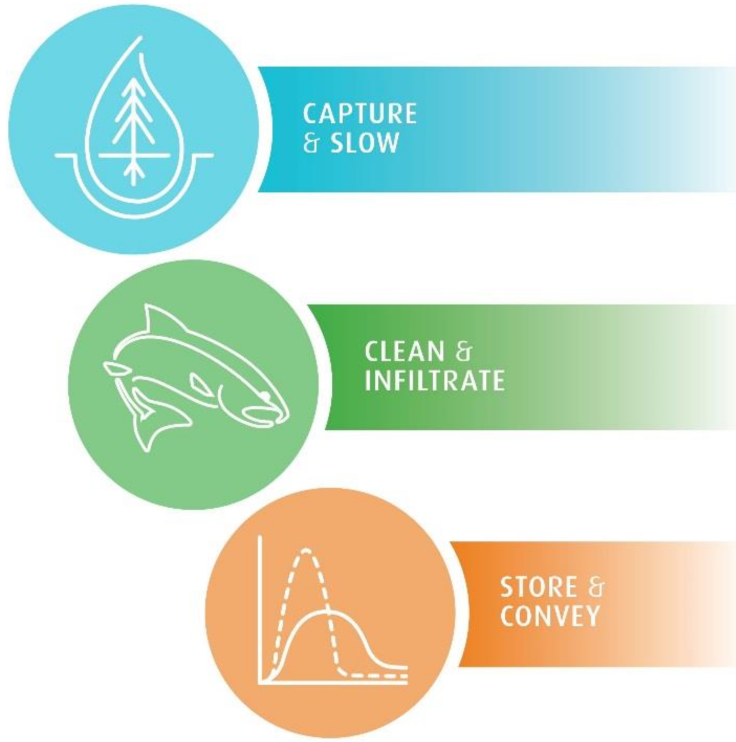


APPENDIX E - INFILTRATION CURB EXTENSIONS & TRAFFIC ISLANDS

Green Stormwater Infrastructure Design Guidelines for the Capital Region

SPRING 2019

Infiltration Curb Extensions & Traffic Islands[1]

Description

Infiltration curb extensions (also called infiltration bulges) is a form of bioretention or infiltration facility located in rights-of-way between the sidewalk and the roadway. Vegetated curb extensions are commonly a concave landscape area where runoff from the street gutter is temporarily collected while it infiltrates into the soils below.


Figure 1 Infiltration curb extension on Shelbourne. Photo Credit: District of Saanich

Infiltration curb extensions can either be positioned mid-block or at street corners.

The surface planting of infiltration curb extensions is dominated by groundcovers and fine close-growing grasses, with planting designs respecting the various soil moisture conditions in the extension. Plantings may also include rushes, sedges and other grass-like plants, as well as sodded lawn areas for erosion control and multiple uses.

Infiltration curb extensions have a drain rock reservoir and perforated drain system to collect excess water. The perforated drain system may connect to a control structure in a catch basin that provides overflow while maintaining a slow decanting of the water in the vegetated curb extensions between storms.

Infiltration curb extensions also provide aesthetic value and can improve the safety of all road users by reducing the width of the road.

Curb extensions visually and physically narrow the roadway which causes drivers to slow the speed of their vehicle. They also create safer and shorter crossings for pedestrians.

Infiltration traffic islands have many of the same features as curb extensions, however, they require the street to be constructed such that stormwater flows towards the center of the street. Due to this, their main application is during new street construction or a major street rehabilitation.

[1] Authored by: Opus International Consultants (Canada) Limited
Design guidelines drawings by: Kerr Wood Leidal Associates Ltd and/or as noted in figure.

Selection, Application and Limitations

- Infiltration curb extensions are utilized for volume capture and stormwater treatment. Treatment is provided by the soil layer and volume capture by infiltration from the rock reservoir.
- If treatment is not required (e.g., for pre-treated or roof water only), an infiltration rock trench is more economical and space efficient, but does not provide the aesthetics and interactive value of the vegetated curb extension.
- Will provide increased volume capture over an infiltration trench due to the surface ponding and plant uptake or moisture.

Figure 2 Curb side infiltration, Saanich

- The availability of street space and presence of utilities will affect the placement and design.
- Infiltration curb extensions and traffic islands promote traffic calming and pedestrian safety.
- Trees may be included, columnar versions of tree species are recommended due to less maintenance for overhead wires and vehicle clearance.

Design Guidelines

1. Detailed design requirements should be evaluated for each individual application based on site-specific constraints and objectives.
2. Follow all applicable federal, provincial and municipal regulations.
3. Geo-technical investigations are recommended with soil permeability testing being the minimum requirement for design. Advice from a professional engineer for design is recommended.
4. Site vegetated curb extensions similar to other infiltration facilities – minimum 30 m from wells, minimum 3 m downslope of building foundations, and only in areas where foundations have footing drains.
5. A minimum length of 4 m and width of 2 m should be achieved.

Figure 3 vegetated infiltration traffic island, Island Highway, View Royal. Photo Credit: Town of View Royal

6. A steel curb inlet is used to allow water to pass through the concrete curb but protect road users from entering the vegetated curb extension, however, require higher maintenance to prevent clogging. Newer topless designs that are less likely to clog with debris include concreate curb cuts with steel or concrete flow dissipator (see Figure 9).
7. When infiltration curb extensions are installed at corners with pedestrian curb ramps, stormwater should be collected within the facility.
8. When infiltration curb extensions are installed at mid-block locations, stormwater can either be collected within the facility or flow through the facility.
9. A minimum drop of 50 mm from the pavement or flat curb edge to the top of the vegetated curb extension surface is required to accommodate sediment accumulation.
10. Clean crushed rock or rounded river rock may be used at inflow point(s). The slope of the transition area should be greater than 10% to move sediment through to the curb extension.
11. Experience has shown that grass is efficient at trapping sediment at a pavement edge and the sediment and grass matt will aggrade rapidly. In addition to the 50 mm drop (see Item 9, above) it is recommended that the transition slope or vegetated curb extension edge be covered with rock or sturdy mulch at the surface rather than grass.

Figure 4 Steel curb inlet example

Figure 5 Curb example with steel flow dissipator

12. Provide a 50 mm–75 mm layer of non-floating organic mulch – well-aged compost, bark mulch or similar weed-free material. The mulch is important for both erosion control and maintaining infiltration capacity.
13. Rock reservoir depth should generally not exceed the depth of the surrounding utilities.
14. Drawdown time for the maximum surface ponded volume: 48 hours preferred (72 hours max.).
15. A non-erodible outlet or spillway must be established to discharge overflow to the storm sewer system. This often takes the form of a grated inlet raised above the vegetation to create the ponding depth.

16. Bioretention Soil Media (BSM) (i.e., treatment soil, growing medium) depth: 450 mm minimum for most applications. Treatment soil should have a minimum infiltration rate (lab tested) of 70 mm/hr, which is assumed in the sizing approaches in this document.

17. Slope of the drain rock reservoir bottom shall be level to maximize infiltration area.

18. Avoid utility or other crossings of the vegetated curb extension. Where utility trenches must be constructed crossing below the vegetated curb extension, install low permeability trench dams to avoid infiltration water following the utility trench.

Figure 6 Curb cut example - Concrete curb let down with rocks

19. Drain rock reservoir and subdrain may be omitted where infiltration tests by the design professional taken at the level of the base of the proposed construction show an infiltration rate that exceeds the inflow rate for the design.

20. A perforated pipe subdrain is required to drain excess water from the soil and prevent root drowning of vegetated curb extension plantings in poorly draining soils. The subdrain should always be embedded in drain rock near the top of the rock reservoir to provide a storage volume below the subdrain unless a vegetated curb extension with flow restrictor option is used.

21. The subdrain should have flow and inlet capacity to carry the flow infiltrated through the soil layer. Consult pipe manufacturer for perforation inflow capacity. A maximum infiltration rate through the soil can be estimated by applying Darcy's equation:

$$Q_{\max} = k \times L \times W_{base} \times \frac{h_{\max} + d}{d}$$

where:

k is the hydraulic conductivity of the growing medium (soil) (m/s), as measured in winter saturated soil conditions

W_{base} is the average width of the base area zone (m)

L is the length of the base area zone (m)

$h_{\max}$ is the depth of the ponding above the growing medium (m)

d is the thickness of the growing medium layer (m).

22. See Table 1 vegetated curb extension setbacks.

23. Refer to Figure 9 for detailed design for curbing, inlet and flow dissipator options.

Table 1 Vegetated Curb Extension Setbacks

Setback From	Distance (m)
Down Slope of Building Foundations	3-5
Property Line	3
Drinking Water Well	30
Septic Field	3
Seasonal High Water Table	1
Active or inactive landfill or contaminated site	30
Existing trees	Outside root protection zone

Infiltration Vegetated Curb Extensions Sizing

1. In general, the size of vegetated curb extensions should balance the need for stormwater management with other roadway needs.
2. Where on-street parking is present, the width is typically the width of the parking lane (roughly 2.5 m).
3. The area is sized based on the upstream impervious area that it serves. This relationship can be defined by the ratio of impervious area to pervious area (e.g., I/P ratio). For the simplified sizing approaches here, this represents the ratio of upstream impervious area (also called catchment area) to base area of the vegetated curb extension. The I/P ratio to achieve the target capture criteria will be calculated by the sizing method below.
4. The maximum allowable I/P ratio for given surface types is shown in Table 2. This maximum is based on ability of the vegetation to handle flows and pollutants and is not related to capture. Regardless of sizing calculation below, maximum I/P ratio for a given surface type should not be exceeded.
5. Sizing presented here is for infiltration of rainwater for "capture" and prevention of site runoff. Sizing and design according to this guidance will generally provide water quality treatment for the volume of water infiltrated. If "water quality" criteria volumes are larger than "capture" volumes, additional sizing may be required and a professional engineer should be consulted.

Table 2 Vegetated Curb Extension Maximum I/P Ratios by Surface Type

Surface Type	Max. I/P Ratio
Divided or Undivided Major Road (Expressway or Highway)	20:1
Collector Road	20:1
Parking >1 car/day/parking space	20:1
Local Road	30:1
Low traffic areas, no parking	50:1

Sizing Method Using Depth Capture Criteria: R mm in 24 hours

See Appendix A, Table 1 to determine R mm of rain in 24 hrs area-specific GSI facility rainfall capture targets – confirm with respective municipality.

1. Determine the maximum rock depth according to the drain time (4 days max.) and round down to the nearest 50 mm increment for constructability; allowable depth range is 300 to 2,000 mm:

$$D_R = \frac{Ks \times T \times 24}{n}$$

Where:
D_R = Depth (thickness) of rock reservoir (mm)
Ks = Saturated hydraulic conductivity of subsurface soil (mm/hr)
T = allowable drain time (days)
n = porosity of drain rock in reservoir (unitless, e.g., 0.35)

2. Use the following equation to determine the area of the vegetated curb extension and rock reservoir required by finding the I/P ratio for the site:

$$I/P = \frac{24 \times Ks + D_P + D_R \times n + 0.2 \times D_S}{R} - 1$$

Where:
I/P = Ratio of impervious tributary area to vegetated curb extension base area (unitless)
R = Rainfall capture depth (mm)
Ks = Saturated hydraulic conductivity of subsurface soil (mm/hr), as measured during winter saturated soil conditions
D_P = Depth of ponding (mm); 200 mm standard
D_R = Depth (thickness) of rock reservoir (mm)
n = porosity of drain rock in reservoir (unitless, e.g., 0.35)
D_S = Soil layer depth (thickness); standard value = 450 (mm)

3. Check that the I/P ratio calculated is less than the maximum allowed (Table 2). If it is not, use the maximum allowed I/P ratio. This may mean that the vegetated curb extension will exceed the % capture desired.a

4. To find the vegetated curb extension base area:

$$BaseArea = \frac{\text{Impervious } TributaryArea}{I/P}$$

Guideline Specifications

Materials shall meet Master Municipal Construction Document 2009 (MMCD) requirements, and:

1. Infiltration Drain Rock: clean round stone or crushed rock, with a porosity of 35% to 40 % such as 75 mm max, 38 mm min., or MMCD Section 31 05 17 Part 2.6 – Drain Rock, Coarse.
2. Pipe: PVC, DR 35, 150 mm min. dia., with cleanouts, certified to CSA B182.1, as per MMCD.
3. Geosynthetics: as per Section 31 32 19, select for filter criteria or from approved local government product lists.
4. Sand: Pit Run Sand as per Section 31 05 17.
5. Growing Medium: Bioretention Soil Media (i.e., growing media): As per Tables 3a and 3b Bioretention Soil Medium, but with required minimum saturated hydraulic conductivity of 70 mm/hr.
6. Seeding: conform to Section 32 92 20 Seeding or 32 92 19 Hydraulic Seeding (Note: seeding may not be required for erosion control in most instances).
7. Sodding: conform to MMCD Section 31 92 23 Sodding (Note: seeding may not be required for erosion control in most instances).
8. Planting: see Supplemental 1 Planting Templates & Plant Lists.

Construction Practices shall meet Master Municipal Construction Document 2009 (MMCD) requirements, and:

1. Isolate the vegetated curb extension site from sedimentation during construction, either by use of effective erosion and sediment control measures upstream, or by delaying the excavation of 300 mm of material over the final subgrade of the vegetated curb extension until after all sediment-producing construction in the drainage area has been completed.
2. Prevent natural or fill soils from intermixing with the Infiltration Drain Rock. All contaminated stone aggregate must be removed and replaced.
3. Infiltration Drain Rock shall be installed in 300 mm lifts and compacted to eliminate voids between the geotextile and surrounding soils.
4. Plant and maintain planted areas to conform with municipal standards for visibility and access in the Right-of-Way and Landscape Maintenance standards shall be to the Canada Landscape Standard, 1st Edition, Maintenance Level.

Bioretention Soil Medium

Composition of Bioretention Soil Medium (BSM) is an important factor in the performance of GSI facilities. Soil mixes for bioretention and vegetated infiltration facilities need to balance 3 primary design objectives for optimum performance:

- ✓ High enough infiltration rates to meet desired surface water drawdown and system dewatering.
- ✓ A growth media to support long term plant and soil health and water quality treatment capability.
- ✓ Infiltration rates that are not too high in order to optimize pollutant removal capability.

For the latest information on bioretention soil research see the Washington Stormwater Center's webpage on Bioretention http://www.wastormwatercenter.org/lid-bioretention/

Below are 2 local BSM suggested mixes. Minimum infiltration rate (lab tested) of 70 mm/hr for BMS.

Table 3.a Infiltration Curb Extension Bioretention Soil Mediums Mix 1[2]

Infiltration Curb Extension Bioretention Soil Medium (BSM) Mix 1 Recommended depth: minimum of 450 mm Minimum required saturated hydraulic conductivity of 70 mm/hr.	
Component (partial size classes)	**Percentage by Weight**
Gravel (greater than 2.5 mm)	0
Sand (greater than 0.05 mm and less than 2.5 mm) • Sand to be hard, granular sharp sand well washed and free of impurities, chemicals or organic matter; and • Particle size in sand to be: a) 90-100% passing a 2.50 mm sieve, b) 0-65% passing a 0.500 mm sieve, c) 0-5% passing a 0.0500 mm sieve	70-80
Silt (greater than 0.002 mm and less than 0.05 mm)	5-15
Clay (less than 0.002 mm)	2-5
Organic Content (%dry weight) • must be well aged organics, weed free, preferably manure free and biosolid free.	10-15
Other Soil Considerations	
• **pH** of mixed materials between 6-8.5 • **Phosphorus (P) and Nitrogen (N) Management Recommendations**: In some cases, bioretention facilities have the potential to export P and N at a higher rate than contained in the storm water they are receiving. See Low Impact Development Technical Guidance Manual for Puget Sound 2012 (chapter 6.1.2 Bioretention Design) for nutrient management suggestions. http://www.psp.wa.gov/downloads/LID/20121221_LIDmanual_FINAL_secure.pdf • **Safe Soils:** The spread and proliferation of invasive species through many regions of the province comes from the re-distribution of invasive species laden soils. In 2016, a Soils and Invasive Species Sub-Working Group was developed to explore province-wide solutions regarding the movement of soil and related materials that may contain invasive species. This Sub-Working Group involves provincial and local government representation. Learn more: Provincial Response to the Resolutions of the 2016 Union of British Columbia Municipalities Convention FEBRUARY 2017 B113 SAFE SOILS PROGRAM (page 111) http://www.ubcm.ca/assets/Resolutions~and~Policy/Resolutions/Provincial_Responses-2016_UBCM_Resolutions.pdf	

[2] Source: Rain Gardens, Stormwater Best Management Practices, District of Saanich
http://www.saanich.ca/assets/Community/Documents/Rain%20Garden.pdf

Table 3.b Vegetated Curb Extension Bioretention Soil Mediums Mix 2[3]

Infiltration Curb Extension **Bioretention Soil Medium (BSM) Mix 2*** Recommended depth: minimum of 450 mm **Minimum required saturated hydraulic conductivity of 70 mm/hr.**	
Component (partial size classes)	**Percentage by Weight**
Coarse Gravel (particles greater than 19 mm and less than 40 mm)	0 to 1
All Gravels (particles greater than 2 mm and less than 40 mm)	10 to 25
Sand, Silt, Clay & Organic components measured from remaining non gravel portion of sample (% dry weight)	
Sand (greater than 0.05 mm and less than 2.5 mm) • Sand to be hard, granular sharp sand well washed and free of impurities, chemicals or organic matter. • Note: Growing medium/BSM to be manufactured with '2 mm minus' sand to reduce gravel content in the soil. 2 mm minus sand is available from most local quarries upon request.	60-70
Combined Silt and Clays (less than 0.05 mm)	10-20
Organics (% dry weight) • must be well aged organics, weed-free, preferably manure-free and biosolid free.	15-20
Other Soil Considerations	
• **pH** of mixed materials between 6-8.5 • **Phosphorus (P) and Nitrogen (N) Management Recommendations**: In some cases, bioretention facilities have the potential to export P and N at a higher rate than contained in the storm water they are receiving. See Low Impact Development Technical Guidance Manual for Puget Sound 2012 (chapter 6.1.2 Bioretention Design) for nutrient management suggestions. http://www.psp.wa.gov/downloads/LID/20121221_LIDmanual_FINAL_secure.pdf • **Safe Soils:** The spread and proliferation of invasive species through many regions of the province comes from the re-distribution of invasive species laden soils. In 2016, a Soils and Invasive Species Sub-Working Group was developed to explore province-wide solutions regarding the movement of soil and related materials that may contain invasive species. This Sub-Working Group involves provincial and local government representation. Learn more: Provincial Response to the Resolutions of the 2016 Union of British Columbia Municipalities Convention FEBRUARY 2017, page 111 for B113 SAFE SOILS PROGRAM. http://www.ubcm.ca/assets/Resolutions~and~Policy/Resolutions/Provincial_Responses-2016_UBCM_Resolutions.pdf	

[3] Source: City of Victoria, Rainwater Management Standards – Professional Edition (June 2015) http://www.victoria.ca/assets/Departments/Engineering~Public~Works/Documents/SWVictoria_Professional_Rainwater_Mgmt_Stds_June2015.pdf

Vegetated Curb Extension Design Example for Capture of R mm/24-hour Criteria

Scenario Description

A vegetated curb extension is proposed to capture a portion of the runoff from a paved local road (see Figure 7).

The following parameters are known:

- Local road, Total pavement area = 225 m^2
- 2-year 24-hour rain depth = 53 mm
- Native soil infiltration rate = 1.5 mm/hr
- Capture target is 72% of 2-year 24-hour rain amount = 38 mm

Determine the curb extension footprint area and rock trench depth.

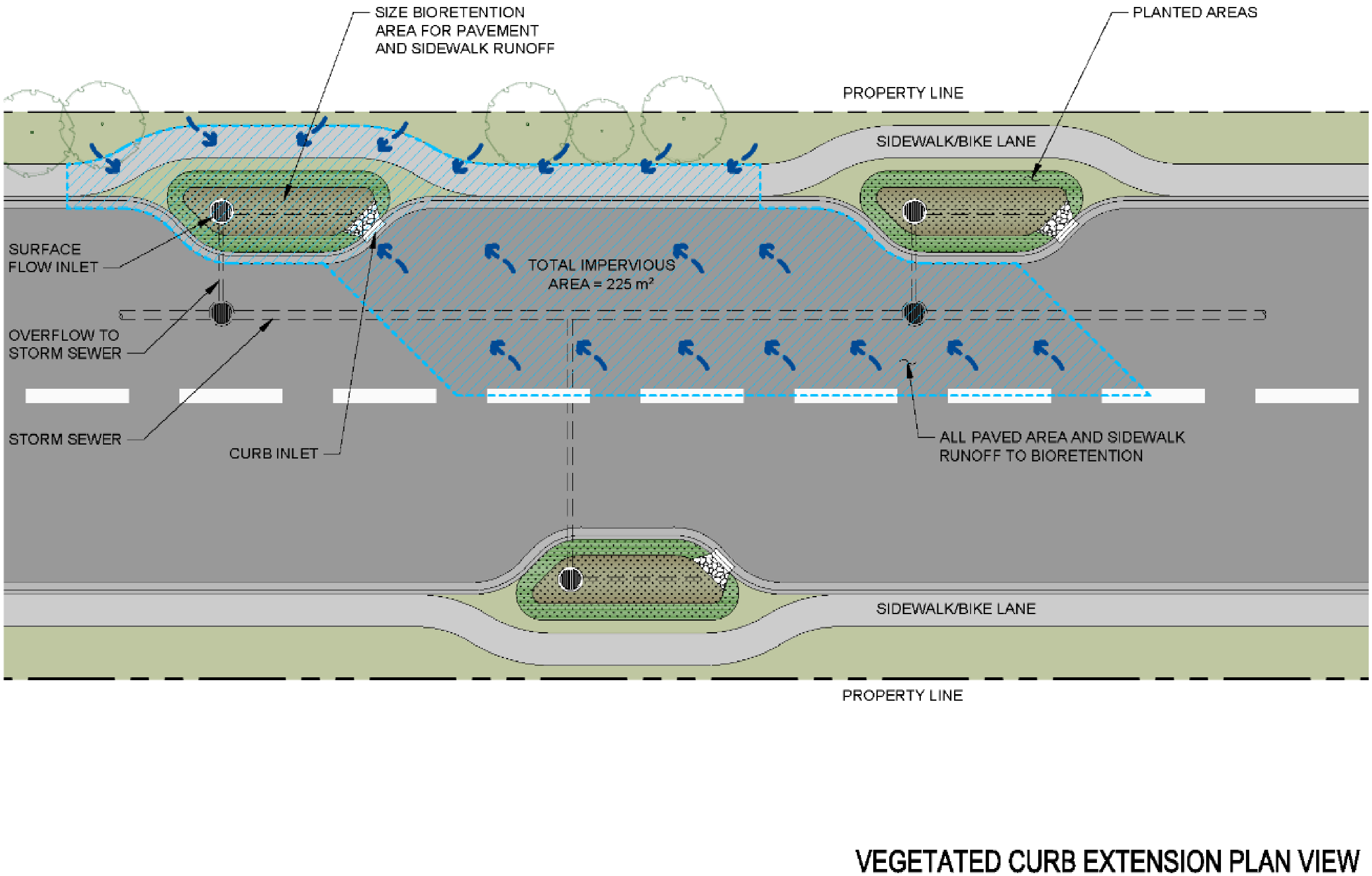


Figure 7 Example - Local Residential Street Retrofitted with a Mid-Block Vegetated Curb Extension

Sizing

Determine the maximum rock depth based on the 4-day maximum drain time:

$$D_R = \frac{Ks \times T \times 24}{n} = \frac{1.5mm/hr \times 4days \times 24hr/day}{0.35} = 411mm$$

Use 400 mm rock depth.

Determine the maximum I/P ratio (see Table 2). Local road use yields a maximum I/P ratio of 30.

Determine the area of the vegetated curb extension and rock reservoir required by calculating the required I/P ratio:

$$I/P = \frac{24 \times Ks + D_P + D_R \times n + 0.2 \times D_S}{R} - 1$$

$$I/P = \frac{24 \times 1.5mm/hr + 200mm + 400mm \times 0.35 + 0.2 \times 450mm}{38mm} - 1$$

$$I/P = 11.3$$

Check that the I/P ratio is less than the maximum (11.3 < 30, therefore OK).

Calculate the vegetated curb extension base area:

$$BaseArea = \frac{imperviousTributaryArea}{I/P} = \frac{225sq.m}{11.3} = 20sq.m$$

Example Hydraulic Components

- Inlet: Pavement runoff sheet flows over a panel curb into the vegetated curb extension.
- Overflow: A perforated pipe located along the top of the rock layer decants excess water into the municipal storm sewer connection when the rock layer is full of water.

Example Operation and Maintenance

- Correct erosion problems as necessary. Ensure distributed sheet flow into the vegetated curb extensions.
- Mow to keep grass in the active growth phase, remove clippings to prevent clogging of outlets, and remove trash and debris.
- Remove leaves each fall, inspect overflow, hydraulic and structural facilities annually.
- Replace dead plants, as required.

GSI Driver Effectiveness – Runoff Reduction and Contaminant Removal

International Stormwater BMP Database http://www.bmpdatabase.org/ is a recommended resource for performance summaries of GSI facilities and latest research.

Bioretention areas function as soil and plant-based devices that can achieve both runoff reduction and pollutant removal. Runoff reduction is achieved through canopy interception, soil infiltration, and evapotranspiration. Pollutant removal is achieved through a variety of physical, biological, and chemical treatment processes. A number of pollutants including trace metals, suspended solids, nutrients, and oil and grease are removed from stormwater by filtering, adsorption, biological uptake, and denitrification within the bioretention cell's mulch and soil media. The pollutant removal efficiency can be increased or decreased based on the design components, underlying soil infiltration capabilities and what pollutants are being targeted for reduction. The following table shows the effectiveness of bioretention facilities for GSI drivers, including pollutant removal and stormwater runoff reduction.

Table 4 Runoff Reduction and Contaminant Removal

Bioretention and Vegetated Infiltration GSI Facilities (rain gardens, swales, planters, curb extensions)	
GSI Driver	***Estimated Effectiveness or Typical % Reduction or Removal**
Capture & Slow – Volume Runoff Reduction	85% without underdrain 45% with underdrain low with liner and underdrain
Store & Convey – Rate Control Delay Peak	Medium to high without under drain Medium with underdrain Low with liner and underdrain
Clean & Infiltrate – Water Quality Treatment	Highly variable with design, BSM, native soil and depth, plant type. Below are typical results. Research has observed good retention and at times production and export. Export is more likely with an underdrain.
Heavy Metals (Copper, Lead, Zinc)	35-90
Oil and Grease	>70% (higher with mulch)
Phosphorus	(+70) – 85
Nitrogen	20 – 30+
Total Suspended Solids (TSS)	60 – 95+
Bacteria (Fecal coliform bacteria or E. coli)	>70%

Note: *Performance of individual GSI facilities will vary depending on site-specific contexts and facility design.

Sources:

http://www.psp.wa.gov/downloads/LID/20121221_LIDmanual_FINAL_secure.pdf
http://www.creditvalleyca.ca/wp-content/uploads/2012/02/lid-swm-guide-chapter4-4.5-bioretention.pdf
http://www.lid-stormwater.net/bio_benefits.htm
https://stormwater.pca.state.mn.us/index.php/Information_on_pollutant_removal_by_BMPs
http://your.kingcounty.gov/dnrp/library/water-and-land/stormwater/juanita-retrofit/appendix-d-removal-rates.pdf
http://www.bmpdatabase.org/
https://stormwater.pca.state.mn.us/index.php?title=Information_on_pollutant_removal_by_BMPs

Maintenance

Infiltration areas require annual plant, soil, and mulch layer maintenance to ensure optimal infiltration, storage, and pollutant removal capabilities. The successful establishment of an infiltration area requires a first year inspection and maintenance operation that includes the following tasks:

- Initial inspections after storm events of over 13 mm of rainfall
- Spot reseeding of bare or eroding areas
- Spot fertilization requirements of initial plantings
- Watering once a week during first 2 months and as needed during first growing season
- Remove and replace dead plants to ensure that vegetation is properly established (up to 10% of plant stock may die off in the first year)

After the first year, it is highly recommended that an annual spring maintenance inspection and cleanup be conducted at all infiltration facilities which would include the following:

- Check % cover of mulch plus vegetative cover
- Check for sediment buildup at entrance points
- Check for winter killed vegetation and replace
- Note presence of accumulated sediment
- Check for any erosion
- Check for signs of excessive ponding
- Check for clogged soil media and crust formation

Maintenance of infiltration areas can be divided into routine and non-routine tasks.

Routine Maintenance

Most of the routine maintenance procedures are typical landscape care activities.

ACTIVITY	OBJECTIVE	SCHEDULE
Watering (by hand or irrigation system)	Maintain a minimum 80% survival rate of plants	Once established, water thoroughly every 2 weeks or as indicated by plant health
Cleaning entrance points	Maintain proper flow from impervious areas	Twice annually (October & January)
Pruning vegetation	Maintain plant coverage and health, soil health, and infiltration capability	Once or twice annually
Weeding (by hand)	Reduce plant competition and maintain aesthetics	Twice annually preceding weed seed disbursement
Mulching (replace or add mulch to a depth of 23 inches)	Replenish organic material, reduce erosion, and maintain soil moisture	Annually
Trash removal	Maintain aesthetics and prevent clogging	Twice annually
Minor sediment removal (with shovel or rake)	Reduce clogging, maintain plant survival, maintain ponding depths	Annually

Non-routine Maintenance

The most common non-routine maintenance problem involves standing water. If water remains on the surface for more than 48 hours after a storm, adjustments or repairs may be needed.

ACTIVITY	OBJECTIVE	SCHEDULE
Major sediment removal (with shovel, vactor intake structures)	Reduce clogging, maintain plant survival, maintain ponding depths	Determined by inspection
Clean under drains (jet clean or rotary cut roots)	Maintain drainage, ponding depths, and dewatering rates	Determined by inspection
Clean border of pavement and vegetation (trimmer, rake, or shovel)	Maintain proper sheet flow to bioretention area	By inspection
Replace vegetation (reseed or replant)	Maintain dense vegetation to prevent erosion and exclude weeds	By inspection
Replace soil (by hand or small excavator)	Maintain infiltration, soil fertility, and pollutant removal capability	By inspection (visual and infiltration testing)
Rebuild structures (walls, intakes, weirs, etc.)	Maintain proper drainage	By inspection
Re-grade side slopes (by hand or small excavator)	Prevent erosion	By inspection

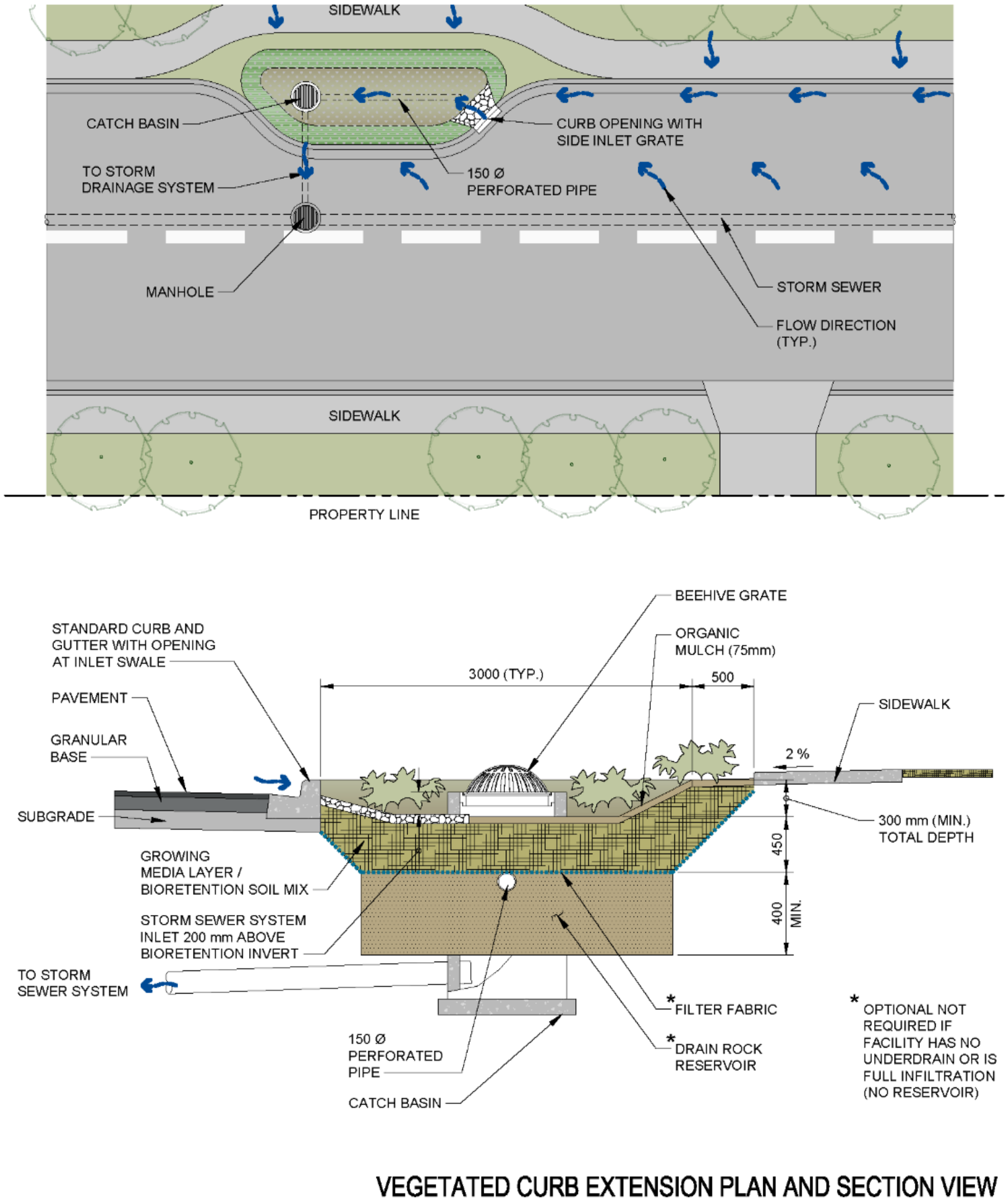
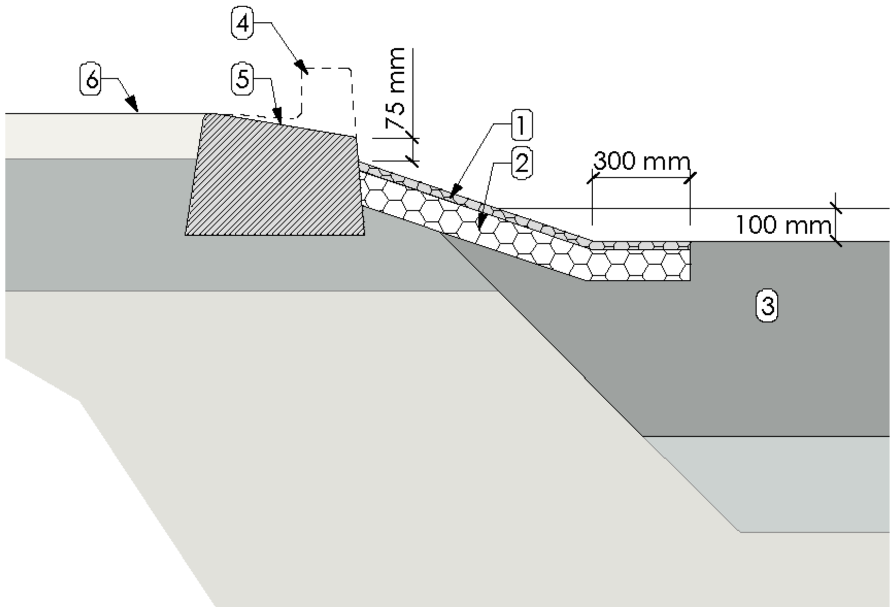


Figure 8 Vegetated Curb Extension Plan and Section View



MATERIALS

1. 25 mm - 25 mm dia drain rock
2. 100 mm - 50-75 mm dia drain rock
3. Growing medium
4. Curb (beyond).
5. Curb inlet, min 2%
6. Adjacent street surface

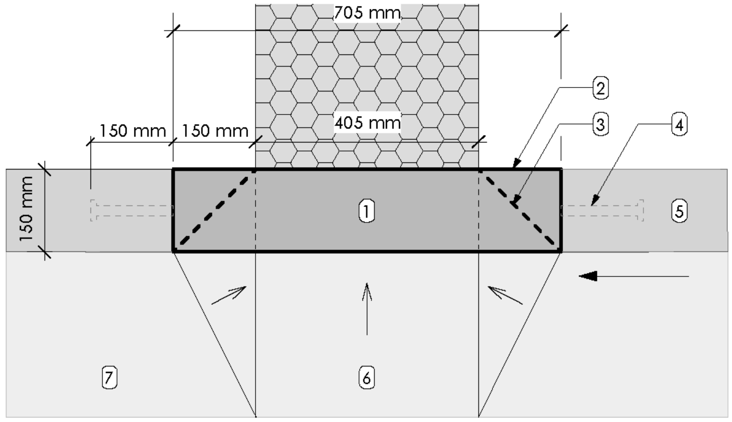
FLOW DISSIPATOR - PROFILE

NOT TO SCALE

PROFILE

Figure 9 Flow Dissipator Option

Modified from: District of Saanich Stormwater Management Guidebook (2011, Unpublished Draft), written by Kerr Wood Leidal Associates Ltd. and Murdoch de Greeff Inc.

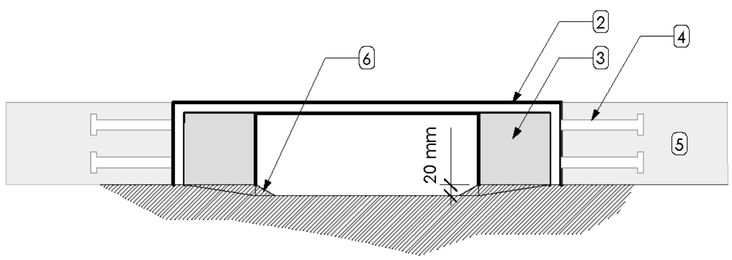


MATERIALS

1. Steel inlet structure
2. Steel rear wall
3. Steel baffle, angled 45 degrees towards rear wall.
4. Steel anchor, welded to inlet structure (2 each side)
5. Cast in place concrete curb
6. Hand trowel gutter to meet inlet base. Ensure positive drainage towards inlet.
7. Concrete gutter

STEEL CURB INLET

NOT TO SCALE — PLAN

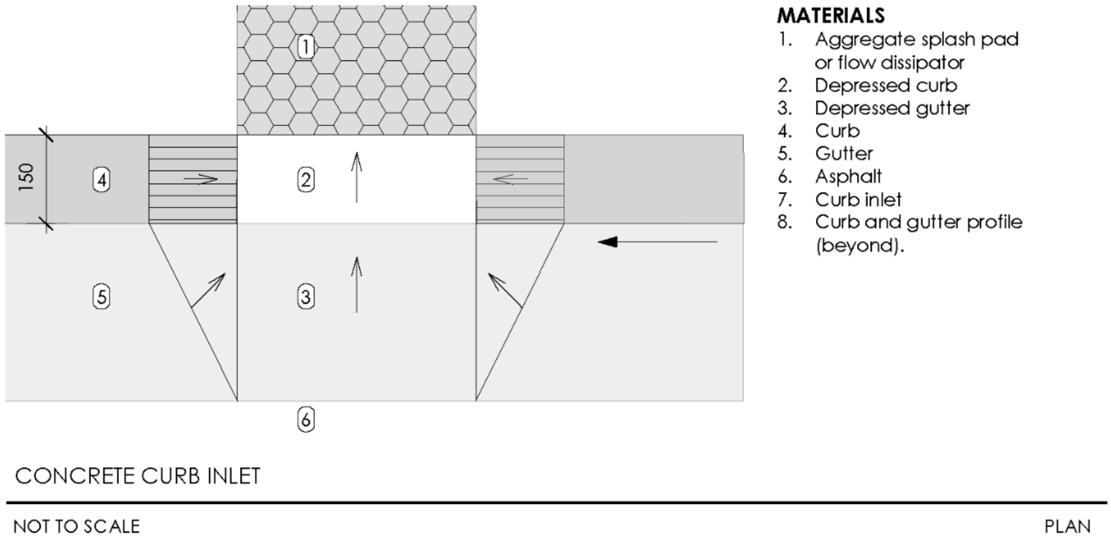


STEEL CURB INLET

NOT TO SCALE — FRONT SECTION/ELEVATION DETAIL

Figure 10 Steel Curb Inlet Option

Modified from: District of Saanich Stormwater Management Guidebook (2011, Unpublished Draft), written by Kerr Wood Leidal Associates Ltd. and Murdoch de Greeff Inc.



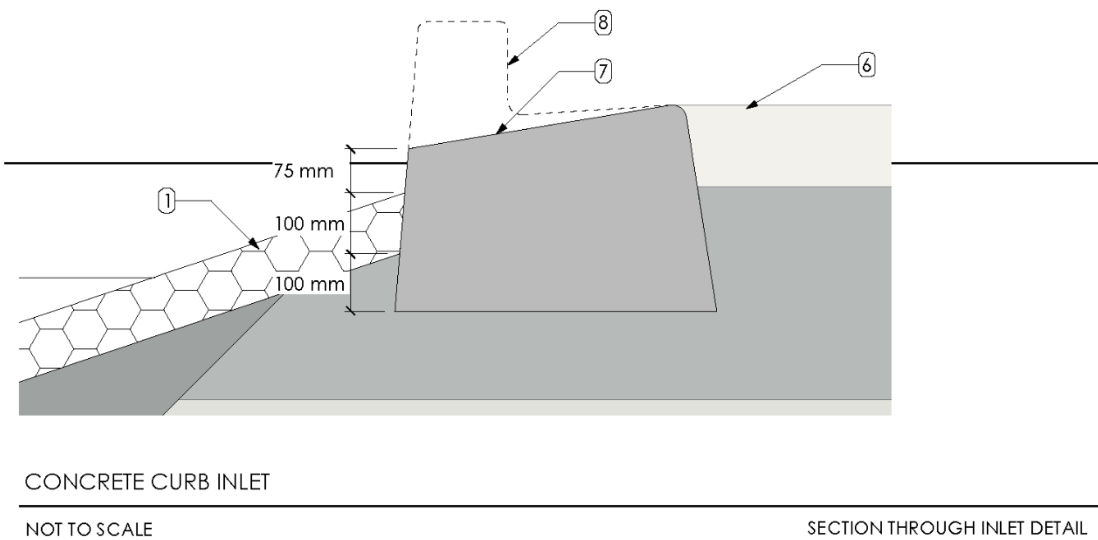


Figure 11 Concrete Curb Inlet Option

Modified from: District of Saanich Stormwater Management Guidebook (2011, Unpublished Draft), written by Kerr Wood Leidal Associates Ltd. and Murdoch de Greeff Inc.