

# *Living Cities Canada: A Virtual Forum*

*Session 4 - Wednesday, March 30, 2022*

*A Thriving Living City*



## *Bridging the GI “Theory to Implementation” Gap*

*Bert van Duin, M.Sc., P.Eng.*

*Drainage Technical Lead, City of Calgary Water Resources*

# Bert van Duin, M.Sc., P.Eng.



Drainage Technical Lead, City of Calgary Water Resources

[bert.vanduin@calgary.ca](mailto:bert.vanduin@calgary.ca)

(403) 268-6449

## AFFILIATIONS

Assistant Adjunct Professor, Department of Civil Engineering, University of Calgary

Adjunct Professor, Department of Civil Engineering, University of Alberta

Chair, Technical Committee, *Green Infrastructure for Stormwater*, CSA Group

Member, Technical Committee for *Flood Resilient Design for New Residential Communities*, CSA Group

Member, Technical Committee for *Flood Resilient Design for Existing Communities*, CSA Group

Member, Technical Committee for *Development, Interpretation and Use of Intensity-Duration-Frequency (IDF) information: Guideline for Canadian water resources practitioners*, CSA Group

Member, Water Task Force of the Natural Resources Strategic Steering Committee, CSA Group

Past President, Alberta Low Impact Development Partnership

Chair, Events & Activities Working Group, Alberta Low Impact Development Partnership

## PROFESSIONAL INTERESTS

Urban stormwater analysis, hydraulic design, sustainable development, water resources engineering



## Toward More Resilient Urban Stormwater Management Systems – Bridging the Gap From Theory to Implementation

Bert van Duin<sup>1,2\*</sup>, David Z. Zhu<sup>1</sup>, Wenming Zhang<sup>1</sup>, Robert J. Muir<sup>3</sup>, Chris Johnston<sup>4</sup>, Craig Kipkie<sup>5</sup> and Gilles Rivard<sup>6</sup>

<sup>1</sup> Department of Civil and Environmental Engineering, University of Alberta, Edmonton, AB, Canada, <sup>2</sup> Water Resources, City of Calgary, Calgary, AB, Canada, <sup>3</sup> Dillon Consulting Limited, Toronto, ON, Canada, <sup>4</sup> Kerr Wood Leidal Associates Ltd., Burnaby, BC, Canada, <sup>5</sup> Kerr Wood Leidal Associates Ltd., Calgary, AB, Canada, <sup>6</sup> Lasalle | NHC, Laval, QC, Canada

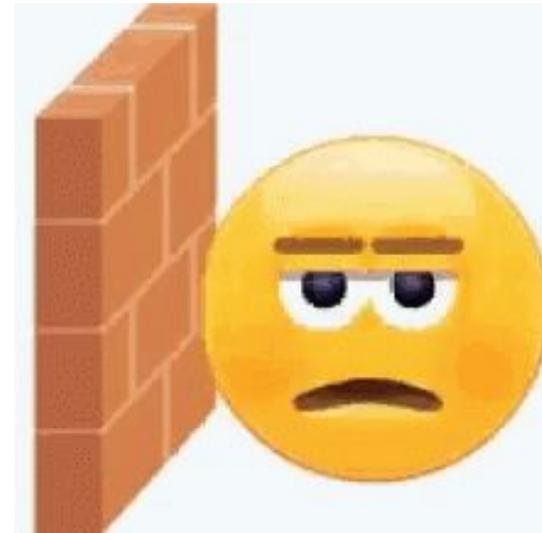
Published as  
part of  
Specialty Issue  
on *Resiliency of  
Urban Systems  
to  
Water-related  
Disasters*

Frontiers in  
Water: Water  
and Built  
Environment

Open Source

<https://www.frontiersin.org/articles/10.3389/frwa.2021.671059/full>

# Are there gaps from “Theory to Implementation” that need to be bridged?



# What is holding us back from wholesale implementation of green infrastructure and LID?

## Considerations

- Lack of targets to shoot for
- Role of private land
- Lack of common terminology
- Lots of different permutations --- people don't see the forest for the trees
- Lack of integrated, system thinking
- Multi-disciplinary nature

## Comments

- Engineers need numbers
- Many expectations are not necessarily traditionally engineering based (e.g., urban heat island or aesthetics)
- Progress: upcoming Ontario LID Manual
- It is wishful thinking that property owners will simply accept LID on their land. Social aspects are vital
- Look at it as function of land use and parcel size and whether property manager exists
- E.g., rain gardens  $\neq$  bioretention
- Need to understand the primary, secondary and tertiary functions of the infrastructure (e.g., rate, volume and water quality control) and how different components can act together
- All disciplines need to be represented

# What is holding us back from wholesale implementation of green infrastructure and LID?

## Considerations

- Has LID Theory been settled?
- What about the urban myths and “naysayers”?

## Comments

- The need for LID and GSI has been settled; however, the optimal combination of grey, green and natural infrastructure is still open to debate. This combination will vary significantly from region to region.
- There are legitimate questions that cannot be belittled, e.g., fate of infiltrating runoff and contaminants, leaching of nutrients, use of energy and other resources. We must address these nagging questions
- *It is difficult for a man to understand something when his salary depends on him not understanding it – Upton Sinclair*
- A central database of where urban myths are addressed will be useful



# What is holding us back from wholesale implementation of green infrastructure and LID?

## Considerations

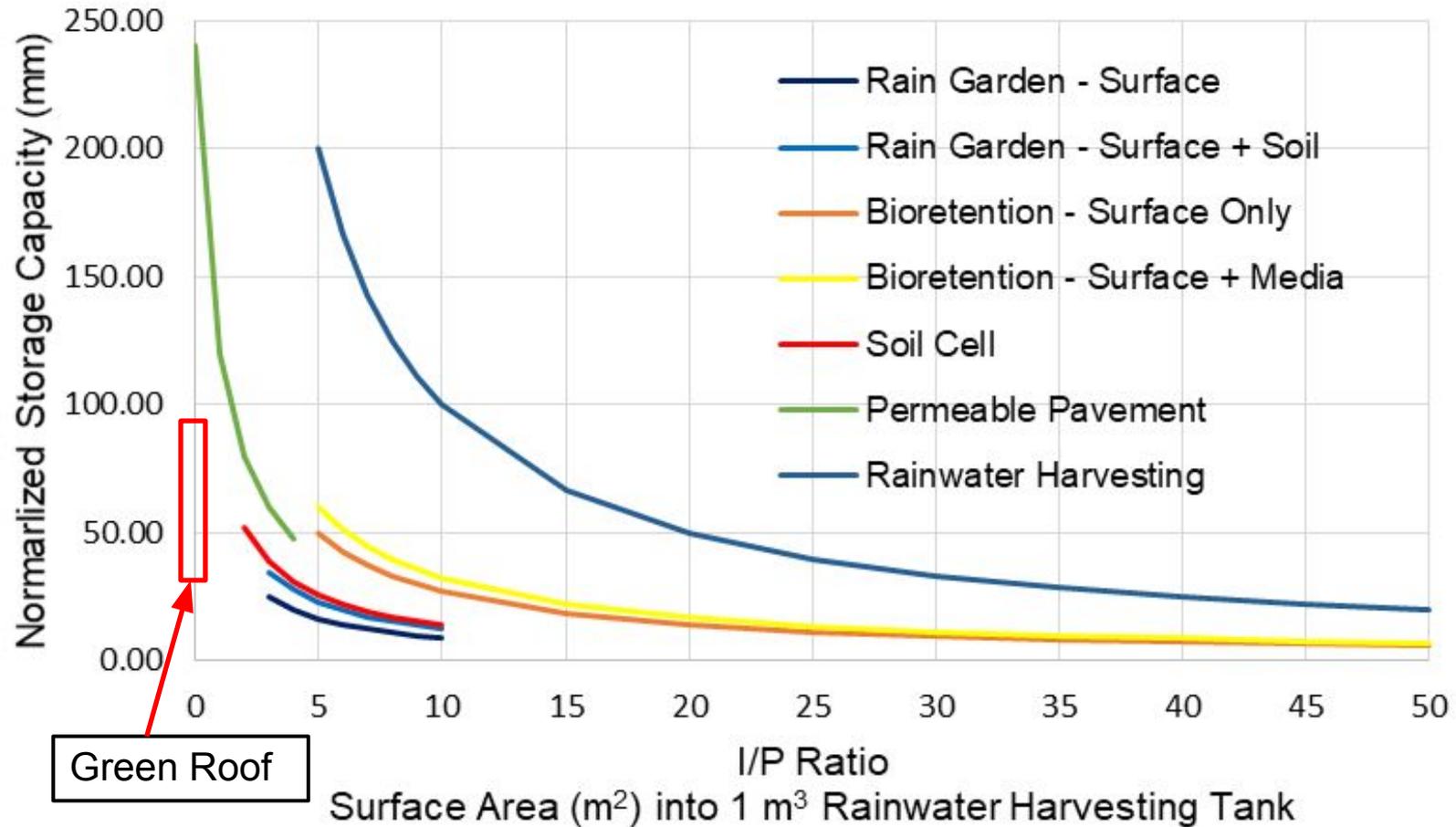
- Regional differences can be significant
- Lack of long-term performance data
- Lack of ***normalized*** performance data

## Comments

- Context is everything as due to varying geography and climate, both hydrologic and contaminant loadings will differ across the country
- As a result, the LID approaches of interest may differ significantly across Canada
- And, findings from one region cannot necessarily be extrapolated to other regions
- However, the processes and unit operations are the same
  
- ASCE/WEF International BMP database  
<https://bmpdatabase.org/>
- *Optimizing Stormwater Treatment Practices – A Handbook of Assessment and Maintenance* (Andy Erickson, Peter Weis and John Gulliver)



# Normalized Storage Capacity of LID





# What is holding us back from wholesale implementation of green infrastructure and LID?

## Considerations

- Analytical tools are still in their infancy
- Lack of life-cycle costing tools
- Need for TBL Tools that cover secondary benefits

## Comments

- Tools provided by suppliers often serve a single purpose rather than allowing for a systems approach
- LID and GSI are still poorly represented in urban drainage analytical tools, especially when considering the water balance and water quality (continuous simulation needed)
- A good appreciation of soil moisture conditions is needed
- That said, design and plant for drought, and use native species that will enjoy some extra moisture
- STEP's Life-Cycle Tool, see <https://sustainabletechnologies.ca/lid-lcct/> is a step in the right direction, but it needs cross-Canada data
- The Risk / Return on Investment Tool, see <https://risksciences.com/rroit/> by Risk Sciences International and Credit Valley Conservation is a Canadian based tool of interest, but it needs more data re secondary benefits



# What is holding us back from wholesale implementation of green infrastructure and LID?

## Considerations

- Asset management is still in its infancy in urban drainage
- Lack of success stories
- Lack of information and data re failure mechanisms
- Lack of optimization

## Comments

- For instance, we often lack proper as-built or as-planted information
- Progress: Ontario Regulation 588/17 re asset management
- See also *Integrated Asset Management Framework: Combining Green and Gray Assets* <https://swefc.unm.edu/iamf/>
- Success stories are wonderful, but they don't necessarily tell us why an approach or system has been successful
- Investigations into the root causes of failures tell us what we should avoid in the future
- We have various CSA Standards (e.g., W200 and W201 *Design and Construction of Bioretention Systems*, W204 *Flood Resilient of New Residential Communities* and W210 *Prioritization of Flood Resilience of Existing Communities*) **but more are needed**
- However, don't make it overly complex
- SHARE --- SHARE --- SHARE



# What is holding us back from wholesale implementation of green infrastructure and LID?

## Considerations

- Educational gap
- Lack of communications across the country

## Comments

- There is a lack of expertise across the board. We need both generalists and specialists across the many disciplines that will be involved
- Our universities and colleges do not meet our needs
- But, those of us in either industry or government should be willing to collaborate with academia as part of either research or CAPSTONE projects
- Can we please share information?
- This information should be free and readily available. STEP, see <https://sustainabletechnologies.ca/> is great, but users will need to “translate” it to make it relevant to their specific regions as context is everything
- See e.g., Green Infrastructure Leadership Exchange, <https://giexchange.org/> but a peer platform across Canada will help



**Reality Check**: stormwater management, let alone LID, is still quite immature:

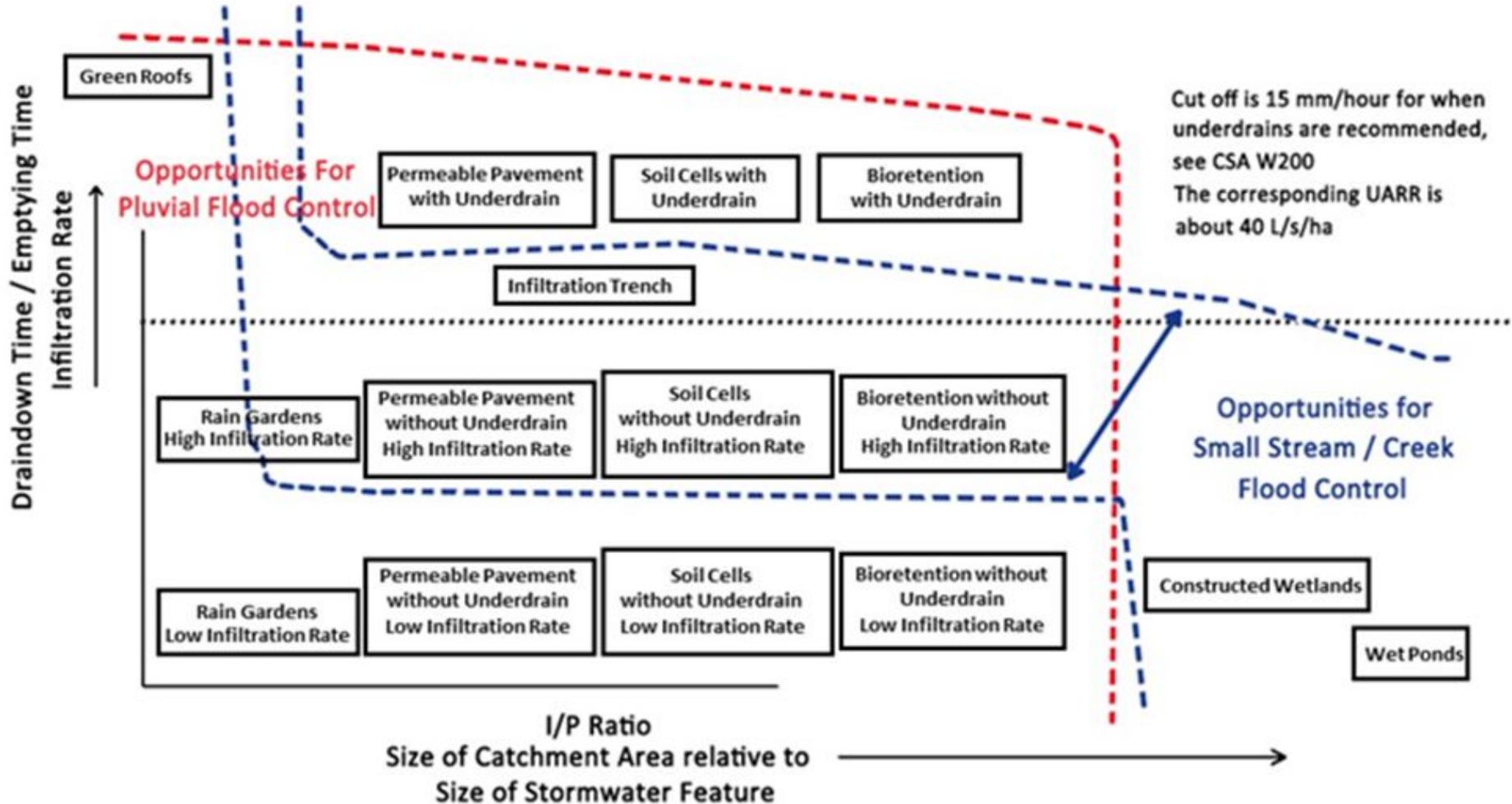
- But, somehow, “magically”, we have made lots of progress already

and

- Don't be so Canadian in being hesitant in calling out that grey infrastructure does NOT meet all of our objectives ...



# Normalized Benefits of LID





Thank you for  
your time,  
attention and  
interest!!

Bert van Duin, M.Sc., P.Eng.  
Drainage Technical Lead  
City of Calgary Water Resources  
Infrastructure Planning  
403-268-6449  
[Bert.vanDuin@calgary.ca](mailto:Bert.vanDuin@calgary.ca)

This presentation was prepared for general  
informational purposes only.

All images © unless otherwise referenced. Please  
contact the author for permission to use.