planned to accommodate higher density residential developments with differing forms of dwellings along with multi-model transportation and accessibility to create more vibrant and sustainable design. To accommodate these objectives, the standard roadway cross sections have been modified resulting in slightly narrower width of road right-of-way. In addition, with zero lot line dwellings, installation of utilities has to be completed without encroaching on the property line. As a result of these changes, the locations of the deep and shallow utilities have been placed at the best locations for each cross section. This varies on some cross sections due to available right of width, although attempts have been made to provide more consistent offsets with the intent to keep the manholes and water structures out of the wheel paths.

Some general guidelines for utility locations in the Bremner ACP:

- Location of all surface appurtenances associated with underground utilities (including, but not limited to, transformers, cubicles, catch basins, manholes and utility covers, water valves, power/telecom vaults) are to be located outside of any sidewalks, multi-use trails, walkways, crosswalks, and curb ramps.
- Locate watermain along the edge of the outside curb line (1.5m minimum offset) Underground pipe offsets have been taken into consideration to where the manhole cover would fall outside of the wheel paths.
- Because of the reduced Right of Way and Boulevard within the Typical Sections, the deep utilities have been placed within the roadway keeping best practices in mind for maintenance, installation of shallow utilities in the boulevards and future consideration for mature trees. For example, mature trees won't need removal, only one lane of roadway needs to be closed while sanitary and storm maintenance could be planned at the same time. This installation is also more cost effective at time of construction.

See Standard Drawings (Section 6) for location of shallow and deep utilities within rights of way.

5.5.2 Low Impact Development

Low impact development (LID) is encouraged within Bremner ACP. Application of LID features varies depending on land use and site configuration. The following table lists selected LID

features based on the Strathcona County climate considerations to reduce runoff volume and enhance quality of water discharged to the downstream watercourses.

Table 5.17: Reference Table for Symbols in LID Appropriateness Table

Symbol	Application and Suitability	Cold Climate Suitability	Maintenance
+	Most Appropriate	Well suited for cold climates	Low
o	May be used if opportunities exist	Average suitability for cold climate	Medium

The suitability ratings have adapted from the City of Edmonton, City of Calgary, and Metro Vancouver LID Manuals.

Table 5.18: Appropriate LID Facilities Based on Street Type and Land Use

Street Type	Bioretention / Rain Garden	Bioswales	Structural Cell Tree Boxes	Absorbent Landscaping	Infiltration Chamber /Trench	Harvesting/Reuse	
						Cistern	Rain Barrel
Laneway					+		
Reverse Housing Laneway	+				+		
Local	+		+		+		
Collector	+		+		+		
Primary Collector	+		+	o	+		
Main Street Collector	+		+		+		
Arterials	+		+	o	+		
Industrial Local	+	+					
Industrial Collector	+	+					
Industrial Arterial	+	+					
Land Use Area	Bioretention/ Rain Garden	Enhanced Swales/Biowales	Tree Boxes	Absorbent Landscaping	Infiltration Chamber/Trench	Harvesting/Reuse	
						Cistern	Rain Barrel
Single Family Residential				+			+

Low Density Multi Family				+		+	+
High Density Multi Family	+	+		+	+	+	
Commercial	+	+		+	+	+	
Cold Climate	+	+		+	+	O	O
Maintenance				+	+	+	+

Better site design is also encouraged within Bremner ACP. Better site design involves techniques that consider site-level opportunities and constraints to stormwater management infrastructure from the beginning of the site design process. There are more than a dozen techniques that can be applied early in the design process; however not every technique will apply to every site. Techniques include natural area conservation, site reforestation, soil conservation, buffers, open space design, disconnection of impervious cover or reducing impervious cover via innovative site design. Better site design will assist with the implementation of LID facilities planning, selection, and design.

5.5.2.1 General Guidelines

The City of Edmonton's *Low Impact Development Best Management and Practices Design* Guide, provides comprehensive guidance reflecting local conditions for soils, rainfall, and climate.

The following list provides general guidelines to maximize the effectiveness of the various LID features:

- Roadway LID practices require pre-treatment prior to infiltration to ensure facilities do not clog, which may include structural treatment practices such as CB inserts or hydrodynamic separators. Vegetative practices do not require specific pre-treatment, but a small forebay or filter strip will improve function especially if roads are sanded in winter.
- 1 m separation from seasonally high groundwater table from the bottom of the infiltration facility recommended.
- Consider placing bottom of facilities located under roadways below the frost depth (1.5 m below surface) to ensure constant operation. This will eliminate any potential frost heave, frozen pipes, or performance decrease due to frozen soils.
- Monitor groundwater for chlorides. If groundwater contamination is a concern, do not infiltrate roads that are salted.
- Select salt tolerant species for vegetation-based facilities.
- Vegetation management will be required for vegetation-based facilities (See section 5.5.2.3)
- Consider a salt management strategy to ensure that minimum salt application required for safety is used.
- Infiltration testing by double ring infiltrometer or permeameter testing should be undertaken at the level of the infiltration surface prior to construction.

- If roads are sanded, consider extra pretreatment volume, sized for the typical yearly sand load.
- Roads should be swept (1-2) times annually.
- CB should be part of a regular clean out program.
- Ensure sediment laden water is not directed to the facility during construction.
- Proper construction staging required to protect facilities permeability.
- Rain barrels must be drained and winterized prior to cold season; will not function in sub-zero conditions.
- Cisterns must be placed below the frost line for annual use; toilet flushing offers the biggest benefits in terms of volume reduction (year-round, consistent demand).

5.5.2.2 General Notes on Facilities

Additional general considerations regarding the selection of different types of LID features are summarized below:

- Due to cost considerations, tree pits are usually not recommended for stormwater management unless it is required for tree health.
- Bioretention/rain gardens can be hard edged (urban planters) or have side slopes (rural cross section).
- Soil with less than 15 mm/hr of infiltration should be under drained.
- A target capture rate of 25 mm of rainfall is recommended.
- If on very low rate soils, consider 'capture and release' using filtering facilities. Filter for treatment and release though the underdrain at very low rates.
- Design should consider impervious to pervious ratio (I/P ratio), a measure of how much imperviousness goes to each facility. Depending on the type of road and amount of traffic allowable I/P may be 15:1 to 40:1, each land use and LID have I/P ratio best practices.

5.5.2.3 Maintenance

Maintenance of LID facilities is very important and generally not as onerous as one might think. Many LID facilities simply replace similar landscapes. For example, a bioretention cell or enhanced grass swale often replace similarly vegetated landscapes like planted parking lot medians or grassed ditches and boulevards. The maintenance of the vegetation for these facilities is similar to the existing landscape, although the overall function is very different since an engineered landscape has a much greater capacity to manage stormwater then the natural systems they are replacing. The City of Edmonton's *Low Impact Development Construction, Inspection, and Maintenance* Guide, provides guidance on construction and maintenance of various LID features. The following sections provides the recommended maintenance tasks for the various LID features. Proprietary facilities like tree boxes and CB inserts will have manufacturer recommended maintenance.

Rain Gardens

Rain gardens, also called bioretention, are vegetated facilities that treat, filter, infiltrate, and slow down runoff. These facilities contain a special sandy soil mix called amended soil that works together with the vegetation to filter small events and treat for suspended solids, heavy metals, and nutrients such as phosphorus and nitrogen, while encouraging infiltration and evapotranspiration. These facilities are often used for road and parking runoff, as the rain garden provides treatment and cleaning for the runoff prior to infiltration, all within a single facility. Rain gardens may be vulnerable to silting up if proper construction practices are not used during installation. Care should also be taken to ensure the overflow outlet in the rain garden is not blocked by trash, leaves, or snow.

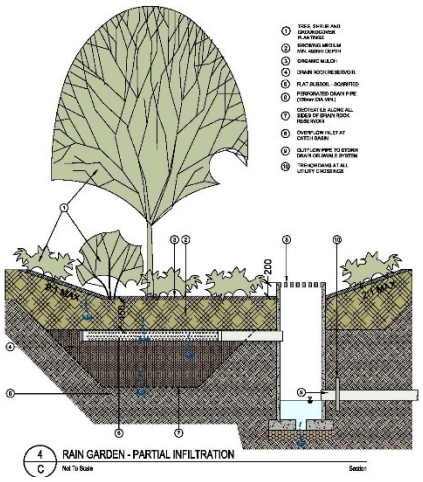


Figure 5.21: Rain Garden Schematic (Source: Metro Vancouver Stormwater Source Control Design Guidelines 2012)

Maintenance during Establishment (1-2 years)

- Water regularly to establish plants or turf;
- Remove weeds as necessary and check the facility monthly for weeds or dead plants;
- Mow turf as needed depending on vegetation selection;
- Remove any debris, garbage, leaves, sticks, or other items from the facility. Pay special attention to the inlet and outlet structures. This should be done monthly with special attention in fall to remove fallen leaves; and
- Correct any observed erosion problems.

Maintenance Long Term

- Water during drought conditions as needed;
- Check biannually for weeds and remove biannually;
- Mow turf monthly depending on vegetation selection;
- Remove sediment from inlet annually;
- Remove accumulated sediment from the bottom of the facility as needed;
- Cut back dead plant material annually, remove and replace plants as needed;
- Maintain mulch if the facility is vegetated every 2 years;
- Remove any debris, garbage, leaves, sticks, or other items from the facility. Pay special attention to the inlet and outlet structures. This should be done biannually with special attention in fall to remove fallen leaves;
- Correct any observed erosion problems as needed;
- Flush underdrain and monitoring well annually; and
- Monitor performance; visit the facility during rain events biannually.

Life Cycle Maintenance

- Life Cycle of at least 50 years
- Rehab soil by removing top 15 mm after 25 years and replace plants and mulch
- Soil properties will be similar to that of stormwater pond sediment and should be disposed or reused according to local regulations

Infiltration Trench/Modified Etobicoke System

Infiltration trenches, or galleries, are underground facilities containing clear stone that store and infiltrate runoff. These facilities are often located under dry ponds, parking lots or other landscape features. Infiltration trenches require runoff from surfaces like parking lots or roads to be treated for suspended solids prior to infiltration to prevent the trench from silting up and failing. Pretreatment for roof surfaces is not required as these surfaces are considered clean runoff. Modified Etobicoke Systems are infiltration trenches under perforated storm sewers, rather than separate systems.

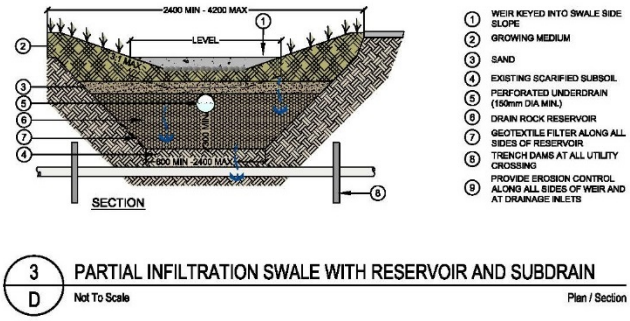


Figure 5.22: Infiltration Swale Schematic (Source: Metro Vancouver Stormwater Source Control Design Guidelines 2012)

- Check Catch basins for blockage, clean out once a year with vacuum truck
- Check trench drain time after large events (> 2-year storm) to ensure trench drain time
- Sweep streets in spring to prevent overloading treatment system with sediment
- Flush infiltration facility as needed

Life Cycle Maintenance

- Life Cycle of at least 50 years
- No additional maintenance required

Swale Maintenance

Figure 5.23: Vegetated Swale

Swales are vegetated conveyance systems similar to ditches. Enhanced grass swales are designed to detain, infiltrate, and convey flows. Check dams may be used to help slow and filter water to enhance sedimentation, infiltration, and evapotranspiration by plants and/or grasses. These swales may incorporate an engineered soil media mix and optional underdrain. The following list represent tasks that should occur to maintain the swales performance. Swale maintenance should not be performed during wet weather to prevent compaction of soils.

Establishment Tasks (2 growing seasons long)

- Water vegetation regularly until plants are well established
- Remove weeds as needed
- Remove any debris or garbage from the facility, especially the inlet and outlet

- Correct any observed erosion areas
- Cut areas above top of bank via spring trimmer during early spring
- Monitor annually to document invasive plants and control if necessary, particularly for phragmites.

Annual Tasks

- ensure that inlet and outlet areas unobstructed and that no scour is present
- clean trash out of forebay and visually inspect check dam heights and for damage
- check sediment depth in forebay and clean out if necessary
- inspect the perimeter of the swale to ensure side slope condition and no erosion or damage is present
- Remove trash from facility

As Needed Tasks

- Check that filter bed drains within 24 hours of major storm events
- remove sediment from filter bed when necessary
- Repair animal burrows, or sunken areas
- Water vegetation in draught conditions
- Regrade and replant eroded areas when greater or equal to 30 cm in length
- Aerate filter bed every 5 years
- Replace dead or diseased plants to maintain vegetative cover
- Cut via string trimmer or similar to a height of no less than 60 cm every other year

Life Cycle Maintenance

- Life Cycle of at least 50 years
- No additional maintenance required

Tree Box

A tree box is a proprietary system for urban tree planting. They typically consist of modular soil cells (which may double as a pavement support system) that allows for tree growth without compromising or damaging paved surfaces. These soil cells can be used for stormwater management by directing flows to the top of the soil cell to be filtered, absorbed, and infiltrated. Each company will have a maintenance guide, the following list represents some of the tasks that should occur to maintain the tree box performance.

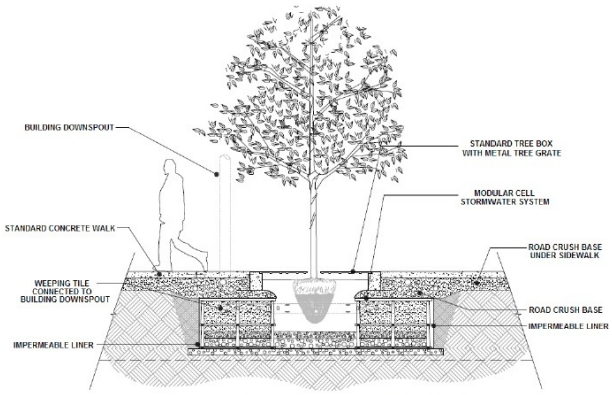


Figure 5.24: Tree Box Schematic (Source: City of Edmonton Low Impact Development Best Management Practices Guide Edition 1.1 2014)

Establishment Tasks (2 growing seasons long)

- Water regularly until trees are well established
- Remove weeds as needed
- Remove any debris or garbage from the facility, especially the inlet and outlet

Annual Tasks

- Ensure that inlet and outlet areas unobstructed and operating correctly
- Remove trash from facility
- Check any distribution pipes and underdrain
- Check trees for:
    - Need for pruning
    - Safety
    - Health

As Needed Tasks

- Check that filter bed drains within 24 hours of major storm events
- Water vegetation in draught conditions

Life Cycle Maintenance

- Life Cycle of at least 50 years, will depend on manufacturer
- No additional maintenance required

Absorbent Landscaping

Absorbent landscaping is the practice of placing an increased depth of well-draining or amended soils under regular landscape such as residential lawns. This practice requires little maintenance, as it is a more passive infiltration measure. Amended landscaping areas are to be treated and maintained the same as similar non-amended landscape areas.

Life Cycle Maintenance

- Life Cycle of at least 50 years
- No additional maintenance required

Water Harvesting

The term water harvesting refers to the practice of collecting rainwater from roofs or other impermeable surfaces for future use. A harvesting system requires a storage system such as an above or below ground cistern or rain barrel. Maintenance requirements for rainwater harvesting systems vary according to use. Systems used only for irrigation have low maintenance requirements while systems designed for indoor use have higher requirements. All rain water systems should undergo regular inspections in the fall and spring and the following tasks should be performed as needed:

- Keep leaf screens, eavestroughs, and downspouts free of leaves and debris
- Check screens and patch holes or gaps immediately
- Clean and maintain any first flush diverters or filters
- Inspect and clean storage tank lids (screens, vents, inflow and outflow spigots)
- Replace damaged components as needed

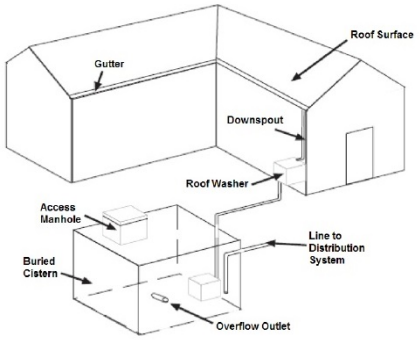


Figure 13.1 Rainwater Harvesting System Schematics
(adapted from Rupp, 1998)

Figure 5.25: Rainwater Harvesting Schematic (Source: City of Edmonton Low Impact Development Best Management Practices Guide Edition 1.1 2014)

Life Cycle Maintenance

- Life Cycle of at least 50 years for large harvesting systems
- If plastic tank is used, will need to be replace at 40 years, concrete tanks will last much longer
- Plastic rain barrels life cycle is approximately 20 years before replacement

5.5.3 Other Utility Requirements

Refer to the Strathcona County Design & Construction Standards for the following requirements:

- Utility Trenches
- Sanitary Sewer System Design, Installation/Construction, and Testing
- Water Distribution System Design, Installation/Construction, and Testing (including Hydrants)
- Storm Water Management System Design, Installation/Construction, and Testing

Refer to the Bremner Utility Master Plan for planning and design of utilities.

5.6 Pavement Markings & Traffic Controls

Pavement markings and traffic controls (signs and signals) provide clarity on intended operation and regulate operations. They reinforce the regulations in the Alberta Traffic Safety Act and associated Use of Highway and Rules of the Road Regulation as well as local traffic and parking bylaws. The Manual of Uniform Traffic Control Devices for Canada (MUTCD-C), published by the Transportation Association of Canada (TAC), provides guidance for the application of pavement markings and traffic controls in Canada and is supplemented by the TAC Bikeway Traffic Control Guidelines for Canada for signs and markings related to bicycle facilities including multi-use trails. The MUTCD-C supports the uniformity of traffic controls across Canada.

Refer to the Strathcona County Design and Construction Standards for requirements on Travelled Way longitudinal and traverse pavement markings for motor vehicle lanes.

The following pavement markings, signs, and traffic signal information for people walking and cycling are required for Bremner.

Bicycle Boulevard and Local Street Pavement Markings

Shared lane markings (i.e., sharrows) are used to guide people cycling along bicycle boulevards and local streets. Sharrows shall be spaced at 75 m intervals along bicycle boulevards. Sharrows can also be used to indicate the intended path of people cycling through intersections along bicycle boulevards (i.e., local streets that form part of the bicycle network).

Figure 5.26: Sharrow Pavement Marking

Cycle Track and Multi-Use Trail Lines

Lane lines shall be used to delineate the edge of a travelled lane dedicated for bicycle use. Lane lines shall be solid, white in colour with a width of 100 mm.

Centrelines shall be used on multi-use trails. Centrelines shall be solid, yellow in colour, and a width of 100 mm.

Cycle Track Pavement Markings at Conflict Zones

At driveways, accesses, intersections, and other conflict points, except at locations with very low motor vehicle volumes (e.g., driveway to a single-family home), the cycle track shall be marked with green dashed pavement markings similar to a zebra crosswalk. The markings shall be 1.5 m in length with a 1.5 m gap between green bars with 100 mm wide white lines on either side. Every second green bar shall be marked with a bicycle symbol.

Figure 5.27: Bicycle Pavement Markings at Mid-Block Conflict Zones

Multi-Use Trail Pavement Markings at Intersections

Crossride bicycle markings (i.e., crossrides) shall be used to define a bicycle traffic crossing area where a multi-use trail intersects a street. Crossride markings shall be two parallel square dashed markings that are 0.4 m by 0.4 m in dimension with a 0.4 m gap between squares.

Figure 5.28: Crossride Treatment for Multi-Use Trail Crossings at Intersections

Crosswalk Markings

Crosswalks shall be marked with series of wide white lines running perpendicular to the crosswalk (i.e., zebra crossing) extending across the Travelled Way from curb to curb.

The minimum width of a crosswalk is 2.5 m, with a recommended width of 4.0 m. Along Main Street Collectors and Primary Collectors, crosswalks shall be at least 5.0 m in width. The width of the crosswalk shall be determine based on the widths of the sidewalks and curb ramps, and the number of people walking across the street.

Decorative/creative crosswalk pavement marking treatments can provide value in highlighting street crossings as an important extension of the public realm and for placemaking. Decorative crosswalks may be applied at standard crosswalk locations and are recommended in areas with high concentrations of people walking such as school zones and Main Streets.

Figure 5.29: Example of Decorative Crosswalk

A decorative crosswalk design shall include the standard parallel white crosswalk pavement markings at the edges of the decorative markings to meet minimum crosswalk design standards and provide clearly defined directional guidance.

Crosswalks at Cycle Tracks

Where a sidewalk or multi-use trail intersects a cycle track, the design of the intersection should intuitively suggest people walking have priority as they are slower and more vulnerable than people cycling. This shall be accomplished using signage and a marked zebra crosswalk.

Traffic Signs to Support Right of Way of People Walking & Cycling at Intersections & Driveways

The following MUTCD-C compliant traffic signs shall be used to indicate right-of-way priority at intersections and other conflict points. They support the pavement markings identified above and are important for winter operations.

Reserved Bicycle Lane Sign (RB-91) used to denote a cycle track. The sign shall be placed at the beginning of each block and at conflict points.

Shared Pathway Sign (RB-93) used to denote multi-use trails. The sign shall be placed at the beginning of each block.

Crosswalk (RA-3) used to denote crosswalks. This sign shall be placed on either side of the crosswalks facing both directions of motor vehicle traffic. Crosswalk signs shall be used at crossings of cycle tracks at intersections and bus stops.

Pedestrian and Bicycle Crossing Sign (WC-46) shall be used at crosswalks and crossrides warning prior to the crossing and shall be located prior to each intersection.

Bicycles Yield to Pedestrians (RB-39) shall be used to denote the right of way of people walking at crossings of cycle tracks prior to intersections or bus stops.

No Right Turn on Red (RB-17, RB-17 with Bicycle Exception shown) shall be used to prohibit right turns for motor vehicle traffic at intersections with cycle tracks.

Right Turning Vehicles Yield to Bikes (RB-37 with tab) and Right Turning Vehicles Yield to Bikes and Pedestrians (RB-38) shall be used to denote right of way of people cycling and cycling and walking, respectively, at intersections and conflict points where turning motor vehicle traffic cross cycle tracks or multi-use trails.

Bicycle Signals

Bicycle signal heads shall be installed on the far side of intersections within 30 m of the stop bar for people cycling along all bike routes. For more complex intersections where the far side is greater than 30 m away, a 300 mm bicycle signal lenses far side signal heads and a 200 mm supplementary bicycle signal lenses on the near side of the intersection or median of the intersecting street shall be installed.

Bicycle Traffic Signal Head

Walk Signals

Pedestrian signal indicators display whether people walking have adequate time to begin crossing a street at a signalized crosswalk. All traffic signals shall be equipped with pedestrian signal indicators with countdown timers. The pedestrian signal indication shall be displayed automatically as part of the signal phasing and not require actuation except for in very low density, non-street oriented in the area south of Highway 16.

Providing adequate crossing time for people walking is a critical element of the walking environment at signalized intersections. The crossing time includes the observation-reaction time, the walking time, plus a safety margin. The MUTCD-C and the TAC Canadian Capacity Guide for Signalized Intersections recommend signal timing requirements to accommodate people walking based on their walking speed and shall be based on the walking speed of an older adult. The length of a motor vehicle signal phase with parallel walking movements shall provide sufficient time for a person walking to safely cross, including both a sufficient “walk” interval and necessary clearance time. If this cannot be provided, a centre refuge area shall be provided.

5.7 Construction Specifications

Refer to the Strathcona County Design and Construction Standards for requirements on contracts and construction specifications and all associated forms.

6 STANDARD DRAWINGS & DETAILS

The standard drawings and details for the Bremner Area Concept Plan have been broken into five areas: cross-sections, details, intersections, pavement markings, and low impact development. Though most drawings have been developed specifically for Bremner, several Strathcona Country Design Standards apply and doesn't require reproducing. The Bremner standard drawings are included in Appendix B. Several of the Strathcona County standard drawings are also referenced.

Cross Sections

- **Walkway**: Refer to Strathcona County Design Standards Drawing (SCDS) Drawing #41214 (requires increased walkway width to accommodate Universal Design)
- **Multi-Use Trail**: Refer to SCDS Drawings #61401, 61402, and 61409.
- **Laneway**: Refer to SCDS Drawing #41114
- **4 Party Trench:** see attached Drawing #1000
- **Reverse Housing Laneway**: see attached Drawing #1001
- **Local Street Boulevard Walk**: see attached Drawing #1002
- **Local Street Mono Walk**: see attached Drawing #1003
- **Collector Street**: see attached Drawing #1004
- **Collector Street Street-Oriented:** see attached Drawing #1005
- **Collector Street at Traffic Calmed Location**: see attached Drawing #1006
- **Main Street Collector:** see attached Drawing #1007
- **Primary Collector 2 Lane with Parking**: see attached Drawing #1008
- **Primary Collector 2 Lane - No Parking**: see attached Drawing #1009
- **Primary Collector 4 Lane with Parking**: see attached Drawing #1010
- **Primary Collector 4 Lane - No Parking**: see attached Drawing #1011
- **Arterial Street 4 Lane**: see attached Drawing #1012
- **Arterial Street 6 Lane**: see attached Drawing #1013
- **LEA Industrial Local Street**: see attached Drawing #1014
- **LEA Industrial Collector Street**: see attached Drawing #1015
- **LEA Industrial Arterial Street 4 Lane**: see attached Drawing #1016
- **LEA Industrial Arterial Street 2 Lane**: see attached Drawing #1017

Details

- **Tactile Walking Surface Indicators Layout for Boulevard Walk**: see attached Drawing #2000
- **Tactile Walking Surface Indicators Layout for Mono Walk:** see attached Drawing #2001
- **Tactile Walking Surface Indicators Layout for Midblock Crossing:** see attached Drawing #2002
- **Tactile Walking Surface Indicators Layout for Offset Intersections:** see attached Drawing #2003
- **Tactile Walking Surface Indicators Median Detail:** see attached Drawing #2004
- **Mid-Block Cycle Track Slip Ramp:** see attached Drawing #2005
- **Accessible Parking**: see attached Drawing #2007
- **Typical Curb Extension**: see attached Drawing #2008
- **Bus Stop and Amenities Pad with Cycle Track:** see attached Drawing #2009
- **Bus Stop and Amenities Pad Rural Roadway:** see attached Drawing #2010
- **Residential Alley Crossing Mono Walk**: see attached Drawing #2011
- **Residential Alley Crossing Boulevard Walk**: see attached Drawing #2012
- **Commercial and Industrial Crossing Boulevard Walk**: see attached Drawing #2013
- **Curb and Gutter**: Refer to SCDS Drawing #41210.
- **Catch Basin**: Refer to SCDS Drawings #44002 and #44003.
- **Sidewalk Ramp Details:** refer to SCDS Drawings #41201 and #41202
- **Commercial Vertical Curb Crossing Detail (Retrofit Only):** reference SCDS Drawing #41203
- **Mountable Curb & Gutter:** reference SCDS Drawing #41205

Intersections

There are a number of elements that affect intersection design. Street classification of the major street, street classification of the minor street, design speed, cycle infrastructure, traffic calming infrastructure, use of the ancillary lane, etc. Having so many different elements creates the potential for dozens (or more) specific intersection designs. Not only will a set of intersection design standards never be complete and cover all circumstances, it is a considerable undertaking to keep all of these standard drawings current as, for example, a standard travel lane width changes. A recommended approach (one adopted by the City of Edmonton) is to provide standardized intersection corner treatment drawings in conjunction with corner radius and sight distance requirements for different intersecting streets. *Section 5.3: Intersections & Driveways*, provides design guidance for corner radius, sight distance, traffic calming features, cycle infrastructure considerations, and roundabouts. These in conjunction with the following standard design drawings will provide the engineer/designer with all the necessary information to design any intersection.

- **Layout of Crosswalks and Ramps at Urban Intersections:** refer to SCDS Drawing #41001 (requires revision to match Bremner sidewalk widths)
- **Typical Requirements for Collector/Arterial Intersections Signage:** refer to SCDS Drawing #41003
- **Typical Requirements for Collector/Arterial Intersection Geometrics:** refer to SCDS Drawing #41005 (requires revision to match Bremner sidewalk widths)
- **Arterial/Collector Developer Site-Specific Contributions**: refer to SCDS Drawing #41006
- **Minimum Intersection Sightline Requirements Undivided Roads:** refer to SCDS Drawing #41008 (requires revisions in table to match Bremner street types)
- **Minimum Intersection Sightline Requirements Divided Roads:** refer to SCDS Drawing #41009 (requires revisions in table to match Bremner street types)
- **Minimum Intersection Sightline Requirements Left Turn From Major Road:** refer to SCDS Drawing #41010 (requires revisions in table to match Bremner street types)

Pavement Markings

- **Typical Layout of Crosswalks at Mid Block Crossings**: refer to SCDS Drawing #41401
- **Typical Layout of Advance Yield Lines – Shark Teeth:** refer to SCDS Drawing #41402
- **Crossrides**: refer to Figures #37 through 41 of the Bikeway Traffic Control Guidelines for Canada

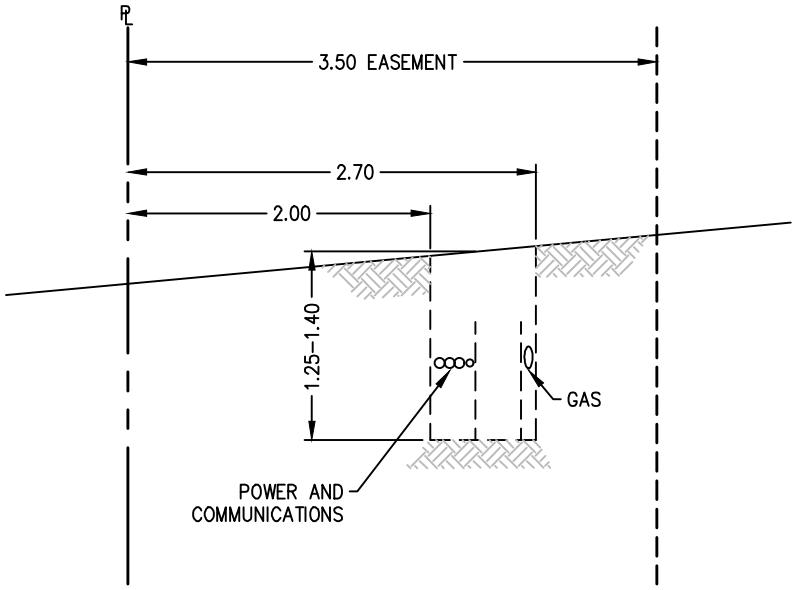
Low Impact Development

- **Bio-retention / Rain Garden:** see attached Drawing #3000
- **Roadside Bio-retention / Rain Garden:** see attached Drawing #3001
- **Roadside Bio-retention / Rain Garden Sections:** see attached Drawing #3002
- **Bioswale:** see attached Drawing #3003
- **Infiltration Trench:** see attached Drawing #3004
- **Permeable Paver:** see attached Drawing #3005
- **Observation Port for Infiltration Facilities:** see attached Drawing #3006
- **Single Layer Structural Cell Tree Box:** see attached Drawing #3007

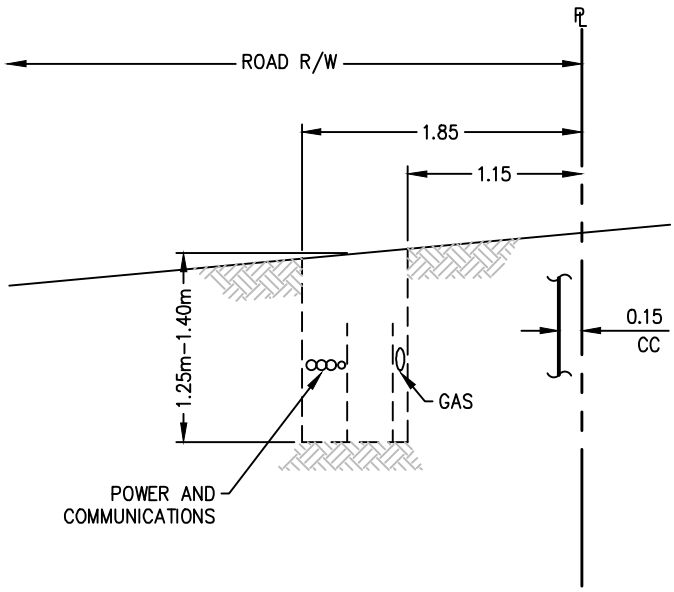
APPENDIX A: STREET TYPE DESIGN CHARACTERISTICS

Street Type	Trip Purposes for Street Users	Design AADT	Design Vehicle	Control Vehicle	Design Speed (km/h)	Typical Land Uses	Street Orientation of Buildings	Walking Facility	Cycling Facility	Minimum Intersection Spacing (m)	Maximum Intersection Spacing (m)	Driveway Spacing
Off-Street Multi-Use Trail	Getting Around Bremner	NA	Bicycle	FT	30	Park, Environmental Reserve, Residential	Street oriented, Non-street oriented			N/A	400 (200 preferred for CPTED)	N/A
Laneway												
Laneway	Getting Around the Neighbourhood	<1000	PC	WT	15	Residential	Non-street oriented	Shared Travelled Way	Shared Travelled Way	N/A	180	N/A
Reverse Housing Laneway	Getting Around the Neighbourhood	<1000	PC	WT, FT	15	Residential	Non-street oriented	Shared Travelled Way	Shared Travelled Way	N/A	180	N/A
Local												
Local	Getting Around Neighbourhoods	<2000	PC	WT, FT, MSU	30	Residential	Street oriented	Boulevard or Monowalk both sides of street	Shared Travelled Way	60	180 (120 for culs-de-sac)	N/A
Shared Street	Getting Around Neighbourhoods	<1000	PC	WT, FT, MSU	15	Commercial, Employment, Mixed-use	Street oriented	Shared Travelled Way plus Pedestrian Through Zone on one of both sides	Shared Travelled Way	60	120	Driveways Prohibited
Collectors												
Collector	Getting Around Bremner	2000 - 10000	B-12	WT, FT	40	Residential, Commercial, Employment, Schools, Parks	Street oriented, Non-street oriented	Boulevard Sidewalk one side, Multi-Use Trail one side	Multi-use Trail on side	60	180	N/A
Primary Collector	Getting Around Bremner	10000 - 20000	B-12	WB-21	50	Residential, Commercial, Employment, Schools, Parks	Street oriented	Boulevard Sidewalk both sides	Unidirections Raised Cycle Track both sides	120	300	No Residential Driveways, Commercial Accesses Design as intersections and minimum spacing of 60
Main Street Collector	Getting Around Bremner	2000 - 10000	MSU	FT	30	Commercial, Mixed-use	Street oriented	Boulevard Sidewalk both sides	Unidirectional Cycle Track both sides	60	120	Driveways Prohibited
Arterials												
Arterials	Getting To and From Bremner	20000 - 35000	WB-21	WB-36	60	Residential, Commercial, Employment, Schools, Parks	Non-street oriented	Multi-Use Trail both sides	Multi-use Trail both sides	400	800	No Residential Driveways, Commercial Accesses Design as intersections and minimum spacing of 200
Industrial Areas												
Industrial Local	Getting Around the Neighbourhood	<5000	WB-21	WB-36	50	Industrial Employment	Non-street oriented	Multi-Use Trail one side	Multi-Use Trail one side	200	500	Accesses Design as intersections and minimum spacing of 60
Industrial Collector	Getting Around Bremner	5000 - 15000	WB-21	WB-36	50	Industrial Employment	Non-street oriented	Multi-Use Trail one side	Multi-Use Trail one side	200	500	Accesses Design as intersections and minimum spacing of 60
Industrial Arterial	Getting To and From Bremner	15000 -30000	WB-21	WB-36	60	Industrial Employment	Non-street oriented	Multi-Use Trail both side	Multi-Use Trail both side	400	800	No Residential Driveways, Commercial Accesses Design as intersections and minimum spacing of 200

APPENDIX B: BREMNER STANDARD DRAWINGS



EASEMENT



RIGHT OF WAY

NOTES

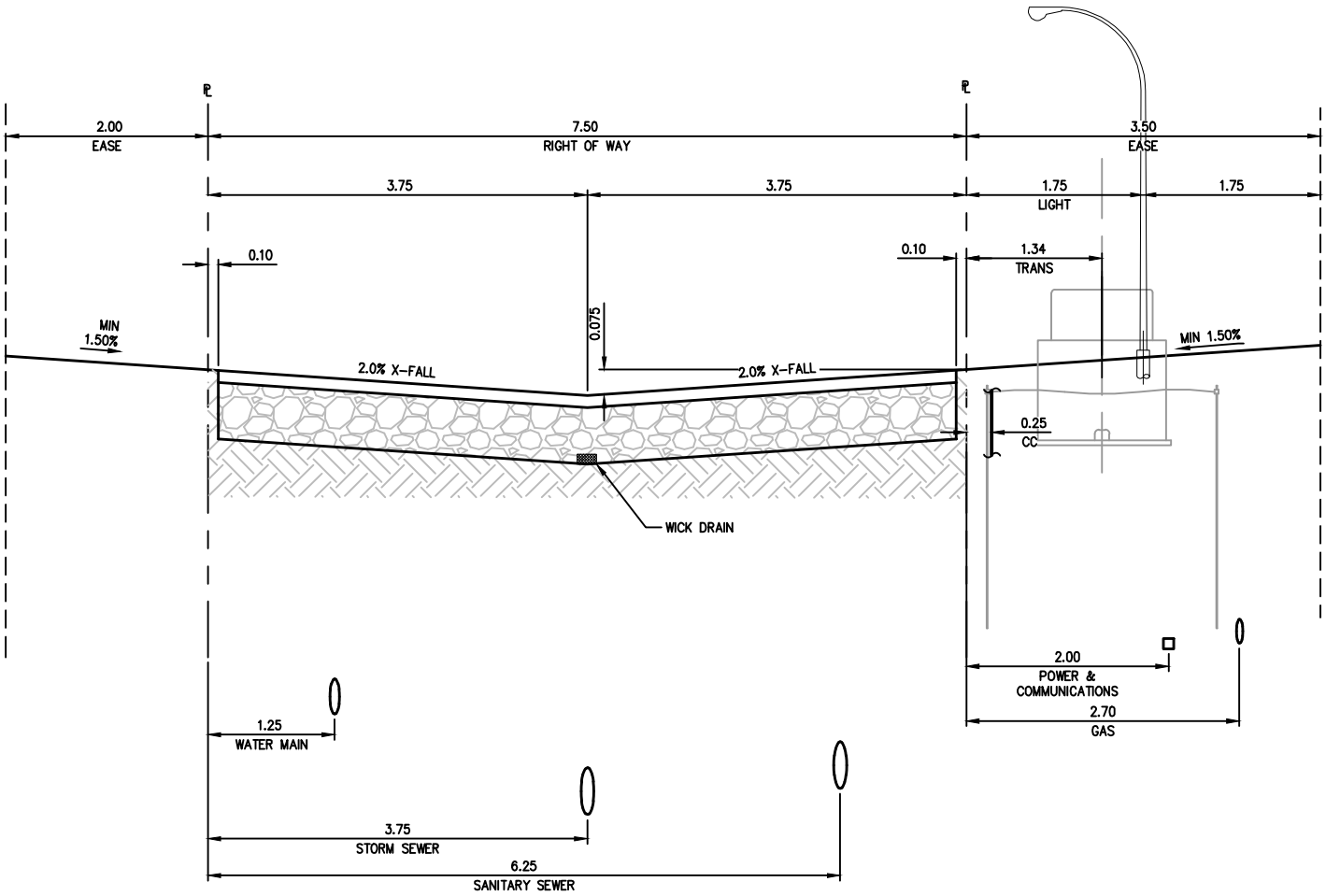
1. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
2. REFER TO FORTIS TYPICAL DETAIL FOUR PARTY TRENCH – MAIN TRENCH FRONT DISTRIBUTION (1260) FOR INSTALLATION DETAILS
3. SERVICES TO BE EXTENDED INTO PRIVATE PROPERTY BEYOND THE FOUR PARTY TRENCH EASEMENT
4. FOUR PARTY CAN ALSO BE INCLUDED WITHIN THE ROAD R/W

BREMNER AREA PROJECT

STRATHCONA COUNTY

4 PARTY TRENCH

REV 0	MARCH 2019	NTS	1000



NOTES

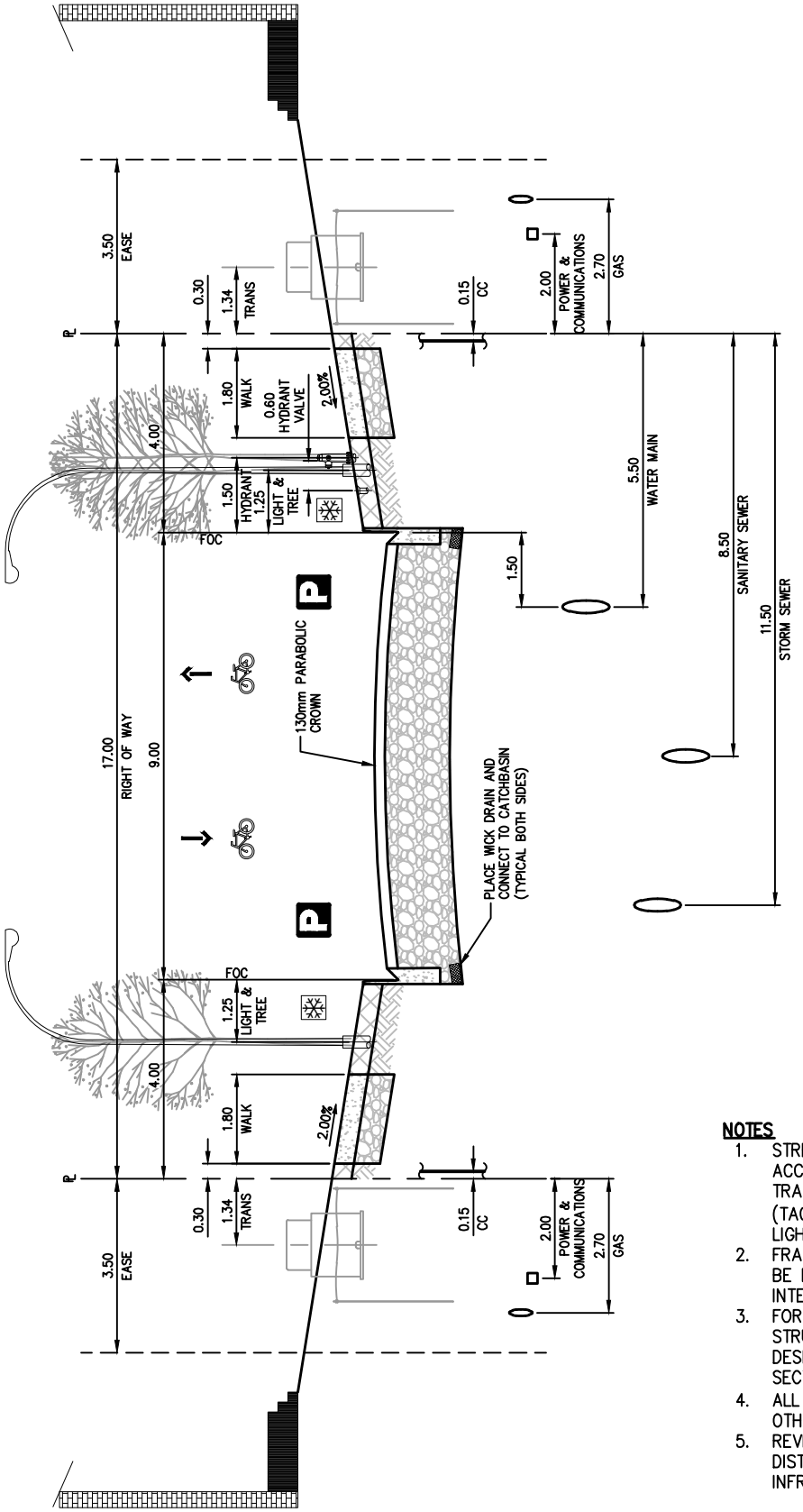
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. MINIMUM LONGITUDINAL GRADE FOR ASPHALT LANES IS 0.8%.
5. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
6. WICK DRAIN SHALL BE INSTALLED IN LANE OR AT CONNECTION TO STREET WHEN STORM SEWER PRESENT
7. 2.0m EASEMENT REQUIRED FOR WATERMAIN MAINTENANCE

BREMNER AREA PROJECT

STRATHCONA COUNTY

REVERSE HOUSING LANEWAY

REV 0	MARCH 2019	NTS	1001



NOTES

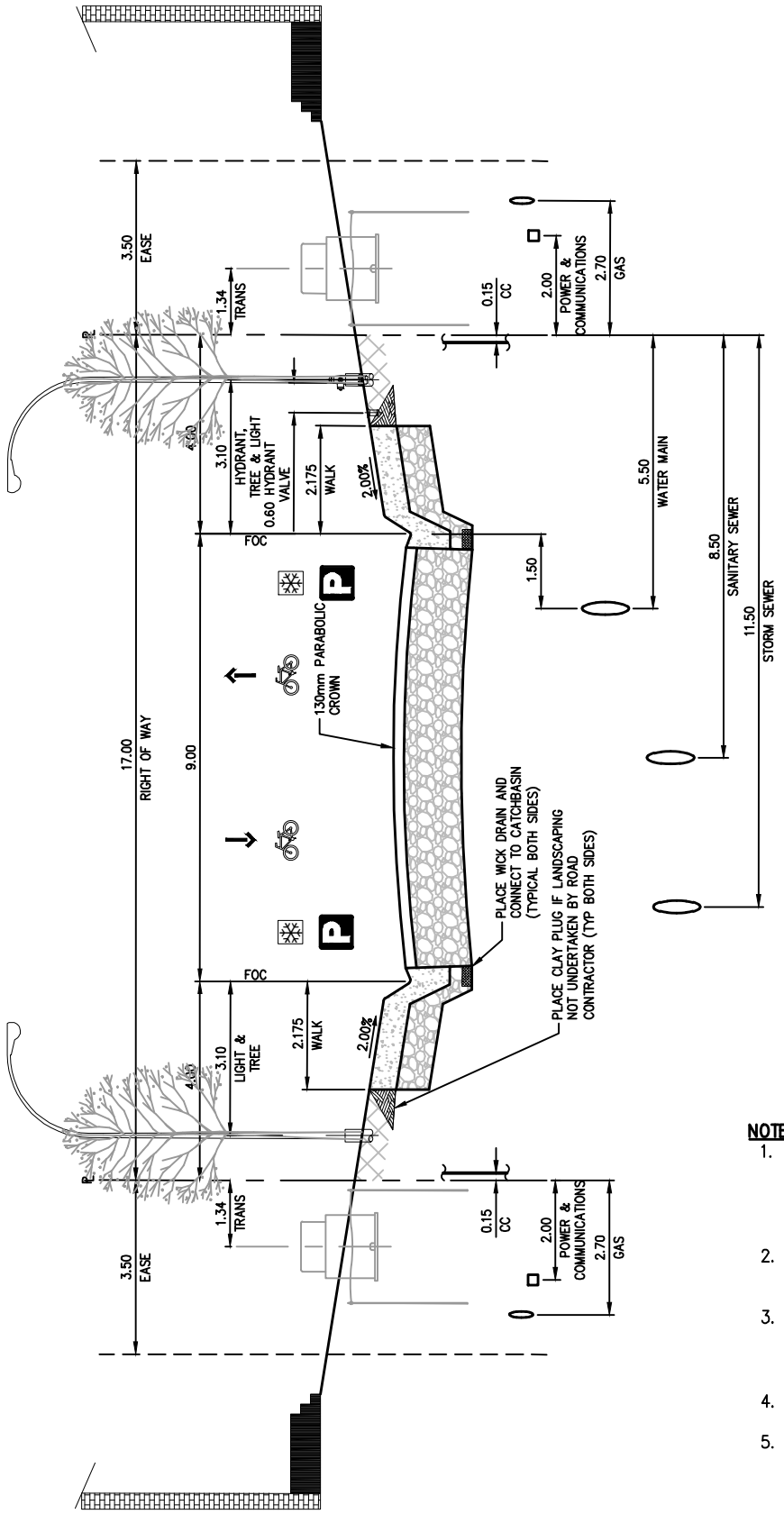
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. REVIEW TREE SUITABILITY TO MINIMIZE DISTURBANCE TO THE ADJACENT INFRASTRUCTURE AT TREES FULL GROWTH

BREMNER AREA PROJECT

STRATHCONA COUNTY

LOCAL STREET BOULEVARD WALK

REV 0	MARCH 2019	NTS	1002



NOTES

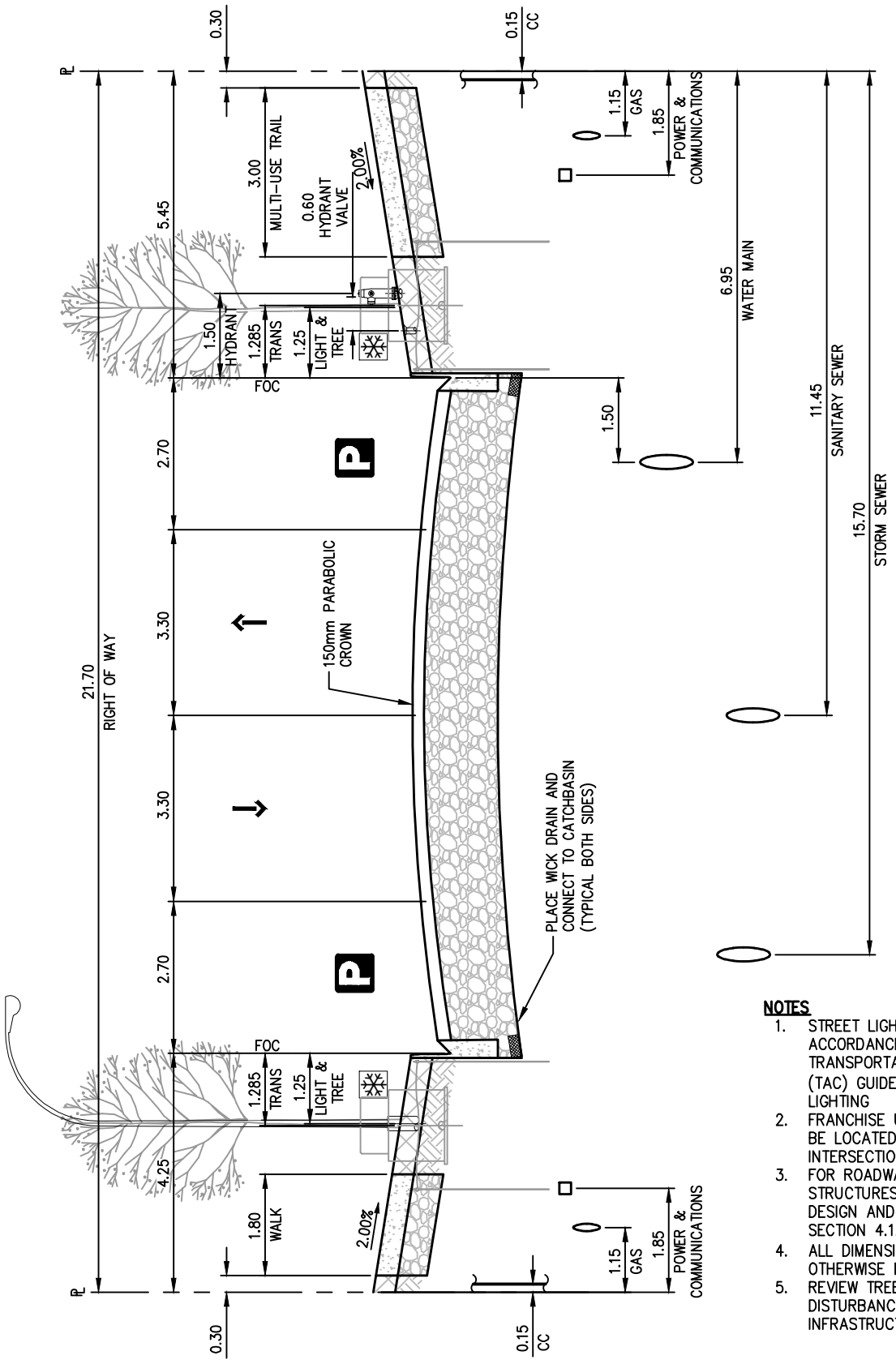
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. REVIEW TREE SUITABILITY TO MINIMIZE DISTURBANCE TO THE ADJACENT INFRASTRUCTURE AT TREES FULL GROWTH

BREMNER AREA PROJECT

STRATHCONA COUNTY

LOCAL STREET
MONO WALK

REV 0	MARCH 2019	NTS	1003



NOTES

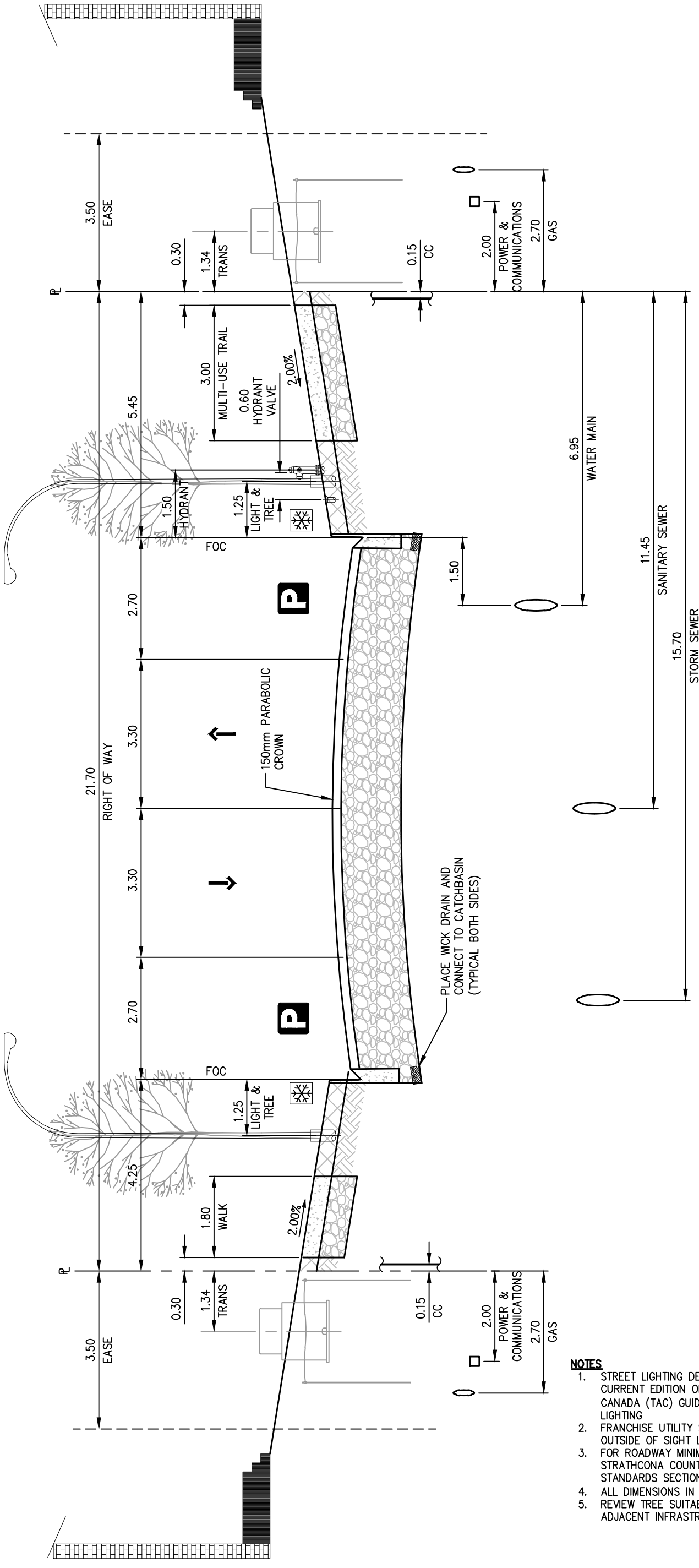
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. REVIEW TREE SUITABILITY TO MINIMIZE DISTURBANCE TO THE ADJACENT INFRASTRUCTURE AT TREES FULL GROWTH

BREMNER AREA PROJECT

STRATHCONA COUNTY

COLLECTOR STREET

REV 0	MARCH 2019	NTS	1004



NOTES

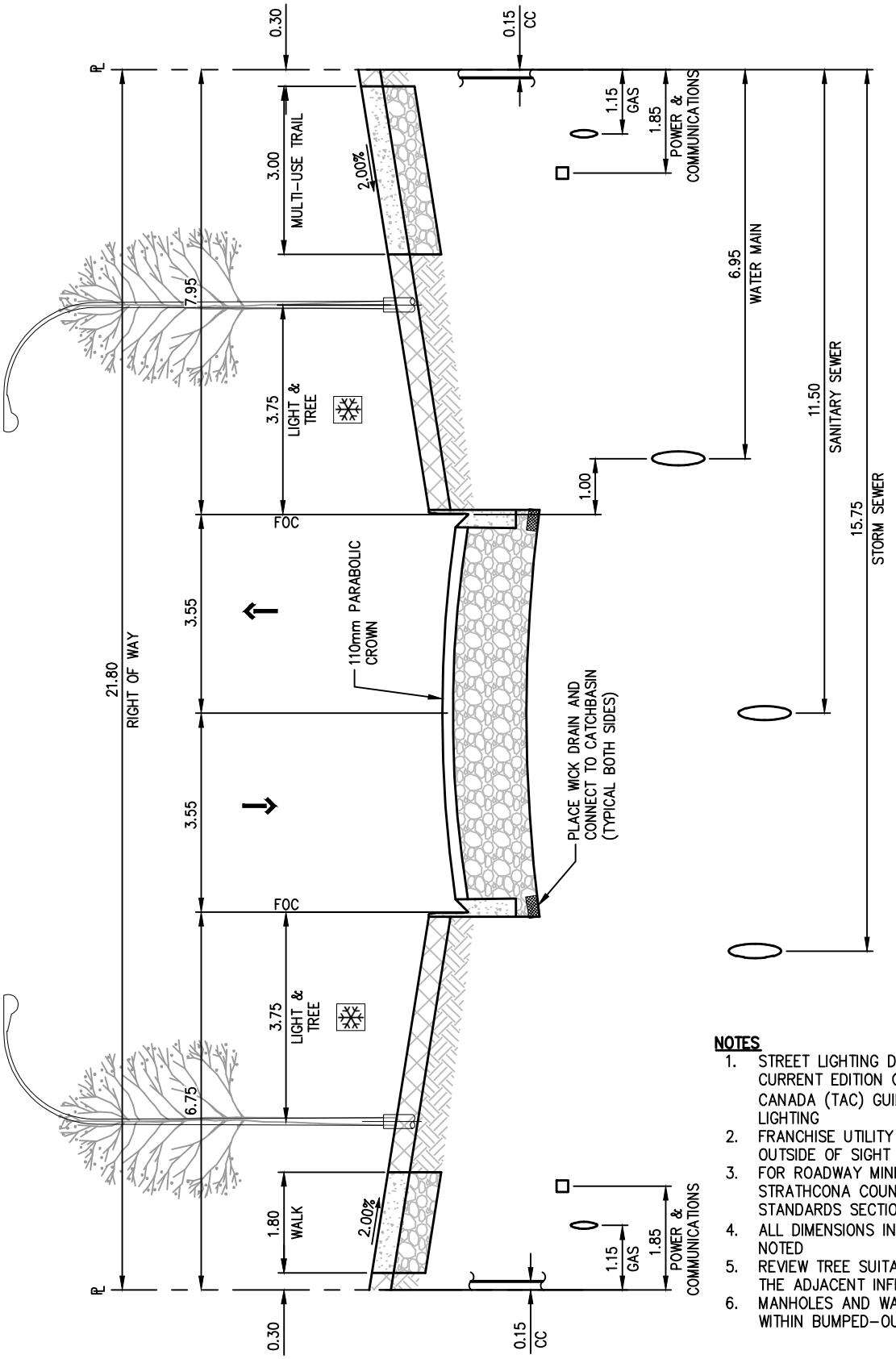
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. REVIEW TREE SUITABILITY TO MINIMIZE DISTURBANCE TO THE ADJACENT INFRASTRUCTURE AT TREES FULL GROWTH

BREMNER AREA PROJECT

STRATHCONA COUNTY

COLLECTOR STREET
STREET ORIENTED

REV 0	MARCH 2019	NTS	1005



NOTES

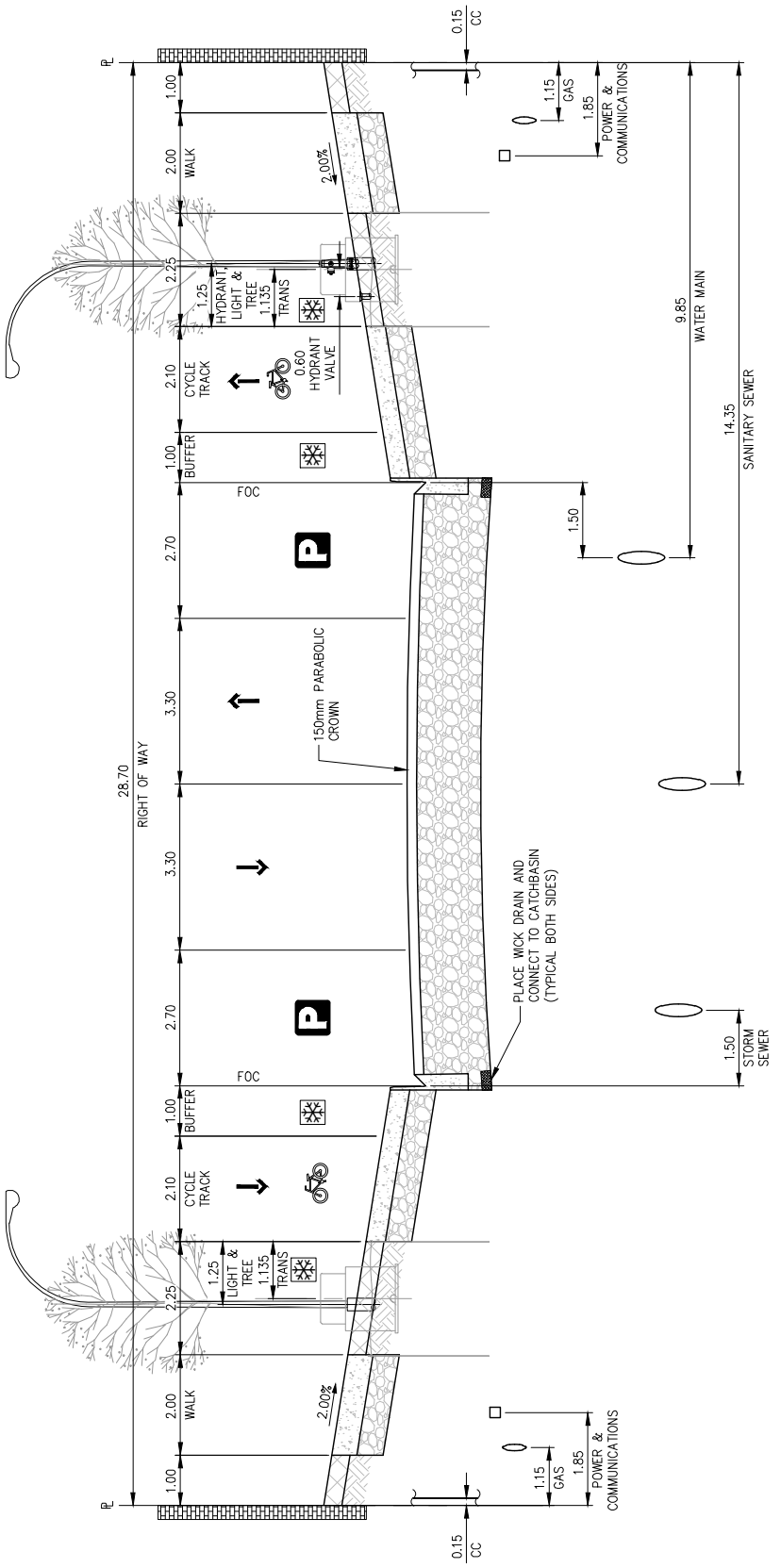
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. REVIEW TREE SUITABILITY TO MINIMIZE DISTURBANCE TO THE ADJACENT INFRASTRUCTURE AT TREES FULL GROWTH
6. MANHOLES AND WATER STRUCTURES ARE NOT TO FALL WITHIN BUMPED-OUT CURB

BREMNER AREA PROJECT

STRATHCONA COUNTY

COLLECTOR STREET AT TRAFFIC CALMED LOCATION

REV 0	MARCH 2019	NTS	1006



NOTES

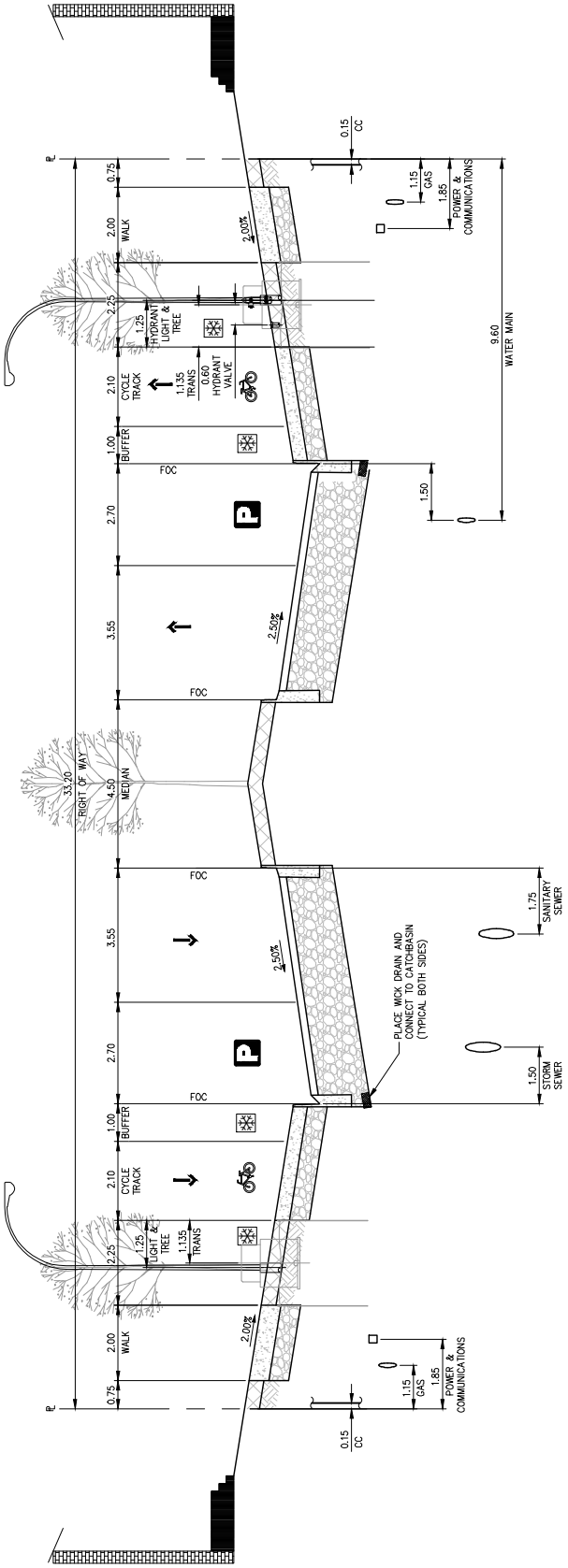
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED

BREMNER AREA PROJECT

STRATHCONA COUNTY

MAIN STREET COLLECTOR

REV 0	MARCH 2019	NTS	1007



NOTES

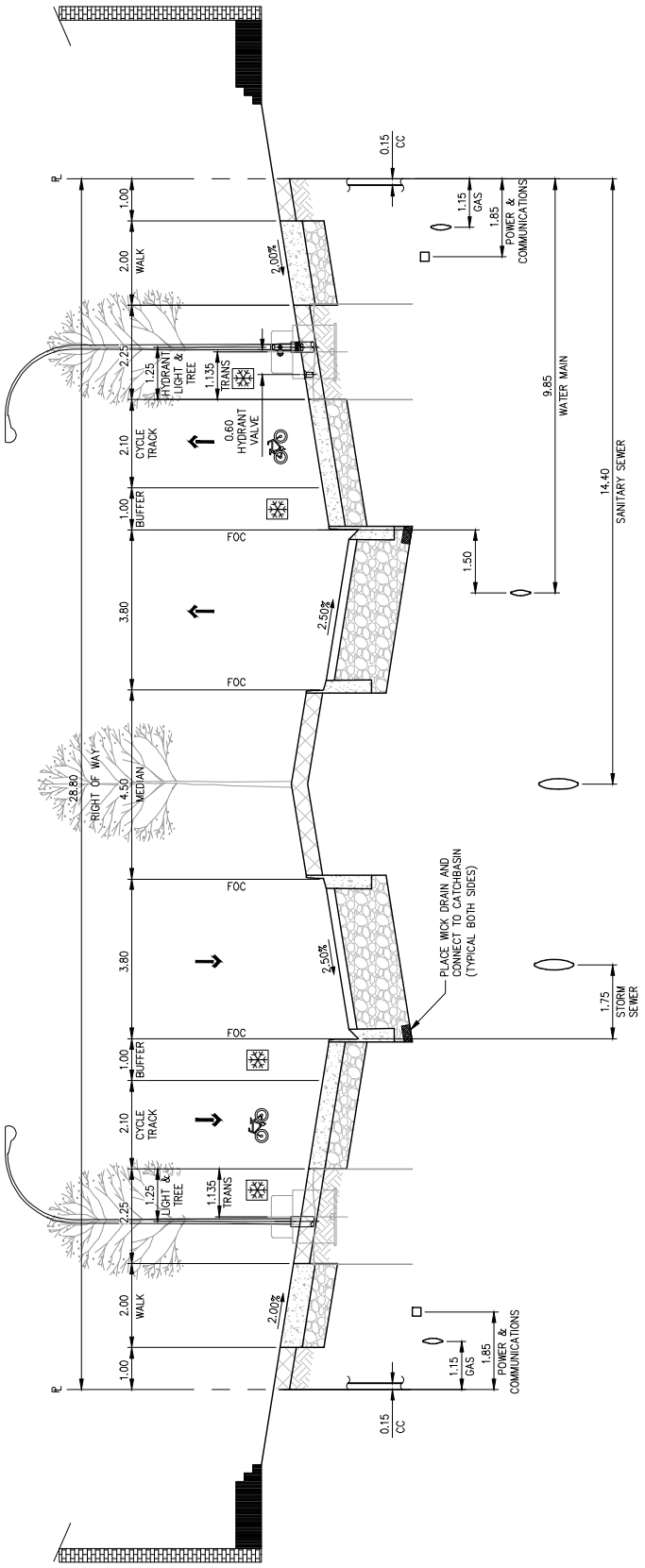
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. REVIEW TREE SUITABILITY TO MINIMIZE DISTURBANCE TO THE ADJACENT INFRASTRUCTURE AT TREES FULL GROWTH

BREMNER AREA PROJECT

STRATHCONA COUNTY

PRIMARY COLLECTOR
2 LANES WITH PARKING

REV 0	MARCH 2019	NTS	1008



NOTES

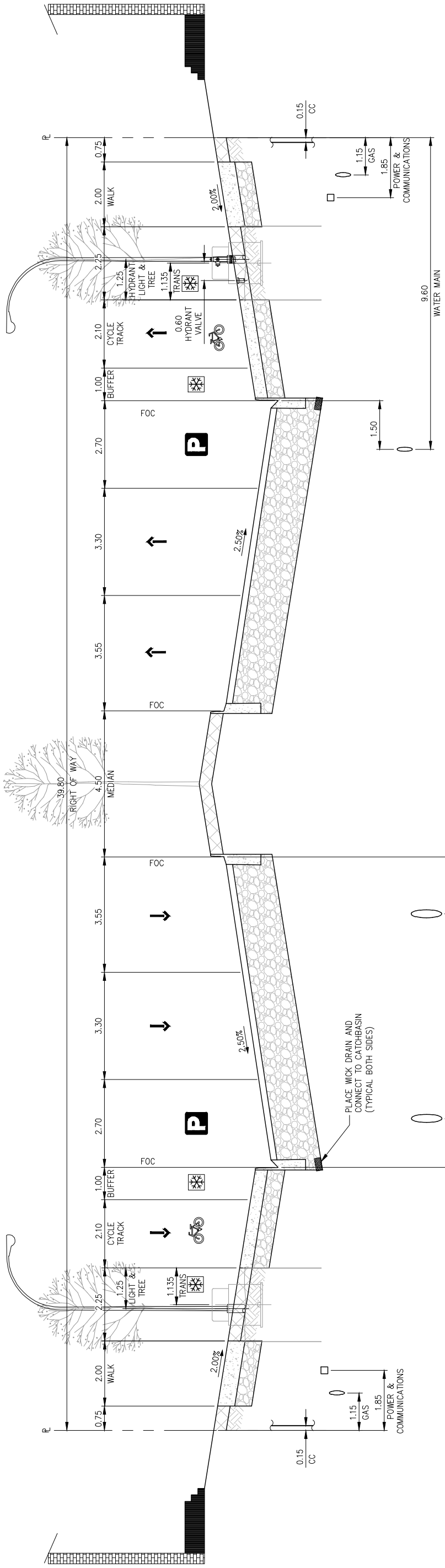
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. REVIEW TREE SUITABILITY TO MINIMIZE DISTURBANCE TO THE ADJACENT INFRASTRUCTURE AT TREES FULL GROWTH

BREMNER AREA PROJECT

STRATHCONA COUNTY

PRIMARY COLLECTOR
2 LANES - NO PARKING

REV 0	MARCH 2019	NTS	1009



NOTES

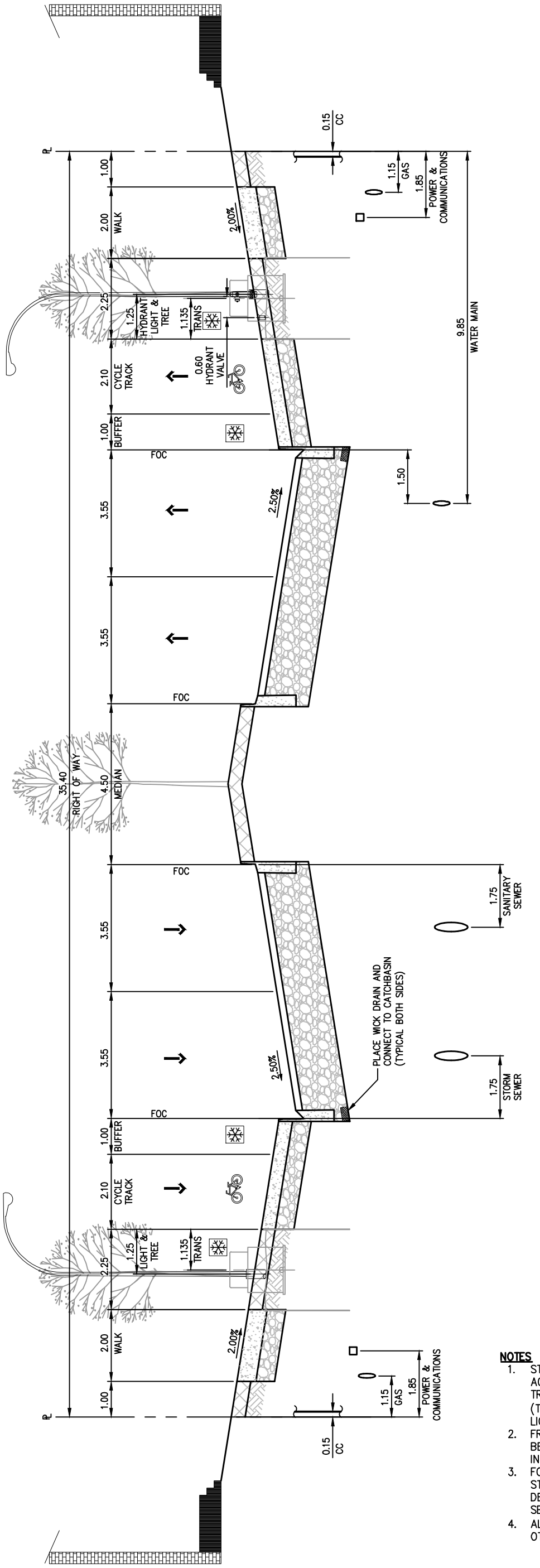
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. REVIEW TREE SUITABILITY TO MINIMIZE DISTURBANCE TO THE ADJACENT INFRASTRUCTURE AT TREES FULL GROWTH

BREMNER AREA PROJECT

STRATHCONA COUNTY

PRIMARY COLLECTOR
4 LANES WITH PARKING

REV 0	MARCH 2019	NTS	1010



NOTES

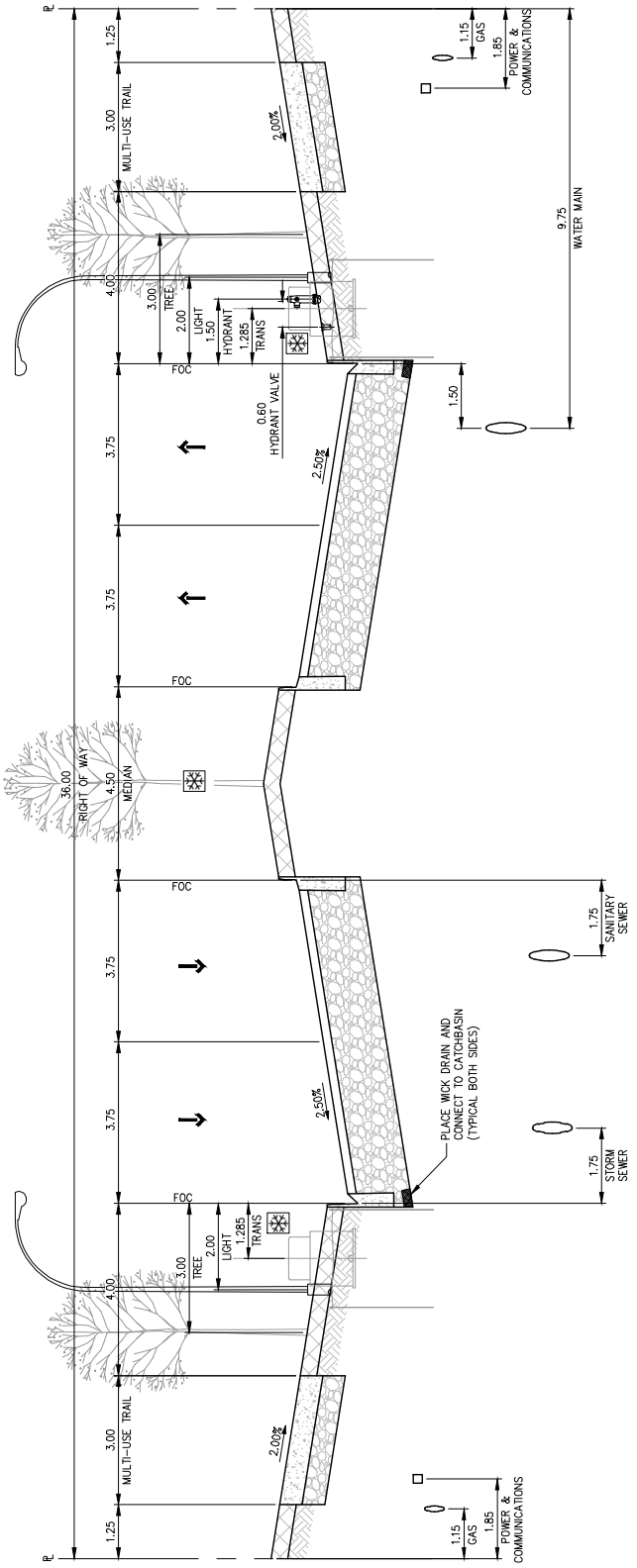
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED

BREMNER AREA PROJECT

STRATHCONA COUNTY

PRIMARY COLLECTOR
4 LANES -NO PARKING

REV 0	MARCH 2019	NTS	1011



NOTES

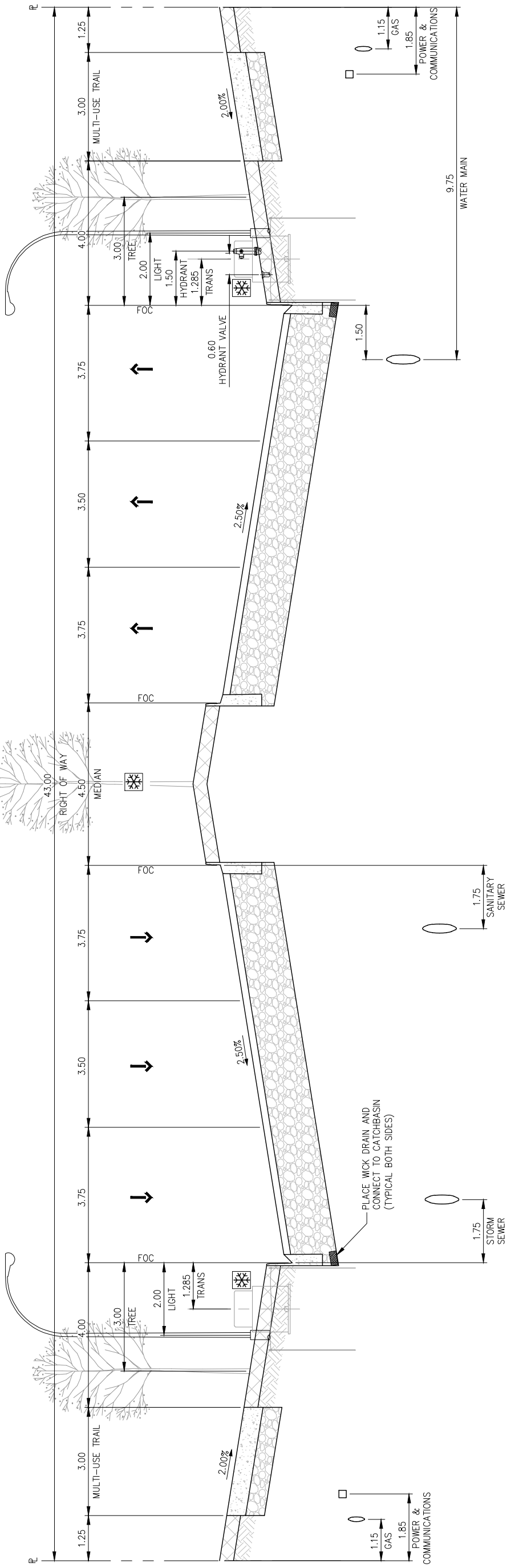
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. POSITIVE OFFSET LEFT TURN LANES SHOULD BE USED WHENEVER POSSIBLE TO INCREASE VISIBILITY
6. FINAL BOULEVARD WIDTH IS SUBJECT TO NOISE ATTENUATION REQUIREMENTS

BREMNER AREA PROJECT

STRATHCONA COUNTY

ARTERIAL STREET
4 LANES

REV 0	MARCH 2019	NTS	1012



NOTES

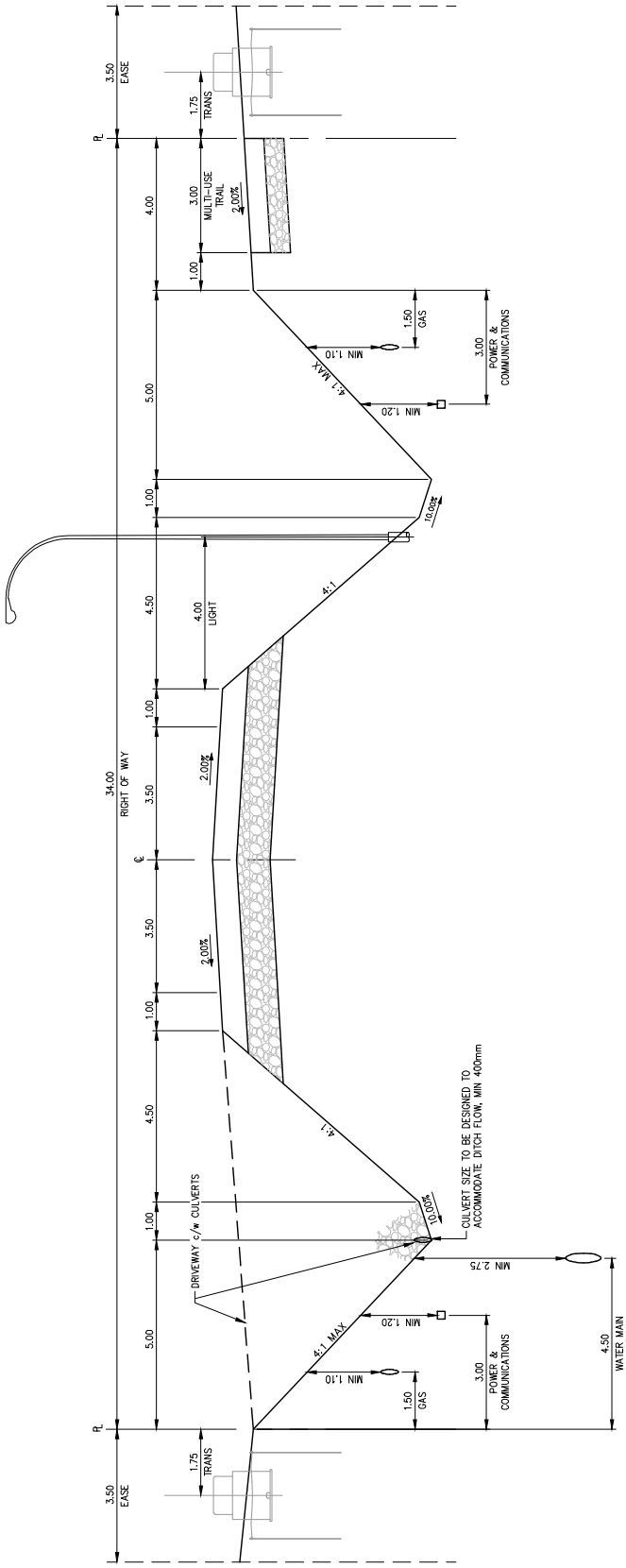
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. POSITIVE OFFSET LEFT TURN LANES SHOULD BE USED WHENEVER POSSIBLE TO INCREASE VISIBILITY
6. FINAL BOULEVARD WIDTH IS SUBJECT TO NOISE ATTENUATION REQUIREMENTS

BREMNER AREA PROJECT

STRATHCONA COUNTY

ARTERIAL STREET
6 LANES

REV 0	MARCH 2019	NTS	1013



NOTES

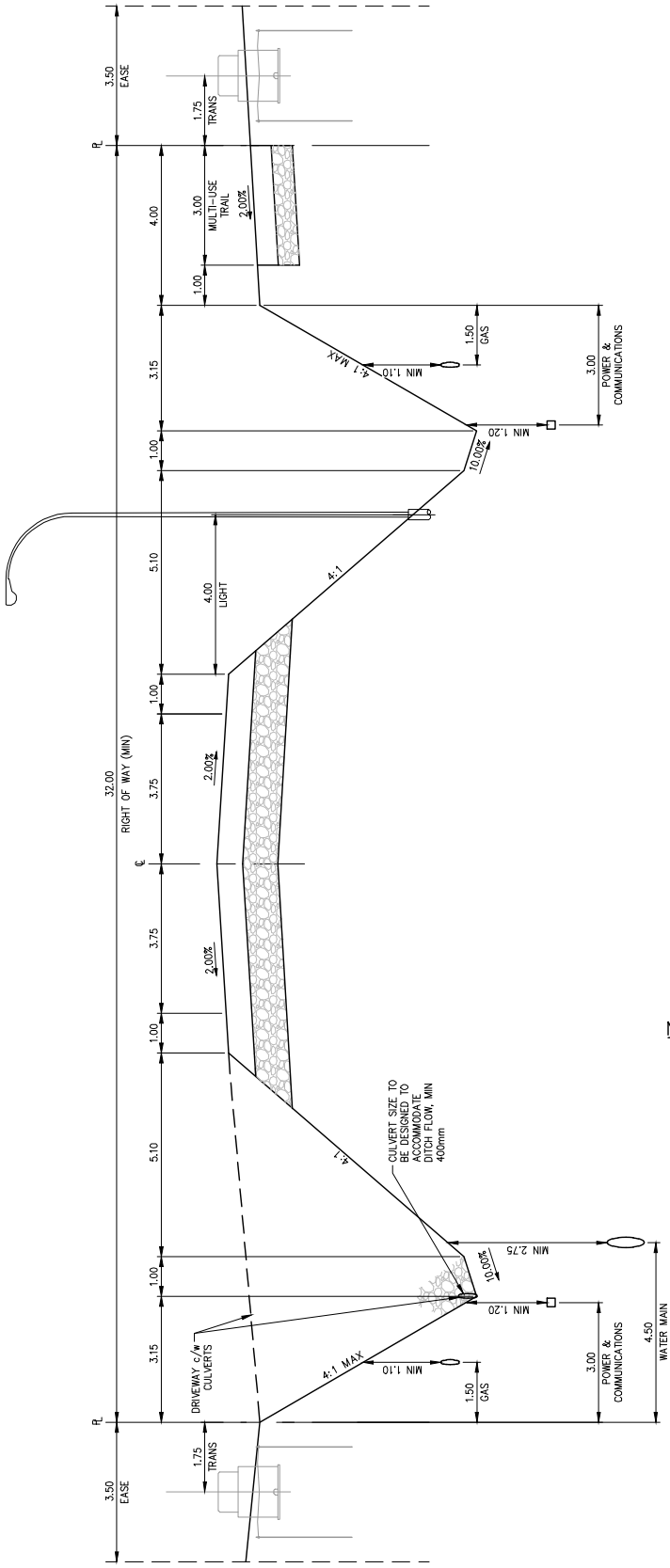
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. MINIMUM LONGITUDINAL GRADE FOR ROAD AND DITCH TO BE 0.6%
6. POSITIVE DRAINAGE IS TO BE MAINTAINED AT ALL LOCATIONS
7. DITCH DEPTH TO BE CONFIRMED BY GEOTECHNICAL REPORT
8. MINIMUM ROAD STRUCTURE SUBJECT TO REVISION BY GEOTECHNICAL REPORT RECOMMENDATIONS
9. ALL TRENCHES IN ROAD OR SIDESLOPE TO REQUIRE COMPACTION TO 98% STANDARD PROCTOR DENSITY, IN DITCH BOTTOM OR BACKSLOPE, 95% STANDARD PROCTOR DENSITY IS ACCEPTABLE

BREMNER AREA PROJECT

STRATHCONA COUNTY

LEA
INDUSTRIAL
LOCAL STREET

REV 0	MARCH 2019	NTS	1014



NOTES

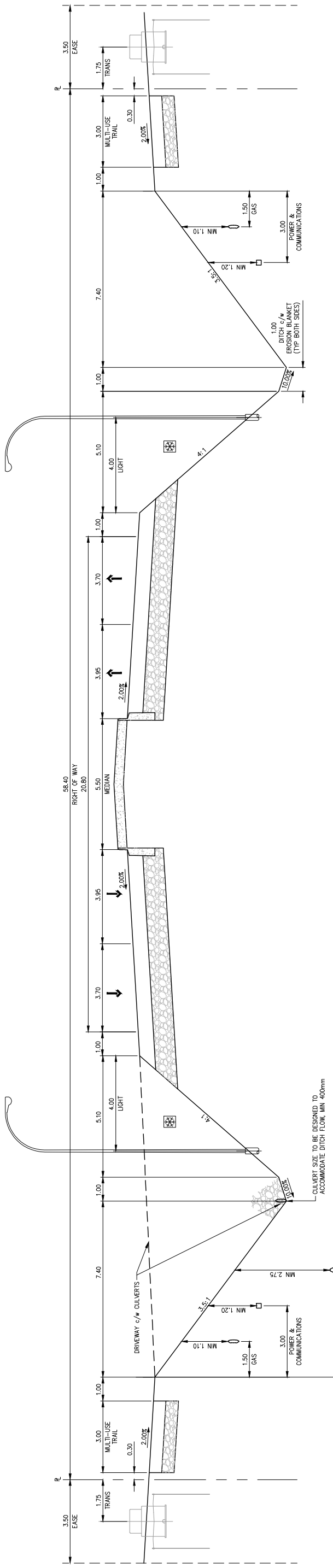
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. MINIMUM LONGITUDINAL GRADE FOR ROAD AND DITCH TO BE 0.6%
6. POSITIVE DRAINAGE IS TO BE MAINTAINED AT ALL LOCATIONS
7. DITCH DEPTH TO BE CONFIRMED BY GEOTECHNICAL REPORT
8. MINIMUM ROAD STRUCTURE SUBJECT TO REVISION BY GEOTECHNICAL REPORT RECOMMENDATIONS
9. ALL TRENCHES IN ROAD OR SIDESLOPE TO REQUIRE COMPACTION TO 98% STANDARD PROCTOR DENSITY, IN DITCH BOTTOM OR BACKSLOPE, 95% STANDARD PROCTOR DENSITY IS ACCEPTABLE

BREMNER AREA PROJECT

STRATHCONA COUNTY

LEA
INDUSTRIAL
COLLECTOR STREET

REV 0	MARCH 2019	NTS	1015



NOTES

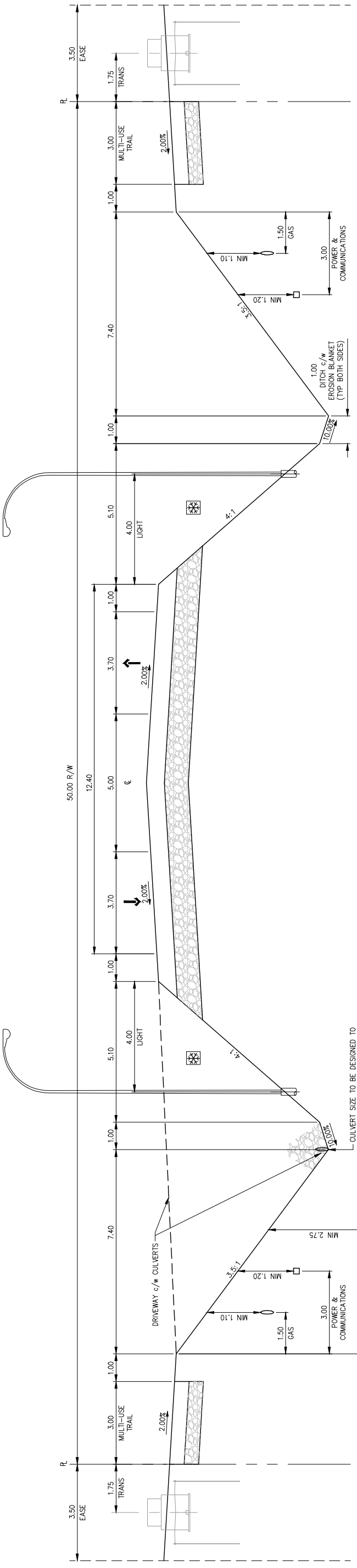
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. MINIMUM LONGITUDINAL GRADE FOR ROAD AND DITCH TO BE 0.6%
6. POSITIVE DRAINAGE IS TO BE MAINTAINED AT ALL LOCATIONS
7. DITCH DEPTH TO BE CONFIRMED BY GEOTECHNICAL REPORT
8. MINIMUM ROAD STRUCTURE SUBJECT TO REVISION BY GEOTECHNICAL REPORT RECOMMENDATIONS
9. ALL TRENCHES IN ROAD OR SIDESLOPE TO REQUIRE COMPACTION TO 98% STANDARD PROCTOR DENSITY, IN DITCH BOTTOM OR BACKSLOPE, 95% STANDARD PROCTOR DENSITY IS ACCEPTABLE

BREMNER AREA PROJECT

STRATHCONA COUNTY

LEA
INDUSTRIAL
ARTERIAL STREET 4 LANES

REV 0	MARCH 2019	NTS	1016



NOTES

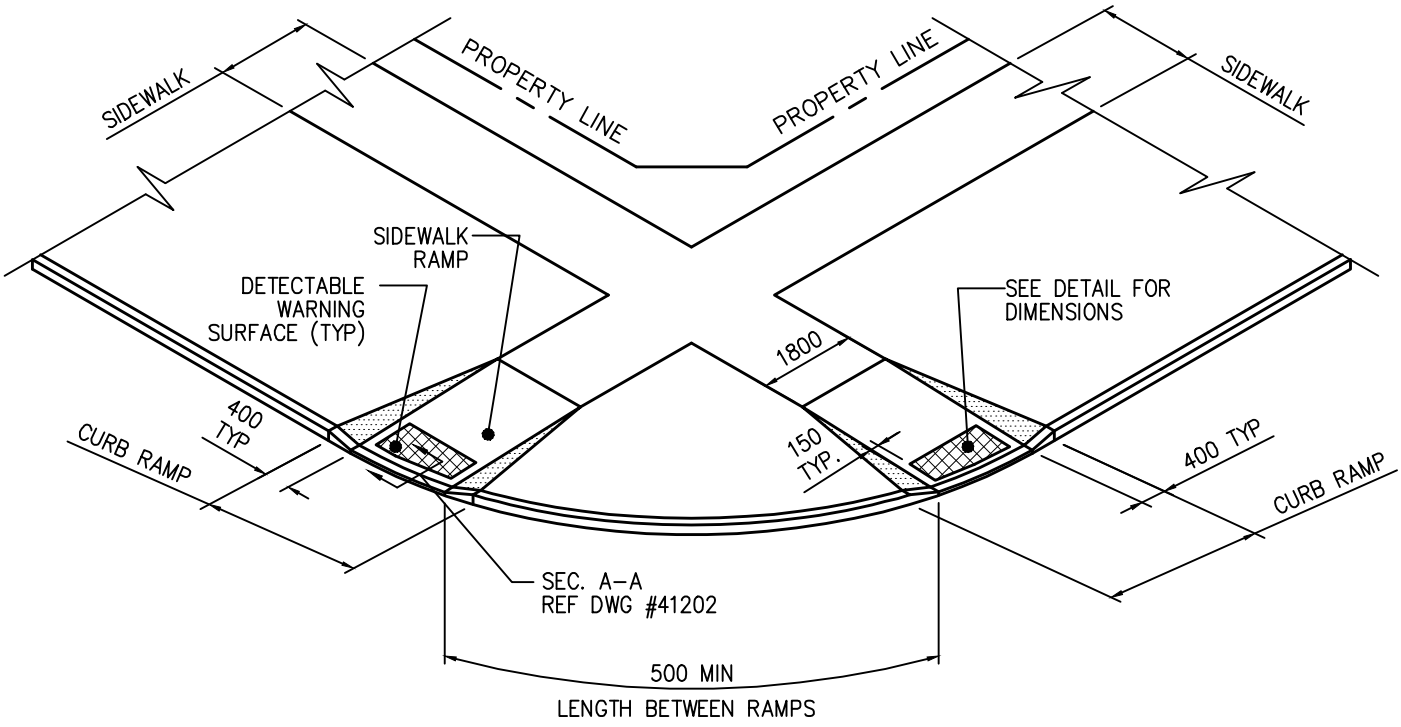
1. STREET LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF TRANSPORTATION ASSOCIATION OF CANADA (TAC) GUIDE FOR THE DESIGN OF ROADWAY LIGHTING
2. FRANCHISE UTILITY STREET FURNITURE SHALL BE LOCATED OUTSIDE OF SIGHT LINES AT INTERSECTIONS
3. FOR ROADWAY MINIMUM PAVEMENT STRUCTURES REFER TO STRATHCONA COUNTY DESIGN AND CONSTRUCTION STANDARDS SECTION 4.1.13
4. ALL DIMENSIONS IN METRES (m), UNLESS OTHERWISE NOTED
5. MINIMUM LONGITUDINAL GRADE FOR ROAD AND DITCH TO BE 0.6%
6. POSITIVE DRAINAGE IS TO BE MAINTAINED AT ALL LOCATIONS
7. DITCH DEPTH TO BE CONFIRMED BY GEOTECHNICAL REPORT
8. MINIMUM ROAD STRUCTURE SUBJECT TO REVISION BY GEOTECHNICAL REPORT RECOMMENDATIONS
9. ALL TRENCHES IN ROAD OR SIDESLOPE TO REQUIRE COMPACTION TO 98% STANDARD PROCTOR DENSITY, IN DITCH BOTTOM OR BACKSLOPE, 95% STANDARD PROCTOR DENSITY IS ACCEPTABLE

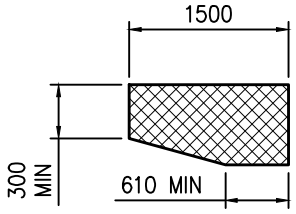
BREMNER AREA PROJECT

STRATHCONA COUNTY

LEA
INDUSTRIAL
ARTERIAL STREET 2 LANES

REV 0	MARCH 2019	NTS	1017





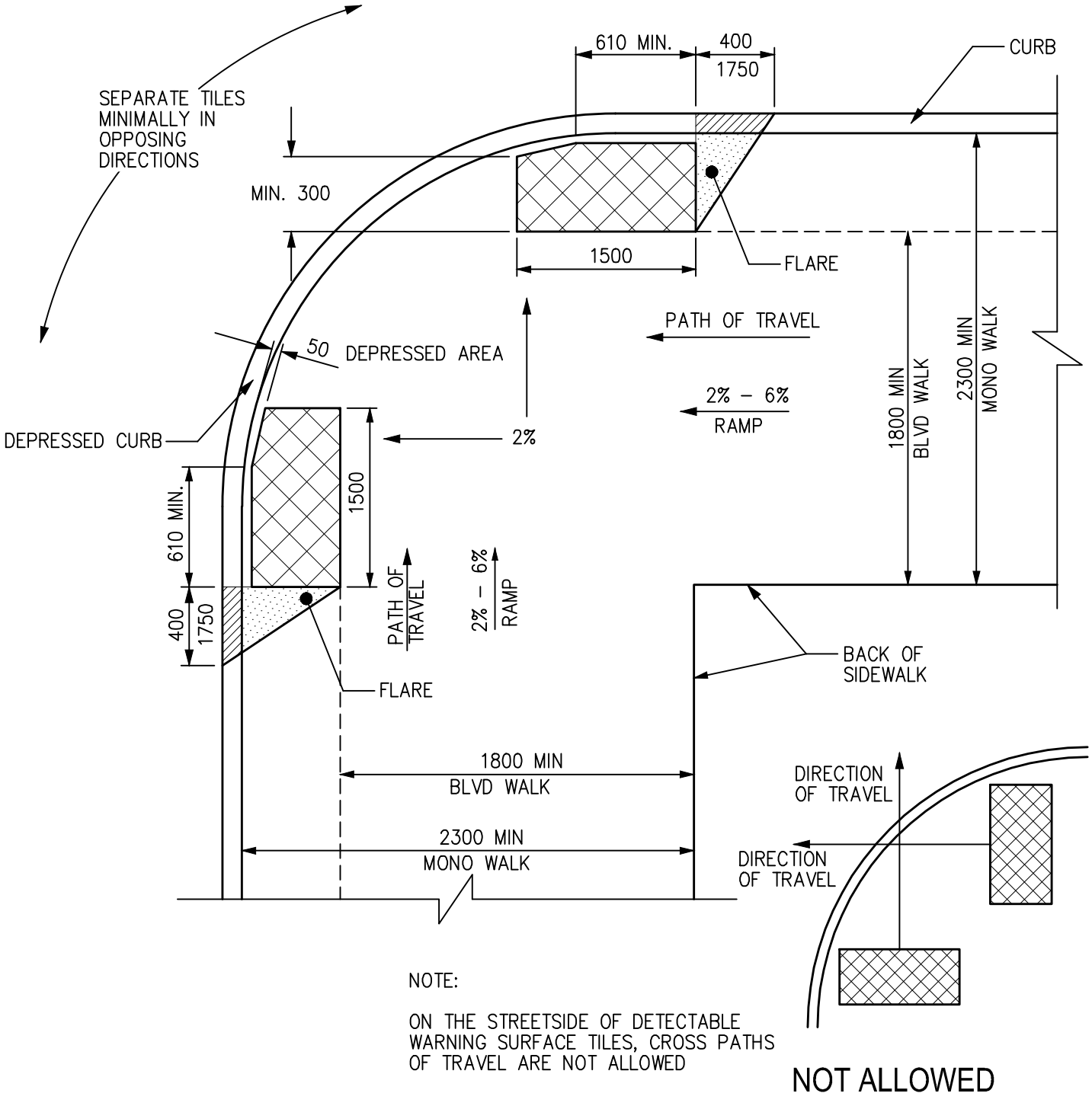
DETECTABLE WARNING SURFACE DETAIL

BREMNER AREA PROJECT

STRATHCONA COUNTY

TACTILE WALKING SURFACE INDICATOR LAYOUT FOR BOULEVARD WALK

REV 0	MARCH 2019	NTS	2000



NOTE:

ON THE STREETSIDE OF DETECTABLE WARNING SURFACE TILES, CROSS PATHS OF TRAVEL ARE NOT ALLOWED

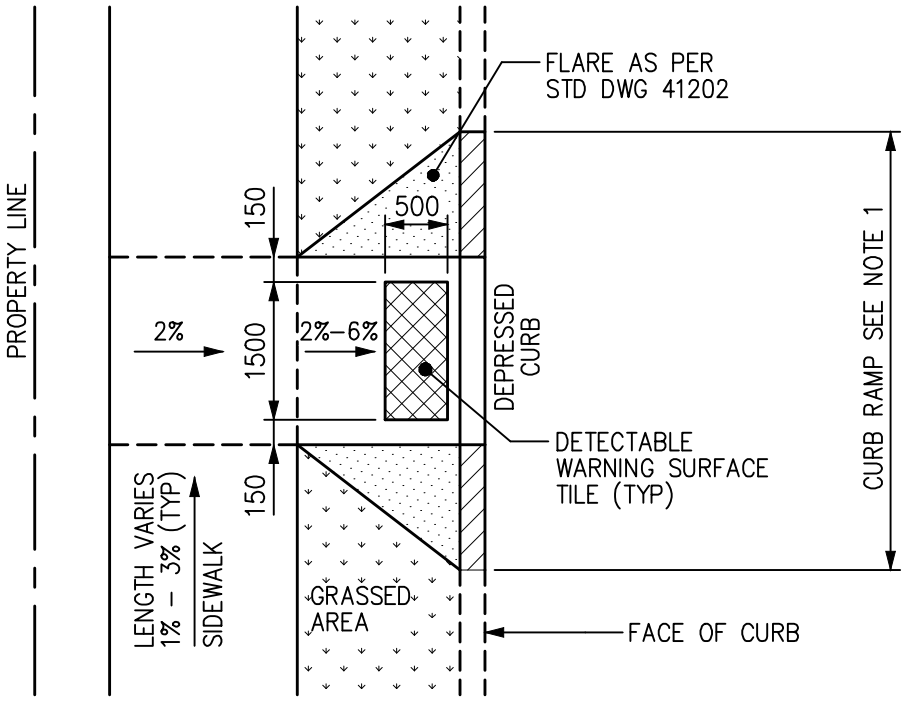
NOT ALLOWED

BREMNER AREA PROJECT

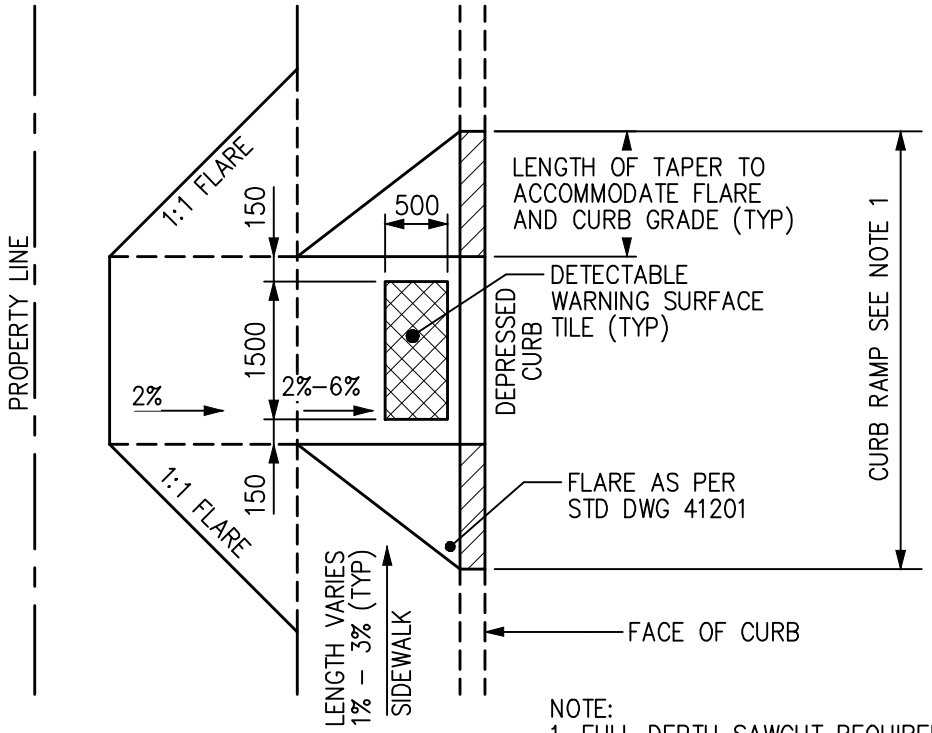
STRATHCONA COUNTY

TACTILE WALKING SURFACE INDICATOR LAYOUT FOR MONO WALK

REV 0	MARCH 2019	NTS	2001



BOULEVARD SIDEWALK



MONOLITHIC SIDEWALK

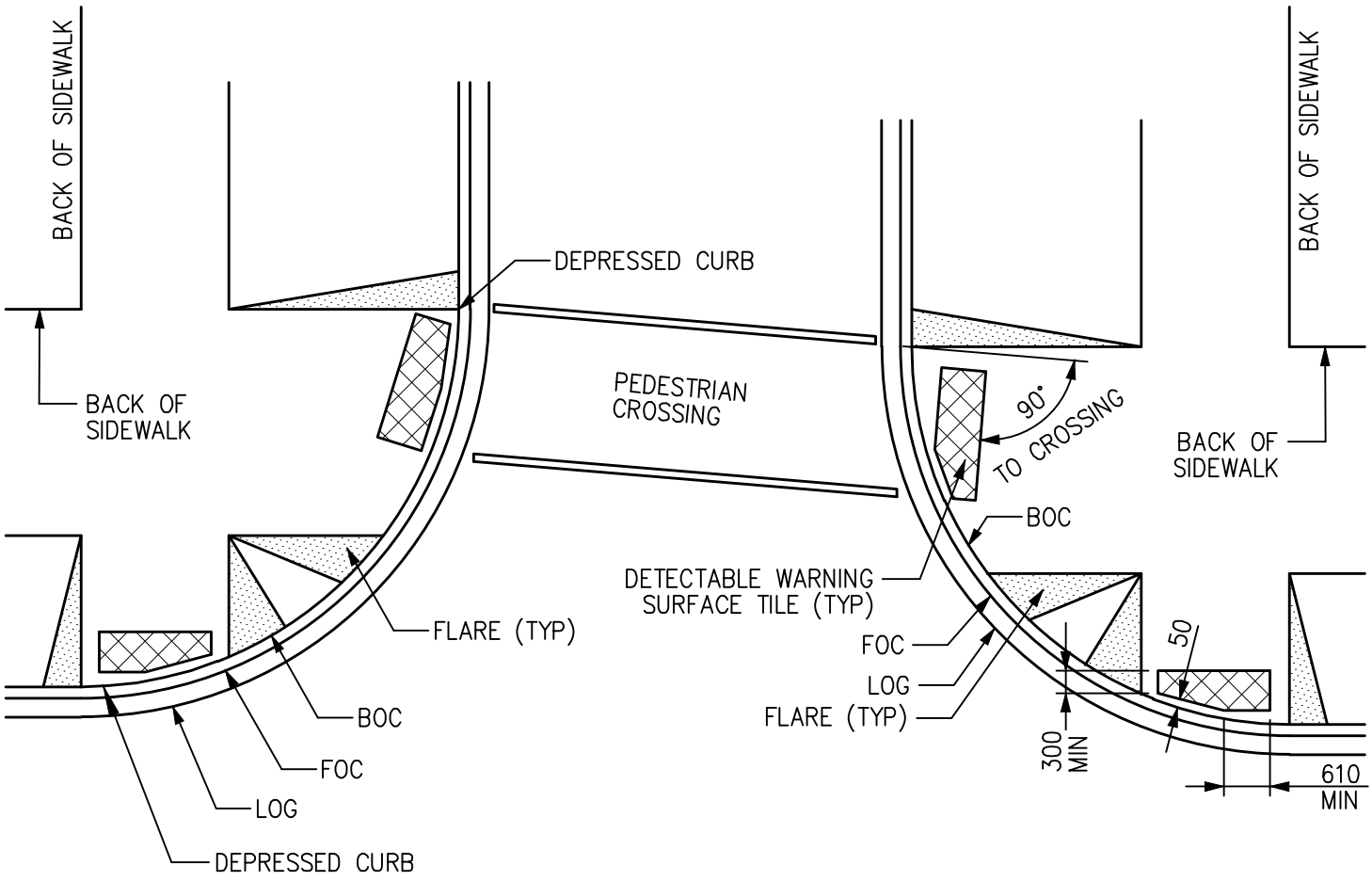
NOTE:
1. FULL DEPTH SAWCUT REQUIRED THROUGH THE STREET SLAB ALONG CURB RAMP.

BREMNER AREA PROJECT

STRATHCONA COUNTY

TACTILE WALKING SURFACE INDICATOR LAYOUT FOR MID-BLOCK CROSSING

REV 0	MARCH 2019	NTS	2002



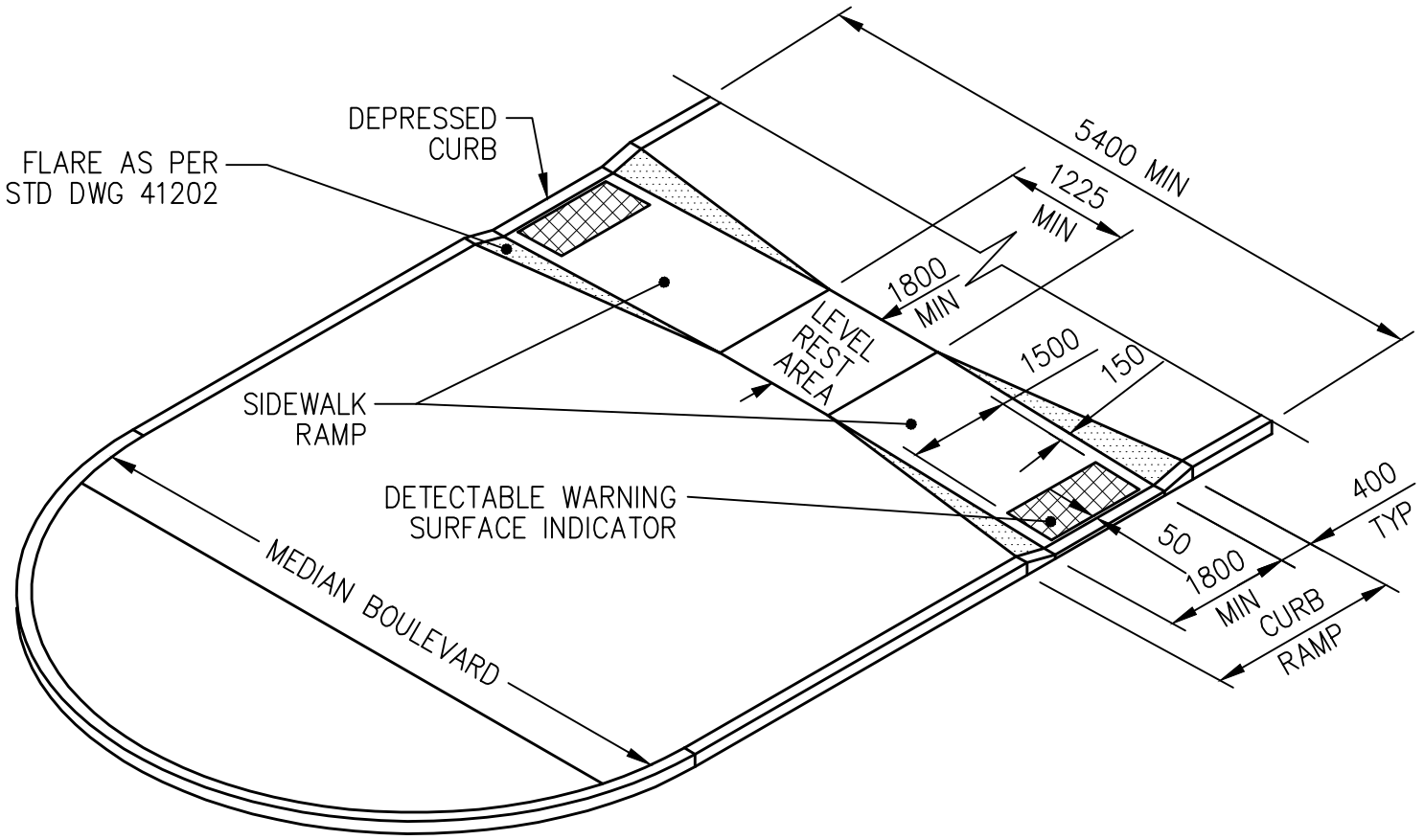
NOTE:
1. LOCATE END OF DEPRESSED CURB IN LINE WITH PROJECTED BACK OF SIDEWALK.

BREMNER AREA PROJECT

STRATHCONA COUNTY

TACTILE WALKING SURFACE INDICATOR LAYOUT FOR OFFSET INTERSECTIONS

REV 0	MARCH 2019	NTS	2003



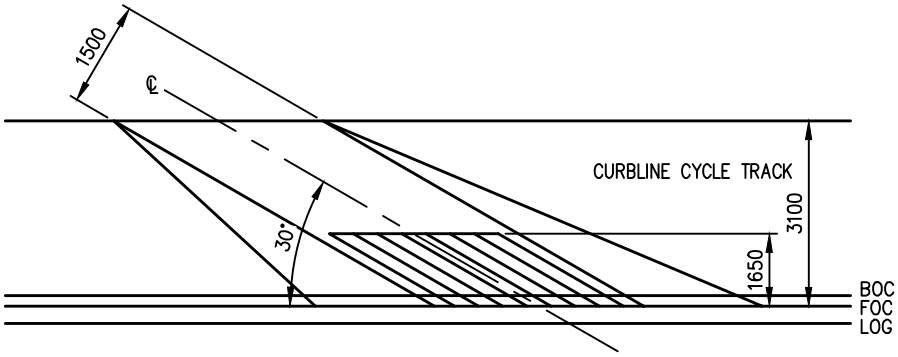
MEDIAN SIDEWALK CROSSING

BREMNER AREA PROJECT

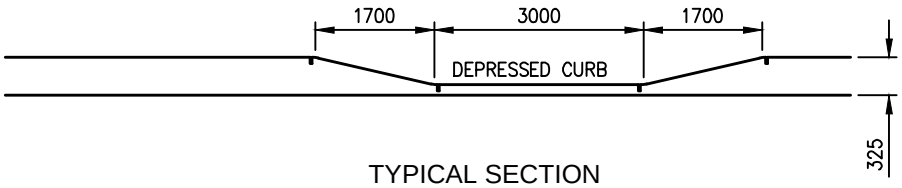
STRATHCONA COUNTY

TACTILE WALKING SURFACE INDICATOR MEDIAN DETAIL

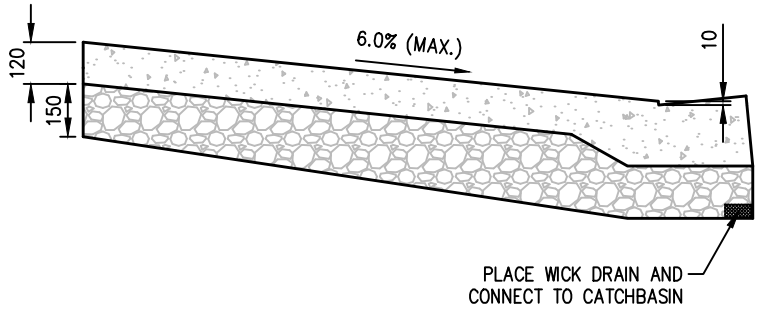
REV 0	MARCH 2019	NTS	2004



TYPICAL PLAN



TYPICAL SECTION



TYPICAL ELEVATION

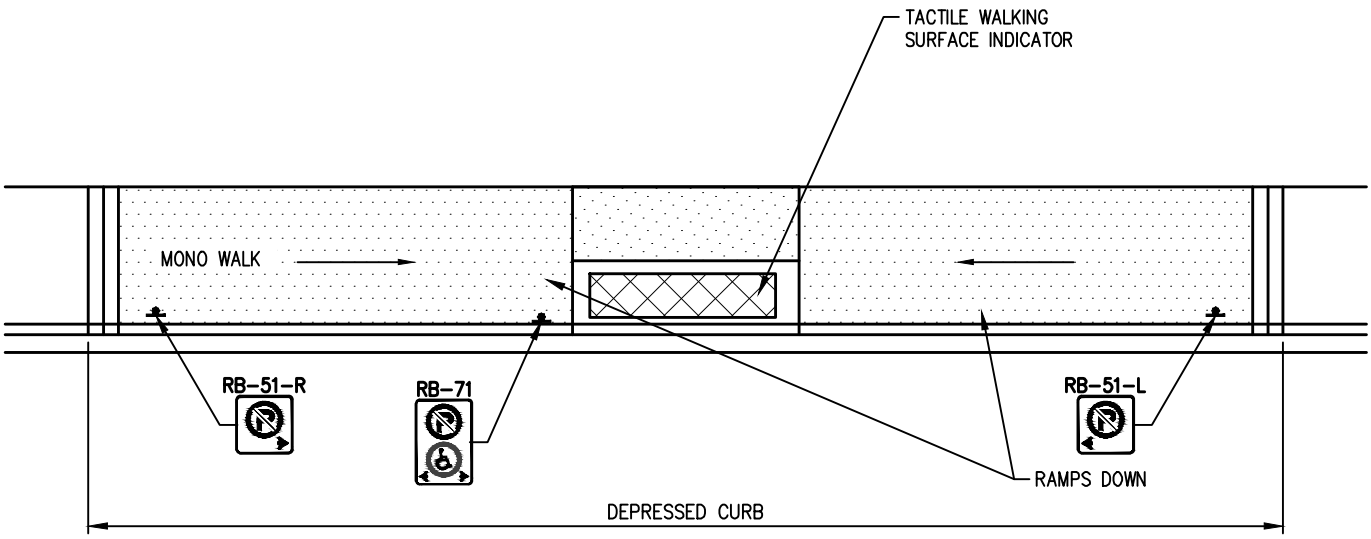
NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. REPLACE CURBLINE CYCLE TRACK TO NEAREST JOINTS.
3. CURB AND RAMP TO BE POURED MONOLITHICALLY.
4. BROOMED FINISH. TOOLED GROOVES 5mm WIDE x 10mm DEEP, SPACED 150mm o.c.

BREMNER AREA PROJECT

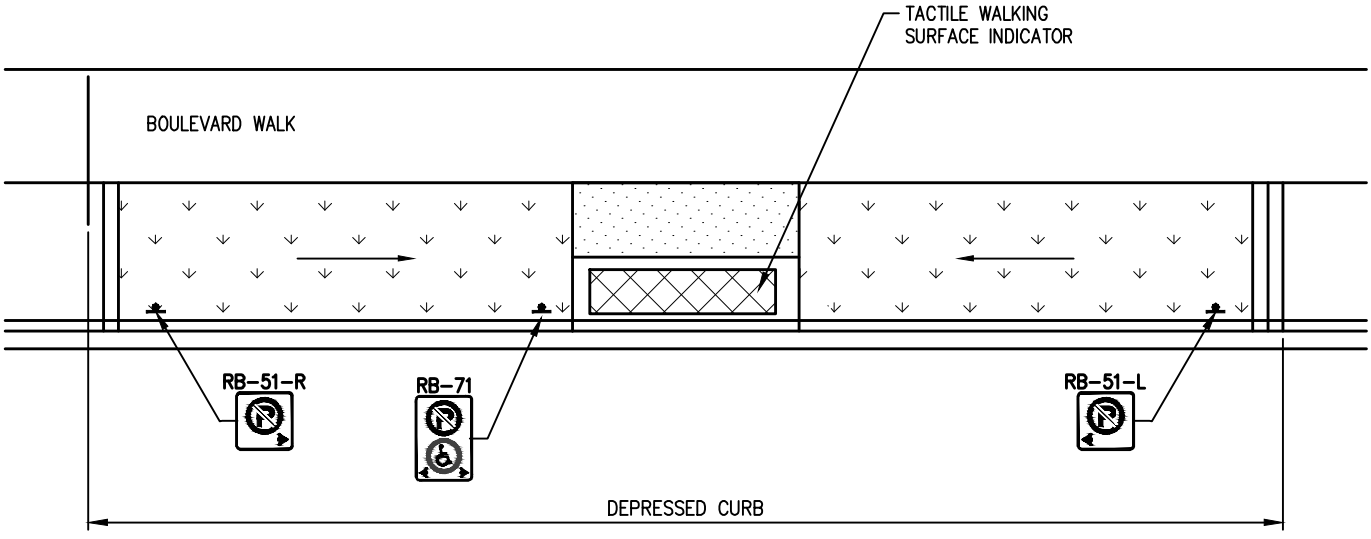
STRATHCONA COUNTY

MID-BLOCK CYCLE TRACK SLIP RAMP

REV 0	MARCH 2019	NTS	2005



MONOLITHIC SIDEWALK



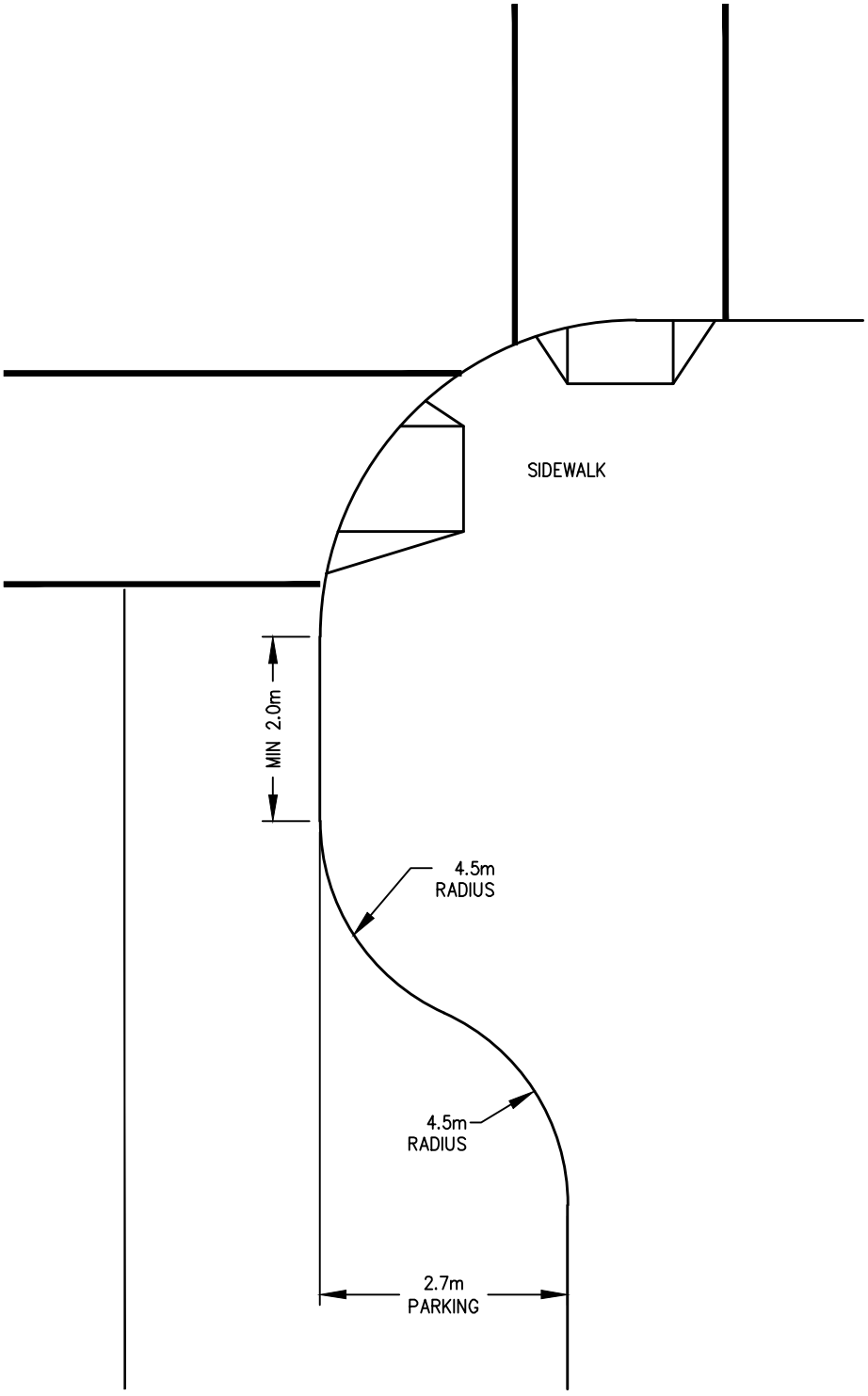
BOULEVARD SIDEWALK

BREMNER AREA PROJECT

STRATHCONA COUNTY

ACCESSIBLE PARKING

REV 0	MARCH 2019	NTS	2007

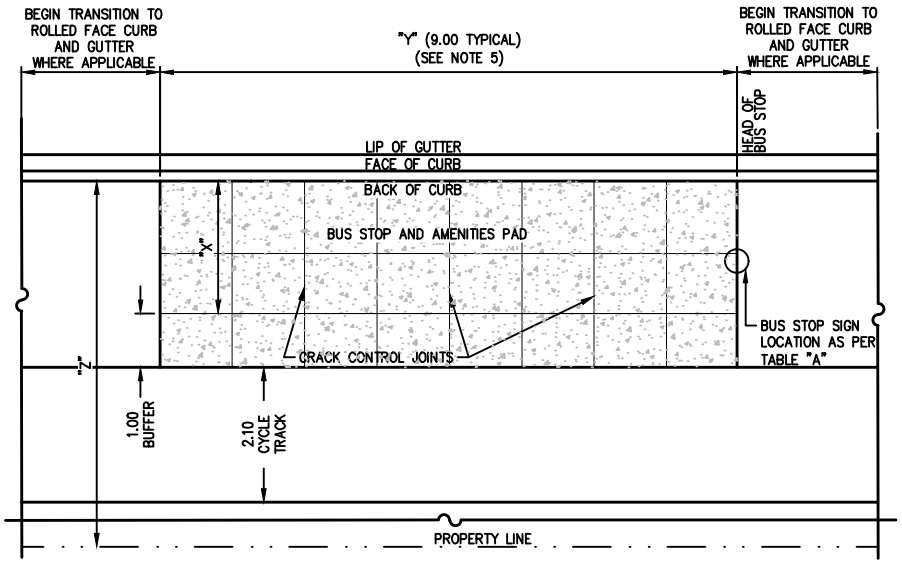


BREMNER AREA PROJECT

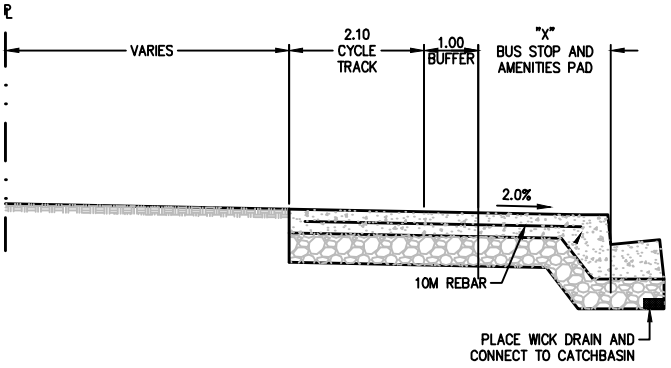
STRATHCONA COUNTY

TYPICAL CURB EXTENSION

REV 0	MARCH 2019	NTS	2008



TYPICAL PLAN



TYPICAL SECTION

CONDITION	"Z" DISTANCE TO PROPERTY LINE	"X" REQUIRED PAD WIDTH
OVER CONSTRAINED	"Z" < 3.1	2.8
CONSTRAINED	3.1 <= "Z" < 3.9	"Z" – 0.30 (MAX 3.0)
NOT CONSTRAINED	"Z" >3.9	"Z" – 0.30 (MAX 3.0)

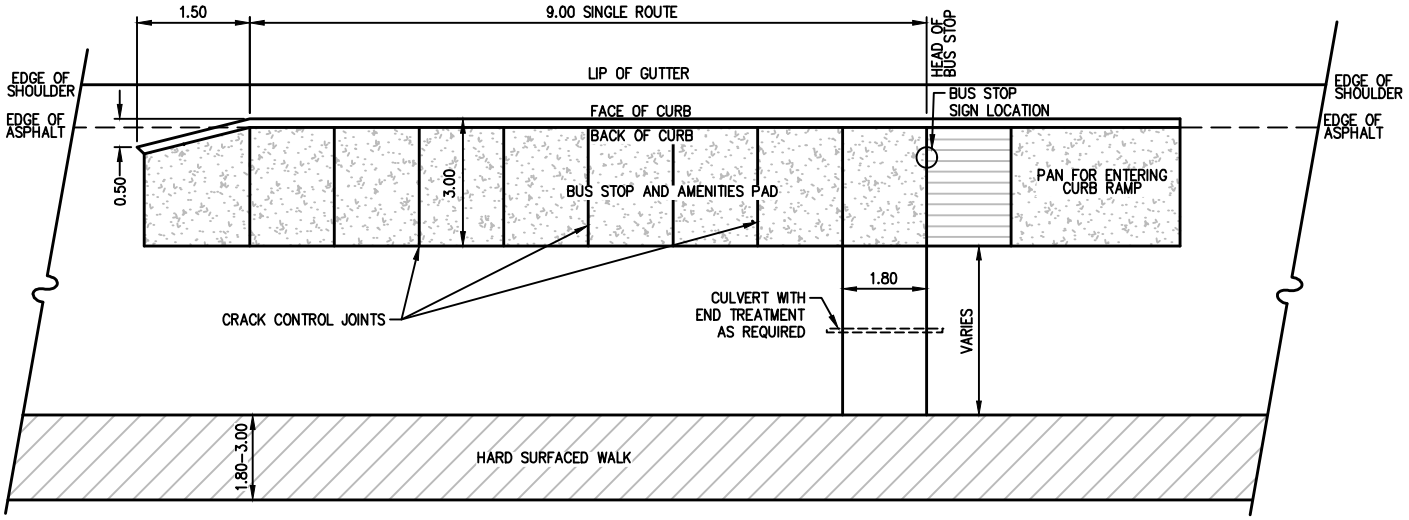
NOTES:
1. ALL DIMENSIONS IN METRES (m) UNLESS OTHERWISE NOTED.
2. PROVIDE BUS STOP AND AMENITIES PAD WITH WIDTH "X" AND LENGTH "Y" IN ACCORDANCE WITH THE DRAWING NOTES AND TABLE ABOVE. PROVIDE APPROPRIATE CRACK CONTROL JOINTS THROUGHOUT.
3. STRAIGHT FACE CURB AND GUTTER REQUIRED AT BUS STOP.
4. BUS STOP AND AMENITIES PAD TO BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
5. MAINTAIN A MINIMUM 0.3m CLEARANCE BETWEEN PROPERTY LINE AND BUS STOP PAD.
6. CONCRETE ROAD BASE MAY BE REQUIRED ADJACENT TO THE BUS STOP PAD, SUBJECT TO REVIEW BY COUNTY.

BREMNER AREA PROJECT

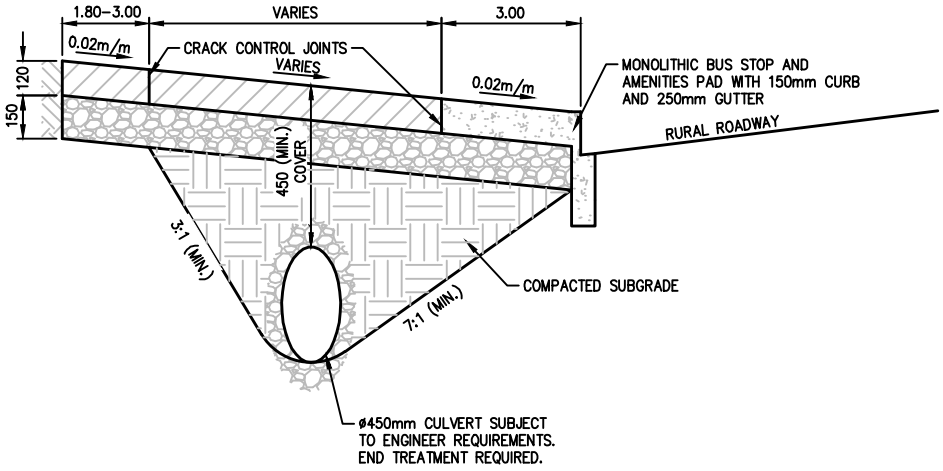
STRATHCONA COUNTY

BUS STOP AND AMENITIES PAD WITH CYCLE TRACK

REV 0	MARCH 2019	NTS	2009



TYPICAL PLAN



TYPICAL SECTION

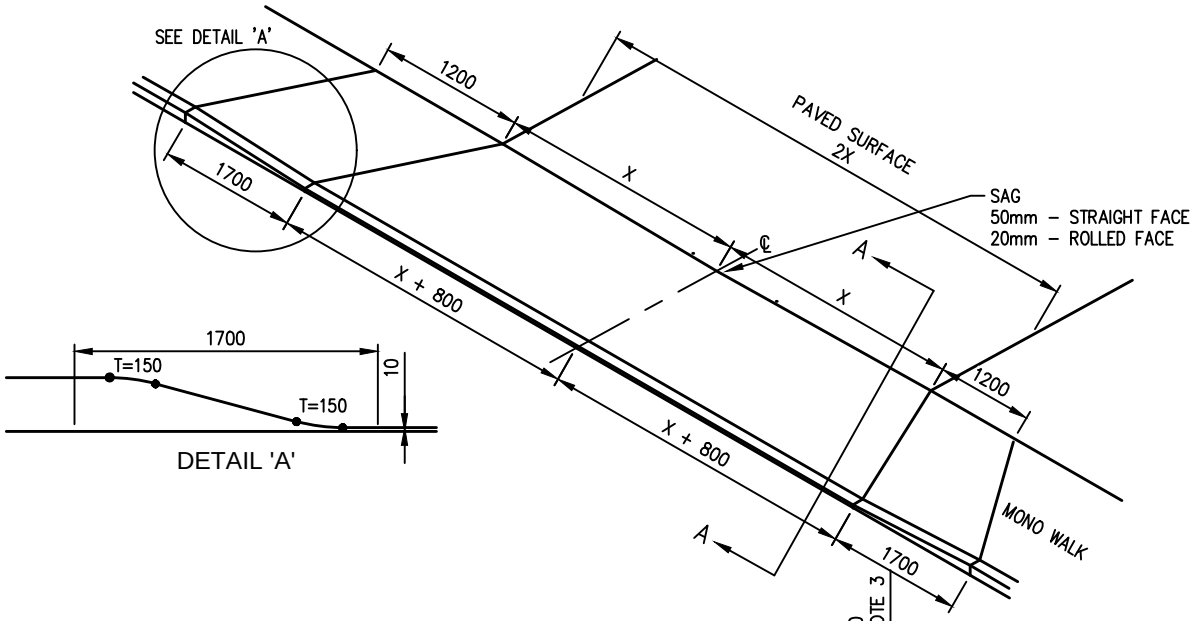
NOTES:
1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.
2. STRAIGHT FACE CURB AND GUTTER REQUIRED AT BUS STOP.
3. CURB RAMP AT HEAD OF BUS STOP IS REQUIRED IF THERE IS NO EXISTING BOULEVARD CONNECTION. CURB RAMP TO BE FLUSHED WITH EDGE OF ASPHALT.
4. RAILING REQUIREMENT AT BACK OF BUS STOP TO BE DETERMINED AT DETAILED DESIGN TO SATISFACTION OF ENGINEER.

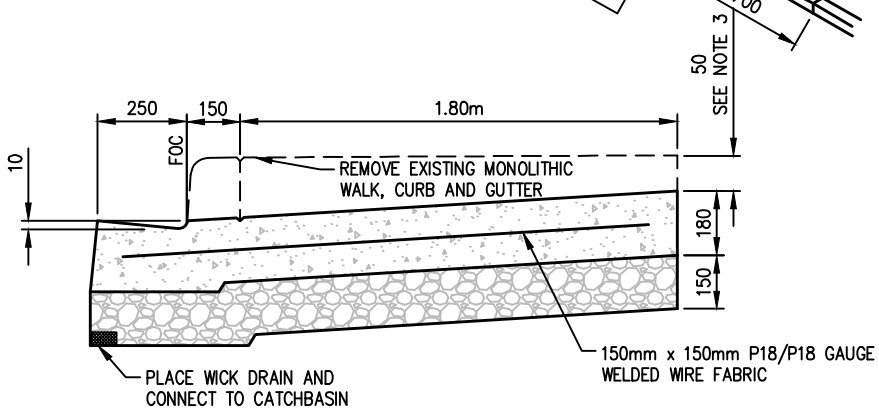
BREMNER AREA PROJECT

STRATHCONA COUNTY

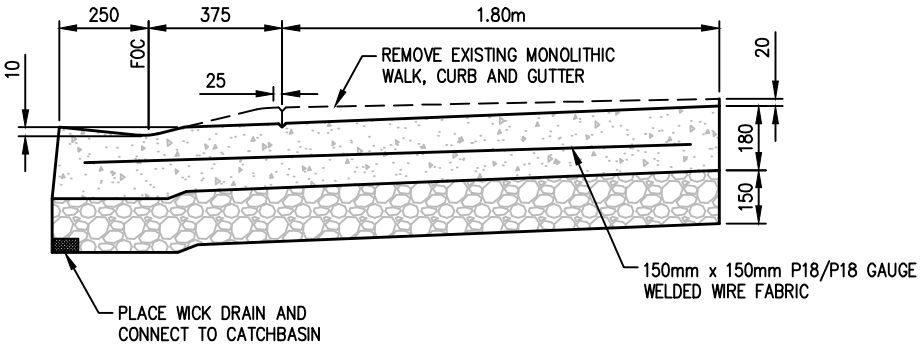
BUS STOP AND AMENITIES PAD RURAL ROADWAY

REV 0	MARCH 2019	NTS	2010





SECTION A-A STRAIGHT FACE



SECTION A-A ROLLED FACE

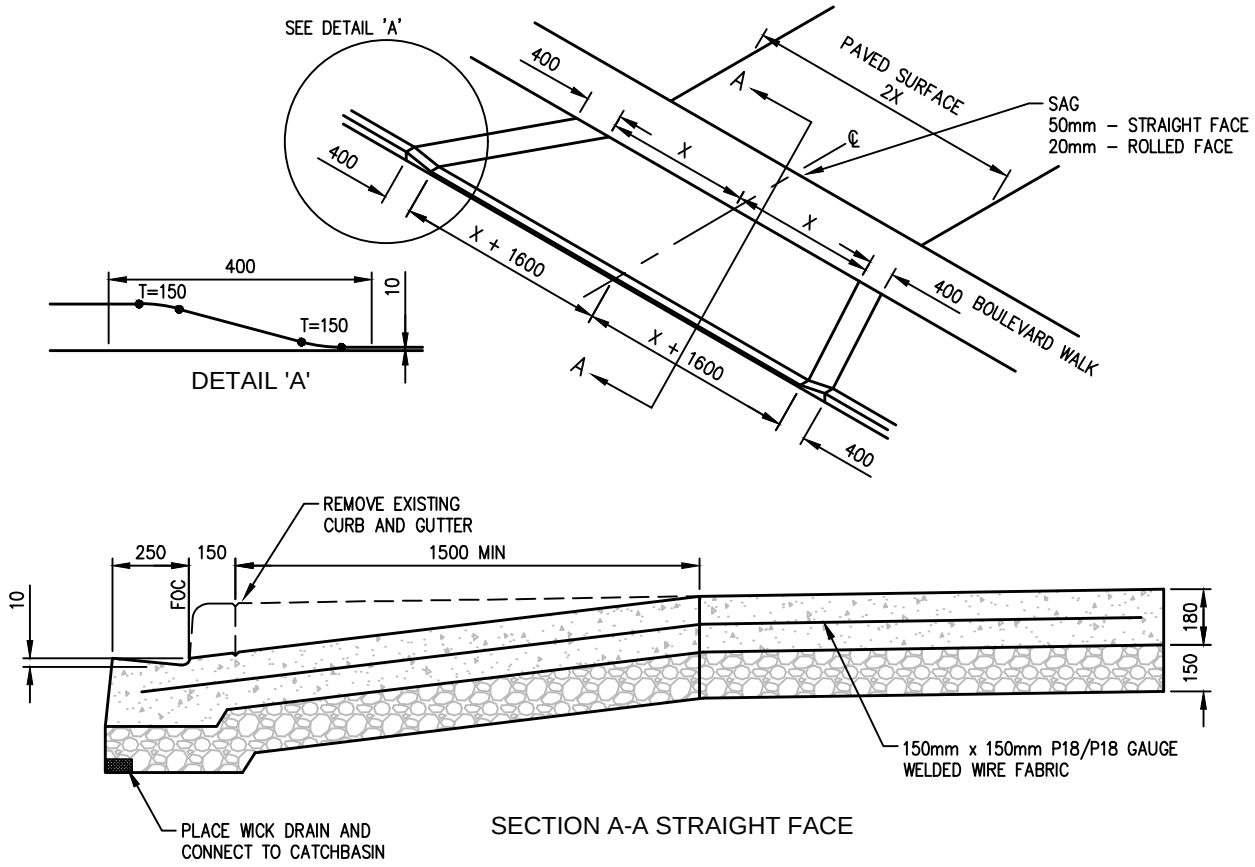
NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. MAXIMUM CROSSFALL SLOPE TO BE 6.00% UNLESS OTHERWISE APPROVED BY ENGINEER.
3. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
4. BACK OF CROSSING DROP FOR EXISTING 200mm CURB FACE TO BE 50mm.

BREMNER AREA PROJECT

STRATHCONA COUNTY

RESIDENTIAL ALLEY CROSSING MONO WALK

REV 0	MARCH 2019	NTS	2011



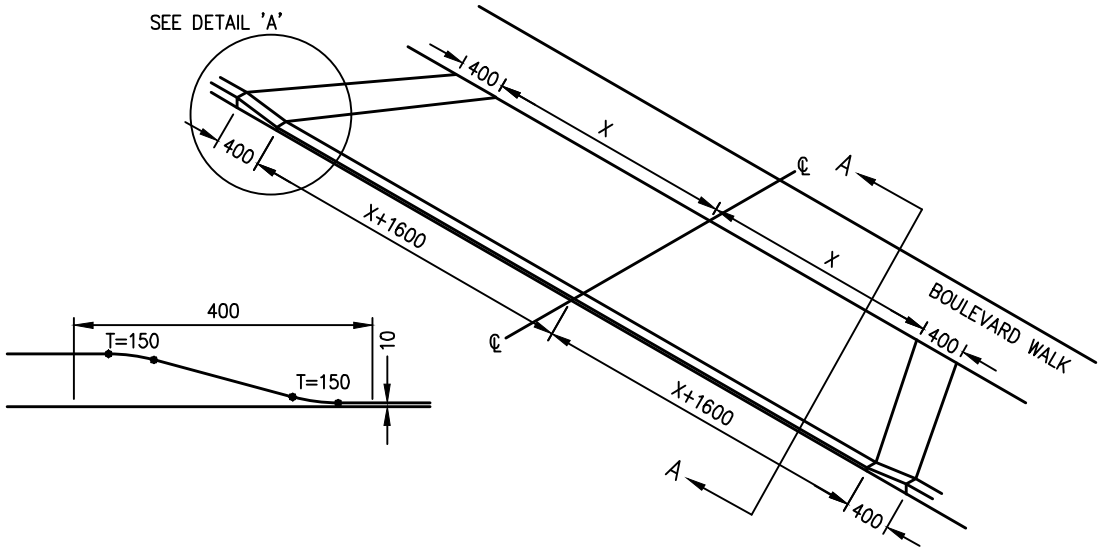
NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. MAXIMUM CROSSFALL SLOPE TO BE 6.00% UNLESS OTHERWISE APPROVED BY ENGINEER.
3. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.
4. ALTERNATIVE REINFORCING 10M REBAR ON 300 GRID WITH 75 COVER FROM BOTTOM AND EDGE OF SLAB.

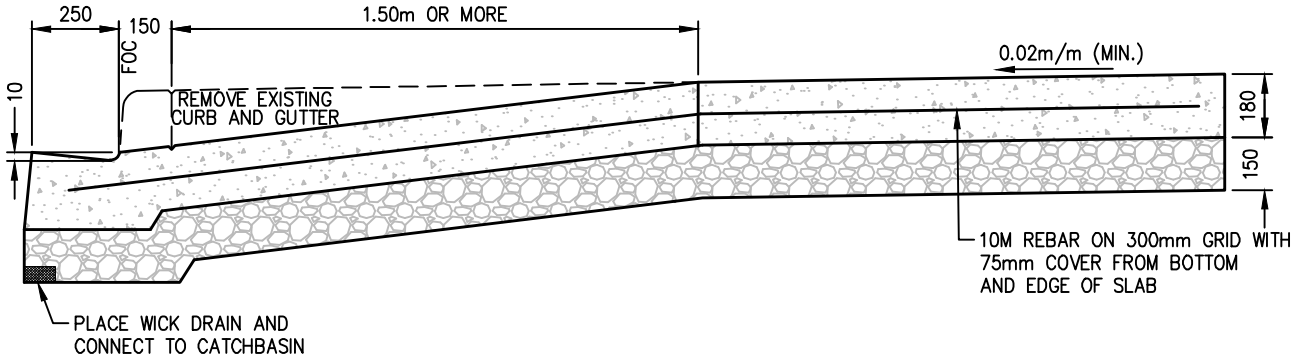
BREMNER AREA PROJECT

STRATHCONA COUNTY

RESIDENTIAL ALLEY CROSSING BOULEVARD WALK

REV 0	MARCH 2019	NTS	2012





NOTES:
1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. MAXIMUM CROSSFALL SLOPE TO BE 6.00% UNLESS APPROVED BY ENGINEER.
3. CROSSING MUST BE POURED MONOLITHICALLY WITH CURB AND GUTTER.

BREMNER AREA PROJECT

STRATHCONA COUNTY

COMMERCIAL AND INDUSTRIAL CROSSING BOULEVARD WALK

REV 0	MARCH 2019	NTS	2013

ALL INFILTRATION FACILITIES

1. INFILTRATION FACILITIES MUST BE 5m FROM ANY BUILDING, BASEMENT, OR FOOTING
2. FACILITIES MUST HAVE EITHER AN OVERFLOW TO THE STORM SYSTEM OR AN OVERLAND OVERFLOW THAT DOES NOT IMPACT OTHER PROPERTIES
3. INFILTRATION FACILITIES SHOULD BE 2m FROM PROPERTY LINES WHEN LOCATED ON PRIVATE PROPERTY
4. BEST PRACTICE IS TO LIMIT THE SLOPE ON INFILTRATION SURFACE (FACILITY BASE) TO <1%. IF BMP LOCATION HAS A GREATER SLOPE, TERRACING, STEP-DOWNS OR MULTIPLE FACILITIES SHOULD BE USED
5. OBTAIN ALL UTILITY LOCATES PRIOR TO CONSTRUCTION
6. ALL FINISH GRADING ACTIVITIES IN THE INFILTRATION BMP SHOULD BE PERFORMED DURING DRY CONDITIONS TO PREVENT SOIL SMEARING AND COMPACTION. DEWATERING MAY BE NECESSARY PRIOR TO COMMENCING WORK.
7. THE RIGHT EQUIPMENT IS CRITICAL TO THE SUCCESS OF THE PROJECT:

   A) EXCAVATION OF THE INFILTRATION BMP SHOULD BE DONE FROM THE OUTSIDE REACHING IN WHEN POSSIBLE, USING A BACK HOE OR BUCKET WITH EXTENSION ARM. A TOOTHED BUCKET IS RECOMMENDED SO COMPACTION CAUSED BY EXCAVATION CAN BE BROKEN UP BY SCARIFYING THE FINISHED SURFACE.

   B) IF EQUIPMENT IS NEEDED INSIDE THE FACILITY, LOW GROUND PRESSURE RATED OR MARSH TRACK EQUIPMENT SHOULD BE USED TO MINIMIZE COMPACTION.
8. ONCE EXCAVATED TO SUBGRADE, THE INFILTRATION BMP BOTTOM AND SIDE SLOPES SHOULD BE SCARIFIED OR TILLED TO LOOSEN COMPACTED SOILS.
9. ONCE EXCAVATED TO SUBGRADE, SOIL TYPES AND DESIGN PARAMETERS AND ASSUMPTIONS SHOULD BE CONFIRMED THROUGH IN-SITU PERMEABILITY TESTING (E.G., PERMEAMETER MEASUREMENTS TO DETERMINE HYDRAULIC CONDUCTIVITY). RESULTS OF PERMEABILITY TESTING SHOULD BE REVIEWED BY THE DESIGNER AND, IF NECESSARY, CHANGES TO THE BMP DESIGN MAY BE REQUIRED.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

ROCK MATERIAL

1. CLEAN, WASHED GRANITIC ROCK MATERIAL IS RECOMMENDED. HOWEVER GRANITIC MATERIAL CAN BE COST PROHIBITIVE IN SOME REGIONS WITH A LIMESTONE- BASED GEOLOGIC HISTORY.
2. IT IS BEST TO AVOID LIMESTONE IF POSSIBLE BUT, IF IT IS SPECIFIED, NO FINES SHOULD BE ASSOCIATED WITH THE MATERIAL. ALL STRUCTURAL APPLICATIONS OF ROCK MATERIAL IN THE BASE AND SUB-BASE SHOULD ALSO FOLLOW THESE RECOMMENDATIONS.

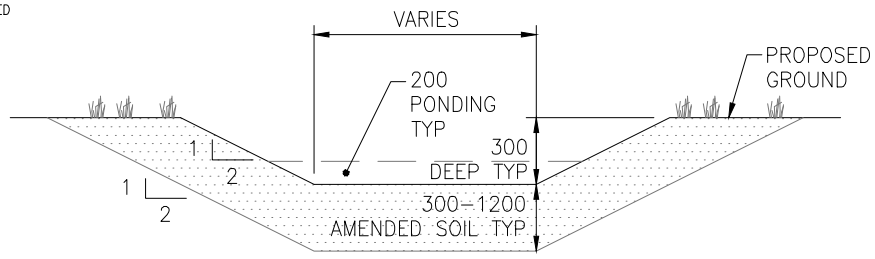
SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

AMENDED SOIL

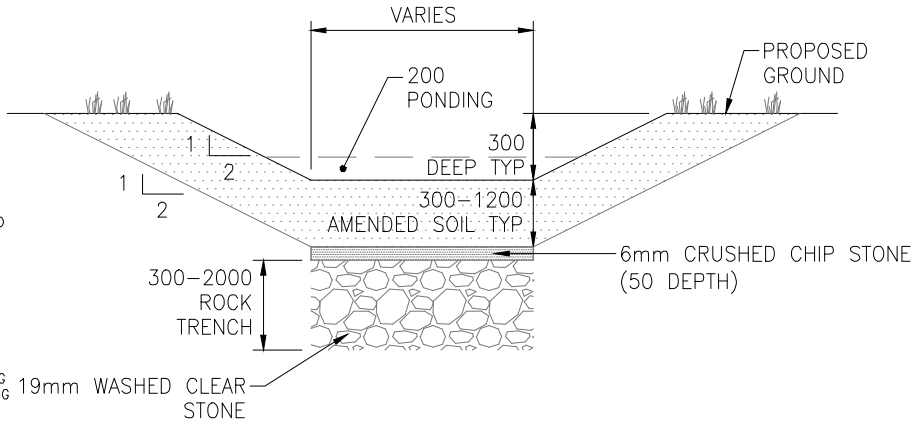
1. TEST MEDIA BEFORE DELIVERY TO SITE

   A) TEST AT LEAST TWO WEEKS BEFORE SOIL WILL BE NEEDED AS ATTAINING A PASSING SOIL MIX CAN TAKE UP TO 2 WEEKS AND MAY AFFECT SCHEDULING
2. TEST PILE IN 3 LOCATIONS (BOTTOM, MIDDLE, AND TOP) AND RETEST IF TEST COME BACK WITH BORDERLINE RESULTS
3. REPEAT TESTING EVERY 250-500 CUBIC YARDS OF SOIL
4. ENSURE FINES ARE OPTIMAL PER DESIGN SPECIFICATION
5. SOILS WILL BE DEEMED ACCEPTABLE BY A QUALIFIED EXPERT (ENGINEER, LANDSCAPE ARCHITECT OR OTHER)
6. INSTALL MEDIA IN 150mm LIFTS AND HYDRAULICALLY COMPACT, BOOT COMPACT, OR COMPACT WITH WEIGHTED LAWN ROLLER
7. ONCE INSTALLED IMMEDIATELY PREPARE THE SOIL MEDIA TO RECEIVE PLANTINGS TO REDUCE POLLUTANTS AND SOIL EROSION
8. IF SOIL MEDIA WILL NOT IMMEDIATELY RECEIVE PLANTINGS, COVER THE SURFACE (E.G. TEMPORARY TARPING, PLYWOOD, SACRIFICIAL SOD OR GEOTEXTILE) TO PROTECT IT IN THE INTERIM
9. RESTRICT ALL VEHICULAR TRAFFIC FORM THE INSTALLED SOIL MEDIA

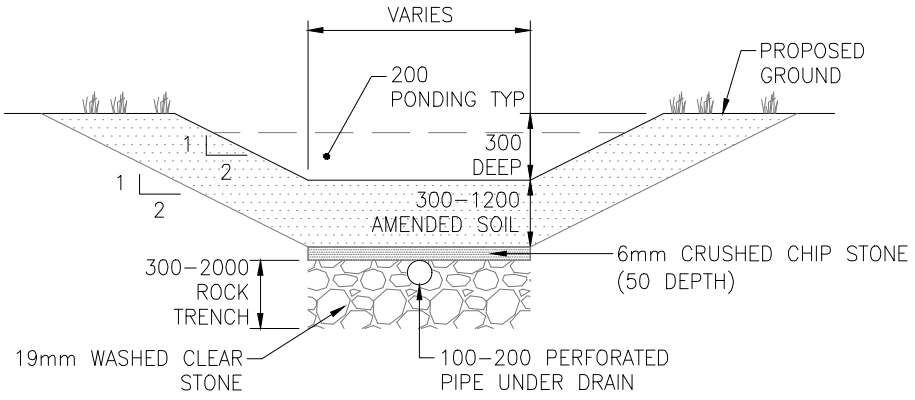
SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION



BIO-RETENTION WITHOUT ROCK TRENCH
WELL DRAINING SOILS



BIO-RETENTION WITH ROCK TRENCH
WELL DRAINING SOILS



BIO-RETENTION WITH ROCK TRENCH
POOR DRAINING SOILS

BREMNER AREA PROJECT

STRATHCONA COUNTY

BIO-RETENTION / RAIN GARDEN

REV 0	MARCH 2019	NTS	3000

ALL INFILTRATION FACILITIES

1. INFILTRATION FACILITIES MUST BE 5m FROM ANY BUILDING, BASEMENT, OR FOOTING
2. FACILITIES MUST HAVE EITHER AN OVERFLOW TO THE STORM SYSTEM OR AN OVERLAND OVERFLOW THAT DOES NOT IMPACT OTHER PROPERTIES
3. INFILTRATION FACILITIES SHOULD BE 2m FROM PROPERTY LINES WHEN LOCATED ON PRIVATE PROPERTY
4. BEST PRACTICE IS TO LIMIT THE SLOPE ON INFILTRATION SURFACE (FACILITY BASE) TO <1%. IF BMP LOCATION HAS A GREATER SLOPE, TERRACING, STEP-DOWNS OR MULTIPLE FACILITIES SHOULD BE USED
5. OBTAIN ALL UTILITY LOCATES PRIOR TO CONSTRUCTION
6. ALL FINISH GRADING ACTIVITIES IN THE INFILTRATION BMP SHOULD BE PERFORMED DURING DRY CONDITIONS TO PREVENT SOIL SMEARING AND COMPACTION. DEWATERING MAY BE NECESSARY PRIOR TO COMMENCING WORK.
7. THE RIGHT EQUIPMENT IS CRITICAL TO THE SUCCESS OF THE PROJECT:

   A) EXCAVATION OF THE INFILTRATION BMP SHOULD BE DONE FROM THE OUTSIDE REACHING IN WHEN POSSIBLE, USING A BACK HOE OR BUCKET WITH EXTENSION ARM. A TOOTHED BUCKET IS RECOMMENDED SO COMPACTION CAUSED BY EXCAVATION CAN BE BROKEN UP BY SCARIFYING THE FINISHED SURFACE.

   B) IF EQUIPMENT IS NEEDED INSIDE THE FACILITY, LOW GROUND PRESSURE RATED OR MARSH TRACK EQUIPMENT SHOULD BE USED TO MINIMIZE COMPACTION.
8. ONCE EXCAVATED TO SUBGRADE, THE INFILTRATION BMP BOTTOM AND SIDE SLOPES SHOULD BE SCARIFIED OR TILLED TO LOOSEN COMPACTED SOILS.
9. ONCE EXCAVATED TO SUBGRADE, SOIL TYPES AND DESIGN PARAMETERS AND ASSUMPTIONS SHOULD BE CONFIRMED THROUGH IN-SITU PERMEABILITY TESTING (E.G., PERMEAMETER MEASUREMENTS TO DETERMINE HYDRAULIC CONDUCTIVITY). RESULTS OF PERMEABILITY TESTING SHOULD BE REVIEWED BY THE DESIGNER AND, IF NECESSARY, CHANGES TO THE BMP DESIGN MAY BE REQUIRED.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

ROCK MATERIAL

1. CLEAN, WASHED GRANITIC ROCK MATERIAL IS RECOMMENDED. HOWEVER GRANITIC MATERIAL CAN BE COST PROHIBITIVE IN SOME REGIONS WITH A LIMESTONE- BASED GEOLOGIC HISTORY.
2. IT IS BEST TO AVOID LIMESTONE IF POSSIBLE BUT, IF IT IS SPECIFIED, NO FINES SHOULD BE ASSOCIATED WITH THE MATERIAL. ALL STRUCTURAL APPLICATIONS OF ROCK MATERIAL IN THE BASE AND SUB-BASE SHOULD ALSO FOLLOW THESE RECOMMENDATIONS.

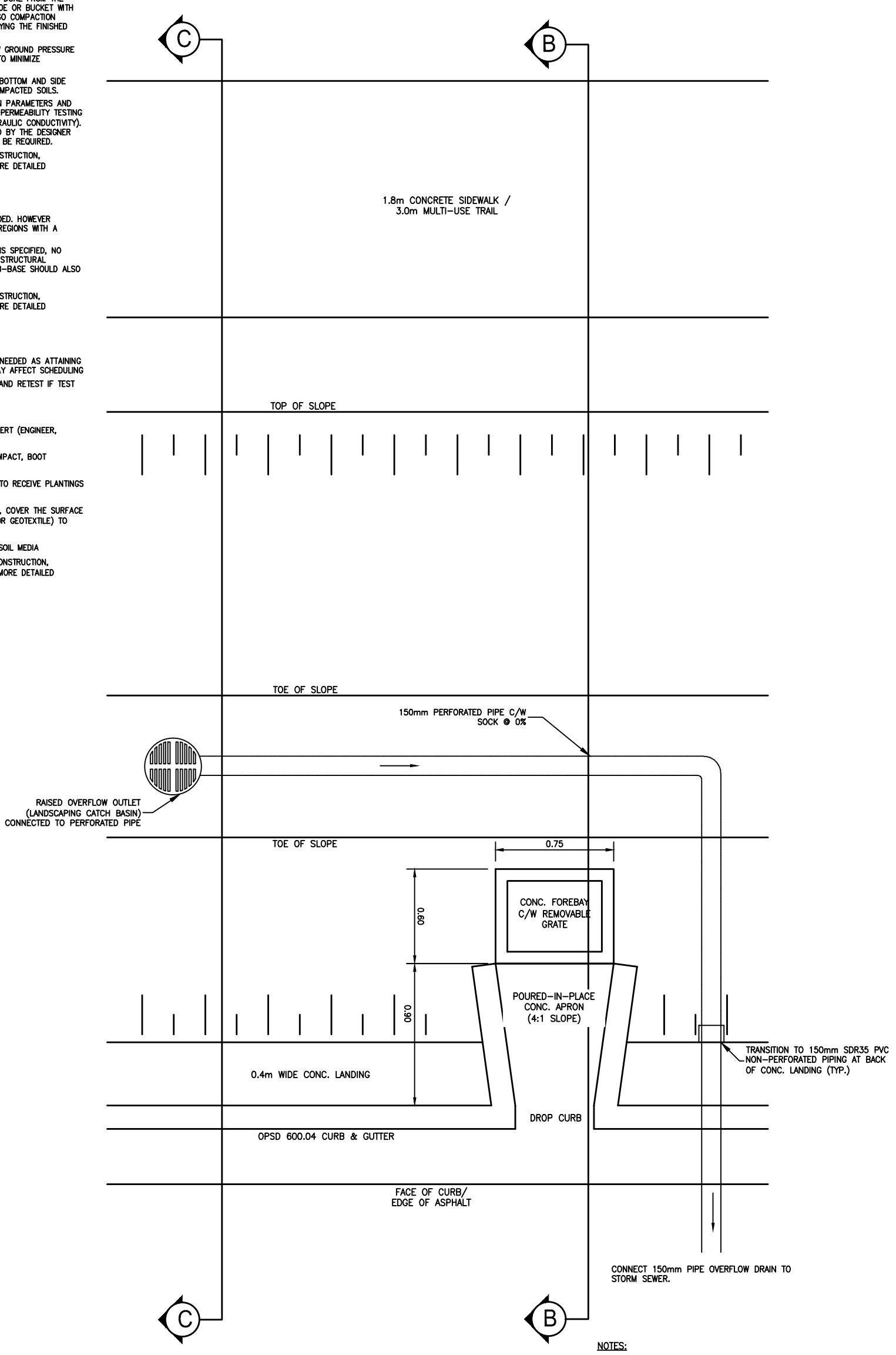
SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

AMENDED SOIL

1. TEST MEDIA BEFORE DELIVERY TO SITE

   A) TEST AT LEAST TWO WEEKS BEFORE SOIL WILL BE NEEDED AS ATTAINING A PASSING SOIL MIX CAN TAKE UP TO 2 WEEKS AND MAY AFFECT SCHEDULING
2. TEST PILE IN 3 LOCATIONS (BOTTOM, MIDDLE, AND TOP) AND RETEST IF TEST COME BACK WITH BORDERLINE RESULTS
3. REPEAT TESTING EVERY 250-500 CUBIC YARDS OF SOIL
4. ENSURE FINES ARE OPTIMAL PER DESIGN SPECIFICATION
5. SOILS WILL BE DEEMED ACCEPTABLE BY A QUALIFIED EXPERT (ENGINEER, LANDSCAPE ARCHITECT OR OTHER)
6. INSTALL MEDIA IN 150mm LIFTS AND HYDRAULICALLY COMPACT, BOOT COMPACT, OR COMPACT WITH WEIGHTED LAWN ROLLER
7. ONCE INSTALLED IMMEDIATELY PREPARE THE SOIL MEDIA TO RECEIVE PLANTINGS TO REDUCE POLLUTANTS AND SOIL EROSION
8. IF SOIL MEDIA WILL NOT IMMEDIATELY RECEIVE PLANTINGS, COVER THE SURFACE (E.G. TEMPORARY TARPING, PLYWOOD, SACRIFICIAL SOD OR GEOTEXTILE) TO PROTECT IT IN THE INTERIM
9. RESTRICT ALL VEHICULAR TRAFFIC FORM THE INSTALLED SOIL MEDIA

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION



NOTES:

1. 19mm CLEAR STONE TO BE TRIPLE WASHED STONE. SEE SPECIFICATIONS FOR ALL SOIL AND GRANULAR REQUIREMENTS FOR L.I.D. RAIN GARDEN INSTALLATIONS.
2. JOINTS IN 0.4m CONC. LANDING TO FOLLOW STRATHCONA COUNTY STANDARDS
3. PRECAST CONC. APRON TO BE MINIMUM 100mm THICK.

BREMNER AREA PROJECT

STRATHCONA COUNTY

ROADSIDE BIO-RETENTION / RAIN GARDEN

REV 0	MARCH 2019	NTS	3001

ROCK MATERIAL

1. CLEAN, WASHED GRANITIC ROCK MATERIAL IS RECOMMENDED. HOWEVER GRANITIC MATERIAL CAN BE COST PROHIBITIVE IN SOME REGIONS WITH A LIMESTONE– BASED GEOLOGIC HISTORY.
2. IT IS BEST TO AVOID LIMESTONE IF POSSIBLE BUT, IF IT IS SPECIFIED, NO FINES SHOULD BE ASSOCIATED WITH THE MATERIAL. ALL STRUCTURAL APPLICATIONS OF ROCK MATERIAL IN THE BASE AND SUB–BASE SHOULD ALSO FOLLOW THESE RECOMMENDATIONS.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

AMENDED SOIL

1. TEST MEDIA BEFORE DELIVERY TO SITE

   A) TEST AT LEAST TWO WEEKS BEFORE SOIL WILL BE NEEDED AS ATTAINING A PASSING SOIL MIX CAN TAKE UP TO 2 WEEKS AND MAY AFFECT SCHEDULING
2. TEST PILE IN 3 LOCATIONS (BOTTOM, MIDDLE, AND TOP) AND RETEST IF TEST COME BACK WITH BORDERLINE RESULTS
3. REPEAT TESTING EVERY 250–500 CUBIC YARDS OF SOIL
4. ENSURE FINES ARE OPTIMAL PER DESIGN SPECIFICATION
5. SOILS WILL BE DEEMED ACCEPTABLE BY A QUALIFIED EXPERT (ENGINEER, LANDSCAPE ARCHITECT OR OTHER)
6. INSTALL MEDIA IN 150mm LIFTS AND HYDRAULICALLY COMPACT, BOOT COMPACT, OR COMPACT WITH WEIGHTED LAWN ROLLER
7. ONCE INSTALLED IMMEDIATELY PREPARE THE SOIL MEDIA TO RECEIVE PLANTINGS TO REDUCE POLLUTANTS AND SOIL EROSION
8. IF SOIL MEDIA WILL NOT IMMEDIATELY RECEIVE PLANTINGS, COVER THE SURFACE (E.G. TEMPORARY TARPING, PLYWOOD, SACRIFICIAL SOD OR GEOTEXTILE) TO PROTECT IT IN THE INTERIM
9. RESTRICT ALL VEHICULAR TRAFFIC FORM THE INSTALLED SOIL MEDIA

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

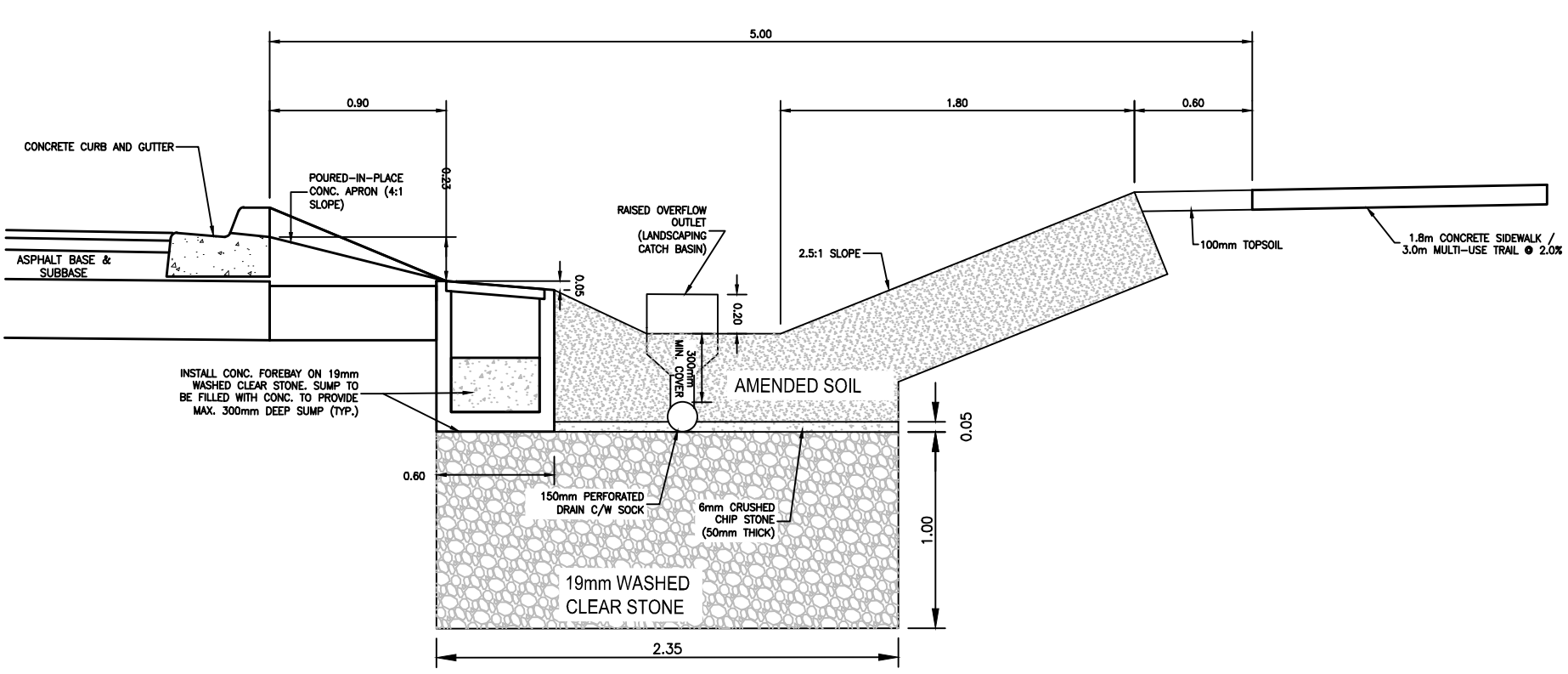
ALL INFILTRATION FACILITIES

1. INFILTRATION FACILITIES MUST BE 5m FROM ANY BUILDING, BASEMENT, OR FOOTING
2. FACILITIES MUST HAVE EITHER AN OVERFLOW TO THE STORM SYSTEM OR AN OVERLAND OVERFLOW THAT DOES NOT IMPACT OTHER PROPERTIES
3. INFILTRATION FACILITIES SHOULD BE 2m FROM PROPERTY LINES WHEN LOCATED ON PRIVATE PROPERTY
4. BEST PRACTICE IS TO LIMIT THE SLOPE ON INFILTRATION SURFACE (FACILITY BASE) TO <1% IF BMP LOCATION HAS A GREATER SLOPE, TERRACING, STEP–DOWNS OR MULTIPLE FACILITIES SHOULD BE USED
5. OBTAIN ALL UTILITY LOCATES PRIOR TO CONSTRUCTION
6. ALL FINISH GRADING ACTIVITIES IN THE INFILTRATION BMP SHOULD BE PERFORMED DURING DRY CONDITIONS TO PREVENT SOIL SMEARING AND COMPACTION. DEWATERING MAY BE NECESSARY PRIOR TO COMMENCING WORK.
7. THE RIGHT EQUIPMENT IS CRITICAL TO THE SUCCESS OF THE PROJECT:

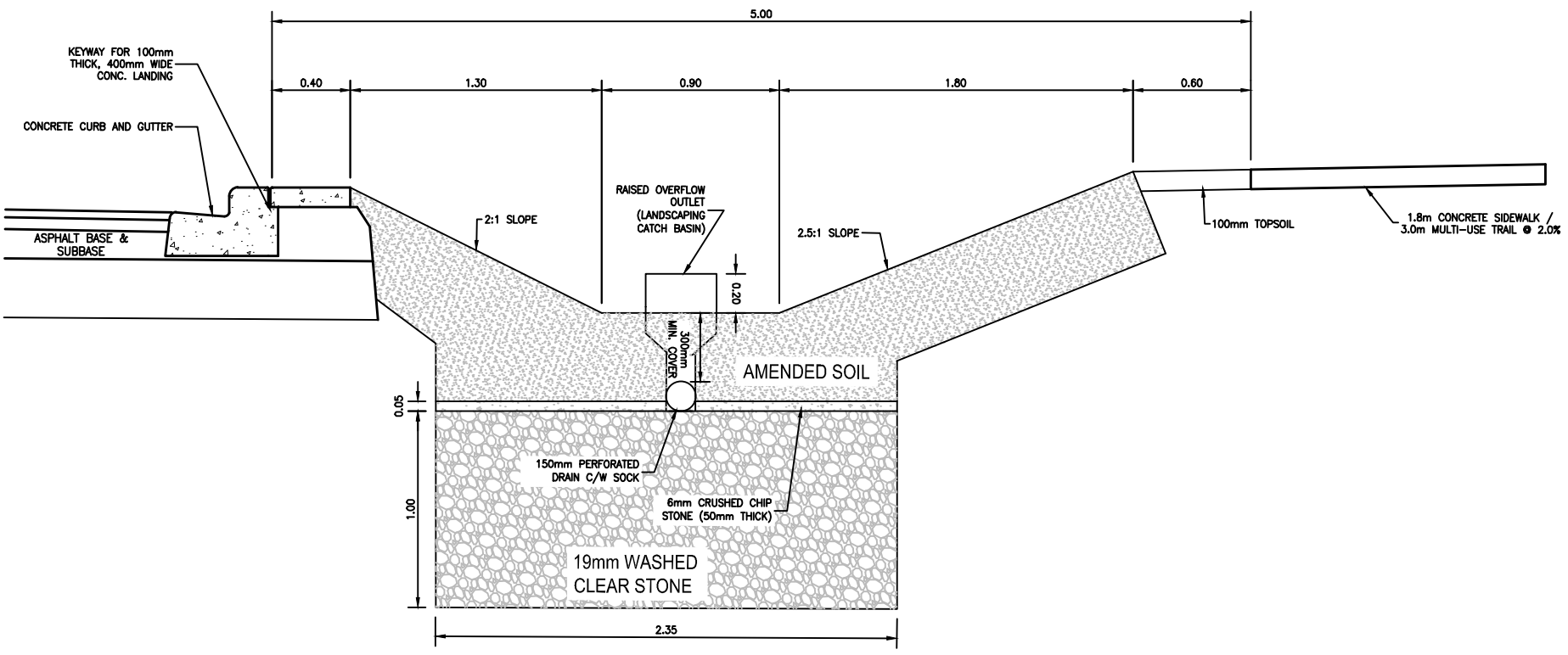
   A) EXCAVATION OF THE INFILTRATION BMP SHOULD BE DONE FROM THE OUTSIDE REACHING IN WHEN POSSIBLE, USING A BACK HOE OR BUCKET WITH EXTENSION ARM. A TOOTHED BUCKET IS RECOMMENDED SO COMPACTION CAUSED BY EXCAVATION CAN BE BROKEN UP BY SCARIFYING THE FINISHED SURFACE.

   B) IF EQUIPMENT IS NEEDED INSIDE THE FACILITY, LOW GROUND PRESSURE RATED OR MARSH TRACK EQUIPMENT SHOULD BE USED TO MINIMIZE COMPACTION.
8. ONCE EXCAVATED TO SUBGRADE, THE INFILTRATION BMP BOTTOM AND SIDE SLOPES SHOULD BE SCARIFIED OR TILLED TO LOOSEN COMPACTED SOILS.
9. ONCE EXCAVATED TO SUBGRADE, SOIL TYPES AND DESIGN PARAMETERS AND ASSUMPTIONS SHOULD BE CONFIRMED THROUGH IN–SITU PERMEABILITY TESTING (E.G., PERMEAMETER MEASUREMENTS TO DETERMINE HYDRAULIC CONDUCTIVITY). RESULTS OF PERMEABILITY TESTING SHOULD BE REVIEWED BY THE DESIGNER AND, IF NECESSARY, CHANGES TO THE BMP DESIGN MAY BE REQUIRED.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION



SECTION B-B



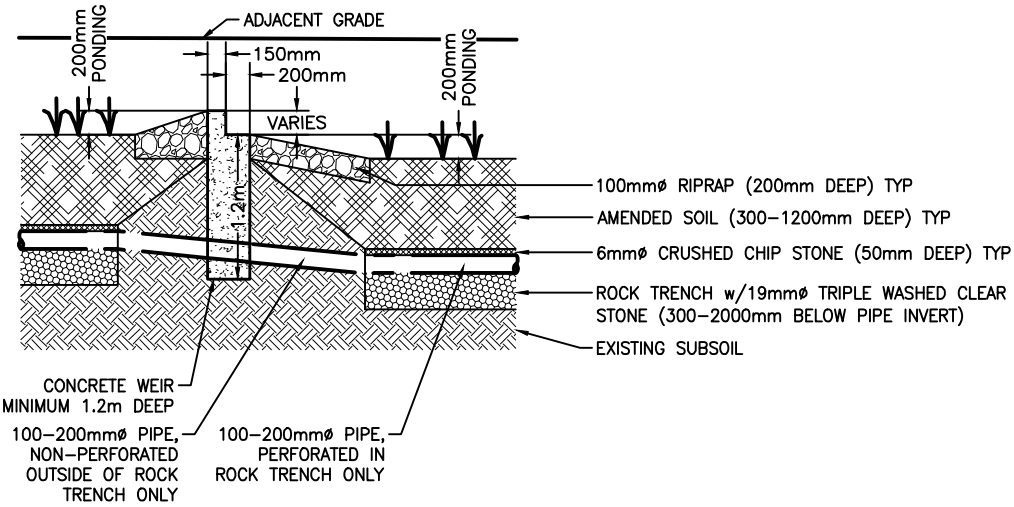
SECTION C-C

BREMNER AREA PROJECT

STRATHCONA COUNTY

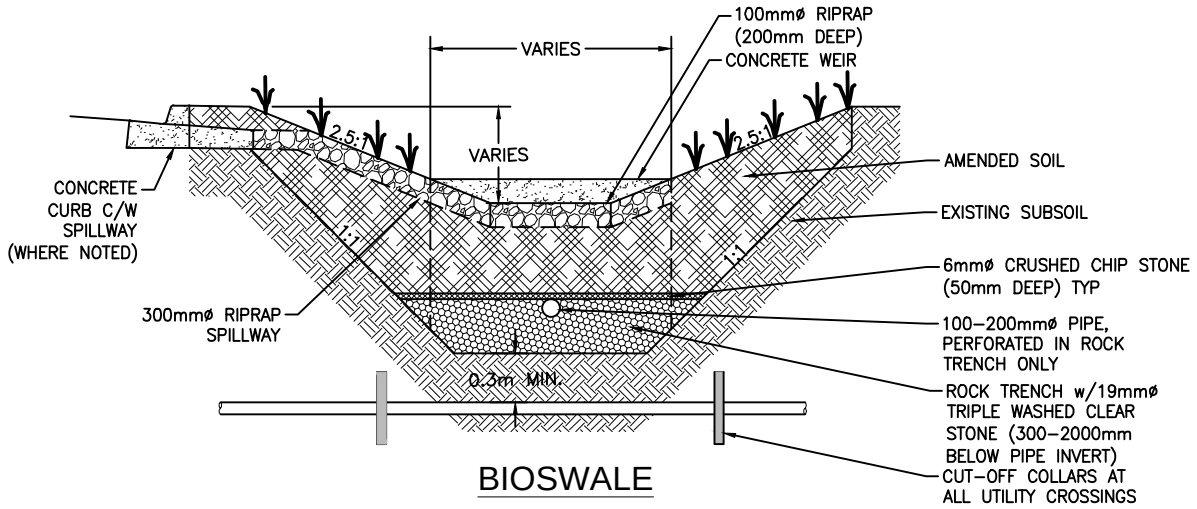
ROADSIDE BIO-RETENTION / RAIN GARDEN SECTIONS

REV 0	MARCH 2019	NTS	3002



BIOSWALE WEIR STRUCTURE

WELL DRAINING SOILS



BIOSWALE

ROCK MATERIAL

1. CLEAN, WASHED GRANITIC ROCK MATERIAL IS RECOMMENDED. HOWEVER GRANITIC MATERIAL CAN BE COST PROHIBITIVE IN SOME REGIONS WITH A LIMESTONE– BASED GEOLOGIC HISTORY.
2. IT IS BEST TO AVOID LIMESTONE IF POSSIBLE BUT, IF IT IS SPECIFIED, NO FINES SHOULD BE ASSOCIATED WITH THE MATERIAL. ALL STRUCTURAL APPLICATIONS OF ROCK MATERIAL IN THE BASE AND SUB–BASE SHOULD ALSO FOLLOW THESE RECOMMENDATIONS.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

AMENDED SOIL

1. TEST MEDIA BEFORE DELIVERY TO SITE

   A) TEST AT LEAST TWO WEEKS BEFORE SOIL WILL BE NEEDED AS ATTAINING A PASSING SOIL MIX CAN TAKE UP TO 2 WEEKS AND MAY AFFECT SCHEDULING
2. TEST PILE IN 3 LOCATIONS (BOTTOM, MIDDLE, AND TOP) AND RETEST IF TEST COME BACK WITH BORDERLINE RESULTS
3. REPEAT TESTING EVERY 250–500 CUBIC YARDS OF SOIL
4. ENSURE FINES ARE OPTIMAL PER DESIGN SPECIFICATION
5. SOILS WILL BE DEEMED ACCEPTABLE BY A QUALIFIED EXPERT (ENGINEER, LANDSCAPE ARCHITECT OR OTHER)
6. INSTALL MEDIA IN 150mm LIFTS AND HYDRAULICALLY COMPACT, BOOT COMPACT, OR COMPACT WITH WEIGHTED LAWN ROLLER
7. ONCE INSTALLED IMMEDIATELY PREPARE THE SOIL MEDIA TO RECEIVE PLANTINGS TO REDUCE POLLUTANTS AND SOIL EROSION
8. IF SOIL MEDIA WILL NOT IMMEDIATELY RECEIVE PLANTINGS, COVER THE SURFACE (E.G. TEMPORARY TARPING, PLYWOOD, SACRIFICIAL SOD OR GEOTEXTILE) TO PROTECT IT IN THE INTERIM
9. RESTRICT ALL VEHICULAR TRAFFIC FORM THE INSTALLED SOIL MEDIA

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

ALL INFILTRATION FACILITIES

1. INFILTRATION FACILITIES MUST BE 5m FROM ANY BUILDING, BASEMENT, OR FOOTING
2. FACILITIES MUST HAVE EITHER AN OVERFLOW TO THE STORM SYSTEM OR AN OVERLAND OVERFLOW THAT DOES NOT IMPACT OTHER PROPERTIES
3. INFILTRATION FACILITIES SHOULD BE 2m FROM PROPERTY LINES WHEN LOCATED ON PRIVATE PROPERTY
4. BEST PRACTICE IS TO LIMIT THE SLOPE ON INFILTRATION SURFACE (FACILITY BASE) TO <1% IF BMP LOCATION HAS A GREATER SLOPE, TERRACING, STEP–DOWNS OR MULTIPLE FACILITIES SHOULD BE USED
5. OBTAIN ALL UTILITY LOCATES PRIOR TO CONSTRUCTION
6. ALL FINISH GRADING ACTIVITIES IN THE INFILTRATION BMP SHOULD BE PERFORMED DURING DRY CONDITIONS TO PREVENT SOIL SMEARING AND COMPACTION. DEWATERING MAY BE NECESSARY PRIOR TO COMMENCING WORK.
7. THE RIGHT EQUIPMENT IS CRITICAL TO THE SUCCESS OF THE PROJECT:

   A) EXCAVATION OF THE INFILTRATION BMP SHOULD BE DONE FROM THE OUTSIDE REACHING IN WHEN POSSIBLE, USING A BACK HOE OR BUCKET WITH EXTENSION ARM. A TOOTHED BUCKET IS RECOMMENDED SO COMPACTION CAUSED BY EXCAVATION CAN BE BROKEN UP BY SCARIFYING THE FINISHED SURFACE.

   B) IF EQUIPMENT IS NEEDED INSIDE THE FACILITY, LOW GROUND PRESSURE RATED OR MARSH TRACK EQUIPMENT SHOULD BE USED TO MINIMIZE COMPACTION.
8. ONCE EXCAVATED TO SUBGRADE, THE INFILTRATION BMP BOTTOM AND SIDE SLOPES SHOULD BE SCARIFIED OR TILLED TO LOOSEN COMPACTED SOILS.
9. ONCE EXCAVATED TO SUBGRADE, SOIL TYPES AND DESIGN PARAMETERS AND ASSUMPTIONS SHOULD BE CONFIRMED THROUGH IN–SITU PERMEABILITY TESTING (E.G., PERMEAMETER MEASUREMENTS TO DETERMINE HYDRAULIC CONDUCTIVITY). RESULTS OF PERMEABILITY TESTING SHOULD BE REVIEWED BY THE DESIGNER AND, IF NECESSARY, CHANGES TO THE BMP DESIGN MAY BE REQUIRED.

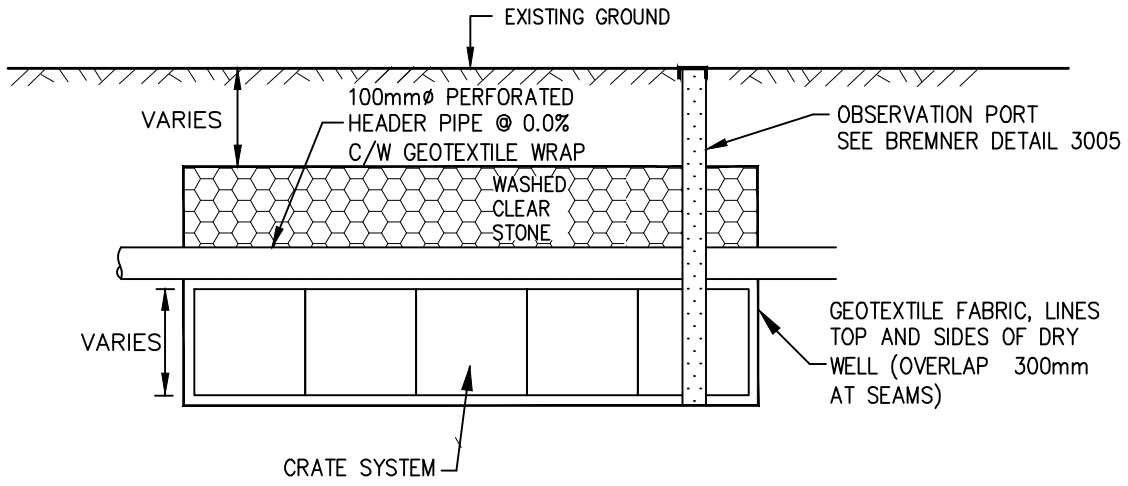
SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

BREMNER AREA PROJECT

STRATHCONA COUNTY

BIOSWALE

REV 0	MARCH 2019	NTS	3003



INFILTRATION TRENCH DETAIL

CRATE TYPE SYSTEM

ALL INFILTRATION FACILITIES

1. INFILTRATION FACILITIES MUST BE 5m FROM ANY BUILDING, BASEMENT, OR FOOTING
2. FACILITIES MUST HAVE EITHER AN OVERFLOW TO THE STORM SYSTEM OR AN OVERLAND OVERFLOW THAT DOES NOT IMPACT OTHER PROPERTIES
3. INFILTRATION FACILITIES SHOULD BE 2m FROM PROPERTY LINES WHEN LOCATED ON PRIVATE PROPERTY
4. BEST PRACTICE IS TO LIMIT THE SLOPE ON INFILTRATION SURFACE (FACILITY BASE) TO <1%. IF BMP LOCATION HAS A GREATER SLOPE, TERRACING, STEP-DOWNS OR MULTIPLE FACILITIES SHOULD BE USED
5. OBTAIN ALL UTILITY LOCATES PRIOR TO CONSTRUCTION
6. ALL FINISH GRADING ACTIVITIES IN THE INFILTRATION BMP SHOULD BE PERFORMED DURING DRY CONDITIONS TO PREVENT SOIL SMEARING AND COMPACTION. DEWATERING MAY BE NECESSARY PRIOR TO COMMENCING WORK.
7. THE RIGHT EQUIPMENT IS CRITICAL TO THE SUCCESS OF THE PROJECT:

   A) EXCAVATION OF THE INFILTRATION BMP SHOULD BE DONE FROM THE OUTSIDE REACHING IN WHEN POSSIBLE, USING A BACK HOE OR BUCKET WITH EXTENSION ARM. A TOOTHED BUCKET IS RECOMMENDED SO COMPACTION CAUSED BY EXCAVATION CAN BE BROKEN UP BY SCARIFYING THE FINISHED SURFACE.

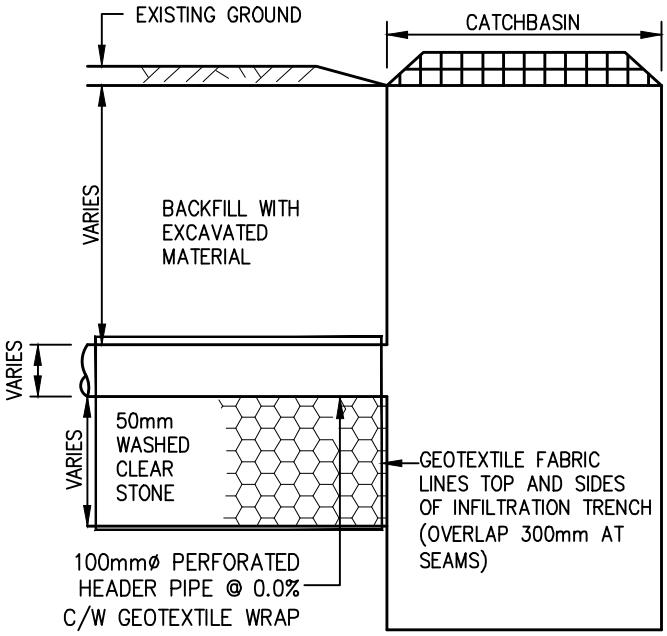
   B) IF EQUIPMENT IS NEEDED INSIDE THE FACILITY, LOW GROUND PRESSURE RATED OR MARSH TRACK EQUIPMENT SHOULD BE USED TO MINIMIZE COMPACTION.
8. ONCE EXCAVATED TO SUBGRADE, THE INFILTRATION BMP BOTTOM AND SIDE SLOPES SHOULD BE SCARIFIED OR TILLED TO LOOSEN COMPACTED SOILS.
9. ONCE EXCAVATED TO SUBGRADE, SOIL TYPES AND DESIGN PARAMETERS AND ASSUMPTIONS SHOULD BE CONFIRMED THROUGH IN-SITU PERMEABILITY TESTING (E.G., PERMEAMETER MEASUREMENTS TO DETERMINE HYDRAULIC CONDUCTIVITY). RESULTS OF PERMEABILITY TESTING SHOULD BE REVIEWED BY THE DESIGNER AND, IF NECESSARY, CHANGES TO THE BMP DESIGN MAY BE REQUIRED.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

ROCK MATERIAL

1. CLEAN, WASHED GRANITIC ROCK MATERIAL IS RECOMMENDED. HOWEVER GRANITIC MATERIAL CAN BE COST PROHIBITIVE IN SOME REGIONS WITH A LIMESTONE- BASED GEOLOGIC HISTORY.
2. IT IS BEST TO AVOID LIMESTONE IF POSSIBLE BUT, IF IT IS SPECIFIED, NO FINES SHOULD BE ASSOCIATED WITH THE MATERIAL. ALL STRUCTURAL APPLICATIONS OF ROCK MATERIAL IN THE BASE AND SUB-BASE SHOULD ALSO FOLLOW THESE RECOMMENDATIONS.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION



INFILTRATION TRENCH

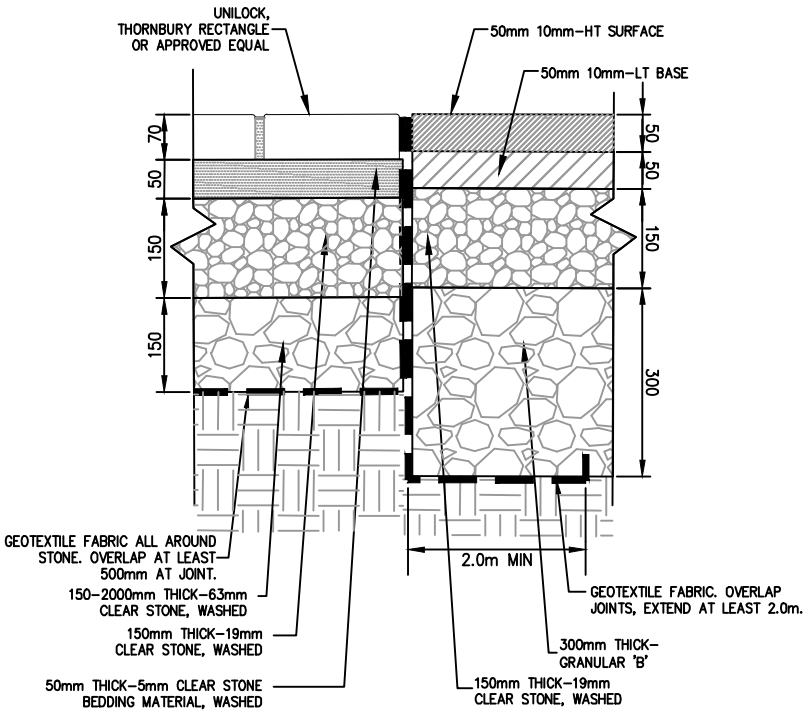
ROCK TYPE SYSTEM

BREMNER AREA PROJECT

STRATHCONA COUNTY

INFILTRATION TRENCH

REV 0	MARCH 2019	NTS	3004



PERMEABLE PAVEMENT & ASPHALT
PAVEMENT INTERFACE DETAIL

ALL INFILTRATION FACILITIES

1. INFILTRATION FACILITIES MUST BE 5m FROM ANY BUILDING, BASEMENT, OR FOOTING
2. FACILITIES MUST HAVE EITHER AN OVERFLOW TO THE STORM SYSTEM OR AN OVERLAND OVERFLOW THAT DOES NOT IMPACT OTHER PROPERTIES
3. INFILTRATION FACILITIES SHOULD BE 2m FROM PROPERTY LINES WHEN LOCATED ON PRIVATE PROPERTY
4. BEST PRACTICE IS TO LIMIT THE SLOPE ON INFILTRATION SURFACE (FACILITY BASE) TO <1%. IF BMP LOCATION HAS A GREATER SLOPE, TERRACING, STEP-DOWNS OR MULTIPLE FACILITIES SHOULD BE USED
5. OBTAIN ALL UTILITY LOCATES PRIOR TO CONSTRUCTION
6. ALL FINISH GRADING ACTIVITIES IN THE INFILTRATION BMP SHOULD BE PERFORMED DURING DRY CONDITIONS TO PREVENT SOIL SMEARING AND COMPACTION. DEWATERING MAY BE NECESSARY PRIOR TO COMMENCING WORK.
7. THE RIGHT EQUIPMENT IS CRITICAL TO THE SUCCESS OF THE PROJECT:

   A) EXCAVATION OF THE INFILTRATION BMP SHOULD BE DONE FROM THE OUTSIDE REACHING IN WHEN POSSIBLE, USING A BACK HOE OR BUCKET WITH EXTENSION ARM. A TOOTHED BUCKET IS RECOMMENDED SO COMPACTION CAUSED BY EXCAVATION CAN BE BROKEN UP BY SCARIFYING THE FINISHED SURFACE.

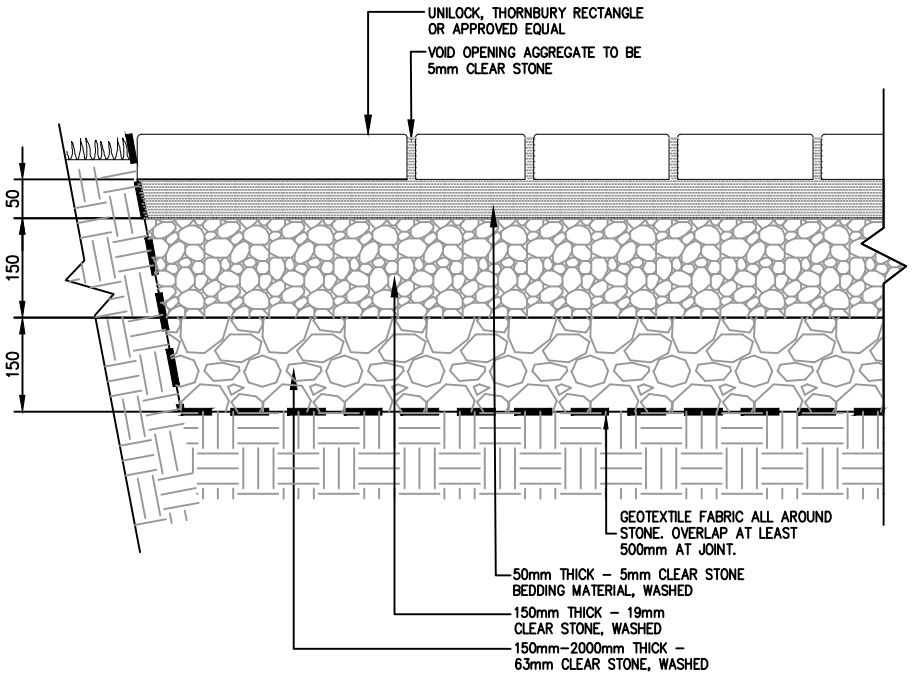
   B) IF EQUIPMENT IS NEEDED INSIDE THE FACILITY, LOW GROUND PRESSURE RATED OR MARSH TRACK EQUIPMENT SHOULD BE USED TO MINIMIZE COMPACTION.
8. ONCE EXCAVATED TO SUBGRADE, THE INFILTRATION BMP BOTTOM AND SIDE SLOPES SHOULD BE SCARIFIED OR TILLED TO LOOSEN COMPACTED SOILS.
9. ONCE EXCAVATED TO SUBGRADE, SOIL TYPES AND DESIGN PARAMETERS AND ASSUMPTIONS SHOULD BE CONFIRMED THROUGH IN-SITU PERMEABILITY TESTING (E.G., PERMEAMETER MEASUREMENTS TO DETERMINE HYDRAULIC CONDUCTIVITY). RESULTS OF PERMEABILITY TESTING SHOULD BE REVIEWED BY THE DESIGNER AND, IF NECESSARY, CHANGES TO THE BMP DESIGN MAY BE REQUIRED.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

ROCK MATERIAL

1. CLEAN, WASHED GRANITIC ROCK MATERIAL IS RECOMMENDED. HOWEVER GRANITIC MATERIAL CAN BE COST PROHIBITIVE IN SOME REGIONS WITH A LIMESTONE- BASED GEOLOGIC HISTORY.
2. IT IS BEST TO AVOID IF LIMESTONE IF POSSIBLE BUT, IF IT IS SPECIFIED, NO FINES SHOULD BE ASSOCIATED WITH THE MATERIAL. ALL STRUCTURAL APPLICATIONS OF ROCK MATERIAL IN THE BASE AND SUB-BASE SHOULD ALSO FOLLOW THESE RECOMMENDATIONS.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION



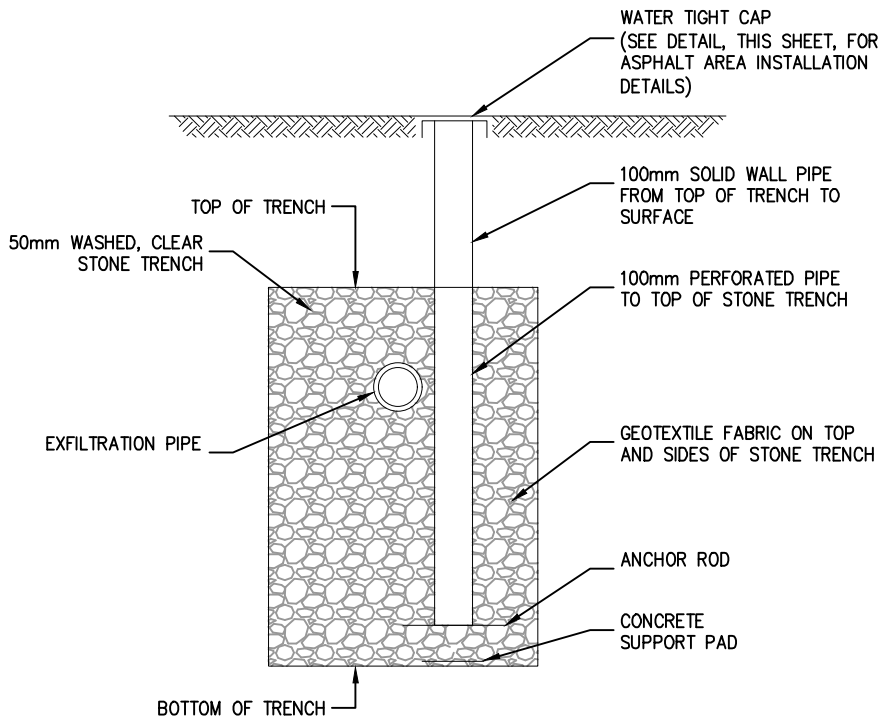
PERMEABLE PAVEMENT DETAIL

BREMNER AREA PROJECT

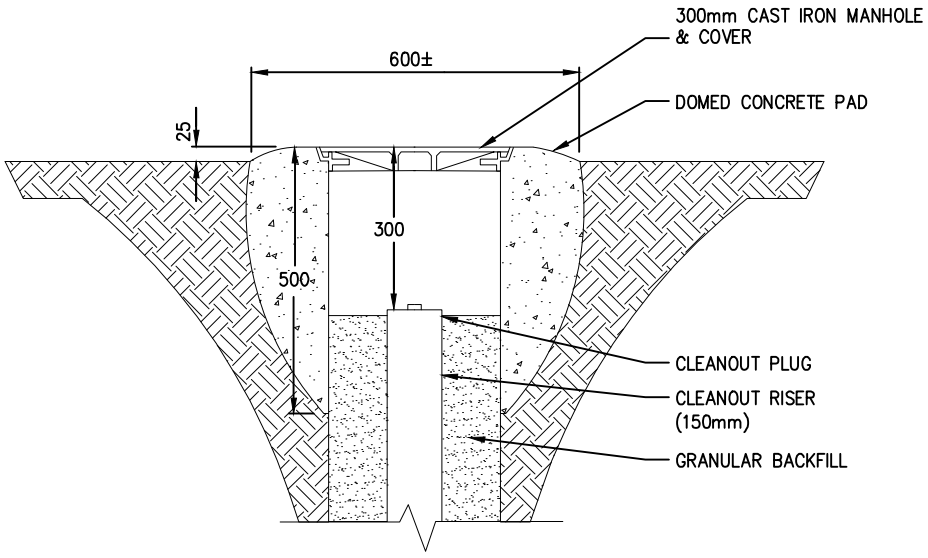
STRATHCONA COUNTY

PERMEABLE PAVER

REV 0	MARCH 2019	NTS	3005



OBSERVATION PORT DETAIL



OBSERVATION PORT CAP
ASPHALT INSTALLATION DETAIL

BREMNER AREA PROJECT

STRATHCONA COUNTY

OBSERVATION PORT FOR INFILTRATION FACILITIES

REV 0	MARCH 2019	NTS	3006

ALL INFILTRATION FACILITIES

1. INFILTRATION FACILITIES MUST BE 5m FROM ANY BUILDING, BASEMENT, OR FOOTING
2. FACILITIES MUST HAVE EITHER AN OVERFLOW TO THE STORM SYSTEM OR AN OVERLAND OVERFLOW THAT DOES NOT IMPACT OTHER PROPERTIES
3. INFILTRATION FACILITIES SHOULD BE 2m FROM PROPERTY LINES WHEN LOCATED ON PRIVATE PROPERTY
4. BEST PRACTICE IS TO LIMIT THE SLOPE ON INFILTRATION SURFACE (FACILITY BASE) TO <1%. IF BMP LOCATION HAS A GREATER SLOPE, TERRACING, STEP-DOWNS OR MULTIPLE FACILITIES SHOULD BE USED
5. OBTAIN ALL UTILITY LOCATES PRIOR TO CONSTRUCTION
6. ALL FINISH GRADING ACTIVITIES IN THE INFILTRATION BMP SHOULD BE PERFORMED DURING DRY CONDITIONS TO PREVENT SOIL SMEARING AND COMPACTION. DEWATERING MAY BE NECESSARY PRIOR TO COMMENCING WORK.
7. THE RIGHT EQUIPMENT IS CRITICAL TO THE SUCCESS OF THE PROJECT:

   A) EXCAVATION OF THE INFILTRATION BMP SHOULD BE DONE FROM THE OUTSIDE REACHING IN WHEN POSSIBLE, USING A BACK HOE OR BUCKET WITH EXTENSION ARM. A TOOTHED BUCKET IS RECOMMENDED SO COMPACTION CAUSED BY EXCAVATION CAN BE BROKEN UP BY SCARIFYING THE FINISHED SURFACE.

   B) IF EQUIPMENT IS NEEDED INSIDE THE FACILITY, LOW GROUND PRESSURE RATED OR MARSH TRACK EQUIPMENT SHOULD BE USED TO MINIMIZE COMPACTION.
8. ONCE EXCAVATED TO SUBGRADE, THE INFILTRATION BMP BOTTOM AND SIDE SLOPES SHOULD BE SCARIFIED OR TILLED TO LOOSEN COMPACTED SOILS.
9. ONCE EXCAVATED TO SUBGRADE, SOIL TYPES AND DESIGN PARAMETERS AND ASSUMPTIONS SHOULD BE CONFIRMED THROUGH IN-SITU PERMEABILITY TESTING (E.G., PERMEAMETER MEASUREMENTS TO DETERMINE HYDRAULIC CONDUCTIVITY). RESULTS OF PERMEABILITY TESTING SHOULD BE REVIEWED BY THE DESIGNER AND, IF NECESSARY, CHANGES TO THE BMP DESIGN MAY BE REQUIRED.

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

ROCK MATERIAL

1. CLEAN, WASHED GRANITIC ROCK MATERIAL IS RECOMMENDED. HOWEVER GRANITIC MATERIAL CAN BE COST PROHIBITIVE IN SOME REGIONS WITH A LIMESTONE- BASED GEOLOGIC HISTORY.
2. IT IS BEST TO AVOID LIMESTONE IF POSSIBLE BUT, IF IT IS SPECIFIED, NO FINES SHOULD BE ASSOCIATED WITH THE MATERIAL. ALL STRUCTURAL APPLICATIONS OF ROCK MATERIAL IN THE BASE AND SUB-BASE SHOULD ALSO FOLLOW THESE RECOMMENDATIONS.

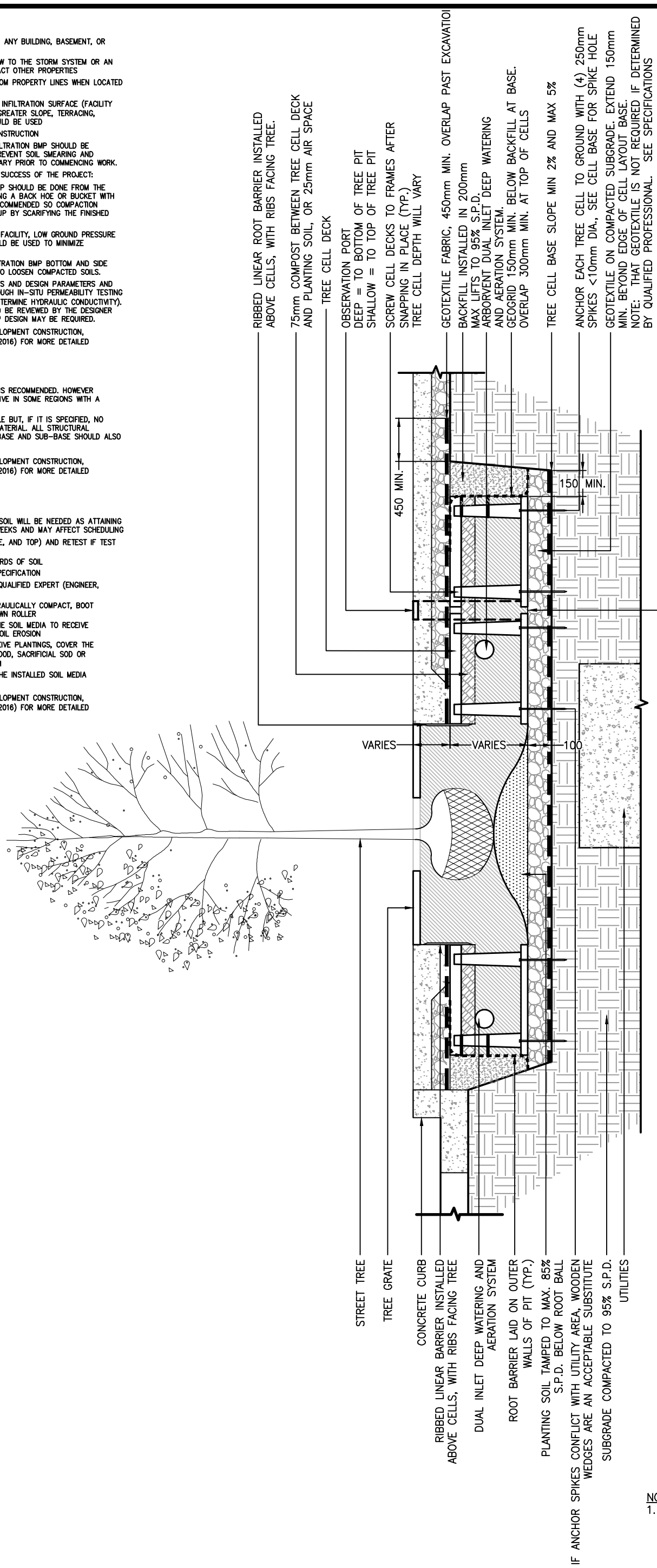
SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION

AMENDED SOIL

1. TEST MEDIA BEFORE DELIVERY TO SITE

   A) TEST AT LEAST TWO WEEKS BEFORE SOIL WILL BE NEEDED AS ATTAINING A PASSING SOIL MIX CAN TAKE UP TO 2 WEEKS AND MAY AFFECT SCHEDULING
2. TEST PILE IN 3 LOCATIONS (BOTTOM, MIDDLE, AND TOP) AND RETEST IF TEST COME BACK WITH BORDERLINE RESULTS
3. REPEAT TESTING EVERY 250-500 CUBIC YARDS OF SOIL
4. ENSURE FINES ARE OPTIMAL PER DESIGN SPECIFICATION
5. SOILS WILL BE DEEMED ACCEPTABLE BY A QUALIFIED EXPERT (ENGINEER, LANDSCAPE ARCHITECT OR OTHER)
6. INSTALL MEDIA IN 150mm LIFTS AND HYDRAULICALLY COMPACT, BOOT COMPACT, OR COMPACT WITH WEIGHTED LAWN ROLLER
7. ONCE INSTALLED IMMEDIATELY PREPARE THE SOIL MEDIA TO RECEIVE PLANTINGS TO REDUCE POLLUTANTS AND SOIL EROSION
8. IF SOIL MEDIA WILL NOT IMMEDIATELY RECEIVE PLANTINGS, COVER THE SURFACE (E.G. TEMPORARY TARPING, PLYWOOD, SACRIFICIAL SOD OR GEOTEXTILE) TO PROTECT IT IN THE INTERIM
9. RESTRICT ALL VEHICULAR TRAFFIC FORM THE INSTALLED SOIL MEDIA

SEE THE CITY OF EDMONTON'S LOW IMPACT DEVELOPMENT CONSTRUCTION, INSPECTION AND MAINTENANCE GUIDE (1.0, MAY 2016) FOR MORE DETAILED INFORMATION



NOTES:
1. CONTRACTOR TO PROTECT AND MAINTAIN ALL UNDERGROUND INFRASTRUCTURE AND UTILITIES.

BREMNER AREA PROJECT

STRATHCONA COUNTY

SINGLE LAYER STRUCTURAL CELL TREE BOX

REV 0	MARCH 2019	NTS	3007