TRIECA 2019 CONFERENCE

Thank you to our sponsors:

www.trieca.com

GOLD SPONSORS

MEDIA SPONSORS

PRINT SPONSOR

HOSTS

TRIECA CONFERENCE

CSA Water Standards for Canada: Bioretention and much more

Presented at the TRIECA Conference – March 20-21, 2019

Lynn Barber

Project Manager II, Natural Resources

Gilles Rivard

Vice-President, Urban Hydrology

CSA Group

lasalle nhc

Outline

- **CSA Group and Standards Development**
- **Standards versus Guidelines**
- **Newly published**
  - **W200 – Design of Bioretention Systems**
  - **W201 – Construction of Bioretention Systems**
- **What is coming up for water-related Standards**

CSA Group - Standards

Canadian Standards Association established 1919

54
Areas of technology

3,000
Standards and codes

Over 9300
Expert committee members

CSA Group

Drivers

Regulators and practitioners of Bioretention and ESC have been asking for Standards to:

- minimize risk associated with inconsistent approaches;
- level playing field – clarify expectations;
- shorten learning curve for those not familiar these practices and which can result in reductions in approval times;
- set up winning conditions for successful projects

CSA Group

Background

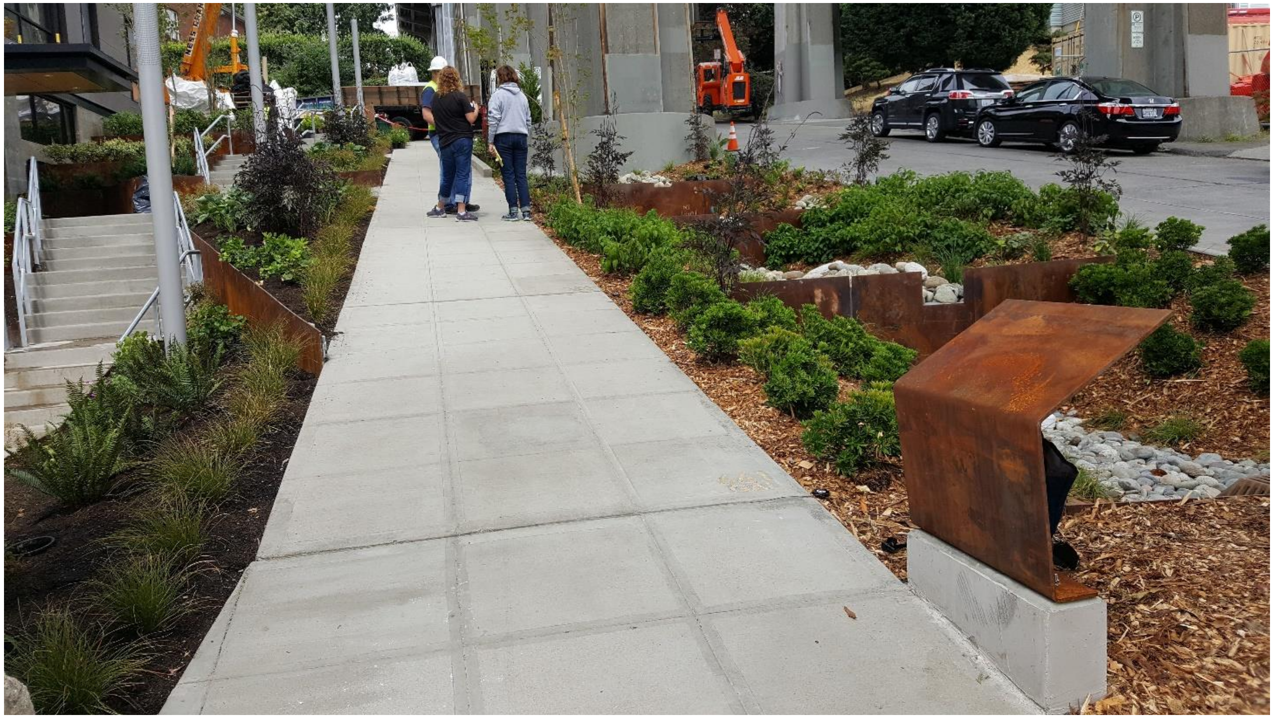
What is a standard?

It's different from a typical guideline.

Accredited Standard	Guideline
➢ Specify expectations and provide a way to measure compliance to the content. ➢ Primarily includes requirements and recommendations. ➢ Written to be compatible with demonstrating due diligence such as with accepted practice or regulations. ➢ Concise, and structured to easily locate specific content. ➢ Developed through a third party accredited process.	➢ Provide advice and help users better understand how to carry out a task or procedure. ➢ Primarily include information, background, and decision support. ➢ Written for practitioners ➢ Less concise with more background and context. ➢ Usually developed by individuals or organizations with restricted target audience and varied objectives.

Consensus

Substantial Agreement by the Technical Committee – implies much more than a simple majority but not necessarily unanimity



How these standards can be used

Standards are compliance tools that can be used in a number of different ways, for instance they can be:

- adopted and inserted, either whole or in part, into regulation or policy
- written into bylaws, contracts, and permits
- looked to as industry best practice

Example 1: federal/provincial agencies may want widespread usage of the provisions of these standards and so decide to reference it, either in regulation or supporting regulatory documents.

Example 2: local authority or project owner as part of the permit specifies these standards shall apply, meaning the contractor needs to meet the provisions in satisfying the terms of the permit.

Example 3: authority may transition to these standards by specifying temporary or permanent deviations reflecting local needs

CSA Group

Hot off the presses – just published 2018!

CSA W200-2018 Design of Bioretention Systems

CSA W201-2018 Construction of Bioretention Systems

W200 Design of Bioretention Systems - Scope

Bioretention Systems in scope include those with and without an underdrain, biofilters, bioretention planters and bump-outs.

This standard does not include bioswales, tree trenches or pits or rain gardens.

CSA Group

W200 Design of Bioretention Systems - Content

- **Roles and Responsibilities**
- **Site Planning, Criteria and Constraints**
- **Cold Climate Suitability**
- **Typical Performance and Design Criteria**
- **Background Investigations**
- **Bioretention Design**
- **O&M Considerations for Design**
- **Documentation**

CSA Group

W200 Design of Bioretention Systems - Content

Roles and Responsibilities

- The design team should be led by an engineer or a landscape architect

Design Team

Other design team roles may include:

- landscape designer;
- arborist or horticulturalist;
- biologist, botanist, or ecologist;
- geotechnical professional or hydrogeologist;
- planner; or
- soil scientist.

All the various roles should be integrated in the design such that there is collaboration throughout the design process.

CSA Group

W200 Design of Bioretention Systems - Content

Site Planning, Criteria and Constraints

Suitability

- High-risk site activities
- Aquifer and wellhead protection
- Available space (10-20 % of contributing area)
- Catchment topography and siting
- Water Table (**0.6 m** separation)
- Subgrade soils
- Contributing catchment area
- Proximity to utilities
- Setback from buildings
- Protection of roadways

CSA Group

W200 Design of Bioretention Systems - Content

Cold Climate Suitability

- **Challenges**
- **Design Modifications for Cold Climate**
  - Off-line if possible
  - Curb openings adapted
  - Minimum diameter of 200 mm for underdrains
  - Outlets
  - Salt-tolerant plant materials
  - Attention for sheet flow conditions or ponding
- **Snow Management !**

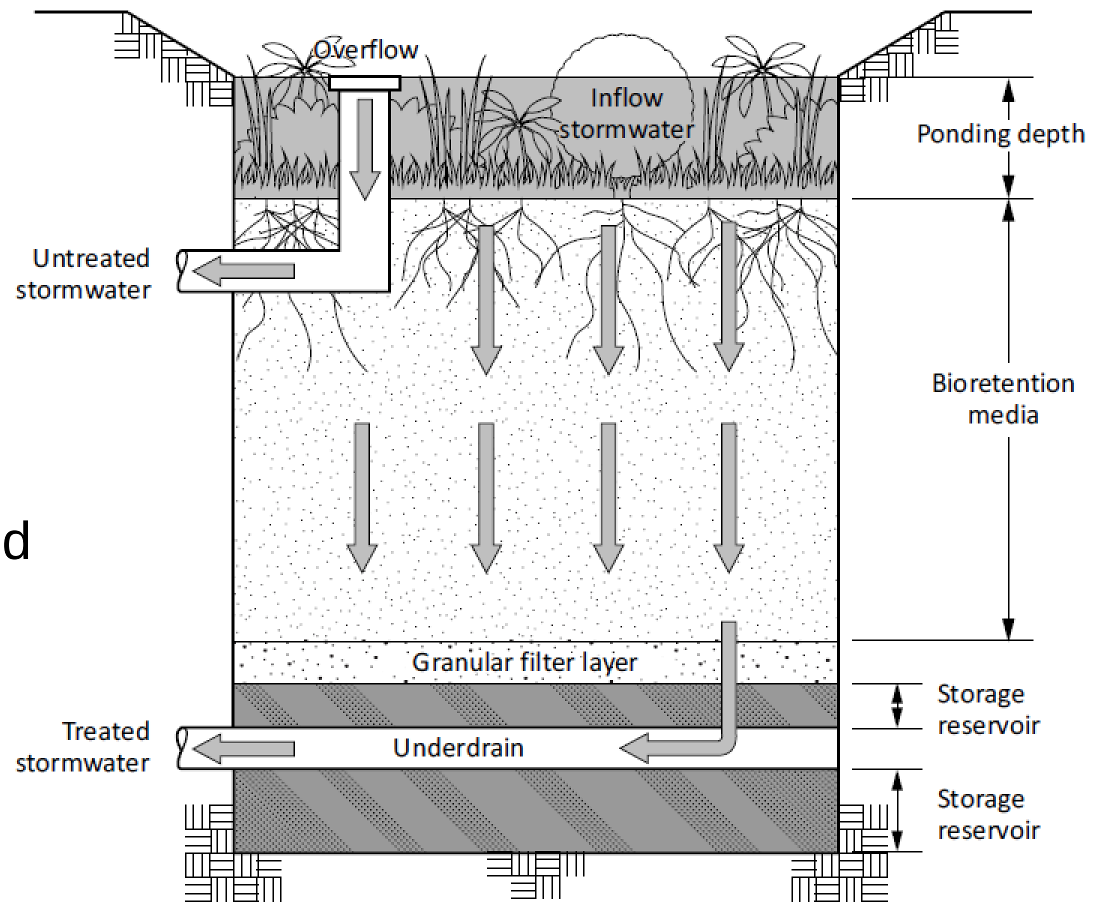
W200 Design of Bioretention Systems - Content

Typical Performance and Design Criteria

Design factors affecting performance

a) impervious area to pervious area ratio (I/P);
b) presence of underdrains;
c) available storage capacity;
d) use of impermeable liners; and
e) bioretention media depth and composition.

Figure 1
Cross-section of a typical bioretention system
(See Clauses 5.1 and 6.1.)



CSA Group

Typical Performance and Design Criteria

Design criteria

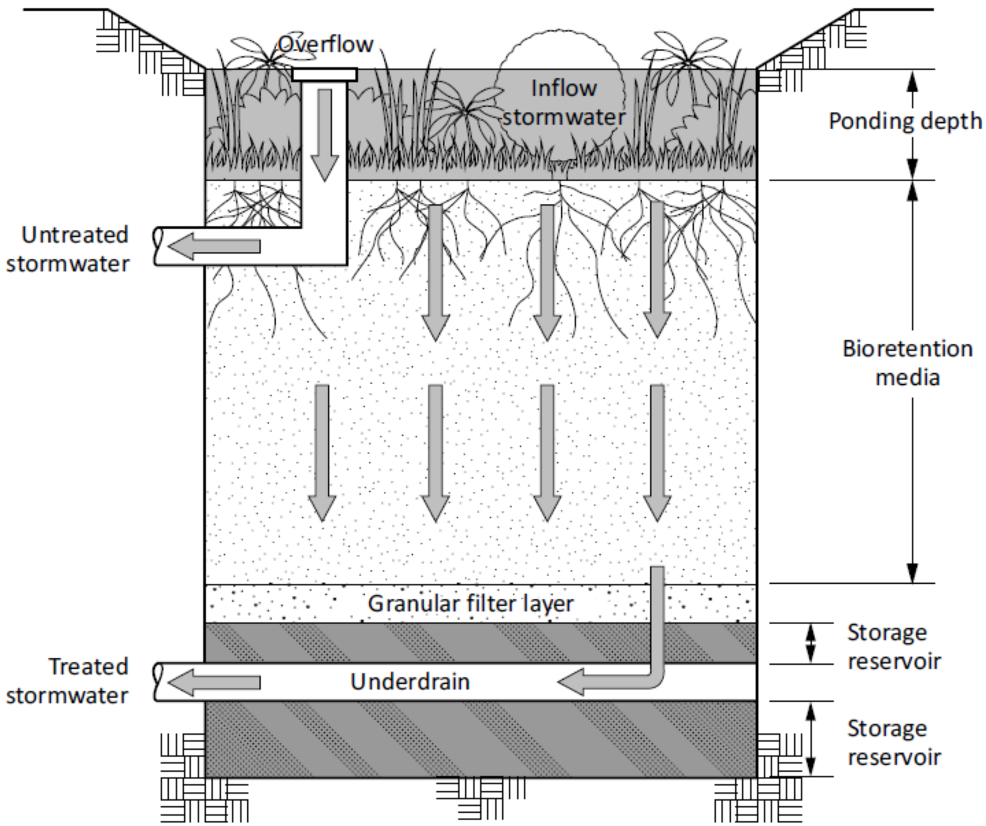
Basic

- volume reduction criteria: capture and **infiltrate** in 48 h the runoff associated with the 90% rainfall event or 25 mm;
- water quality improvement criteria: capture and **treat** the runoff associated with the 90% rainfall event or 25 mm

Optional

- Peak flow and flooding mitigation

Figure 1
Cross-section of a typical bioretention system
(See Clauses 5.1 and 6.1.)



Typical Performance and Design Criteria

Climate Change

a) changes in the design volume (see Clause 9.3);
b) changes in water balance, potentially impacting plant material selection;
c) changes in the hardiness zone, potentially impacting plant material selection;
d) changes in fall and winter temperature, potentially impacting the use of de-icing compounds and traction materials; and
e) changes in the atmospheric deposition of sediments and other contaminants, potentially impacting operational procedures.

W200 Design of Bioretention Systems - Content

Background Investigations

3 Steps

a) Background evaluation of geotechnical material
b) Test pit or soil boring observations
c) Saturated hydraulic conductivity: Field tests

- permeameter test using ASTM D6391 or ASTM D5126/D5126M;
- double-ring infiltrometer test using ASTM D3385 or ASTM D5093; and
- single ring infiltrometer test using ASTM D5126/5126M.

ANNEX B on saturated hydraulic conductivity, infiltration and percolation rates

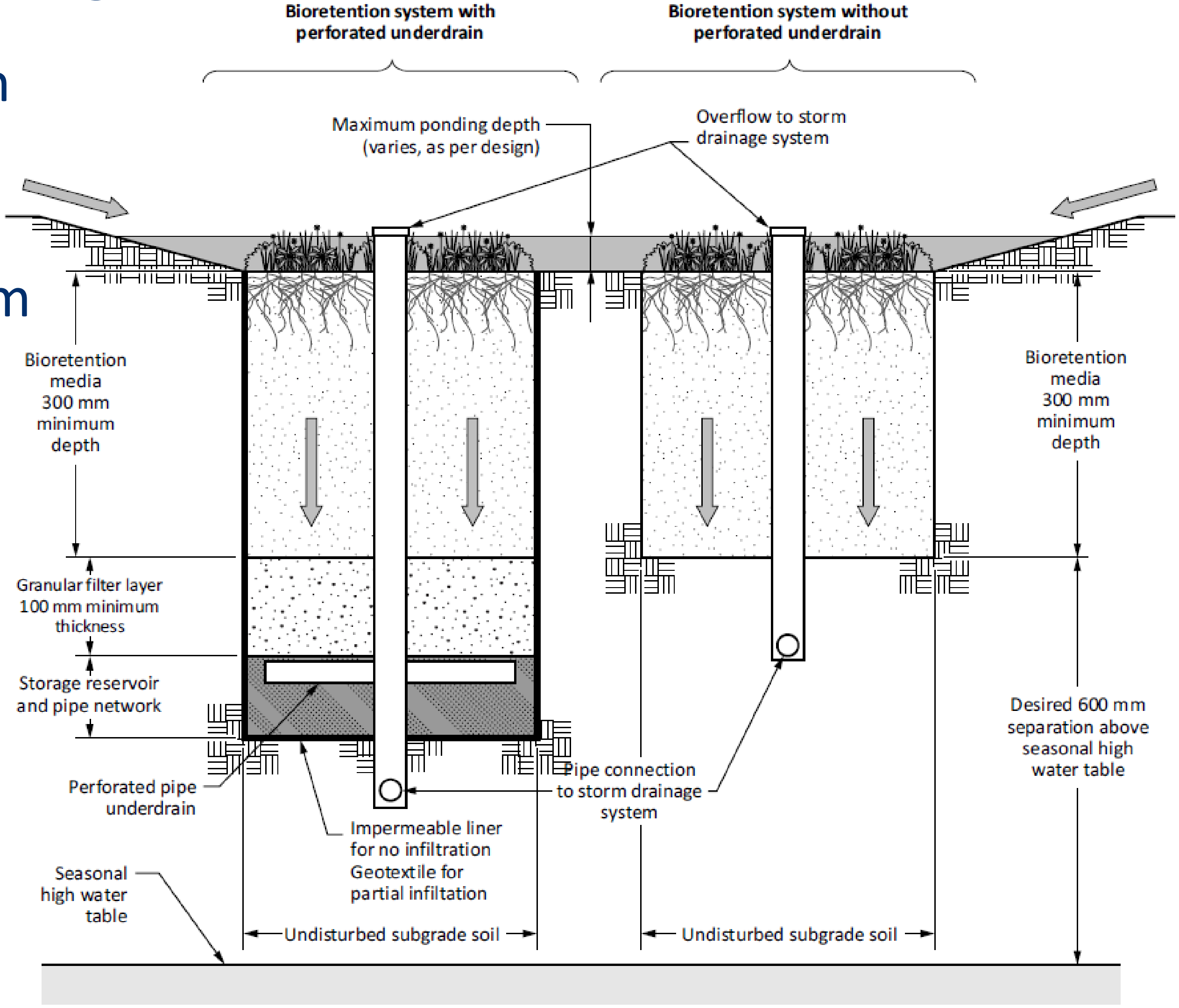
CSA Group

W200 Design of Bioretention Systems - Content

Bioretention Design

- Selection of design function and configuration
- Sizing of the system
- Specify plant material

Basic configurations of bioretention
(See Clause 9.2.1.)



CSA Group

Bioretention Design

Sizing the system

Runoff flow rate	$Q = CiA/360$
Design volume for quality	$V_{quality} = (D \times C_V \times A)/1000$
Storage calculations	*Full or partial infiltration*
Ponded water depth verification	*Time to drain < 48 h*
Footprint area calculations	*I/P Ratio*
Capacity of underdrains	*Used if Ks less than 15 mm/h*

W200 Design of Bioretention Systems - Content

Bioretention Design

Bioretention Media

- **Ranges of parameters provided**
- **Depends of selected plant material and objectives**
- **Should be tested according to W201**

Plant Material

- **Selection depends on context and objectives**
- **List of recommended species**
- **Planting strategy**

ANNEX C gives examples of plant materials selection

CSA Group

Operation and maintenance

Table 10
Typical routine maintenance for bioretention
(See Clauses 10.2 and 10.4.)

Activity	Schedule
• Inspect for plant material density (at least 80% coverage), damage by foot or vehicular traffic, channelization, accumulation of debris, trash and sediment, and structural damage to pre-treatment devices.	After every major storm event (> 25 mm), quarterly for the first two years, and twice annually thereafter.
• Remove trash and debris from pre-treatment devices, the bioretention system surface and inlet and outlets.	At least twice annually. More frequently if desired for aesthetic reasons.
• Remove accumulated sediment from pre-treatment devices, inlets, and outlets • Trim trees and shrubs • Replace dead plant material, remove invasive growth • Repair eroded or sparsely vegetated areas • Remove accumulated sediment on the bioretention media surface when dry and exceeds 25 mm depth • If gullies are observed along the surface, regrading and revegetating might be required	Annually or as needed

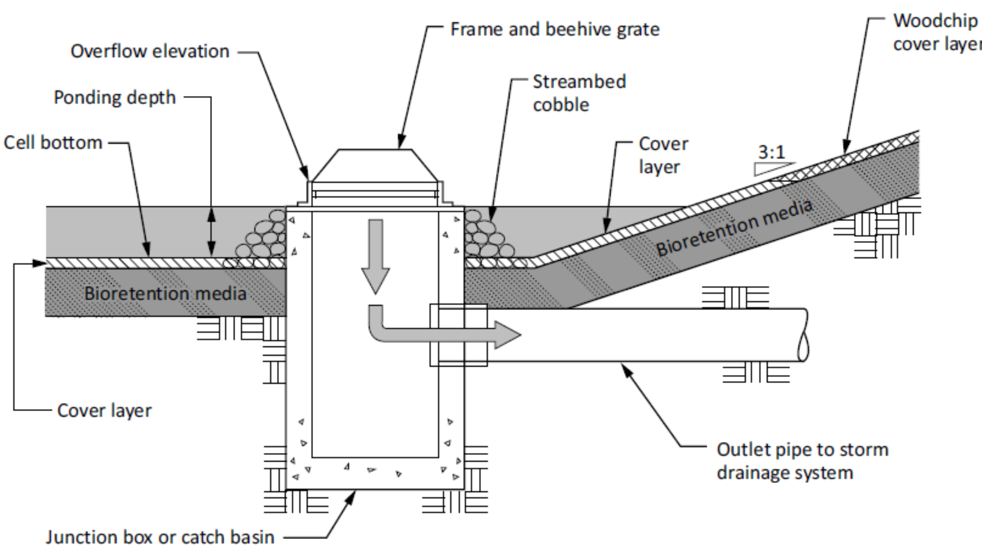
Source: *Adapted from STEP (2018) and Calgary (2016).*

Elements should be considered at the design stage

CSA Group

Inlets and outlets

Figure 10
Bioretention outlet structure
(See Clause 9.3.9.1.)



CAN/CSA W201 Construction of Bioretention Systems

W201 Construction of Bioretention Systems - Scope

This standard covers requirements and recommendations for construction activities specific to bioretention systems.

It does not cover standard construction practices

CSA Group

W201 Construction of Bioretention Systems - content

- Roles and Responsibilities
- Contract Documentation
- Construction Sequencing
- Erosion and Sediment Control for Bioretention Systems
- Material supply and Handling
- Installation Considerations
- Landscape Materials and Maintenance
- Construction Warranty Maintenance
- Assumption Protocols

CSA Group

W201 Construction of Bioretention Systems - highlights

EROSION AND SEDIMENT CONTROL : ESSENTIAL !!

Table 1
Examples of erosion and sediment control measures
(See Clause 8.2.5.)

Erosion control measures	Sediment control measures
Diversion structures • slope drains • diversion berms • conveyance channels	**Perimeter controls** • silt fence barrier • fiber log/roll • compost socks • compost berms
Erosion control methods • soil roughening • seeding or turf establishment – sprayed, drilled, or spread • turf reinforced mats • for drainage channels/conveyance i) soil binders — tackifier or polymers ii) rolled erosion control products • for hillsides i) cover layer application (wet or dry) ii) dry cover layers such as straw, hay, compost, rolled erosion control products, or rock iii) wet cover layers such as shredded wood, corn stalk fiber with or without tackifier or polymers iv) compost/bioretention media blankets	**Check structures** • straw bale barrier-check dam • rock check dam • geosynthetic check structure **Inlet barriers** • curb inlet barriers • straw bale, compost sock, or other type of check dams • inlet inserts **Stabilized construction access controls** • vehicle tracking pad/mud mat • entrance grates or ridge systems • tire washing **Sedimentation basin**

CSA Group

W201 Construction of Bioretention Systems - highlights

Bioretention materials and handling

- media
- media mixing
- testing

Plant materials & landscape considerations

- sourcing
- timing
- watering
- erosion protection for plant material

Installation considerations

- avoidance of compaction
- placement and approval
- liners
- infrastructure

ANNEX A: Inspection checklist

CSA Group

Other Standards Under Development

PLUS 4013 Development, interpretation, and use of rainfall intensity-duration-frequency (IDF) information: Guideline for Canadian water resources practitioners

W203 - Planning, Design, Operation and Maintenance of Municipal Wastewater Treatment in Northern Communities using Lagoon and Wetland Systems

W204 – Flood Resilient Design of New Residential Communities

W205 – Erosion Protection for Northern Community Infrastructure

W20? - Erosion and sediment control: maintenance & installation

CSA Group

Source: Flood Resilient Design Institute

Thank you!!

Any questions?

Lynn Barber
lynn.barber@csagroup.org
416 747-2320

Gilles Rivard
grivard@lasallenhc.com
514 366-2970 x 8037

TRIECA 2019 CONFERENCE

Thank you to our sponsors:

www.trieca.com

GOLD SPONSORS

AECOM
Credit Valley Conservation — inspired by nature
Stantec
AQUATECH
armtec — CANADACULVERT
CIVICA — Water Management Solutions

J. Lipani Turf
CROZIER — CONSULTING ENGINEERS
terrafix — geosynthetics inc.
UNILOCK — DESIGNED TO CONNECT.
GEMS
Hydro International

R&M CONSTRUCTION
filtrexx CANADA — LAND IMPROVEMENT SYSTEMS — let nature do it.
Profile — Solutions for your Environment
Lake Simcoe Region conservation authority
York Region

MEDIA SPONSORS

Environmental Science & Engineering MAGAZINE
WATER CANADA

PRINT SPONSOR

WARREN'S WATERLESS PRINTING INC.

HOSTS

CAN-IECA CANADIAN CHAPTER
Toronto and Region Conservation Authority