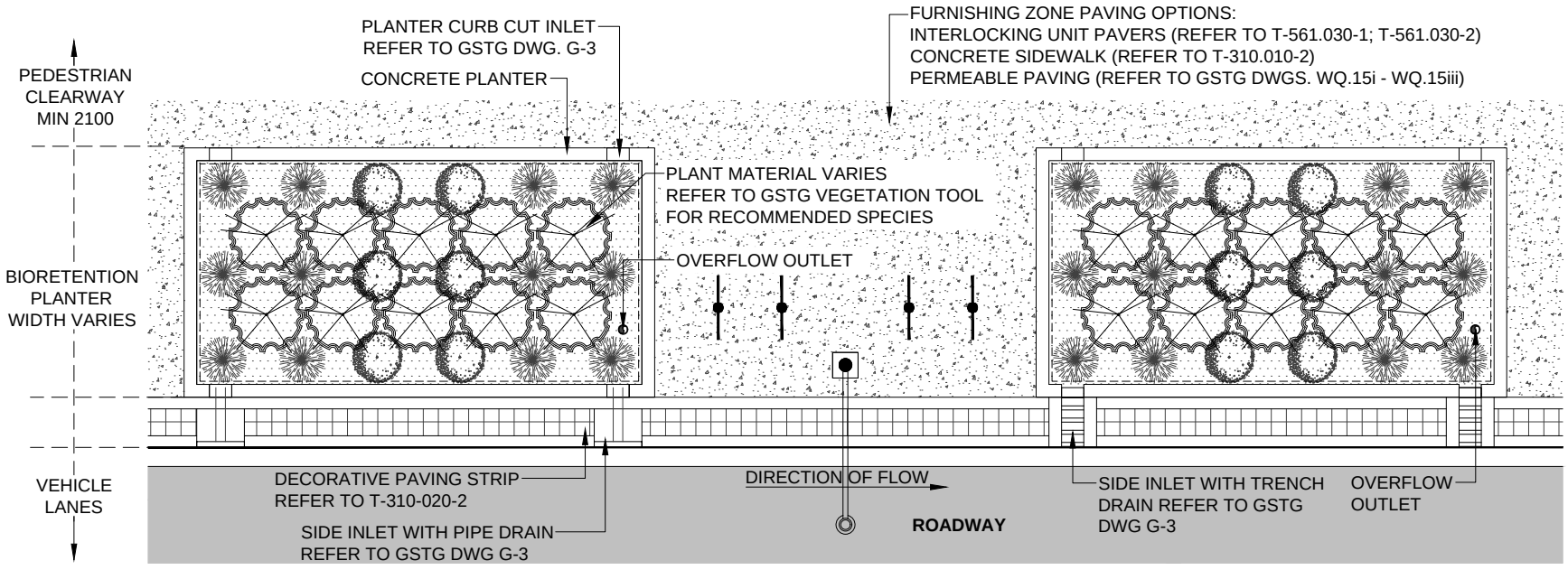
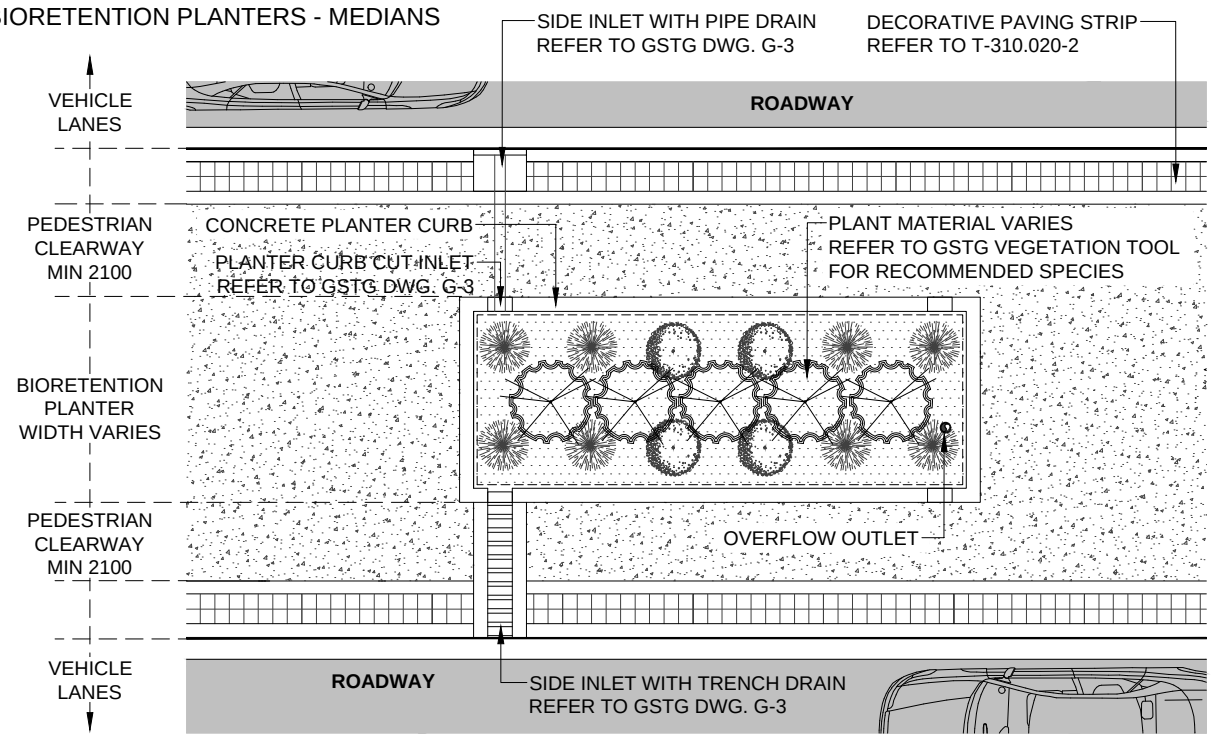
BIORETENTION PLANTERS - FURNISHING ZONES



BIORETENTION PLANTERS - MEDIANS

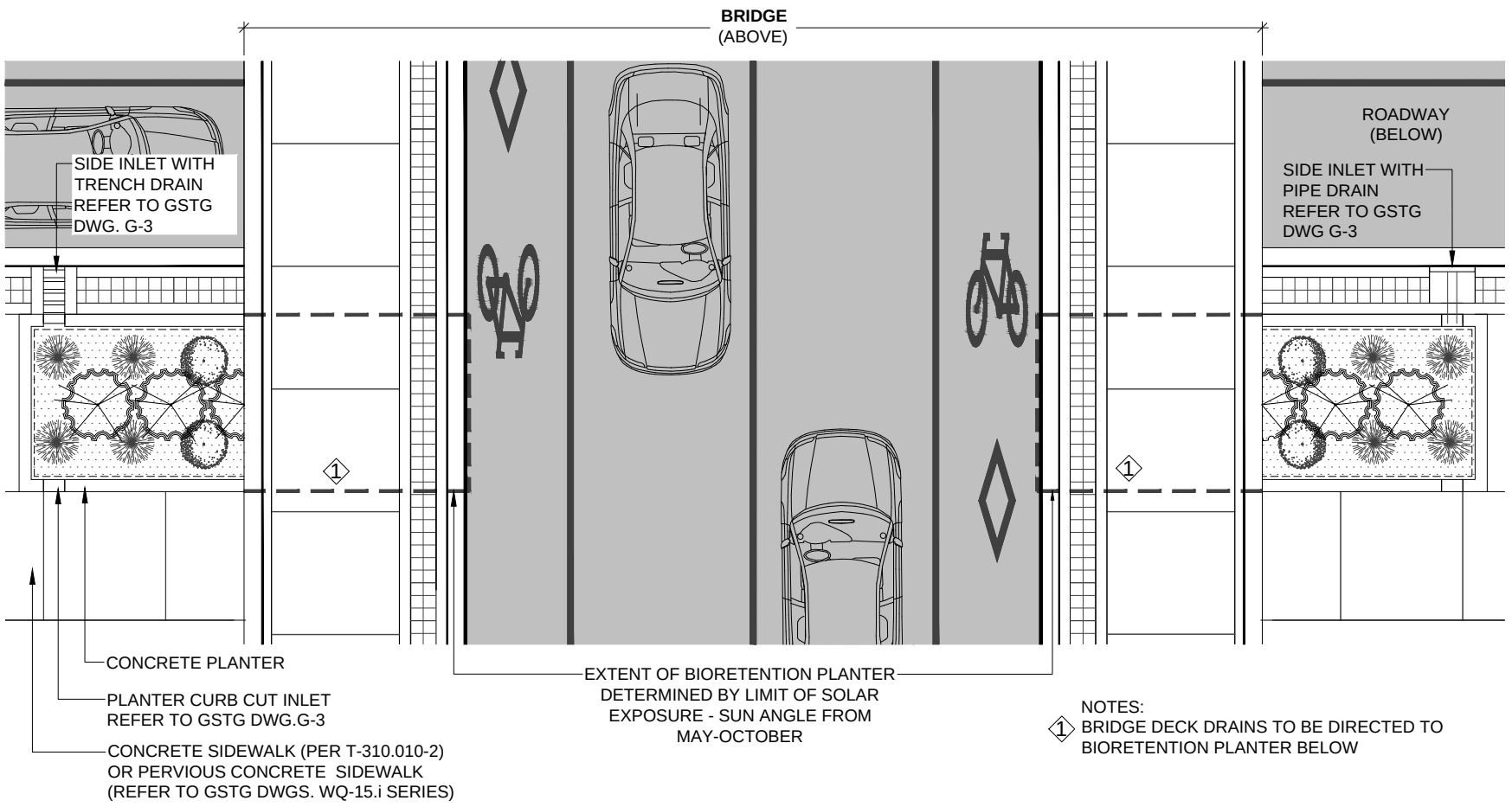


NOTES:

MEDIAN PAVING OPTIONS:

1. INTERLOCKING UNIT PAVERS (REFER TO T-561.030-1; T-561.030-2)
2. CONCRETE PAVING (REFER TO T-310.010-2)
3. PERMEABLE PAVING (REFER TO GSTG DWGS WQ.15i - WQ.15iii)

BIORETENTION PLANTERS - BRIDGES



NOTES:
1. BRIDGE DECK DRAINS TO BE DIRECTED TO BIORETENTION PLANTER BELOW

All dimensions are in millimetres unless otherwise shown.

TORONTO	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
	BIORETENTION PLANTERS LAYOUTS	WQ-1.1b	
		NTS	2 OF 2

A.0 GEOMETRY & LAYOUT

- Minimum footprint based on size of drainage area. Impervious contributing area to treatment facility area ratio should be 5:1 to 15:1.
- Ensure that the surface of the bioretention facility is level.

A.1 PRETREATMENT

- Pre-treatment area varies based on site context. Options include enhanced grass swales, bioswales and mechanical pre-treatment devices.

A.2 FILTER MEDIA

- Pre-mixed from an approved vendor;
- Filter media composition (by weight):
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr
- Materials testing by an independent testing lab is required to confirm filter media composition. Sample to be collected at supply site by a Geotechnical engineer using standard protocols. If issues arise with the performance of an installation, then samples should be collected from the constructed facility for further testing;
- Depth varies - Minimum recommended depth 1.0 - 1.25m for enhanced pollutant removal;
- Bioretention with trees - minimum depth 1.0m. Total volume 30m³/tree or 20m³/tree for trees sharing soil.
- Capacity - Volumetric computation should be based on surface area and depth.
- Refer to TS 5.10 - Construction Specification for Growing Media

A.3 GRAVEL STORAGE

- Depth - Min. 300 mm;
- Material - 50 mm dia. washed clear stone;
- Capacity - Volumetric computation based on depth;
- Choker Layer: 100 mm pea gravel layer between filter media and gravel storage layers.

A.4 MULCH

- Depth - 75 mm;
- Material - Shredded hardwood bark mulch.

A.5 OVERFLOW

- Sized to convey larger storm events;
- PVC Overflow Pipe invert should be set at a maximum of 250mm above the filter bed surface;
- Cap - metal beehive cap or approved equal.

A.6 MONITORING WELL

- Vertical PVC perforated stand pipe (100-150mm dia.) with lockable cap;
- Extend to the bottom of the bioretention facility.

A.7 UNDERDRAIN (OPTIONAL)

- Required where native soil infiltration rates are <15mm/hr or adjacent to structures;
- Min. 200mm dia. perforated pipe installed 100mm above the bottom of the gravel storage layer;
- Capped at upstream end and connected to storm sewer;
- Connected to monitoring well for clean out;
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

A.8 GEOTEXTILE

- Material - Woven monofilament or non-woven needle punched fabrics;
- Refer to OPSS 1860 Material Specification for Geotextiles.

A.9 PLANTING

Plant material selection and arrangement considerations:

- Plant material selection and arrangement should consider the site context;
- Native plant material should be selected wherever possible;
- Plant materials should be selected for their tolerance of salt and urban conditions. Shade should also be considered for herbaceous material planted under trees or in other ultra-urban shaded areas;
- Planting design should provide variety in seasonal colour and winter interest;
- Plant material should be arranged in groupings by relative height texture and aesthetic attributes;
- Refer to the GSTG Vegetation Selection Tool for an appropriate palette;
- Refer to Construction Specification for Planting (TS 5.30).

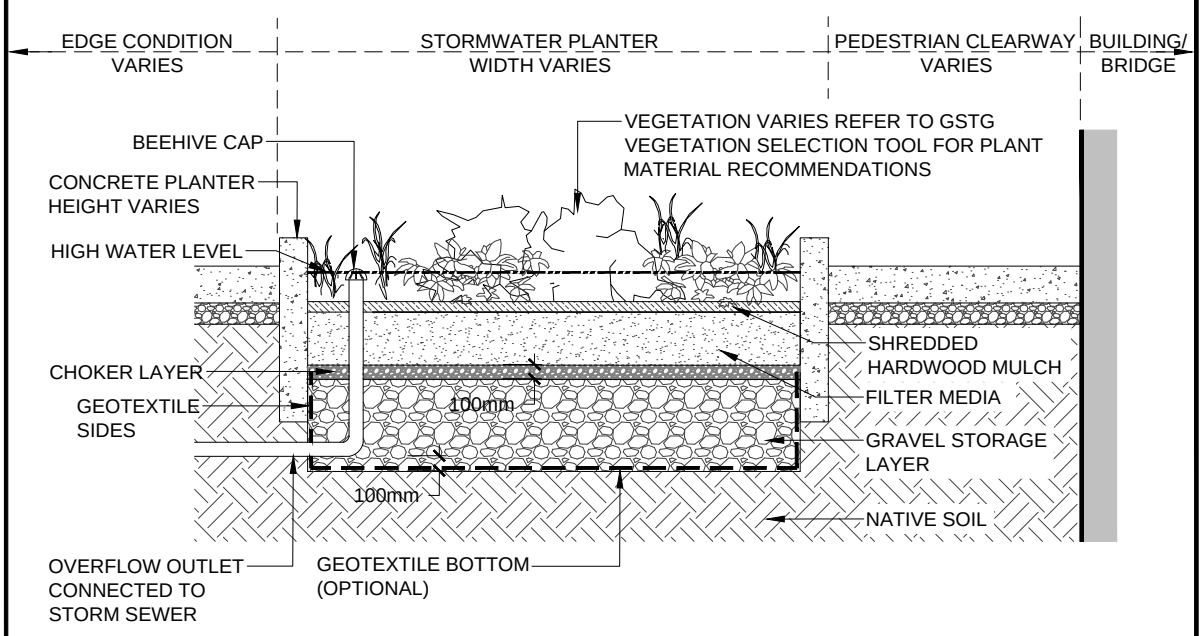
A.10 IDENTIFICATION MEDALLION

- To be installed on planter wall. Refer to guideline drawing G-1.

STORMWATER PLANTER WITHOUT UNDERDRAIN

For sites with subsoil permeability >15mm/hr, water table depth > 1.0m

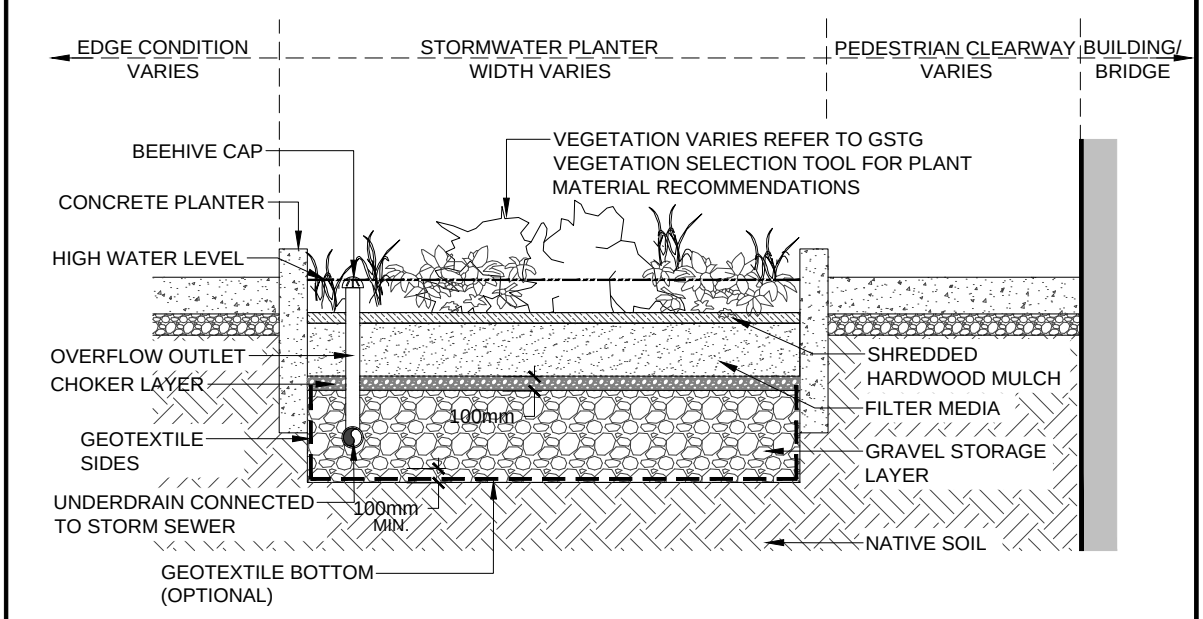
NOTE: 4.0m MIN SETBACK FROM BUILDING FACE



STORMWATER PLANTER WITH UNDERDRAIN

For sites with subsoil permeability <15mm/hr, water table depth > 1.0m

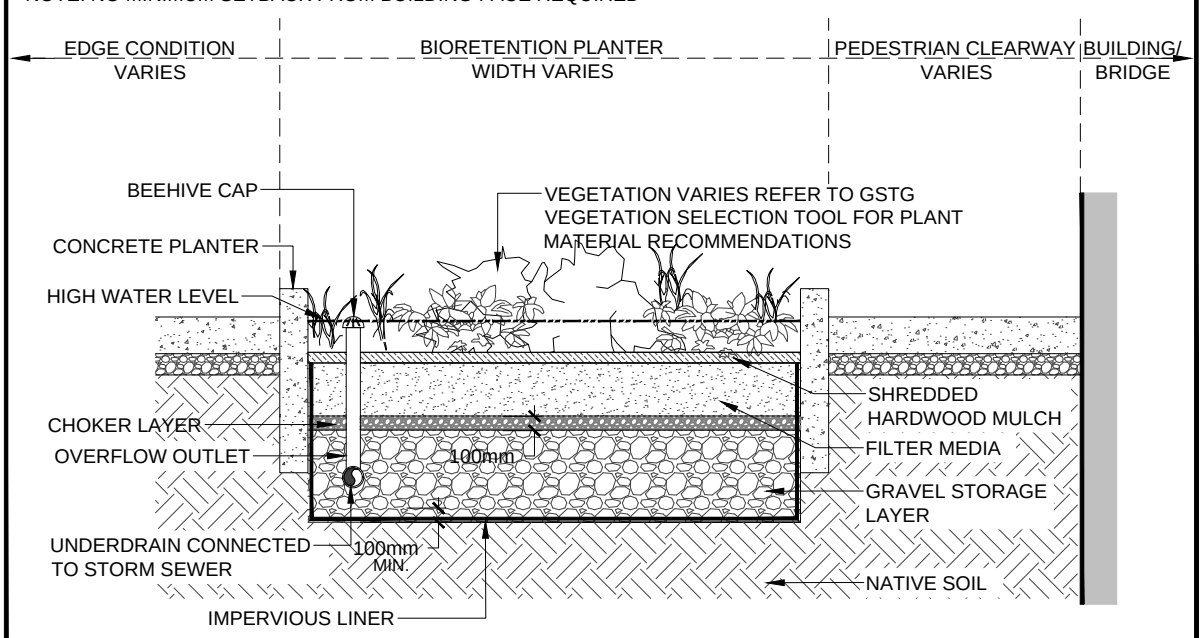
NOTE: 4.0m MIN SETBACK FROM BUILDING FACE



STORMWATER PLANTER WITH UNDERDRAIN AND IMPERVIOUS LINER

For sites with contaminated subsoil or high water table (within 1.0m)

NOTE: NO MINIMUM SETBACK FROM BUILDING FACE REQUIRED

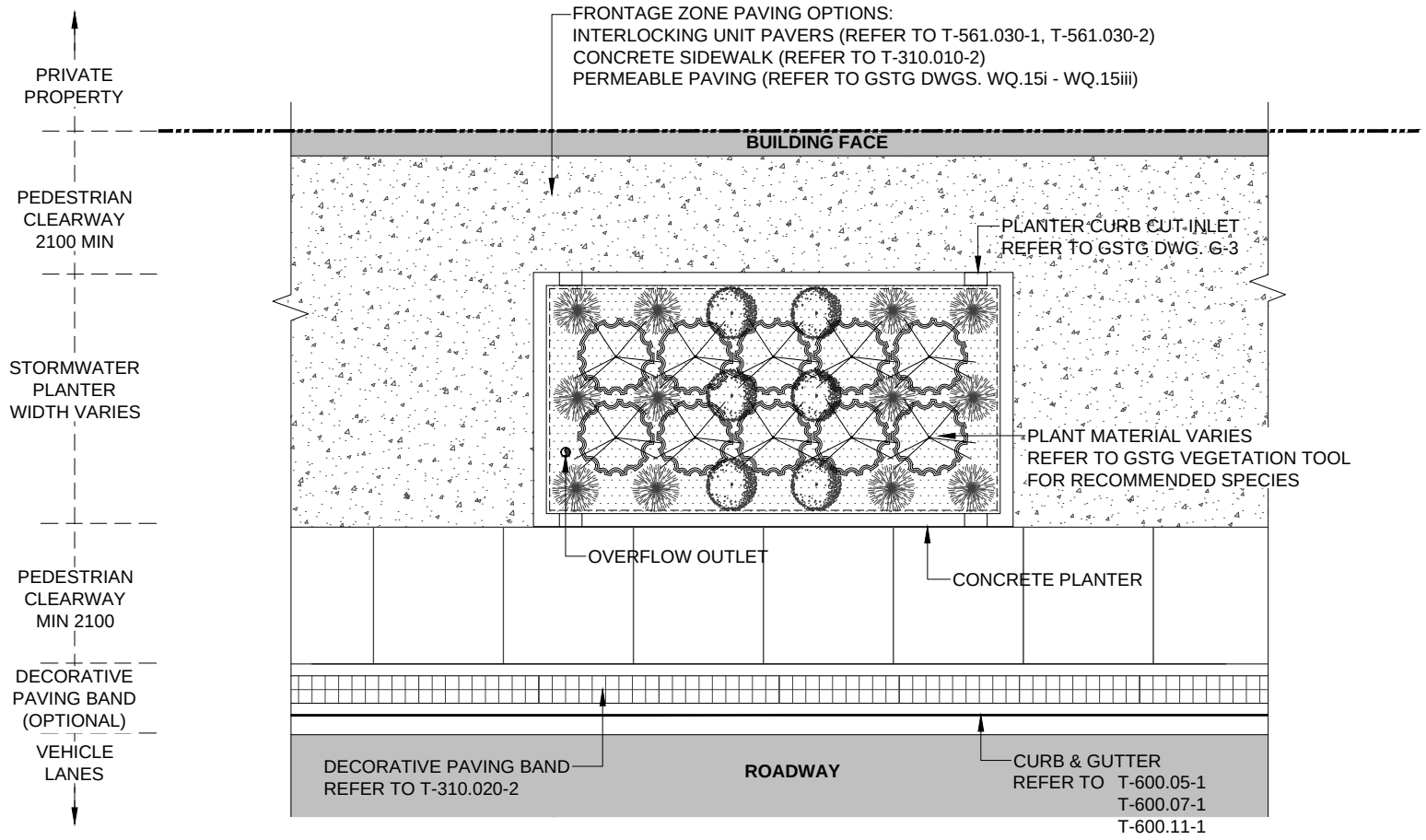


NOTE: SCARIFY BASE OF EXCAVATION

All dimensions are in millimetres unless otherwise shown.

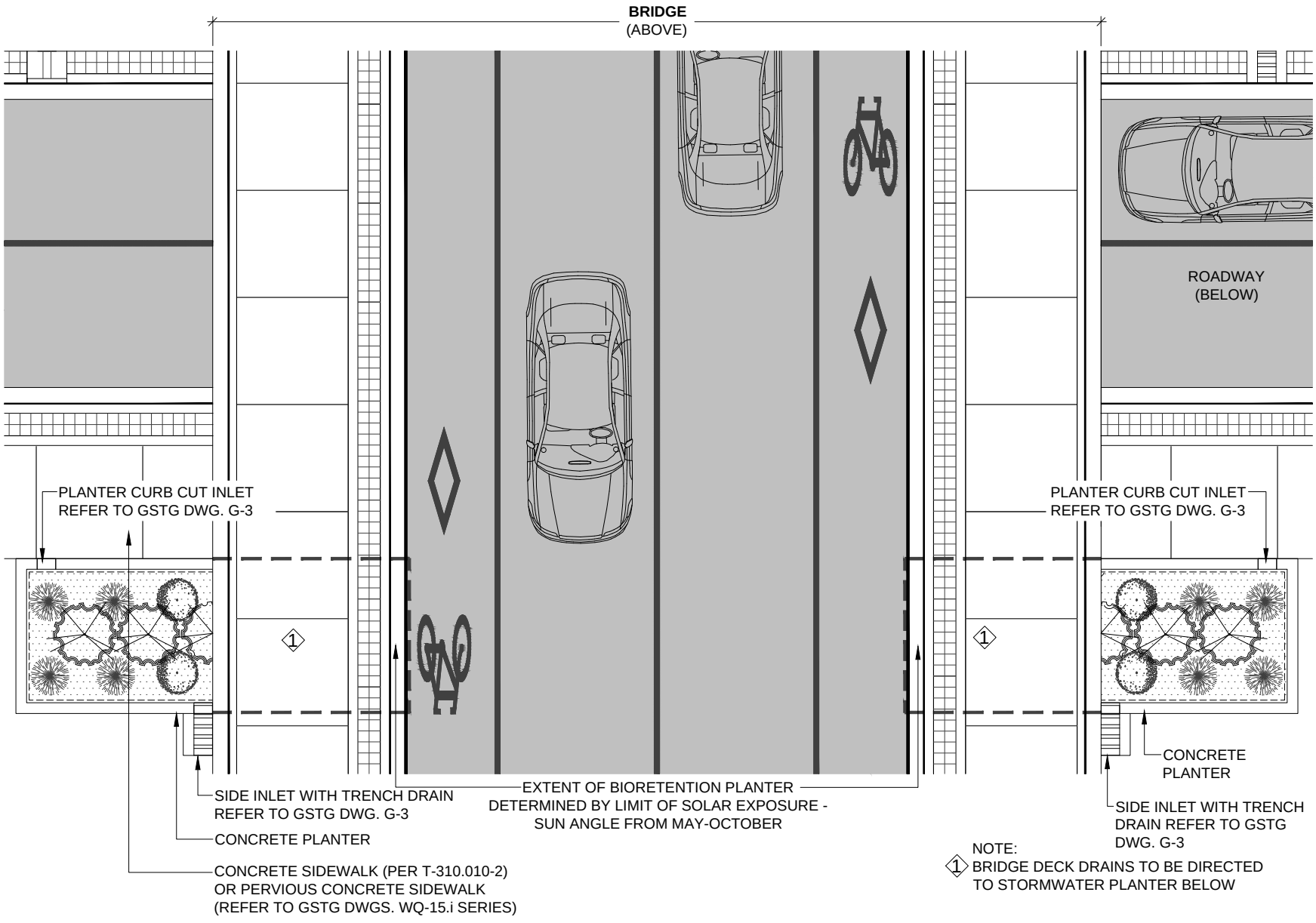
	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
TORONTO	STORMWATER PLANTERS SECTIONS	WQ-2.1a	
		NTS	1 OF 2

STORMWATER PLANTER IN A FRONTAGE ZONE



NOTE: CURB CUT INLET THROAT SIZED ACCORDING TO INLET FLOW RATE

STORMWATER PLANTERS UNDER A BRIDGE



NOTE: CURB CUT INLET THROAT SIZED BASED ON INLET FLOW RATE

All dimensions are in millimetres unless otherwise shown.

TORONTO	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
	STORMWATER PLANTERS LAYOUTS	WQ-2.1b	
		NTS	2 OF 2

A.0 GEOMETRY & LAYOUT

- Minimum footprint based on size of drainage area. Impervious contributing area to treatment facility area ratio should be 5:1 to 15:1.
- Ensure that the surface of the bioretention facility is level.

A.1 PRETREATMENT

- Pre-treatment area varies based on site context. Options include enhanced grass swales, bioswales and mechanical pre-treatment devices.

A.2 FILTER MEDIA

- Pre-mixed from an approved vendor;
- Filter media composition (by weight):
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr
- Materials testing by an independent testing lab is required to confirm filter media composition. Sample to be collected at supply site by a Geotechnical engineer using standard protocols. If issues arise with the performance of an installation, then samples should be collected from the constructed facility for further testing;
- Depth varies - Minimum recommended depth 1.0 - 1.25m for enhanced pollutant removal;
- Bioretention with trees - minimum depth 1.0m. Total volume 30m³/tree or 20m³/tree for trees sharing soil.
- Capacity - Volumetric computation should be based on surface area and depth.
- Refer to TS 5.10 - Construction Specification for Growing Media

A.3 GRAVEL STORAGE

- Depth - Min. 300 mm;
- Material - 50 mm dia. washed clear stone;
- Capacity - Volumetric computation based on depth;
- Choker Layer: 100 mm pea gravel layer between filter media and gravel storage layers.

A.4 MULCH

- Depth - 75 mm;
- Material - Shredded hardwood bark mulch.

A.5 OVERFLOW

- Sized to convey larger storm events;
- PVC Overflow Pipe invert should be set at a maximum of 250mm above the filter bed surface;
- Cap - metal beehive cap or approved equal.

A.6 MONITORING WELL

- Vertical PVC perforated stand pipe (100-150mm dia.) with lockable cap;
- Extend to the bottom of the bioretention facility.

A.7 UNDERDRAIN (OPTIONAL)

- Required where native soil infiltration rates are <15mm/hr or adjacent to structures;
- Min. 200mm dia. perforated pipe installed 100mm above the bottom of the gravel storage layer;
- Capped at upstream end and connected to storm sewer;
- Connected to monitoring well for clean out;
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

A.8 GEOTEXTILE

- Material - Woven monofilament or non-woven needle punched fabrics;
- Refer to OPSS 1860 Material Specification for Geotextiles.

A.9 PLANTING

Plant material selection and arrangement considerations:

- Plant material selection and arrangement should consider the site context;
- Native plant material should be selected wherever possible;
- Plant materials should be selected for their tolerance of salt and urban conditions. Shade should also be considered for herbaceous material planted under trees or in other ultra-urban shaded areas;
- Planting design should provide variety in seasonal colour and winter interest;
- Plant material should be arranged in groupings by relative height texture and aesthetic attributes;
- Refer to the GSTG Vegetation Selection Tool for an appropriate palette;
- Refer to Construction Specification for Planting (TS 5.30).

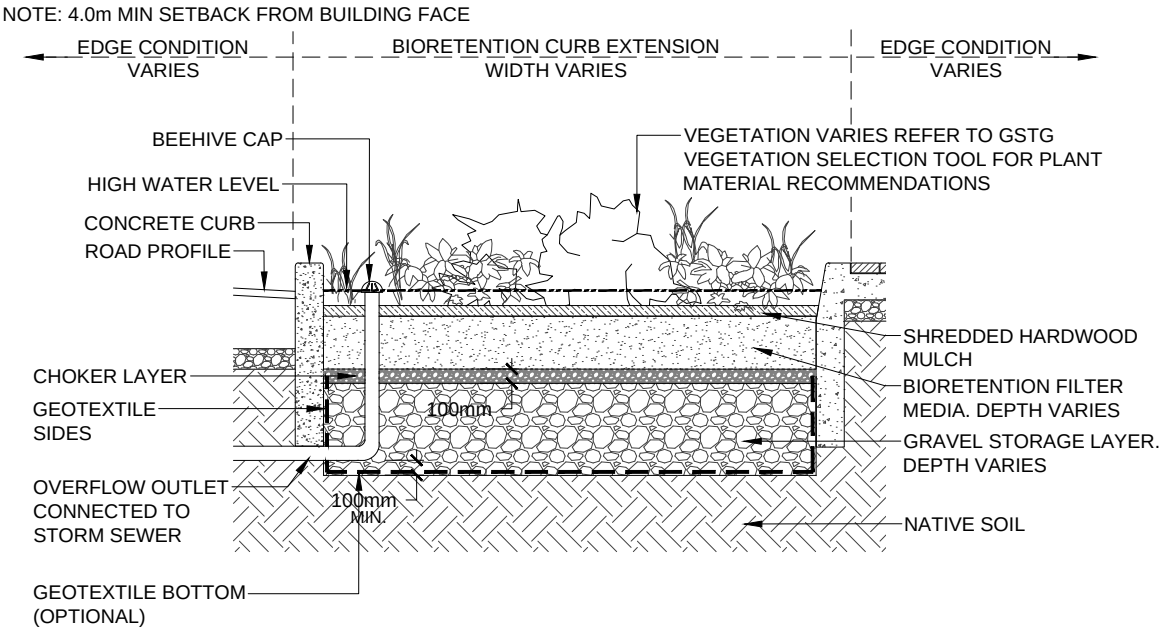
A.10 IDENTIFICATION MEDALLION

- To be installed on curb. Refer to guideline drawing G-1.

BIORETENTION CURB EXTENSION WITHOUT UNDERDRAIN

For sites with subsoil permeability >15mm/hr, water table depth > 1.0m

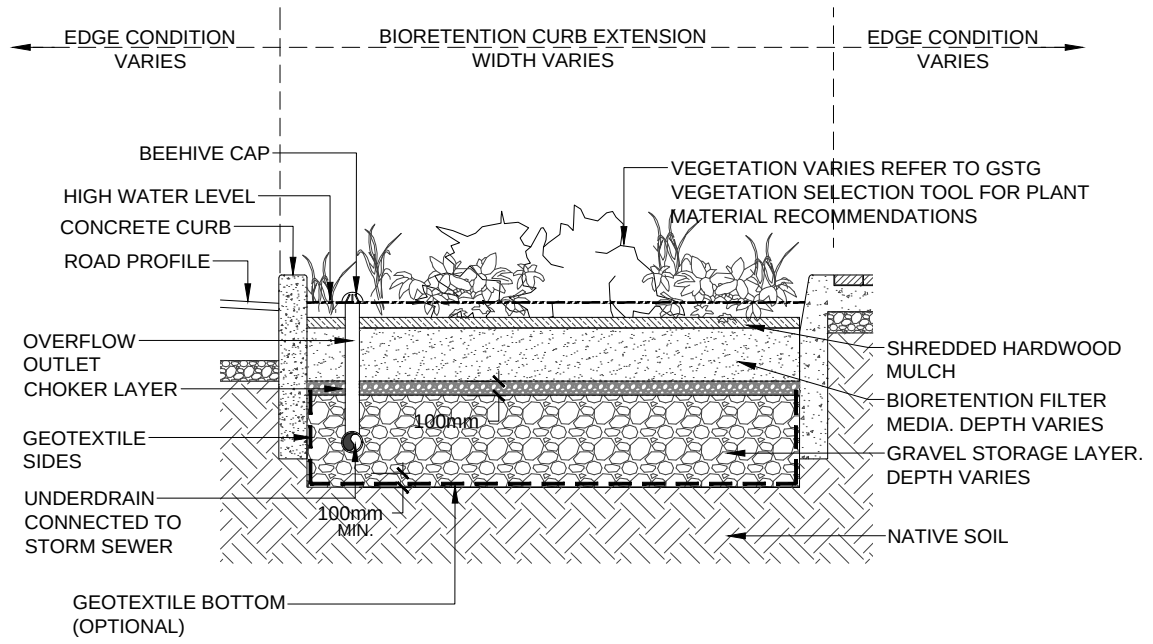
NOTE: 4.0m MIN SETBACK FROM BUILDING FACE



BIORETENTION CURB EXTENSION WITH UNDERDRAIN

For sites with subsoil permeability <15mm/hr, water table depth > 1.0m

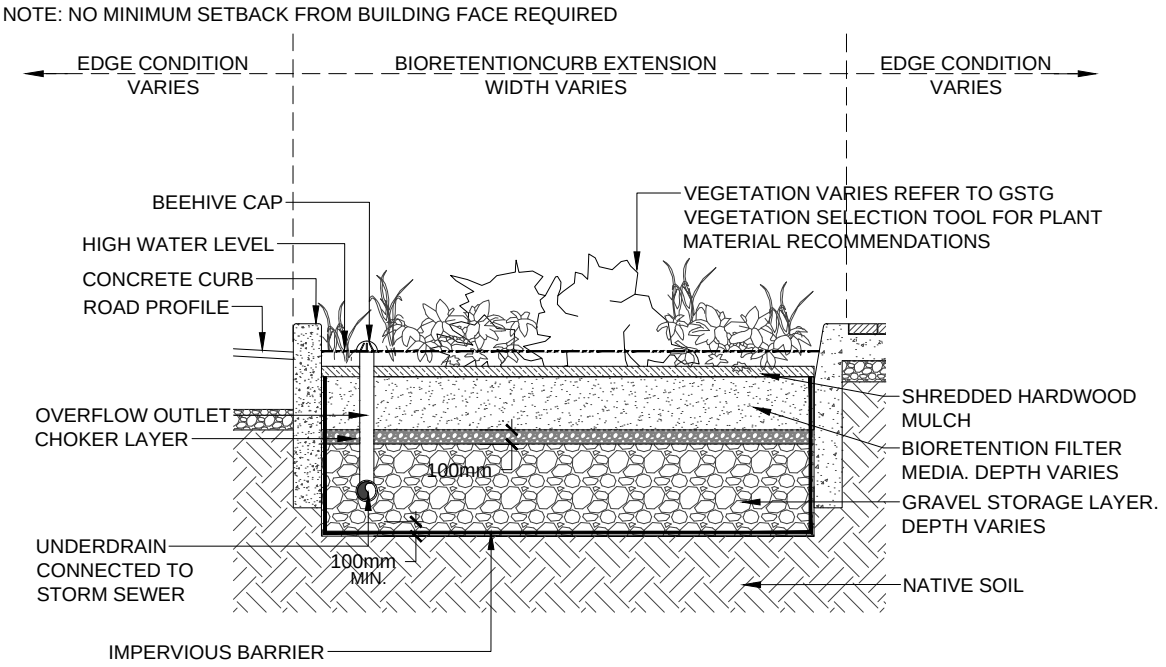
NOTE: 4.0m MIN SETBACK FROM BUILDING FACE



BIORETENTION CURB EXTENSION WITH UNDERDRAIN & IMPERVIOUS LINER

For sites with contaminated subsoil or high water table (within 1.0m)

NOTE: NO MINIMUM SETBACK FROM BUILDING FACE REQUIRED



NOTE: SCARIFY BASE OF EXCAVATION

All dimensions are in millimetres unless otherwise shown.

CITY OF TORONTO GUIDELINE DRAWING

BIORETENTION CURB EXTENSION

SECTIONS

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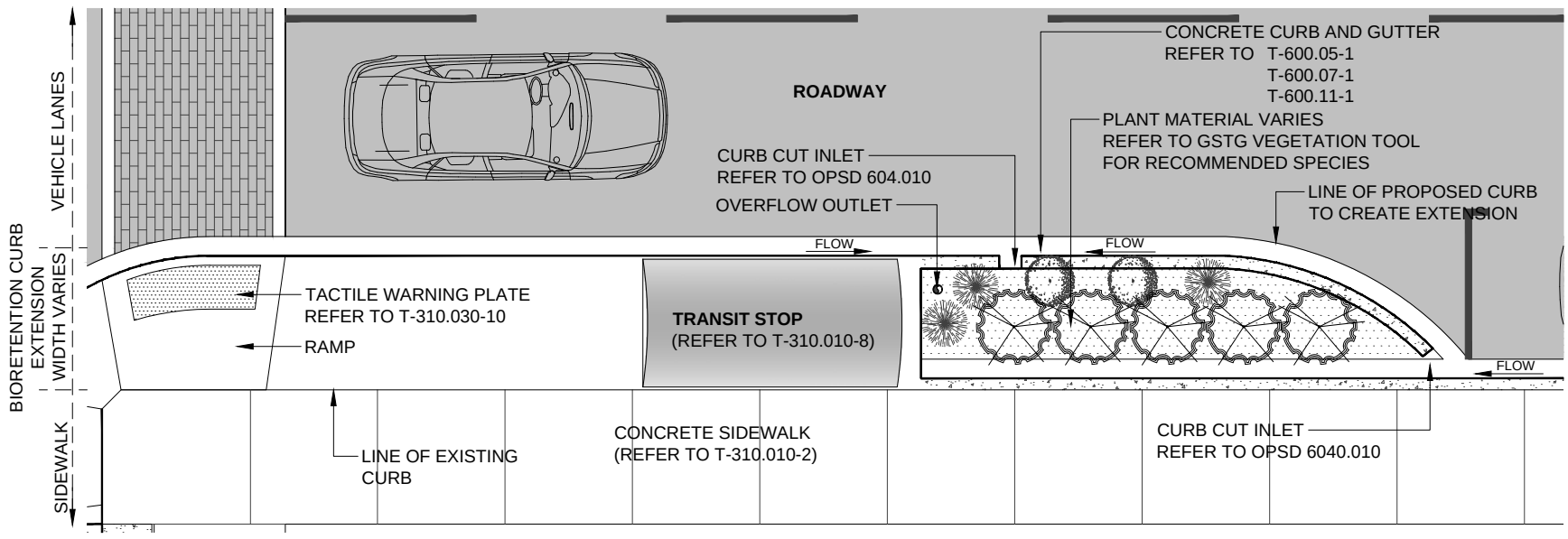
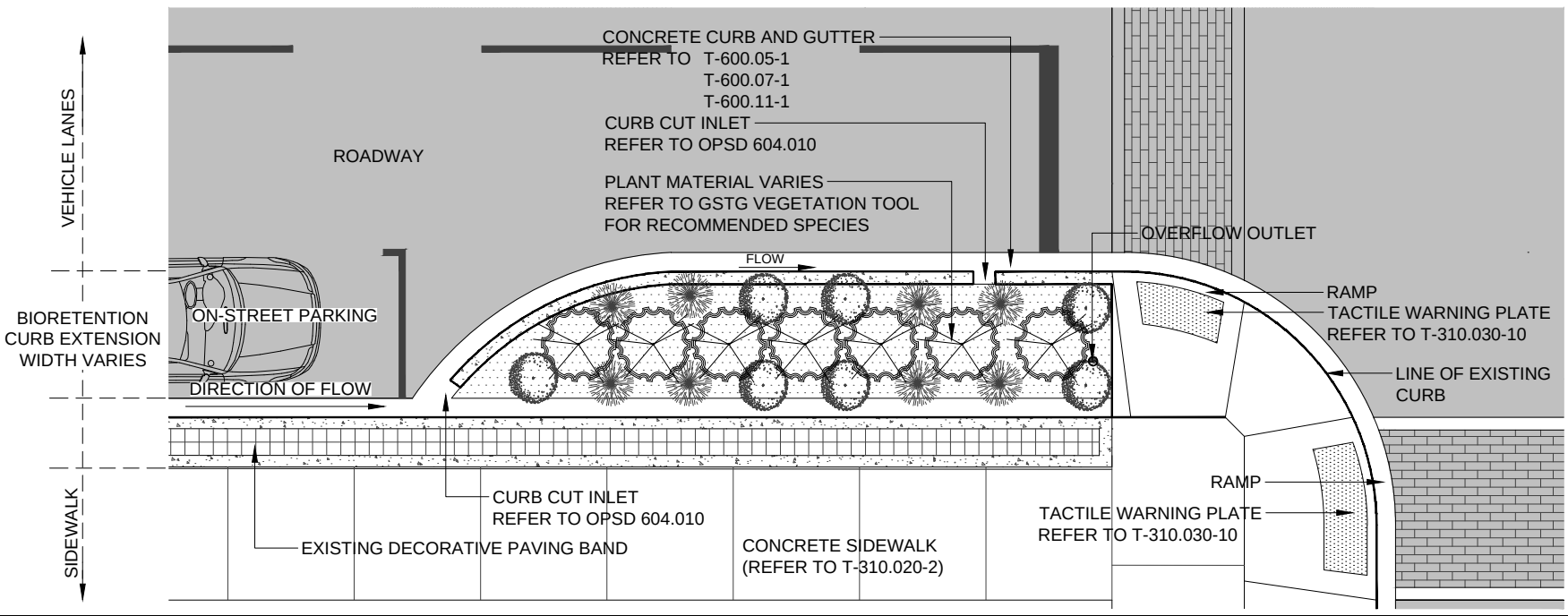
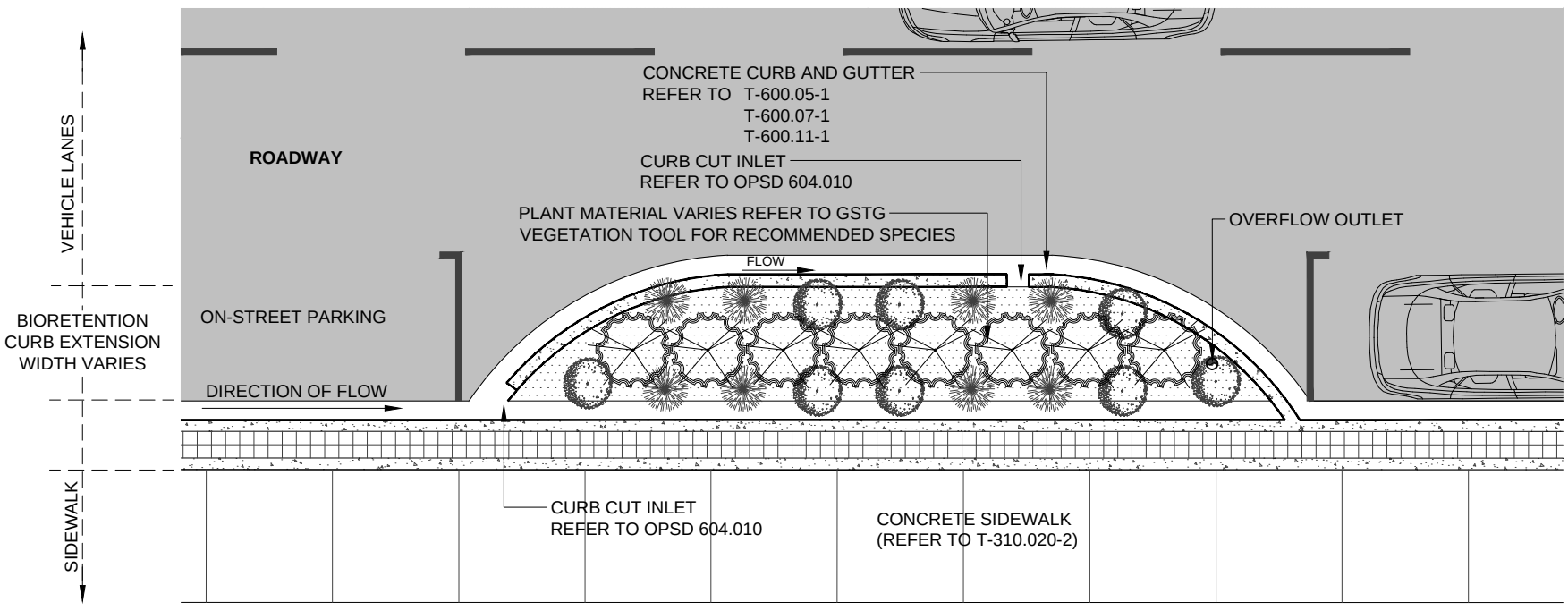
BIORETENTION CURB EXTENSION - TRANSIT STOP



BIORETENTION CURB EXTENSION - INTERSECTION



BIORETENTION CURB EXTENSION - MIDBLOCK



NOTES:
- CURB CUT INLET THROAT SIZED ACCORDING TO INLET FLOW RATE

PLANTING:
- PLANT SPECIES SHOULD BE LOW GROWING IN ORDER FOR VIEWS TO REMAIN UNOBSTRUCTED
- REFER TO THE GSTG VEGETATION SELECTION TOOL FOR PREFERRED SPECIES

All dimensions are in millimetres unless otherwise shown.

	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
TORONTO	BIORETENTION CURB EXTENSION LAYOUT	WQ-3.1b	
		NTS	2 OF 2

A.0 GEOMETRY & LAYOUT

- Minimum footprint based on size of drainage area. Impervious contributing area to treatment facility area ratio should be 5:1 to 15:1.
- Ensure that the surface of the bioretention facility is level.

A.1 PRETREATMENT

- Pre-treatment area varies based on site context. Options include enhanced grass swales, bioswales and mechanical pre-treatment devices.

A.2 FILTER MEDIA

- Pre-mixed from an approved vendor;
- Filter media composition (by weight):
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr
- Materials testing by an independent testing lab is required to confirm filter media composition. Sample to be collected at supply site by a Geotechnical engineer using standard protocols. If issues arise with the performance of an installation, then samples should be collected from the constructed facility for further testing;
- Depth varies - Minimum recommended depth 1.0 - 1.25m for enhanced pollutant removal;
- Bioretention with trees - minimum depth 1.0m. Total volume 30m³/tree or 20m³/tree for trees sharing soil.
- Capacity - Volumetric computation should be based on surface area and depth.
- Refer to TS 5.10 - Construction Specification for Growing Media

A.3 GRAVEL STORAGE

- Depth - Min. 300 mm;
- Material - 50 mm dia. washed clear stone;
- Capacity - Volumetric computation based on depth;
- Choker Layer: 100 mm pea gravel layer between filter media and gravel storage layers.

A.4 MULCH

- Depth - 75 mm;
- Material - Shredded hardwood bark mulch.

A.5 OVERFLOW

- Sized to convey larger storm events;
- PVC Overflow Pipe invert should be set at a maximum of 250mm above the filter bed surface;
- Cap - metal beehive cap or approved equal.

A.6 MONITORING WELL

- Vertical PVC perforated stand pipe (100-150mm dia.) with lockable cap;
- Extend to the bottom of the bioretention facility.

A.7 UNDERDRAIN (OPTIONAL)

- Required where native soil infiltration rates are <15mm/hr or adjacent to structures;
- Min. 200mm dia. perforated pipe installed 100mm above the bottom of the gravel storage layer;
- Capped at upstream end and connected to storm sewer;
- Connected to monitoring well for clean out;
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

A.8 GEOTEXTILE

- Material - Woven monofilament or non-woven needle punched fabrics;
- Refer to OPSS 1860 Material Specification for Geotextiles.

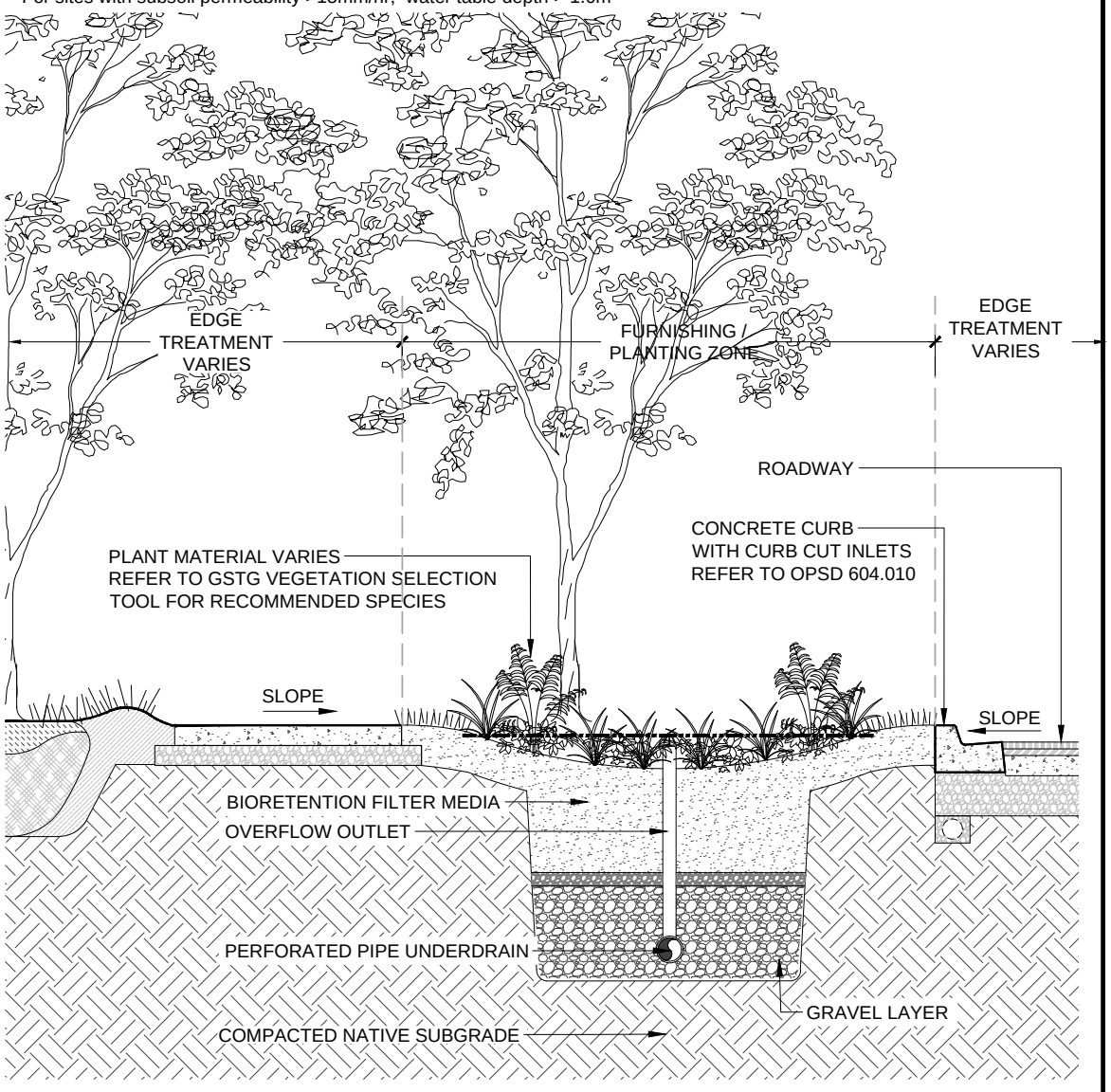
A.9 PLANTING

Plant material selection and arrangement considerations:

- Plant material selection and arrangement should consider the site context;
- Native plant material should be selected wherever possible;
- Plant materials should be selected for their tolerance of salt and urban conditions. Shade should also be considered for herbaceous material planted under trees or in other ultra-urban shaded areas;
- Planting design should provide variety in seasonal colour and winter interest;
- Plant material should be arranged in groupings by relative height texture and aesthetic attributes;
- Refer to the GSTG Vegetation Selection Tool for an appropriate palette;
- Refer to Construction Specification for Planting (TS 5.30).
- NOTE: Facility to be kept offline until seed establishes.

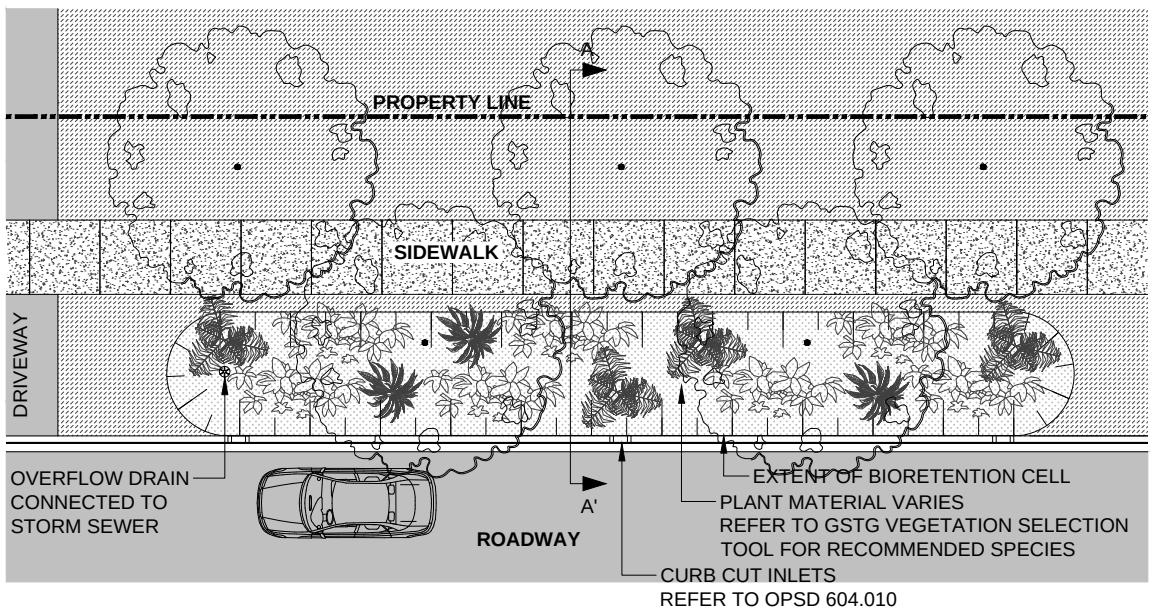
BIORETENTION CELL

For sites with subsoil permeability >15mm/hr, water table depth > 1.0m



SECTION A-A'

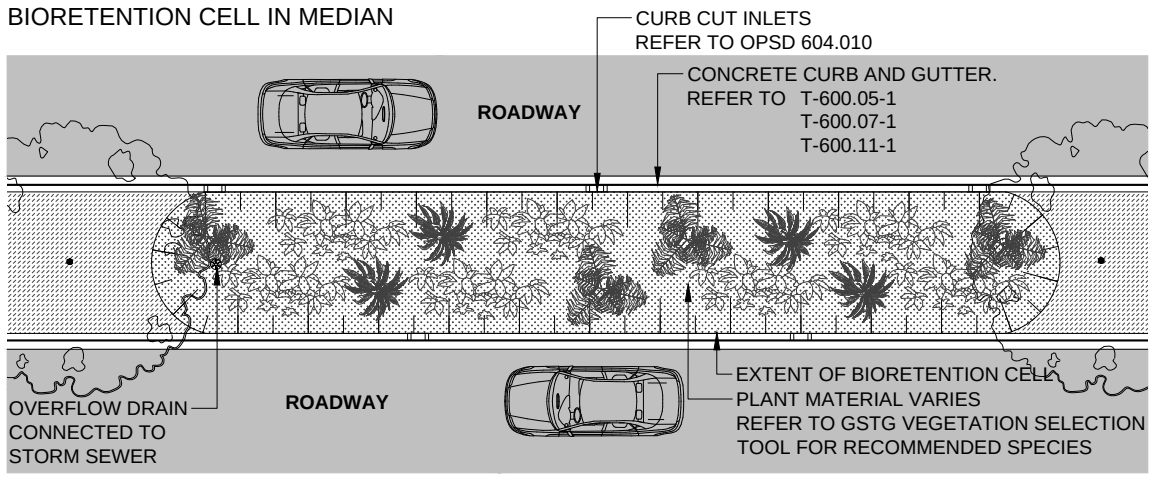
BIORETENTION CELL IN BOULEVARD



PLAN VIEW

NOTE: CURB CUT INLET THROAT SIZED ACCORDING TO INLET FLOW RATE BY ENGINEER

BIORETENTION CELL IN MEDIAN



PLAN VIEW

NOTE: CURB CUT INLET THROAT SIZED ACCORDING TO INLET FLOW RATE BY ENGINEER

All dimensions are in millimetres unless otherwise shown.

TORONTO	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
	BIORETENTION CELL SECTION AND LAYOUTS	WQ-4.1	
		NTS	1 OF 1

A.0 GEOMETRY & LAYOUT

- Size - less than 1000 m²
- Minimum footprint based on size of drainage area. Impervious contributing area to treatment facility area ratio should be 5:1 to 15:1.

A.1 PRETREATMENT

- Pre-treatment area varies based on site context. Options include enhanced grass swales, bioswales and mechanical pre-treatment devices.

A.2 AMENDED SOIL

- Depth - 300mm recommended
- Organic content - 8-15% by weight or 30-40% by volume.

A.3 MULCH

- Depth - 75 mm;
- Material - Shredded hardwood bark mulch
- Refer to OPSS MUNI 804 - Construction Specification for Seed and Cover.

A.4 OVERFLOW

- Sized to convey larger storm events;
- PVC Overflow Pipe invert should be set at a maximum of 250mm above the filter bed surface;
- Cap - Metal beehive cap or approved equal.

A.5 MONITORING WELL

- Vertical perforated stand pipe (100-150mm dia.) with lockable cap;
- Extend to the bottom of the bioretention facility.

A.6 UNDERDRAIN (OPTIONAL)

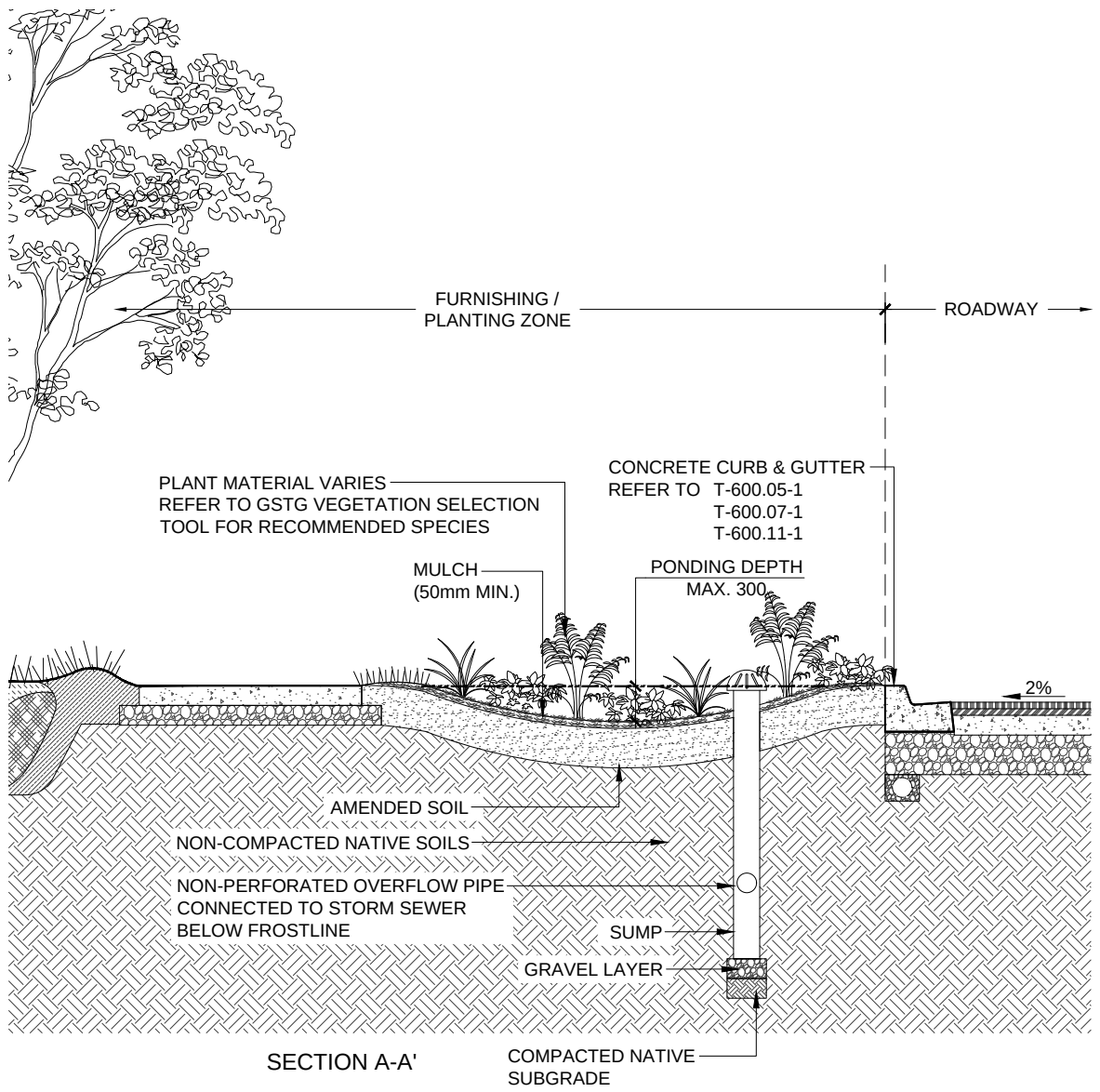
- Required where native soil infiltration rates are <15mm/hr;
- Min. 200mm dia. perforated pipe c/w filter sock installed 100mm above the bottom of the gravel storage layer;
- Capped at upstream end and connected to storm sewer;
- Connected to monitoring well for clean out;
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

A.7 PLANTING

Plant material selection and arrangement considerations:

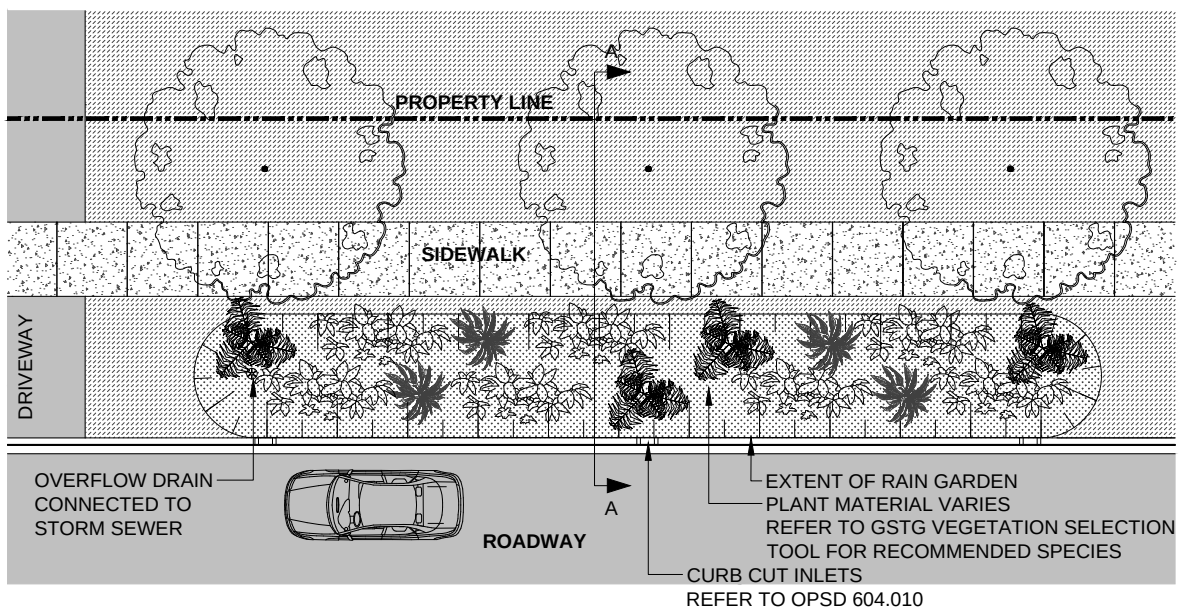
- Plant material selection and arrangement should consider the site context;
- Native plant material should be selected wherever possible;
- Plant materials should be selected for their tolerance of salt and urban conditions. Shade should also be considered for herbaceous material planted under trees or in other ultra-urban shaded areas;
- Planting design should provide variety in seasonal colour and winter interest;
- Plant material should be arranged in groupings by relative height texture and aesthetic attributes
- Refer to the GSTG Vegetation Selection Tool for an appropriate palette;
- Refer to Construction Specification for Planting (TS 5.30);
- Refer to Construction Specification for Direct Seeding (TS 5.10).

RAIN GARDEN (For Sites with Soil Permeability > 15mm/hr)



SECTION A-A'

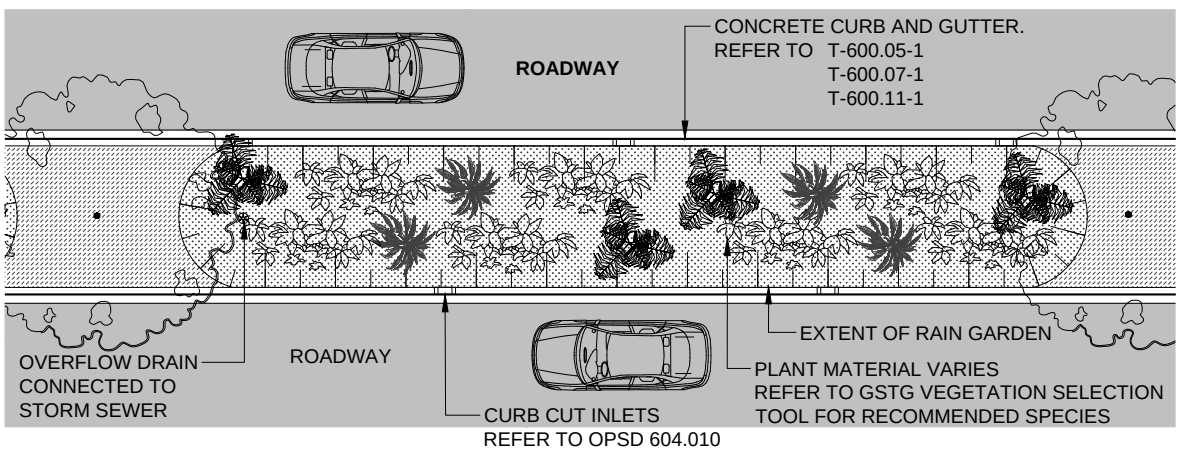
RAIN GARDEN IN BOULEVARD



PLAN VIEW

NOTE: CURB CUT INLET THROAT SIZED ACCORDING TO INLET FLOW RATE BY ENGINEER

RAIN GARDEN IN MEDIAN



PLAN VIEW

NOTE: CURB CUT INLET THROAT SIZED ACCORDING TO INLET FLOW RATE BY ENGINEER

All dimensions are in millimetres unless otherwise shown.

TORONTO	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
	RAIN GARDEN SECTION AND LAYOUTS	WQ-5.1	
		NTS	1 OF 1

A.0 GEOMETRY & LAYOUT

- Geometry - Trapezoidal or parabolic cross section;
- For shallow flow conveyance. Max velocity of 0.5m/s;
- Min. 5m swale length between culverts;
- Width - Bottom 75mm to 3000mm;
- Slopes
  - Longitudinal slopes - 0.5% - 4%. Install check dams on slopes > 3%;
  - Side slopes - 4:1 is preferred;
- Area - Ratio of enhanced grass swale to contributing road surface should equal 1:1 or greater;
- Flow depth - Max. 100mm during a 25mm storm.

A.1 AMENDED SOIL

- Depth - 300mm;
- Organic content - 8 to 15%.

A.2 PLANTING

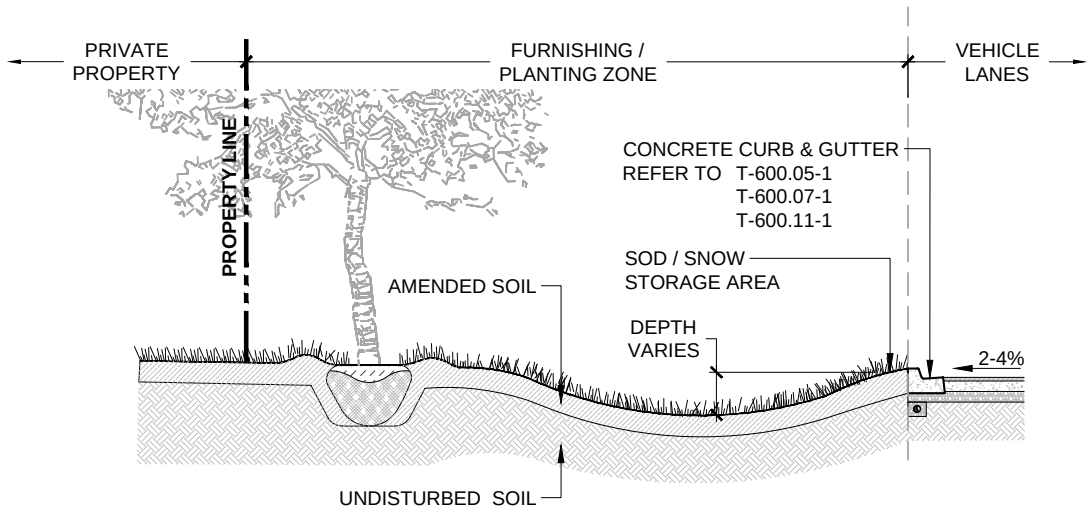
- Salt and drought tolerant low meadow grasses recommended;
- Planting season - spring;
- Maintain plant height of 150mm;
- Refer to Construction Specification for Planting (TS 5.30);
- Refer to Construction Specification for Direct Seeding (TS 5.20);
- Sodded swale: sod to be grown in sand to increase infiltration;
- Seeded swale: facility to be kept offline until seed establishes.

NOTE:

- CONCRETE SPILLWAY THROAT SIZED ACCORDING TO INLET FLOW RATE BY ENGINEER

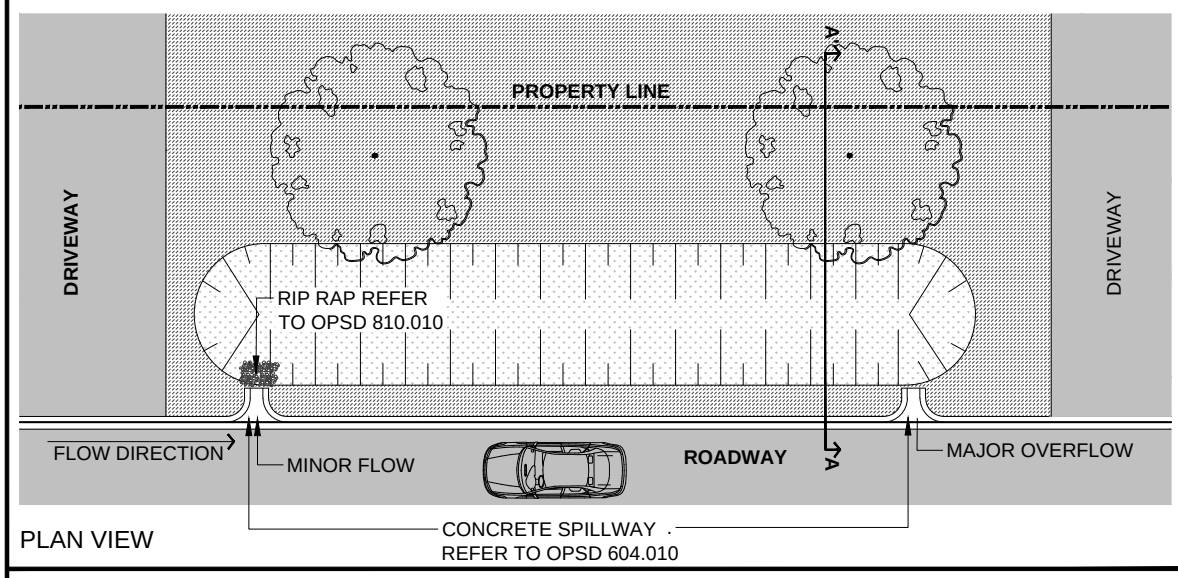
ENHANCED GRASS SWALE

For sites with subsoil permeability >15mm/hr



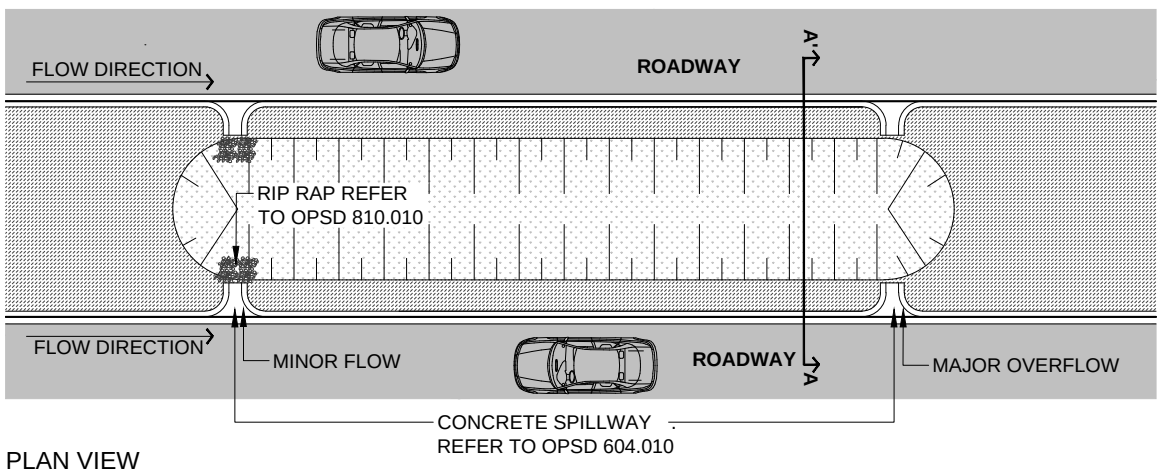
SECTION A-A'

ENHANCED GRASS SWALE IN BOULEVARD



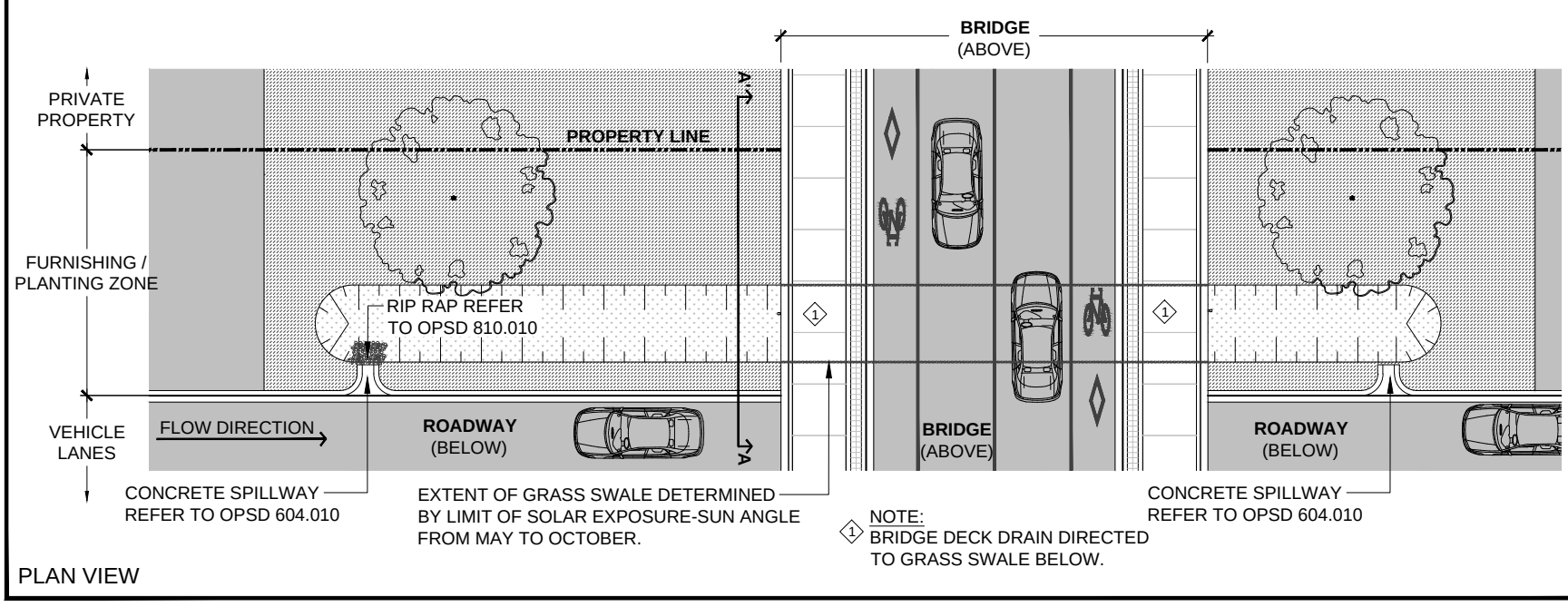
PLAN VIEW

ENHANCED GRASS SWALE IN MEDIAN



PLAN VIEW

ENHANCED GRASS SWALE UNDER BRIDGE



PLAN VIEW

All dimensions are in millimetres unless otherwise shown.

	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
TORONTO	ENHANCED GRASS SWALE SECTION AND LAYOUTS	WQ-6.1	
		NTS	1 OF 1

A.0 GEOMETRY & LAYOUT

- Geometry - Trapezoidal or parabolic cross-section;
- Min. 5m swale length between culverts;
- Width - Bottom 75mm - 2000mm.
- Slopes
  - Longitudinal - 0.5% - 4%. Install check dams on slopes >3%;
  - Sides - Max. 3:1.

A.1 PRETREATMENT

- Pre-treatment area varies based on site context. Options include enhanced grass swales, bioswales and mechanical pre-treatment devices.

A.2 FILTER MEDIA

- Pre-mixed from an approved vendor;
- Filter media composition (by weight):
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr
- Materials testing by an independent testing lab is required to confirm filter media composition. Sample to be collected at supply site by a Geotechnical engineer using standard protocols. If issues arise with the performance of an installation, then samples should be collected from the constructed facility for further testing;
- Depth varies - Minimum recommended depth 1.0 - 1.25m for enhanced pollutant removal;
- Bioretention with trees - minimum depth 1.0m. Total volume 30m³/tree or 20m³/tree for trees sharing soil.
- Capacity - Volumetric computation should be based on surface area and depth.
- Refer to TS 5.10 - Construction Specification for Growing Media

A.3 GRAVEL STORAGE

- Depth - Min. 300 mm;
- Material - 50 mm dia. washed clear stone;
- Capacity - Volumetric computation based on depth;
- Choker Layer: 100 mm pea gravel layer between filter media and gravel storage layers.

A.4 OVERFLOW

- Sized to convey larger storm events;
- PVC Overflow Pipe invert should be set at a maximum of 250mm above the filter bed surface;

A.5 UNDERDRAIN (OPTIONAL)

- Required where native soil infiltration rates are <15mm/hr or adjacent to structures;
- Min. 200mm dia. perforated pipe installed 100mm above the bottom of the gravel storage layer;
- Capped at upstream end and connected to storm sewer;
- Connected to monitoring well for clean out;
- Monitoring well: vertical standpipe connected to the underdrain at downstream;
- Culvert Headwall - Cast-in-place or precast concrete minimum 150mm thick;
- Culvert Header Overflow Inlet Control - Pre-fabricated plastic or metal, sized to correspond to capacity of receiving culvert;
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

A.6 GEOTEXTILE

- Material - Woven monofilament or non-woven needle punched fabrics;
- Refer to OPSS 1860 Material Specification for Geotextiles.

A.7 PLANTING

MAINTAINED SWALE

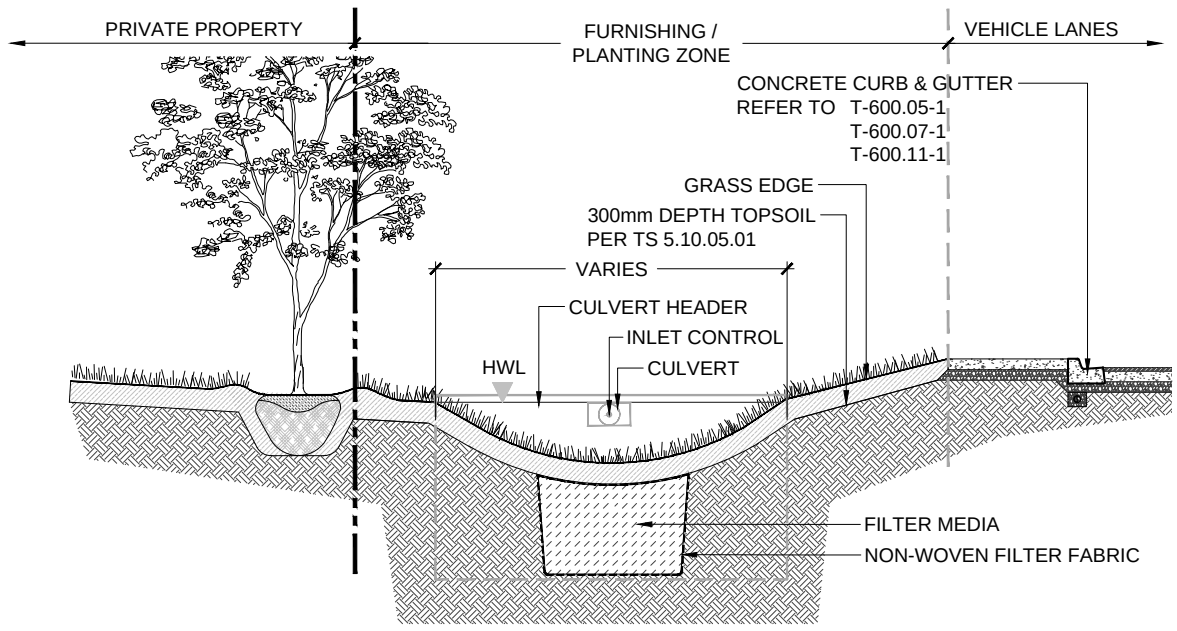
- Bioswale should be sodded per TS 5.00 Construction Specification for Sodding.

NATURALIZED SWALE

- Bioswales should be planted with native drought and salt tolerant grasses;
- Refer to Construction Specification for Direct Seeding (TS 5.20);
- Refer to Construction Specification for Growing Medium (TS 5.10).

OPTION A - BIOSWALE WITHOUT UNDERDRAIN

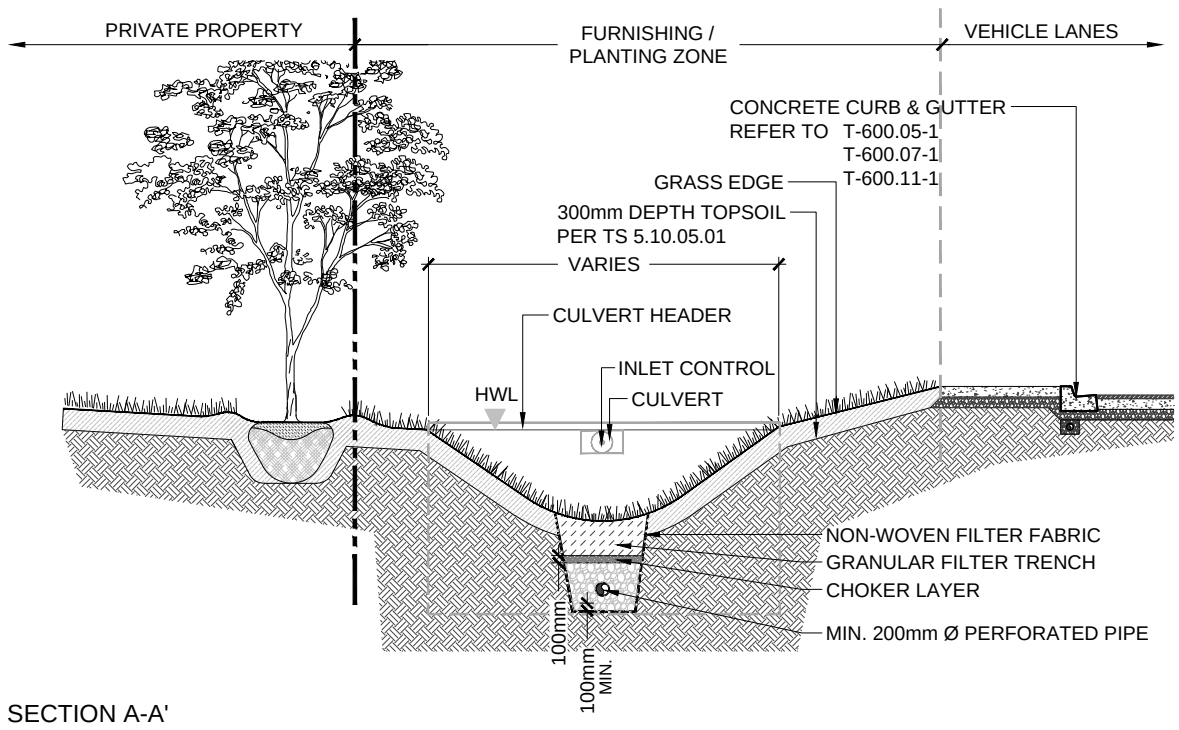
For sites with soil permeability >15mm/hr



SECTION A-A'

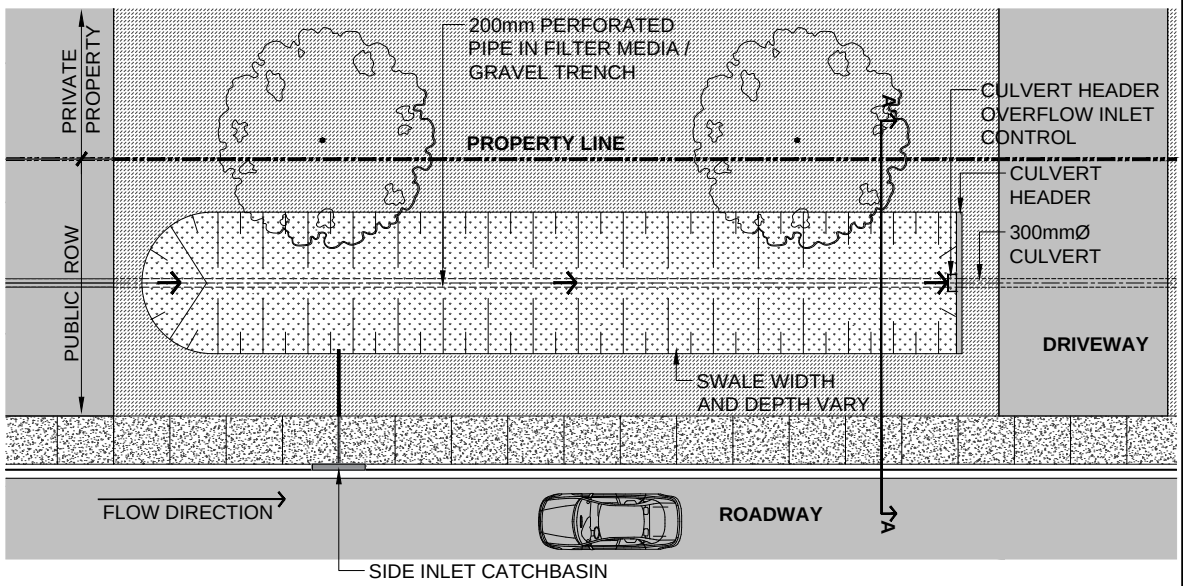
OPTION B - BIOSWALE WITH UNDERDRAIN

For sites with soil permeability <15mm/hr



SECTION A-A'

BIOSWALE



PLAN VIEW

NOTE: SCARIFY BASE OF EXCAVATION

All dimensions are in millimetres unless otherwise shown.

CITY OF TORONTO GUIDELINE DRAWING

BIOSWALE (SUBURBAN)

(SIDEWALK ON STREET SIDE OF BOULEVARD)

REV 0	APR 2017
WQ-7.1a	
NTS	1 OF 5

A.0 GEOMETRY & LAYOUT

- Geometry - Trapezoidal or parabolic cross-section;
- Min. 5m swale length between culverts;
- Width - Bottom 75mm - 2000mm.
- Slopes
  - Longitudinal - 0.5% - 4%. Install check dams on slopes >3%;
  - Sides - Max. 3:1.

A.1 PRETREATMENT

- Pre-treatment area varies based on site context. Options include enhanced grass swales, bioswales and mechanical pre-treatment devices.

A.2 FILTER MEDIA

- Pre-mixed from an approved vendor;
- Filter media composition (by weight):
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr
- Materials testing by an independent testing lab is required to confirm filter media composition. Sample to be collected at supply site by a Geotechnical engineer using standard protocols. If issues arise with the performance of an installation, then samples should be collected from the constructed facility for further testing;
- Depth varies -Minimum recommended depth 1.0 - 1.25m for enhanced pollutant removal;
- Bioretention with trees - minimum depth 1.0m. Total volume 30m³/tree or 20m³/tree for trees sharing soil.
- Capacity - Volumetric computation should be based on surface area and depth.
- Refer to TS 5.10 - Construction Specification for Growing Media

A.3 GRAVEL STORAGE

- Depth - Min. 300 mm;
- Material - 50 mm dia. washed clear stone;
- Capacity - Volumetric computation based on depth;
- Choker Layer: 100 mm pea gravel layer between filter media and gravel storage layers.

A.4 OVERFLOW

- Sized to convey larger storm events;
- PVC Overflow Pipe invert should be set at a maximum of 250mm above the filter bed surface;

A.5 UNDERDRAIN (OPTIONAL)

- Required where native soil infiltration rates are <15mm/hr or adjacent to structures;
- Min. 200mm dia. perforated pipe installed 100mm above the bottom of the gravel storage layer;
- Capped at upstream end and connected to storm sewer;
- Connected to monitoring well for clean out;
- Monitoring well: vertical standpipe connected to the underdrain at downstream;
- Culvert Headwall - Cast-in-place or precast concrete minimum 150mm thick;
- Culvert Header Overflow Inlet Control - Pre-fabricated plastic or metal, sized to correspond to capacity of receiving culvert;
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

A.6 GEOTEXTILE

- Material - Woven monofilament or non-woven needle punched fabrics;
- Refer to OPSS 1860 Material Specification for Geotextiles.

A.7 PLANTING

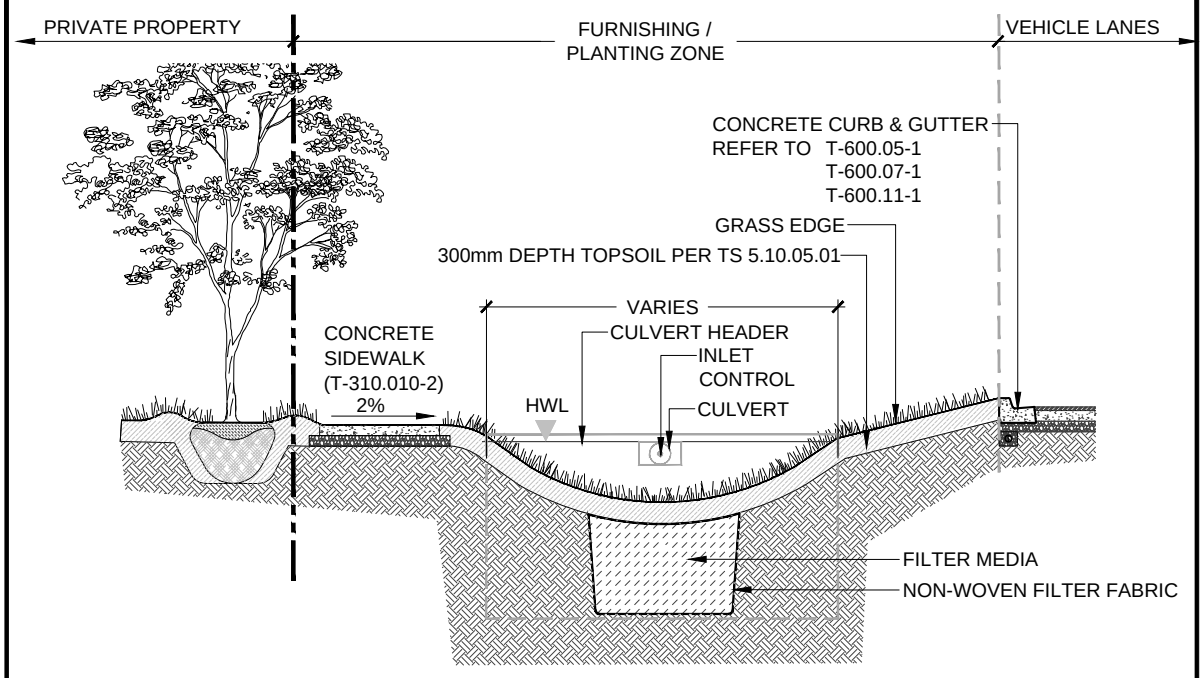
MAINTAINED SWALE
- Bioswale should be sodded per TS 5.00 Construction Specification for Sodding.

NATURALIZED SWALE
- Bioswales should be planted with native drought and salt tolerant grasses;
- Refer to Construction Specification for Direct Seeding (TS 5.20);
- Refer to Construction Specification for Growing Medium (TS 5.10).

NOTE: SCARIFY BASE OF EXCAVATION

OPTION A - BIOSWALE WITHOUT UNDERDRAIN

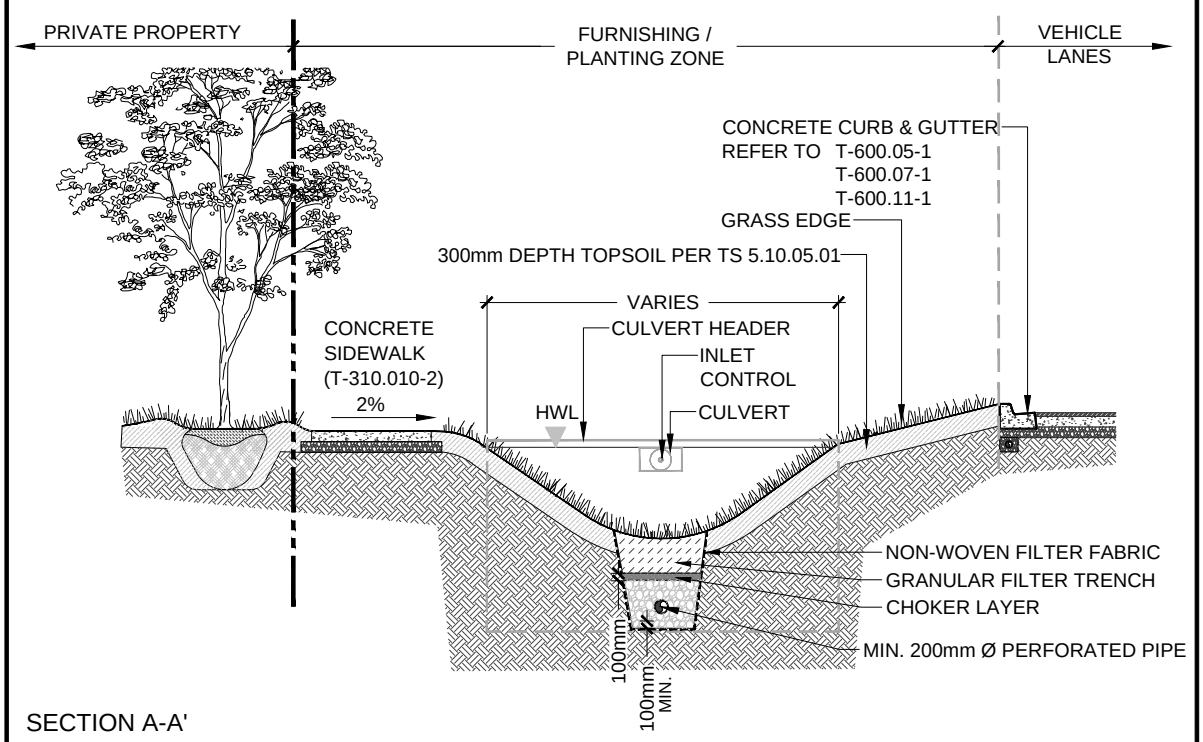
For sites with soil permeability >15mm/hr



SECTION A-A'

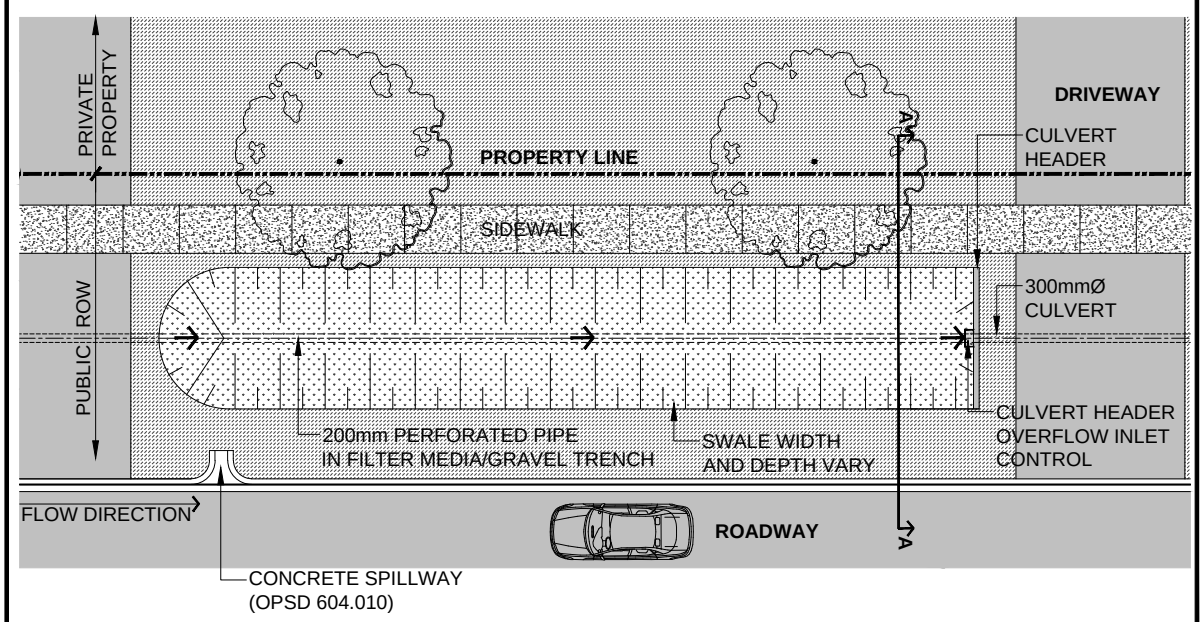
OPTION B - BIOSWALE WITH UNDERDRAIN

For sites with soil permeability <15mm/hr



SECTION A-A'

BIOSWALE



PLAN VIEW

All dimensions are in millimetres unless otherwise shown.

TORONTO	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
	BIOSWALE (SUBURBAN) (BOULEVARD BETWEEN SIDEWALK AND STREET)	WQ-7.1b	
		NTS	2 OF 5

A.0 GEOMETRY & LAYOUT

- Geometry - Trapezoidal or parabolic cross-section;
- Min. 5m swale length between culverts;
- Width - Bottom 75mm - 2000mm.
- Longitudinal slopes - 0.5% - 4%. Install check dams on slopes >3%;
- Side slopes - Max. 3:1.

A.1 FILTER MEDIA

- Pre-mixed from an approved vendor;
- Filter media composition (by weight):
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr
- Materials testing by an independent testing lab is required to confirm filter media composition. Sample to be collected at supply site by a Geotechnical engineer using standard protocols. If issues arise with the performance of an installation, then samples should be collected from the constructed facility for further testing;
- Depth varies -Minimum recommended depth 1.0 - 1.25m for enhanced pollutant removal;
- Capacity - Volumetric computation should be based on surface area and depth.
- Refer to TS 5.10 - Construction Specification for Growing Media

A.2 GRAVEL STORAGE

- Depth - Min. 300 mm;
- Material - 50 mm dia. washed clear stone;
- Capacity - Volumetric computation based on depth;
- Choker Layer: 100 mm pea gravel layer between filter media and gravel storage layers.

A.3 OVERFLOW

- Sized to convey larger storm events;
- PVC Overflow Pipe invert should be set at a maximum of 250mm above the filter bed surface;
- Cap - Metal beehive cap or approved equal.

A.4 UNDERDRAIN (OPTIONAL)

- Required where native soil infiltration rates are <15mm/hr or adjacent to structures;
- Min. 200mm dia. perforated pipe installed 100mm above the bottom of the gravel storage layer;
- Capped at upstream end and connected to storm sewer;
- Connected to monitoring well for clean out;
- Monitoring well: vertical standpipe connected to the underdrain at downstream;
- Culvert Headwall - Cast-in-place or precast concrete minimum 150mm thick;
- Culvert Header Overflow Inlet Control - Pre-fabricated plastic or metal, sized to correspond to capacity of receiving culvert;
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

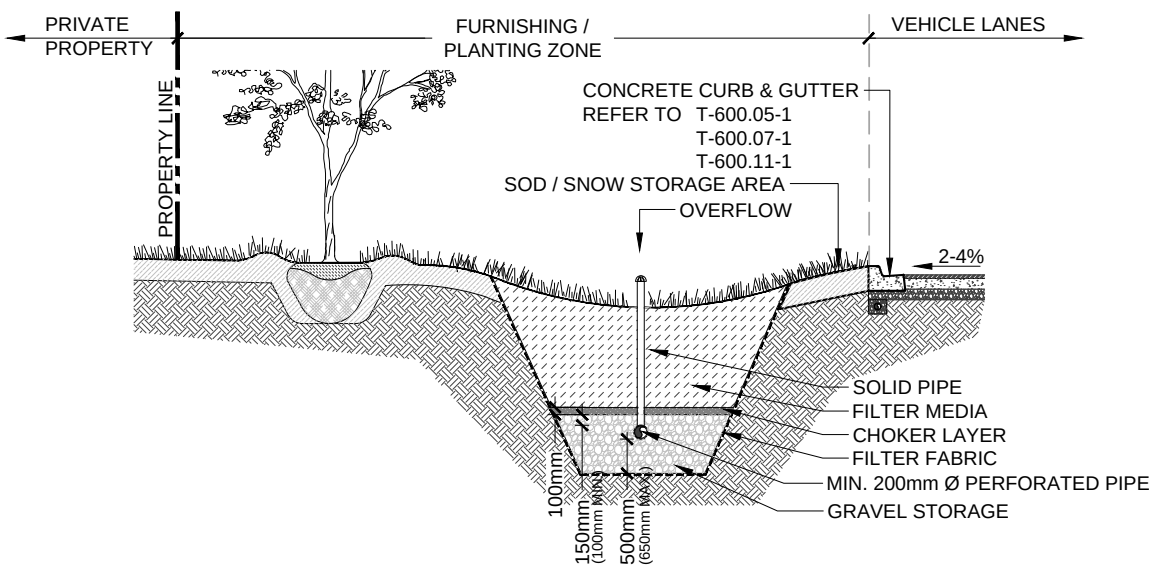
A.5 GEOTEXTILE

- Material - Woven monofilament or non-woven needle punched fabrics;
- Refer to OPSS 1860 Material Specification for Geotextiles.

A.6 PLANTING

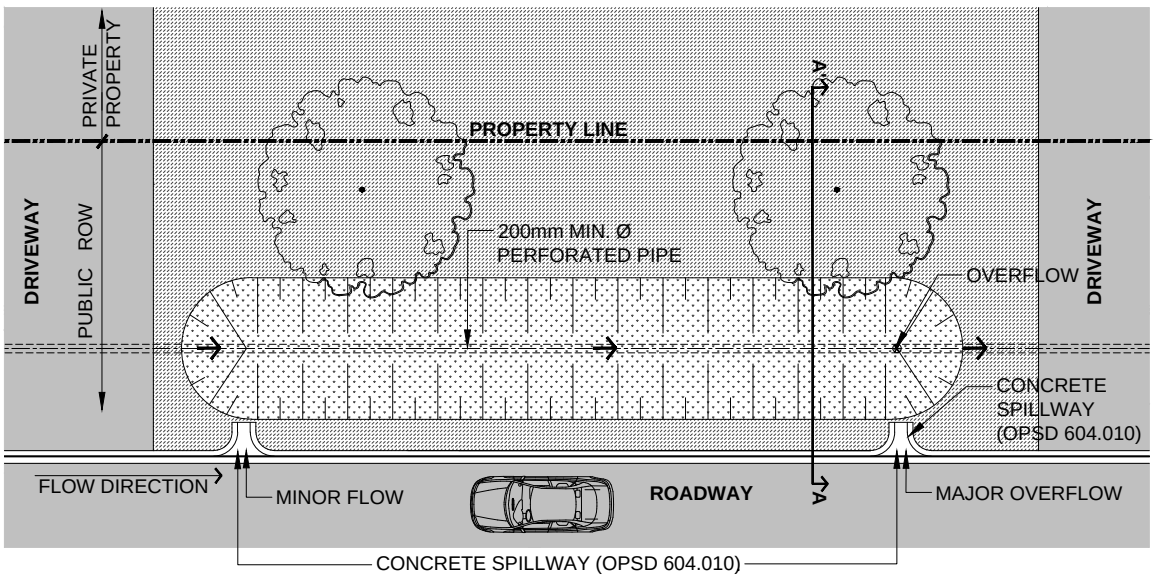
- MAINTAINED Bioswale should be sodded per TS 5.00 Construction Specification for Sodding.
- NATURALIZED Bioswales should be planted with native drought and salt tolerant grasses;
- Refer to Construction Specification for Direct Seeding (TS 5.20);
- Refer to Construction Specification for Growing Medium (TS 5.10).

BIOSWALE WITH UNDERDRAIN (no sidewalks)



SECTION A-A'

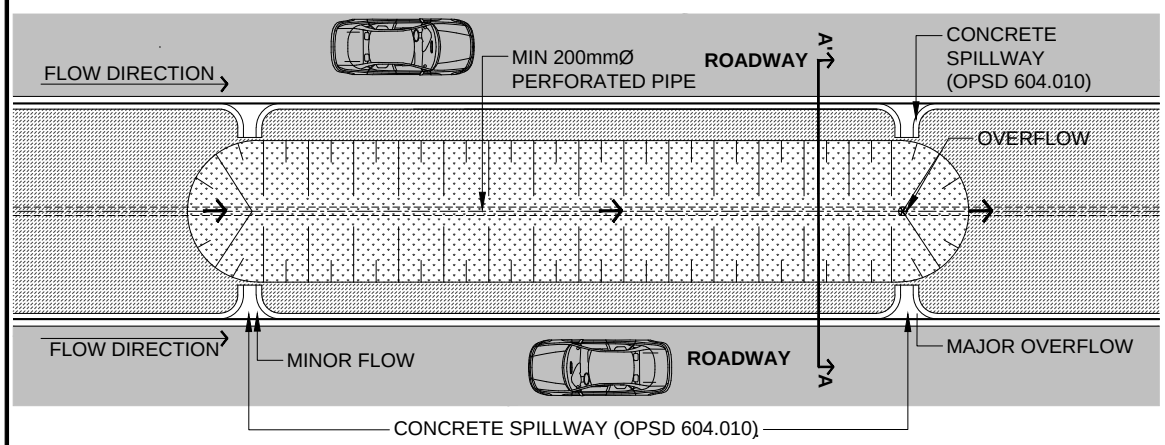
BIOSWALE IN FURNISHING / PLANTING ZONE



PLAN VIEW

NOTE: CONCRETE SPILLWAY THROAT SIZED ACCORDING TO INLET FLOW RATE

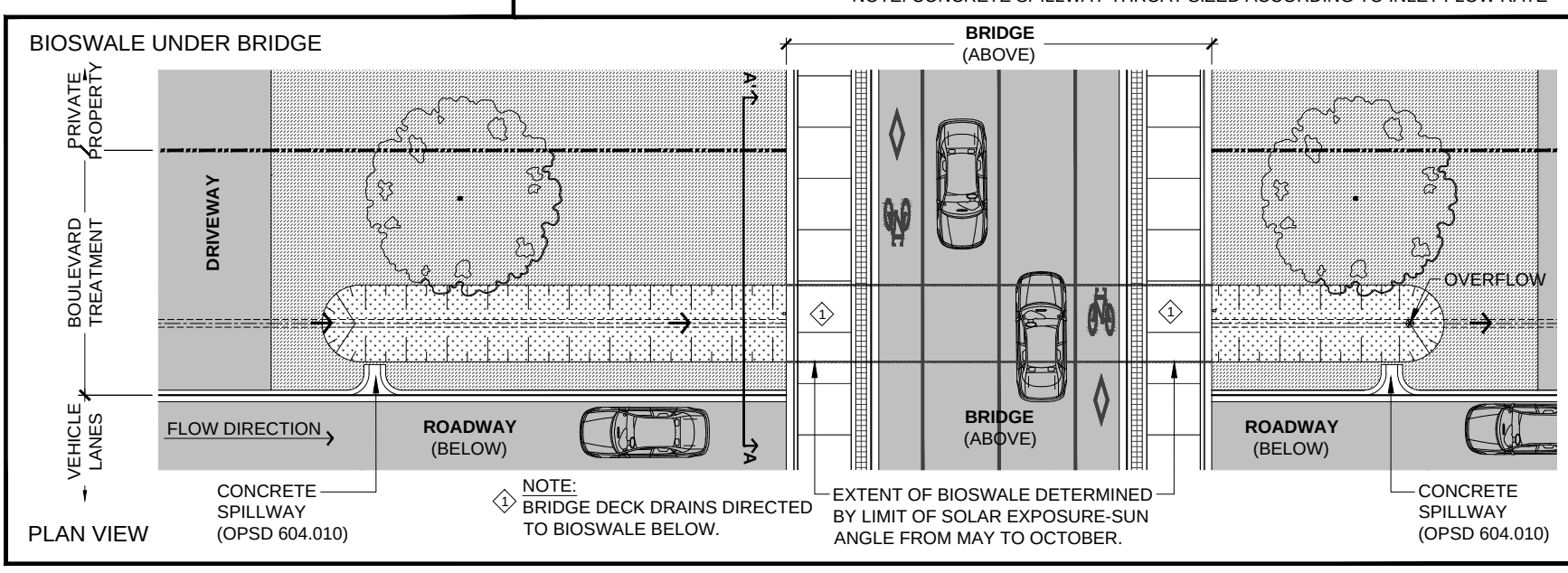
BIOSWALE IN MEDIAN



PLAN VIEW

NOTE: CONCRETE SPILLWAY THROAT SIZED ACCORDING TO INLET FLOW RATE

BIOSWALE UNDER BRIDGE



PLAN VIEW

NOTE: SCARIFY BASE OF EXCAVATION

All dimensions are in millimetres unless otherwise shown.

TORONTO	CITY OF TORONTO GUIDELINE DRAWING	REV 0 / APR 2017
	BIOSWALE (SUBURBAN) (BOULEVARD WITH NO SIDEWALK)	WQ-7.1c
		NTS / 3 OF 5

A.0 FILTER MEDIA

- Pre-mixed from an approved vendor;
- Filter media composition (by weight):
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr
- Materials testing by an independent testing lab is required to confirm filter media composition. Sample to be collected at supply site by a Geotechnical engineer using standard protocols. If issues arise with the performance of an installation, then samples should be collected from the constructed facility for further testing;
- Depth varies -Minimum recommended depth 1.0 - 1.25m for enhanced pollutant removal;
- Bioretention with trees - minimum depth 1.0m. Total volume 30m³/tree or 20m³/tree for trees sharing soil.
- Capacity - Volumetric computation should be based on surface area and depth.
- Refer to TS 5.10 - Construction Specification for Growing Media

A.1 GRAVEL STORAGE

- Depth - Min. 300 mm;
- Material - 50 mm dia. washed clear stone;
- Capacity - Volumetric computation based on depth;
- Choker Layer: 100 mm pea gravel layer between filter media and gravel storage layers.

A.2 MULCH

- Depth - 75 mm;
- Material - Shredded hardwood bark mulch.

A.3 UNDERDRAIN (OPTIONAL)

- Required where native soil infiltration rates are <15mm/hr or adjacent to structures;
- Min. 200mm dia. perforated pipe installed 100mm above the bottom of the gravel storage layer;
- Capped at upstream end and connected to storm sewer;
- Connected to monitoring well for clean out;
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

A.4 GEOTEXTILE

- Material - Woven monofilament or non-woven needle punched fabrics;
- Refer to OPSS 1860 Material Specification for Geotextiles.

A.5 PLANTING

Plant material selection and arrangement considerations:

- Plant material selection and arrangement should consider the site context;
- Native plant material should be selected wherever possible;
- Plant materials should be selected for their tolerance of salt and urban conditions. Shade should also be considered for herbaceous material planted under trees or in other ultra-urban shaded areas;
- Planting design should provide variety in seasonal colour and winter interest;
- Plant material should be arranged in groupings by relative height texture and aesthetic attributes;
- Refer to the GSTG Vegetation Selection Tool for an appropriate palette;
- Refer to Construction Specification for Planting (TS 5.30).

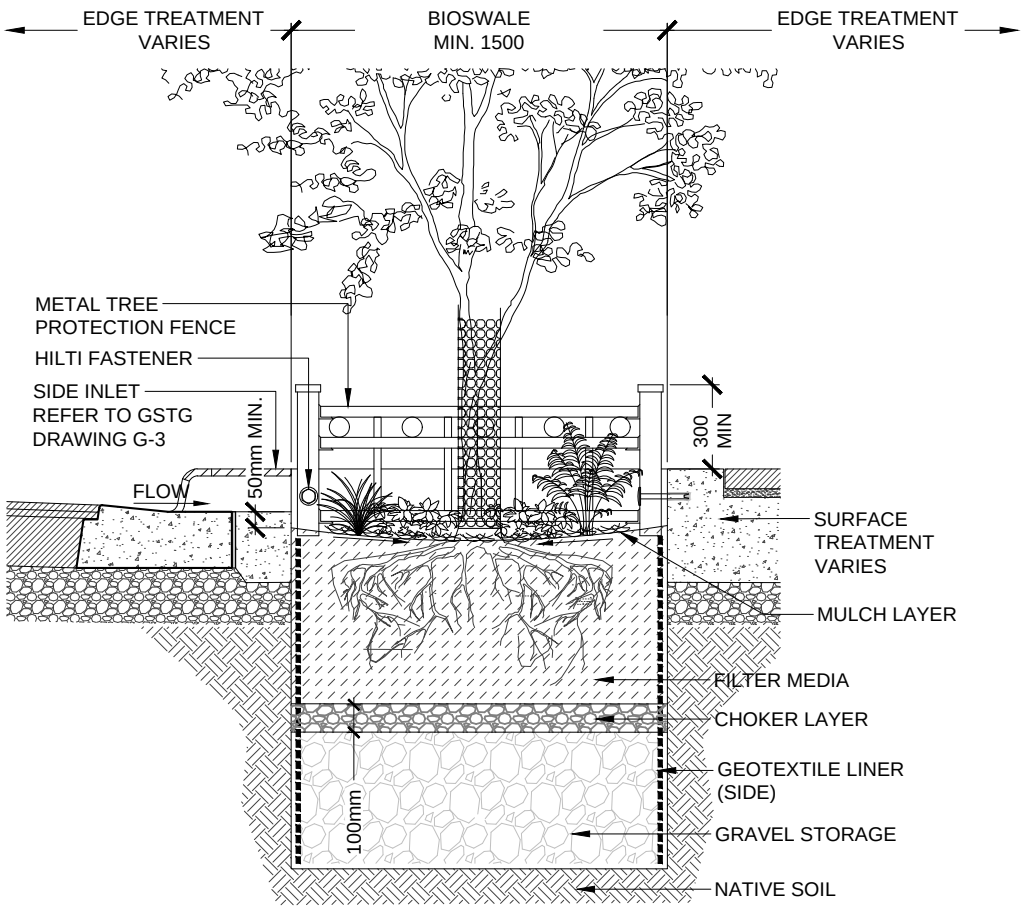
A.6 IDENTIFICATION MEDALLION

- To be installed on curb. Refer to guideline drawing G-1.

NOTE: SCARIFY BASE OF EXCAVATION

BIOSWALE WITHOUT UNDERDRAIN

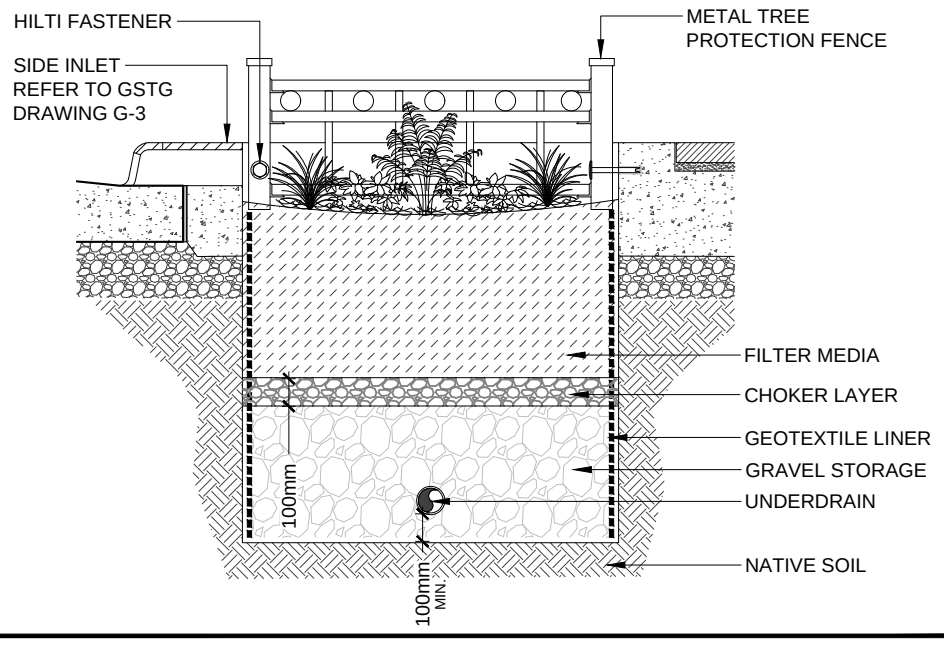
For sites with subsoil permeability >15mm/hr



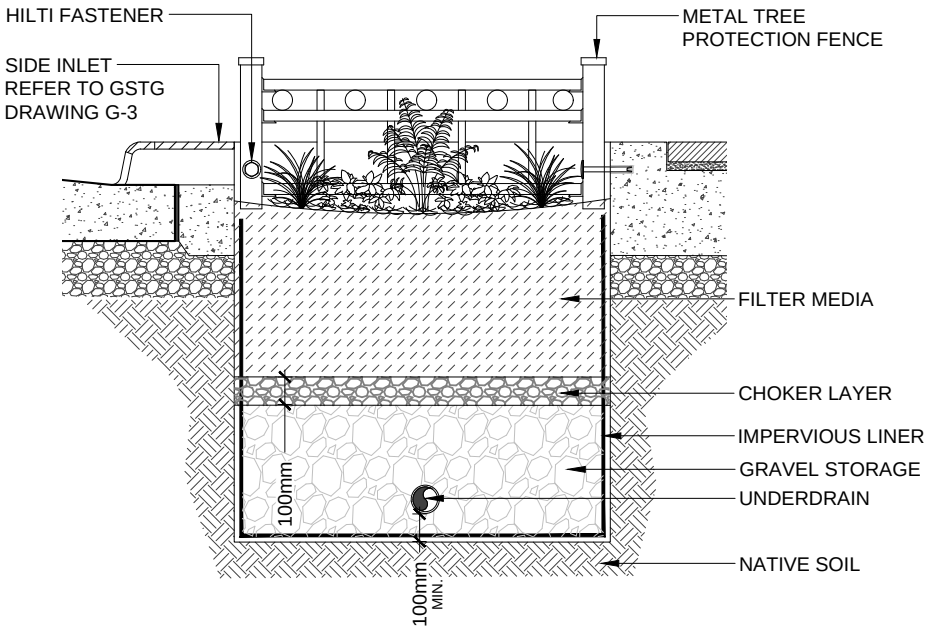
SECTION

BIOSWALE WITH UNDERDRAIN

For sites with subsoil permeability <15mm/hr



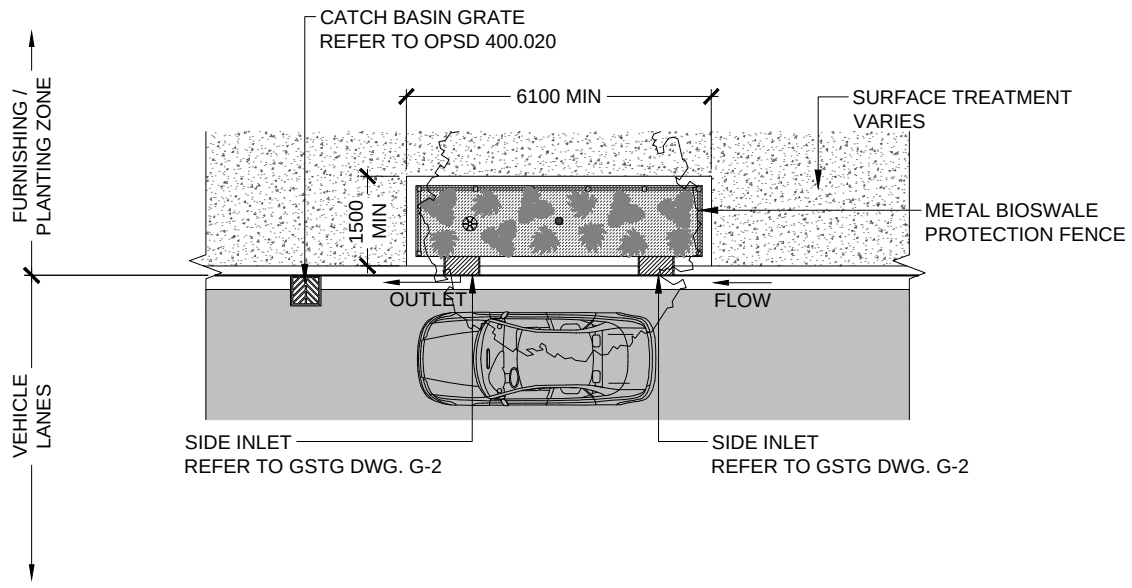
BIOSWALE WITH UNDERDRAIN AND IMPERVIOUS LINER



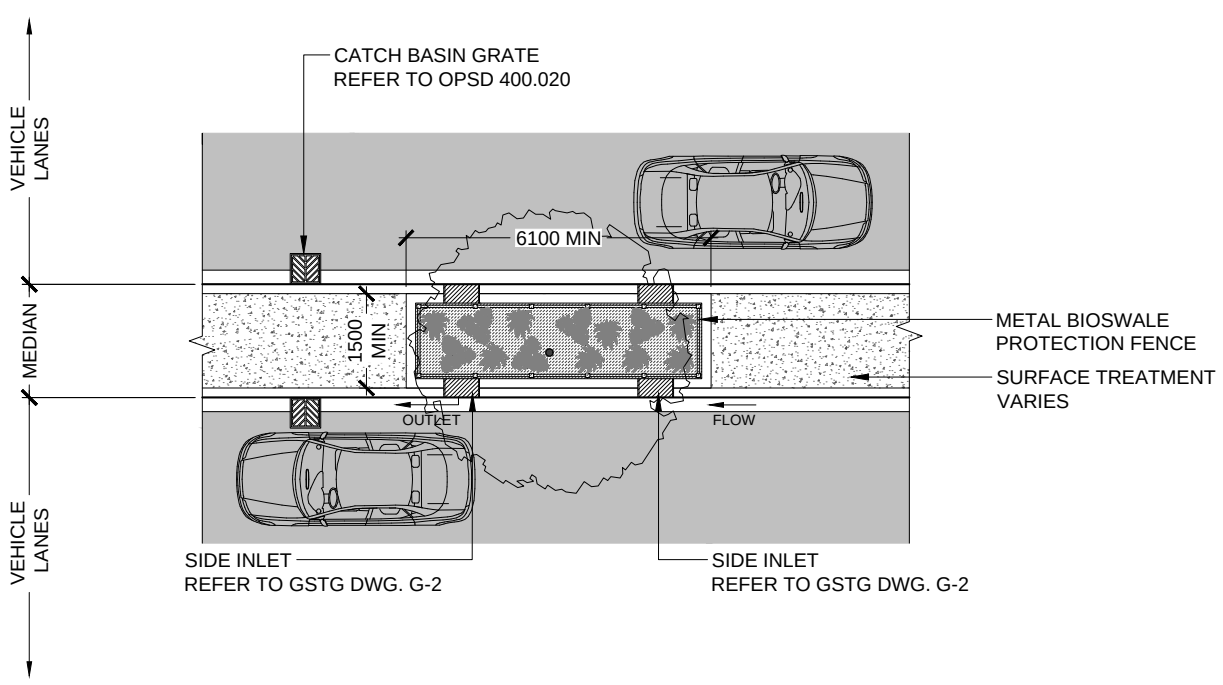
All dimensions are in millimetres unless otherwise shown.

	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
TORONTO	BIOSWALE (URBAN) SECTIONS	WQ-7.1d	
		NTS	1 OF 1

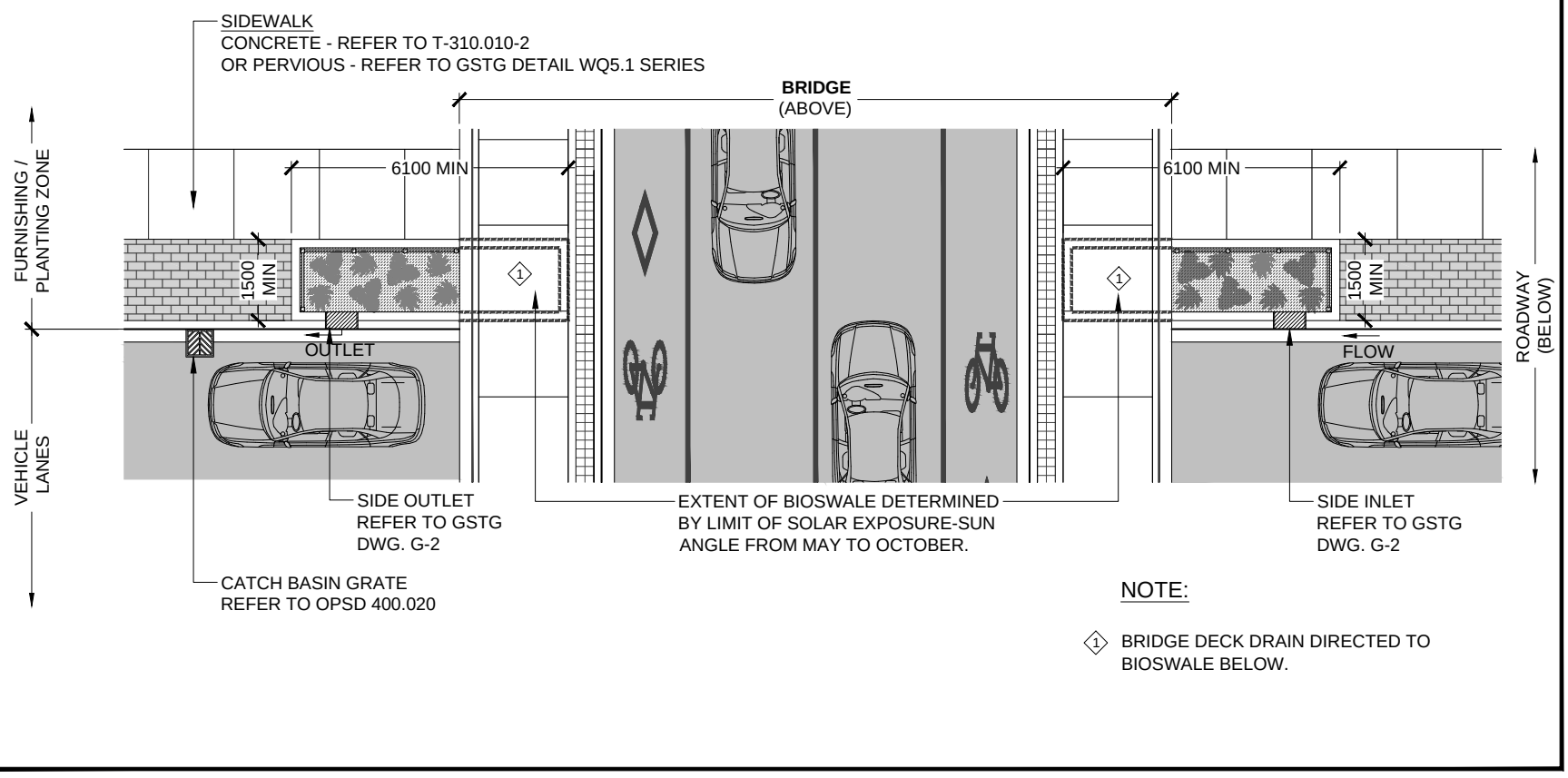
BIOSWALE IN FURNISHING ZONE



BIOSWALE IN MEDIAN



BIOSWALE UNDER BRIDGE



NOTE:

1. BRIDGE DECK DRAIN DIRECTED TO BIOSWALE BELOW.

All dimensions are in millimetres unless otherwise shown.

	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
TORONTO	BIOSWALE (URBAN) LAYOUTS	WQ-7.1e	
		NTS	5 OF 5

A.0 FILTER MEDIA

- Pre-mixed from an approved vendor;
- Filter media composition:
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr
- Depth varies -Minimum recommended depth 1.0 -1.25 m for enhanced pollutant removal;
- Capacity - Volumetric computation should be based on surface area and depth.

A.1 GRAVEL STORAGE

- Depth - Min. 300 mm; sized to provide required storage
- Material - 50 mm dia. clear stone;
- Capacity - Volumetric computation based on depth.

A.2 MULCH

- Depth - 75 mm;
- Material - Shredded hardwood bark mulch.

A.3 STONE WELL

- Vertical stone well
  - Installed at equidistant intervals;
  - Solid PVC pipe connected to a perforated PVC pipe;
  - Perforated section of pipe augured into native soil to a min. 1500mm depth;
  - Filled with 50mm dia. clear stone
  - Well head to be lined with filter fabric and filled with pea gravel.
- Refer to OPSS 405 - Construction Specification for Subdrain Pipe.

A.4 GEOTEXTILE

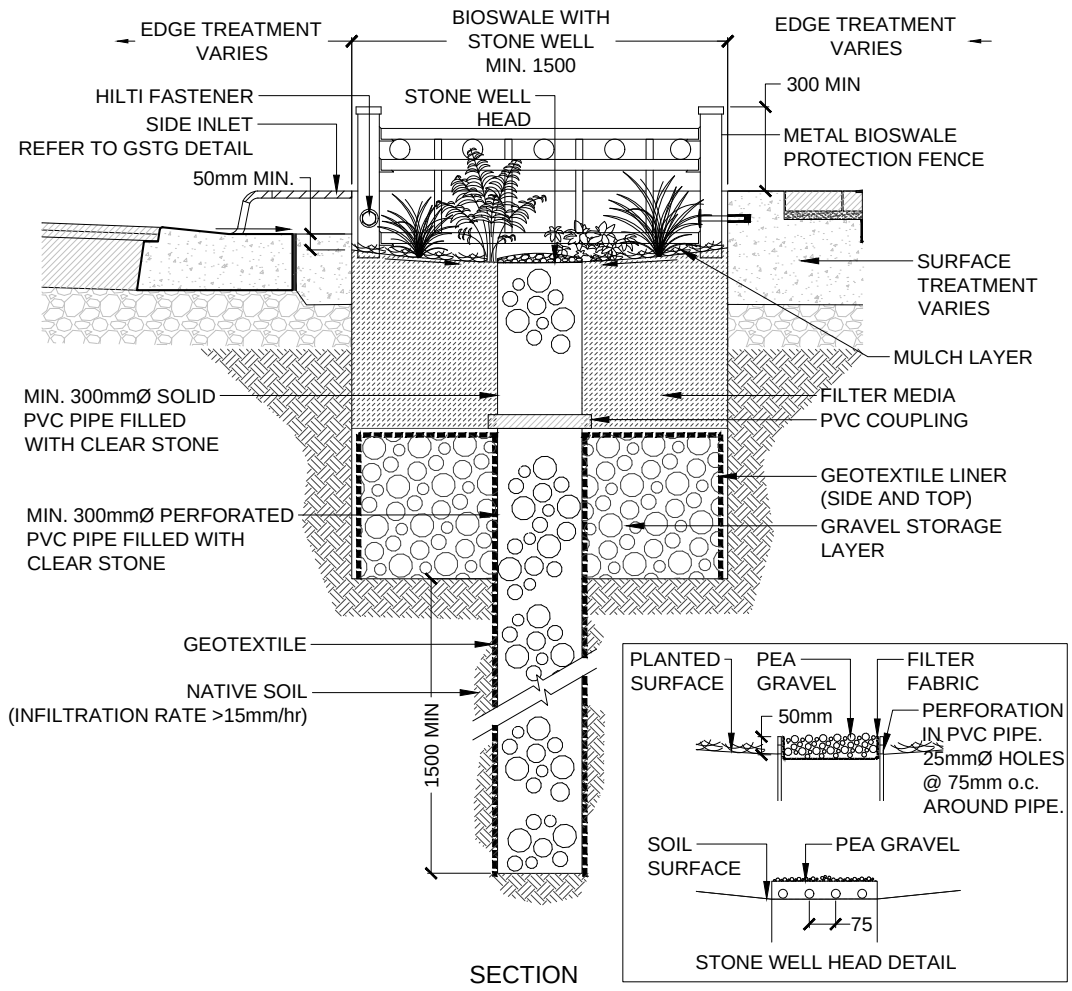
- Material - Woven monofilament or non-woven needle punched fabrics;
- Refer to OPSS 1860 for Class II Geotextile Fabrics.

A.5 IDENTIFICATION MEDALLION

- To be installed on curb. Refer to guideline drawing G-1.

NOTE: SCARIFY BASE OF EXCAVATION

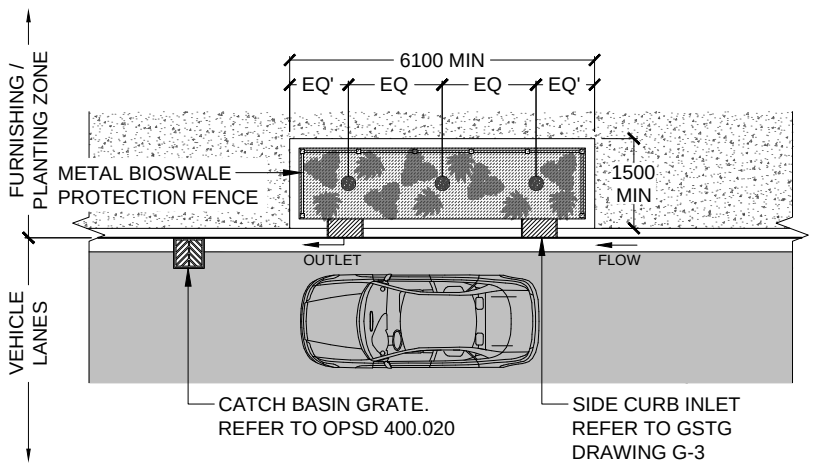
BIOSWALE WITH STONE COLUMNS



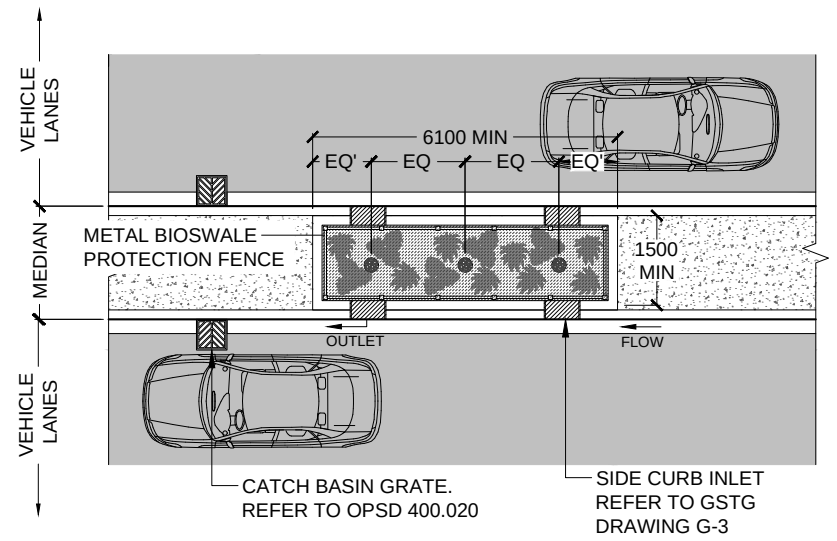
A.6 PLANTING

- Plant material selection and arrangement should consider the site context;
- Native plant material should be selected wherever possible;
- Plant materials should be selected for their tolerance of salt and urban conditions. Shade should also be considered for herbaceous material planted under trees or in other ultra-urban shaded areas;
- Planting design should provide variety in seasonal colour and winter interest;
- Plant material should be arranged in groupings by relative height texture and aesthetic attributes;
- Refer to the GSTG Vegetation Selection Tool for an appropriate palette; and,
- Refer to Construction Specification for Planting (TS 5.30).

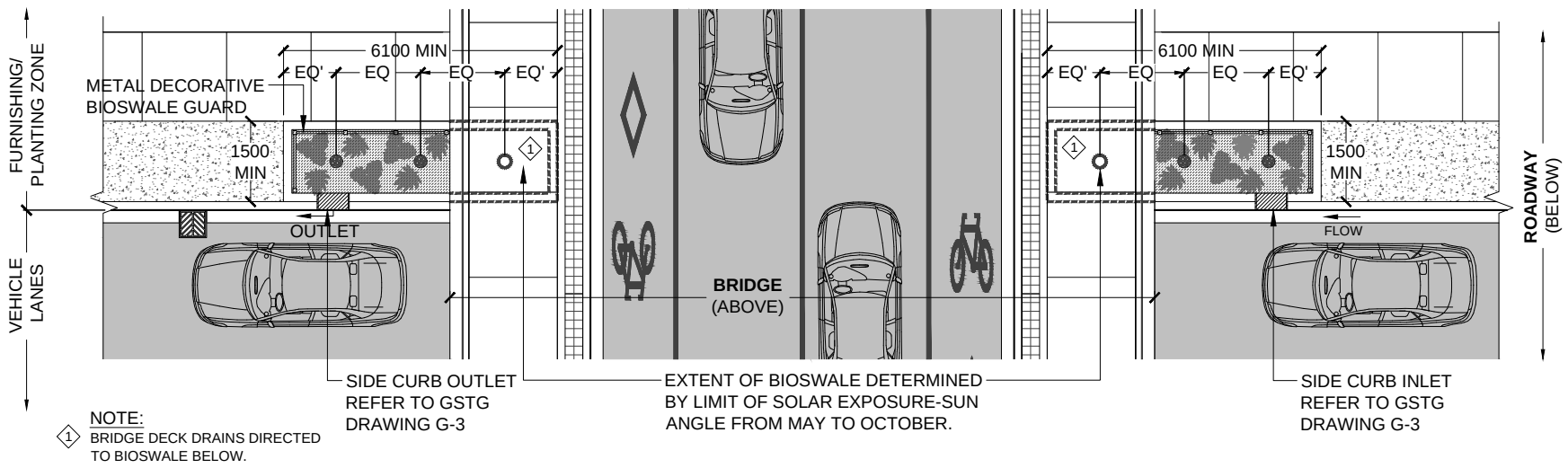
BIOSWALE IN FURNISHING ZONE



BIOSWALE IN MEDIAN



BIOSWALE UNDER BRIDGE



All dimensions are in millimetres unless otherwise shown.

TORONTO	CITY OF TORONTO GUIDELINE DRAWING	REV 0	APR 2017
	BIOSWALE WITH STONE WELL SECTION & LAYOUT	WQ-7.2	
		NTS	1 OF 1

A.0 GEOMETRY & LAYOUT

- Width varies based on context. Max 1.0m;
- Green Gutter extends the length of street or transit line, with crossings at intersections and transit stops.

A.1 ENGINEERED SOIL

- Pre-mixed from an approved vendor;
- Filter media composition (by weight):
  - Sand - 75 to 85%
  - Fines - 2 to 5%
  - Organic Matter - 8 to 10%
  - P-Index value 12 to 30 ppm
  - Soluble Salts <2.0mmhos/cm
  - Cationic exchange capacity >5 meq/100 g
  - pH - 5.5 to 7.5
  - Infiltration rate > 120 mm/hr, max. 300mm/hr

- Materials testing by an independent testing lab is required to confirm soil composition. Sample to be collected at supply site by a Geotechnical engineer using standard protocols. If issues arise with the performance of an installation, then samples should be collected from the constructed facility for further testing;

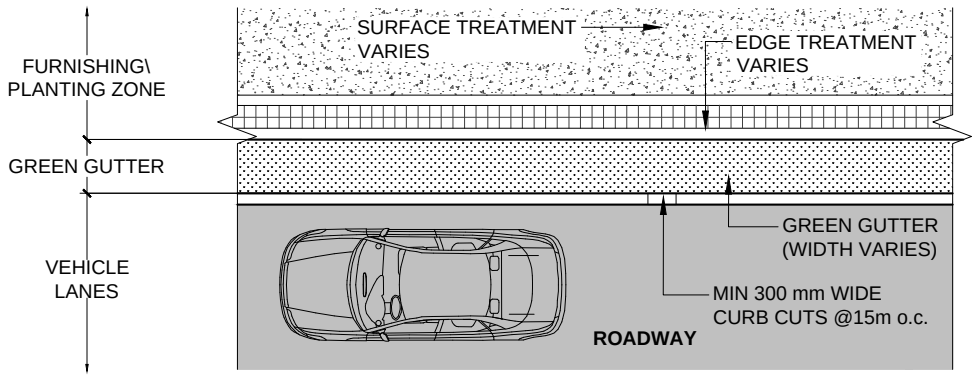
- Depth varies - Minimum recommended depth 450mm;

A.2 PLANTING

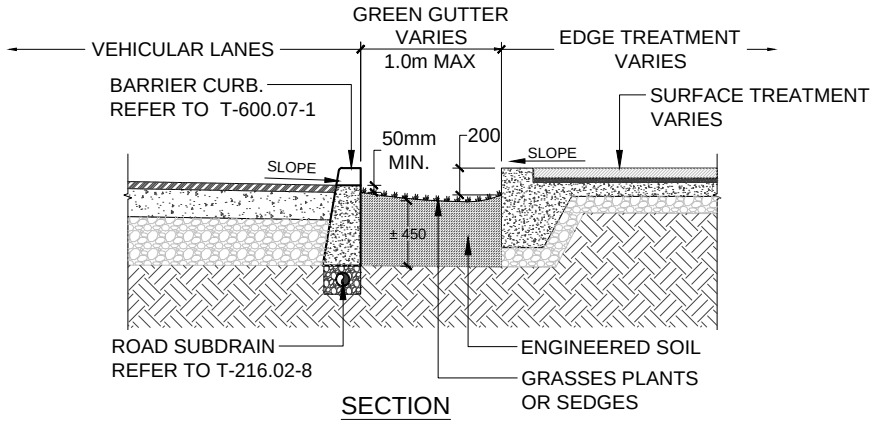
- Should be planted with salt tolerant grasses or sedges
- Refer to the GSTG Vegetation Selection Tool for an appropriate palette.
- Refer to Construction Specification for Planting (TS 5.30)

NOTE: CURB CUT INLET THROAT SIZED BY ENGINEER ACCORDING TO INLET FLOW RATE.

GREEN GUTTER - IN-BETWEEN ZONE

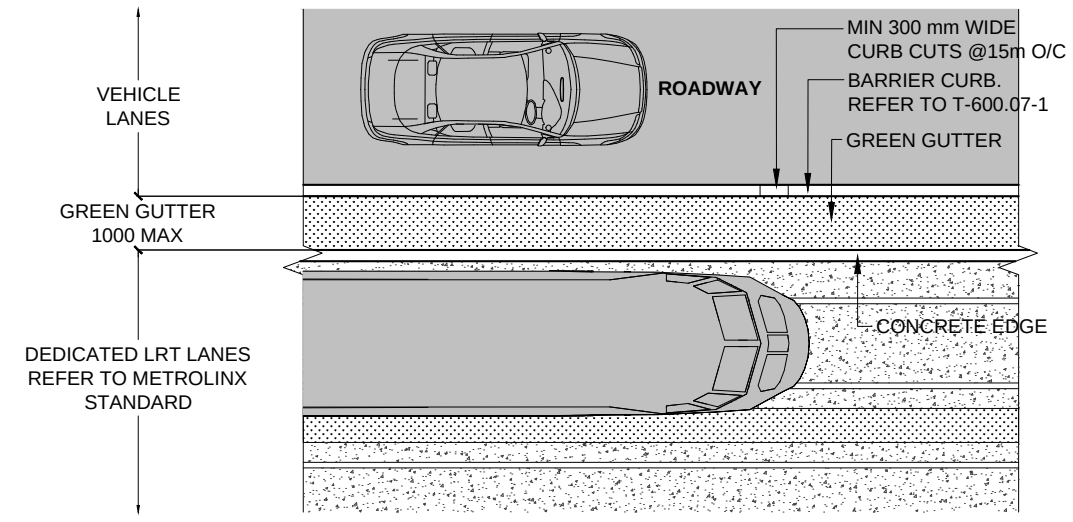


PLAN

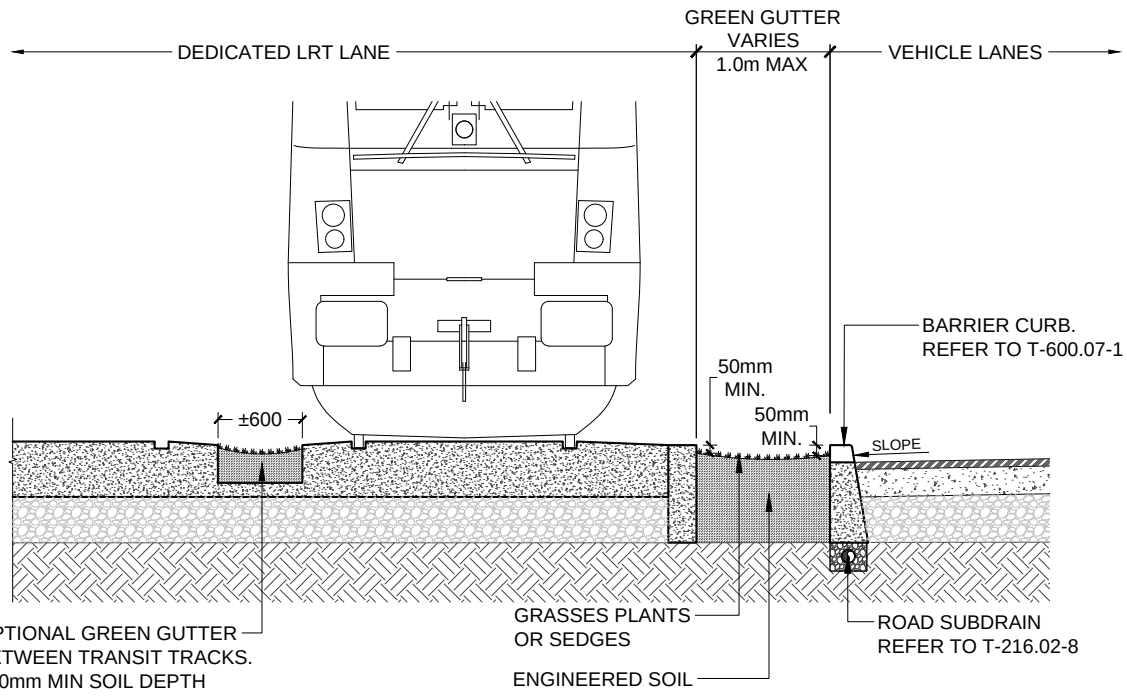


SECTION

GREEN GUTTER IN DEDICATED LRT LANE



PLAN



SECTION

All dimensions are in millimetres unless otherwise shown.

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A.0 GEOMETRY & LAYOUT

- Contributing area:
  - Max slope 3%;
  - Flow path length 5-25m.

A.1 PRETREATMENT

- Pea gravel diaphragm;
- Level spreaders - Used on slopes greater than 5%.

A.2 AMENDED TOPSOIL

- Organic content - 5 to 15% by weight
- pH - 6.0-7.8
- P-index value 12-40 ppm
- Soluble Salts < 2.0 mmhos/cm
- Bulk density ≤ 1.42 g/cm³
- Infiltration rate ≥ 120mm/h

A.3 GRAVEL / EARTHEN BERM

- Material - 15-25mm dia. gravel
  - Sand 35 - 60%;
  - Silt 30 - 55%;
  - Gravel 10 - 25% .

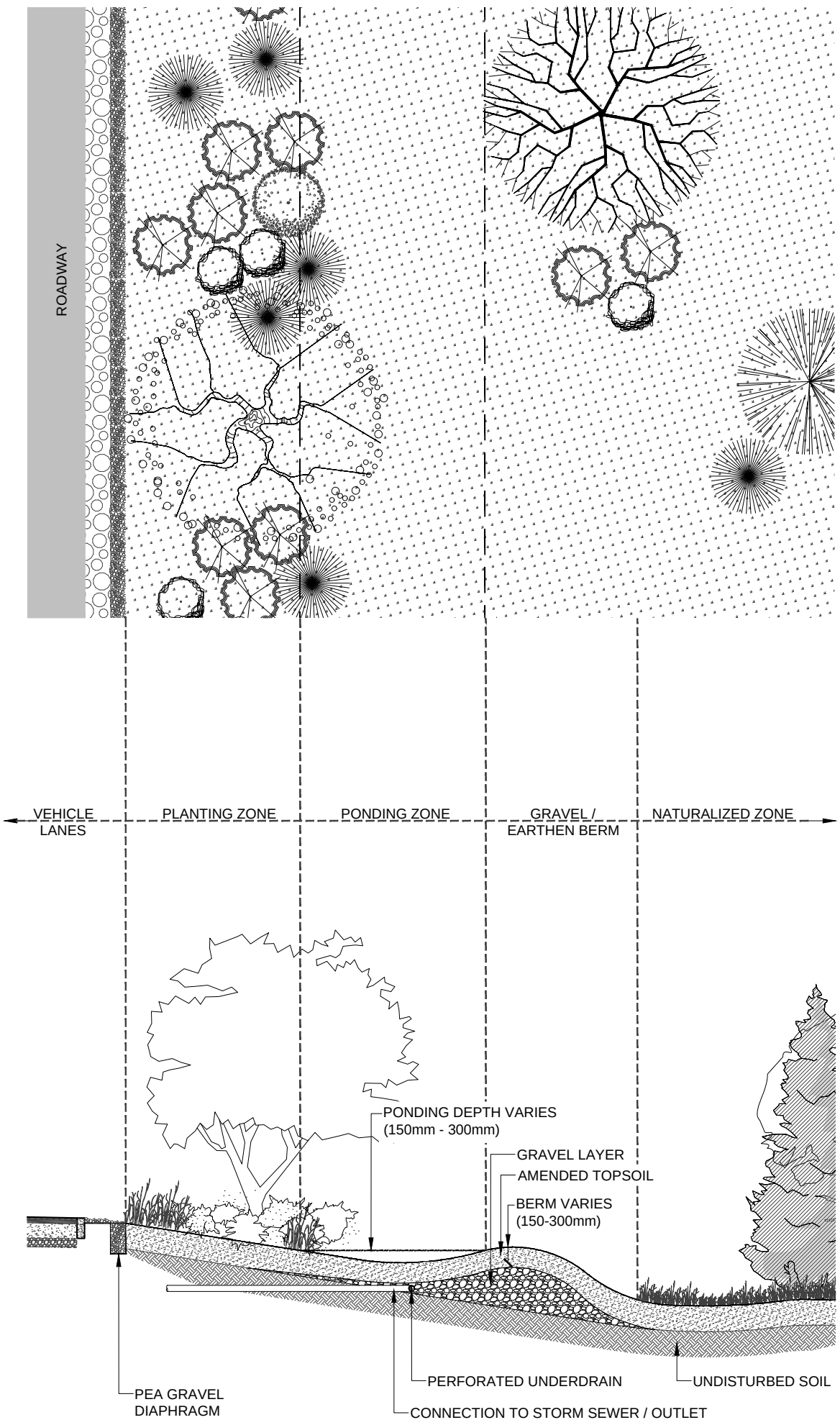
A.4 PLANTING

Plant material selection and arrangement considerations:

- Plant material selection and arrangement should consider the site context;
- Native plant material should be selected wherever possible;
- Plant materials should be selected for their tolerance of salt and urban conditions;
- Refer to the GSTG Vegetation Selection Tool for an appropriate palette;
- Refer to Construction Specification for Planting (TS 5.30);
- Refer to Construction Specification for Direct Seeding (TS 5.20);
- Refer to Construction Specification for Growing Medium (TS 5.10).

FILTER STRIP WITH UNDERDRAIN

Subsoil permeability of <15mm/hr



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