



WORLD PLUMBING COUNCIL

Education and Training Scholarship for Applicants
from Developing or Least Developed Countries 2019

A Report on learnings and experience from the scholarship.

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Purpose of the Report

The purpose of this document is to share my experience and learning that I gained during my further education sponsored by the World Plumbing Council under “Education and Training Scholarship for applicants from Developing or Least Developed Countries 2019” and help inspire the next generation of young engineers.

About the Author

Keval Vejani is a recent graduate from Toronto Metropolitan University (Formerly Ryerson University) specializing in Water Resources Engineering with a research project focused on ‘Low Impact Development (LID) Stormwater Management Practices’. Currently working with the Water Resources Team at Urbantech Consulting, bringing over 4+ years of experience in stormwater, water, and wastewater management. Over these years in industry, I consider it as a moral responsibility to provide best water and wastewater management solutions to every surrounding and help each other towards sustainability.

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I deeply acknowledge the committee members of Indian Plumbing Association (IPA) – Ahmedabad Chapter that infused water positive mindset, namely Mr. Apurva Shah, Mr. Minesh Shah, Mr. Dipen Mehta, and Mr. Harshal Parikh. The immense support and co-operation from my past employers, VMS Engineering and Design Services Pvt. Ltd. and INI Infrastructure and Engineering Pvt. Ltd., that always provided open grounds to fly and lastly World Plumbing Council (WPC) for the golden opportunity to outgrow myself and take my career and understanding about stormwater, water, and wastewater management to next level.

1. Introduction

1.1 Background Story

While working my first job in the water and wastewater industry, I got introduced to the Indian Plumbing Association (IPA) and participated in their Indian Plumbing Professional League (IPPL) in 2018 of which we stood runner's up at our chapter. The seed was planted then and my passion for the subject grew and soon I heard about the World Plumbing Council and their scholarships. I applied in 2018 itself but didn't succeed, but it was in 2019 I got the coveted "World Plumbing Council Education and Training Scholarship for applicants from Developing or Least Developed Countries" to pursue a short course at IHE Delft, Institute of Water Education in Netherlands. Due to pandemic, the course was cancelled and so was my initial plan. Further, WPC was generous enough to extend our scholarship till next year when I planned to pursue Master's in Civil Engineering with specialization in Water Resources and Environmental Engineering from the Toronto Metropolitan University (formerly Ryerson University) in Toronto, Ontario, Canada.

1.2 Why Master's at TMU?

As a Design Engineer back home, I use to plan and design stormwater networks for many industrial and institutional campuses, without any conservation of pre-development hydrology. This was when I came across research of Dr. Darko Joksimovic, who is currently Associate Professor at TMU, in the field of 'Low Impact Development (LID)' stormwater management practices that got my attention and interest. It was then I decided to pursue master's degree under his supervision, and we successfully carried extensive research in this subject together, which I will talk in detail in preceding section.

2. Learnings

2.1 Research Project at TMU

Background Study: Effective Stormwater Management (SWM) is critical to the continued health of streams, rivers, lakes, fisheries, and terrestrial habitats. In natural settings (undeveloped catchments) the presence of vegetation and the lack of impervious surfaces define this distribution such that a relatively small part of the rainfall produces runoff. While in built communities (developed catchment), the introduction of impervious surfaces, compaction of soils, and the reduction in vegetated cover alter this proportion such that significantly more runoff is generated, and less water is taken up by evapotranspiration from natural vegetation or makes its way into the ground to naturally recharge streams, wetlands, and groundwater resources. This is where the problem of urbanization starts and as a solution, an ecosystem-based water balance approach to stormwater management should be emphasized to maintain the natural hydrologic cycle and 'Low Impact Development (LID)' stormwater management practices are something that helps achieve it.

Low Impact Development Practices: implemented and tested for the research project were the Etobicoke Exfiltration System (EES) and 'Inline Flow Restrictors (IFRs)'. EES refers to a system in which two perforated pipes are placed beneath the storm-sewer system to allow exfiltration and IFRs refers to a system which introduces baffle inside the storm sewer system to allow peak flow reductions while utilizing the storage capacity of storm sewer system at the fullest. General assembly of these two LID practices are shown in Figure 1 and numbers 1, 2 and 3 represents the flow advancements in the system.

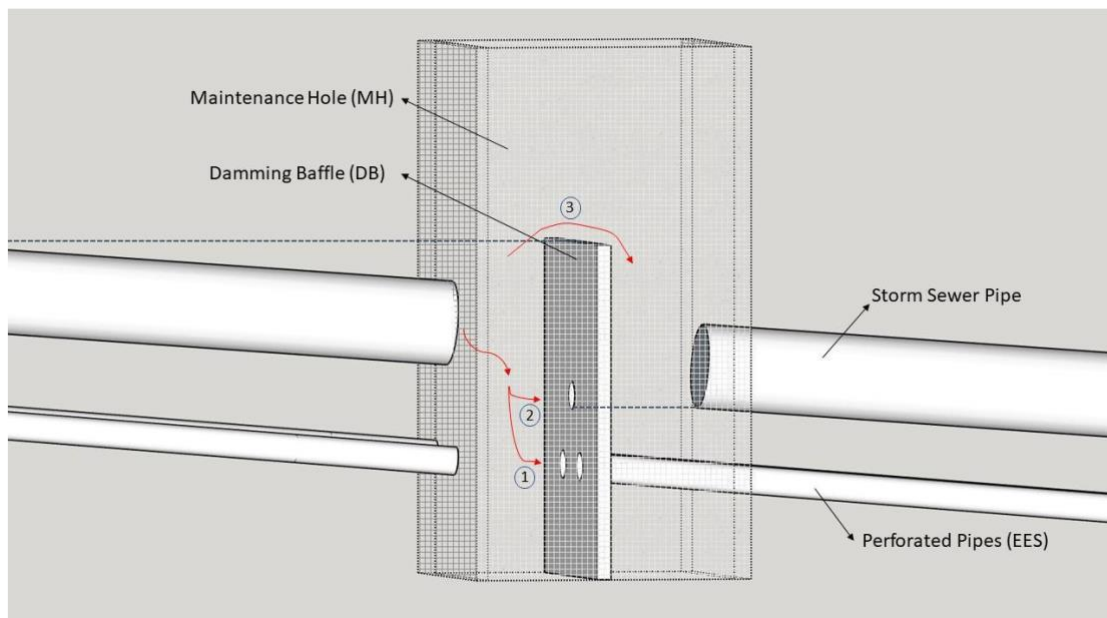


Figure 1 EES and IFRs arrangement in a storm sewer system.

The results: shows significant reduction of runoff volume and peak flows by implementing the EES and IFRs respectively, along with the storm sewer system through exfiltration and retention of runoff. The hydrological and hydraulic modelling was carried out in USEPA SWMM v5.2 for a case study area in Town of Richmond Hill, Ontario.

Detailed Report on the research project can be viewed at this link: [\(1\) Keval Vejani | LinkedIn](#)

2.2 Other Courses undertaken at TMU

Apart from the research, I undertook 8 different courses during the tenure of my Master’s Degree. Each course had different learnings as described in below Table.

Course	Learnings
Bioenergy and Biofuels	The course explored theories and applied technologies for production and conversion of biomass into energy and co-products, focusing on biomass waste for bioenergy and biofuel recovery with methane, hydrogen, and ethanol production. Biochemical processes (fermentation and anaerobic digestion) were introduced and explained, followed by an overview of engineering tools applied to the analysis of energy conversion processes involving biomass thermochemical energy processes
Infrastructure Asset Management	This course discussed the framework, concepts, and methods of infrastructure asset management. Topics included system analysis, lifecycle costing, decision making under uncertainty, demand forecasting, performance measure and monitoring, inspection technologies, condition assessment, deterioration modeling and lifetime prediction, maintenance and rehabilitation optimization, prioritization and programming, innovative project delivery, and project and program management.
Processes of Water Pollution Control	This course taught principles and designs involved in wastewater treatment. Topics covered physical, chemical, biological treatment processes, and advanced treatment methods including biological nitrification-denitrification, enhanced biological phosphorus removal, membrane bioreactors, biofilm processes, and alternative disinfection methods. A theoretical approach, supplemented by practical design applications and problem-solving, was adopted.
Hydroinformatics	This course introduced the integration of water management with information and communication technologies in Hydroinformatics concepts, methods and tools. Relevant systems analysis, modelling and decision support concepts were discussed in the context of current and future environmental challenges. The use of simulation models, optimization (single and multi-objective) techniques, machine learning, open data and data management were introduced and explained.
Environmental Impact Assessment	The course overviewed sustainable development and engineering and focus on the Canada Environmental Assessment Act and the Ontario Environmental Assessment Act. Topics included sustainable development and engineering, concepts and methods of environmental impact assessment, physical/economic/social impacts, multi-objective evaluation of alternatives, cumulative impact assessment, and strategic environmental assessment.

Course	Learnings
Satellite Remote Sensing of Urban Areas	Major topics included overview of high-resolution satellite remote sensors; multi-sensor data fusion; Knowledge-based image analysis; Satellite images for object extraction; Intelligent change detection systems; Selected case studies in urban transportation planning, Land-use/land-cover mapping, and environmental impact analysis.
Construction Administration and Management	Skills and techniques useful in administering and managing in a construction project environment, including international and Canadian construction, organizational design for projects and companies, management control structures and processes, meetings, and negotiations, managing change in organizations, power struggles and politics in organizations, conflicts, and their resolutions, claims and disputes in the industry, and the all-important issues of construction safety.
Optimization in Urban Drainage Systems	Understanding of general optimization methods. Formulation of a formal optimization problems in urban drainage system applications and Hands-on application of a coupled optimization-simulation approach

3. Experiences

3.1 Research Presentation at Conference

The research we conducted on ‘Low Impact Development Stormwater Management Practices’ was presented at the 57th Conference of Canadian Association of Water Quality (CAWQ) which won the Philip H. Jones award for the ‘Best Student Presentation’.



Figure 2 Photos from the presentation at the 57th CAWQ conference



Figure 3 Photos from the presentation at the 57th CAWQ conference

3.2 Extracurricular activities at TMU

Along with the academics, I participated in University Table Tennis competitions, stood runners up and learned a new skill, ice skating, and explored the most happening city of Toronto.



Figure 4 Photos of extra-curricular activities while at TMU



Figure 5 Photos of extra-curricular activities while at TMU

4. Outcomes

The learnings and experiences while here at TMU, got me a step ahead in my career. The prime learning that I have taken back home is about efficient stormwater management practices and how important is to maintain the pre-development hydrology and ways to do so. I have never seen this being practices in my home country, India, and I am eager to implement them successfully.

Another major learning was about the hydrological and hydraulic modelling software's. We generally practiced using spreadsheets for the stormwater, sanitary and water supply networks in India, but I happen to learn USEPA SWMM and EPANET which are used for stormwater and water supply networks modelling. The modelling software's gives an upper edge in design as it can simulate the systems for continuous rainfall as compared to simple distribution of storm while designing using spreadsheets.

I expect to use these learnings and experiencing in my practice to provide optimal and sustainable stormwater management solutions to our clients in India.

