Matthew Tenney
Team Lead Spatial Data Science and Visualization

Information and Technology Services
Pilot Project Outline

Geospatial Competency Centre
Data Analysis and Visualization Team
18 Dyas Rd.
4th Floor
Toronto, Ontario M3B1V5

Tel: 416-338-3962
matthew.tenney@toronto.ca

Project Overview:

Many of our projects aim to increase the permeability of urban environment by replacing sealed surfaces with unsealed or porous surfaces.

This means that more water can pass through to the soil below, reducing flood risk and improving soil moisture. Projects that improve permeability are often located near trees or green spaces because the increased soil moisture can encourage healthy growth. We will focus on comparing four different "environment types" in our analysis: 1) Industrial, 2) Rural, 3) Suburban, and 4) Urban.

The media used for the base of permeable paving may be porous to allow for fluids to flow through it or nonporous media that are spaced so that fluid may flow in between the crack may be used. In addition to reducing surface runoff, permeable paving can trap suspended solids, therefore, filter pollutants from stormwater. Examples include roads, paths, and parking lots that are subject to light vehicular traffic, such as cycle-paths, service or emergency access lanes, road and airport shoulders, and residential sidewalks and driveways.

Although some porous paving materials appear nearly indistinguishable from nonporous materials, their environmental effects are qualitatively different. Whether it is pervious concrete, porous asphalt, paving stones or concrete or plastic-based pavers, all these pervious materials allow stormwater to percolate and infiltrate the surface areas, traditionally impervious to the soil below. The goal is to control stormwater at the source, reduce runoff and improve water quality by filtering pollutants in the substrata layers.

Scope:

This is a pilot project for the development of a water runoff analysis on permeable impermeable surfaces in the City of Toronto. We will deliver an analytical model simulation infrastructure load and point-source locations of runoff/absorption rates for our study area(s). A means to visualize this model and the results will also be delivered as part of the project.

Assumptions:

Using data analysis we can model and measure the impacts and risks associated with water runoff to provide evidence-based environmental and water policy governance, stormwater, and planning initiatives for City of Toronto Divisions (e.g., WaterTO). In other words, cities are built on the assumption that the water that would have been absorbed back into the land they occupy can be transported away instead of impacting the infrastructure and environment in surrounding areas.

Constraints:

We will execute a proof-of-concept where we will be investigating multiple different approaches, software, analysis, and visualization techniques for this project. We will need to obtain relevant data and resources from relevant Divisions and stakeholders.

Methodology:

Explore readily available software and data requirements for each. For example, QGIS plugin for such purpose(s), ArcGIS Flow Tool, and other relevant resources. We will need to visualize our analysis in a meaningful way. Web mapping front-ends (2D and 3D) will be viable options. We will need to explore which option is best and clearly document our chosen methodology as weighted against other approaches. For pilot projects, all methods are subject to change once integrated with stakeholder needs and demands.

Resources:

Primary resources for this project are obtaining relevant datasets and staff-training on needed technologies and methodologies.

Initial Data Requirements:

1. Surface Layers (impermeable/permeable)
2. Elevation model (DEM or LiDAR ground converted to DEM)
3. Hydrological Features/Network
4. Daily Precipitation – Start with 1 year (2016) but multiple years (5yr lookback) preferred.
    a. Daily, site-specific
5. Daily Temperature - Start with 1 year (2016) but multiple years (5yr lookback) preferred.
6. Sewer/Drainage network - drains, sewer lines, flood plains, etc.
7. Building Features
8. Parcels

Schedule:

All data should be collected by end of the week and relevant stakeholders notified/contacted (e.g., WaterTO). Methodology development and investigation should be underway by Monday, November 20th. Concurrently data visualization and dissemination approaches should be explored and compared. Implementation of the initial workflow should be defined and documented on Monday, November 27th. Execution and adjustment as needed the following week.

- Stage 1: Data Collection
- Stage 2: Methodology Research and Development
- Stage 3: Prototyping and Comparison
- Stage 4: Initial Execution

Documentation:

Please document your process along the way and be prepared to contribute to the documentation process at each stage of the project.