

Digital Twin Solution for Low Impact Development Natural & Built Infrastructure

“How can we improve Green Infrastructure maintenance and care practices to support long term stormwater management?”

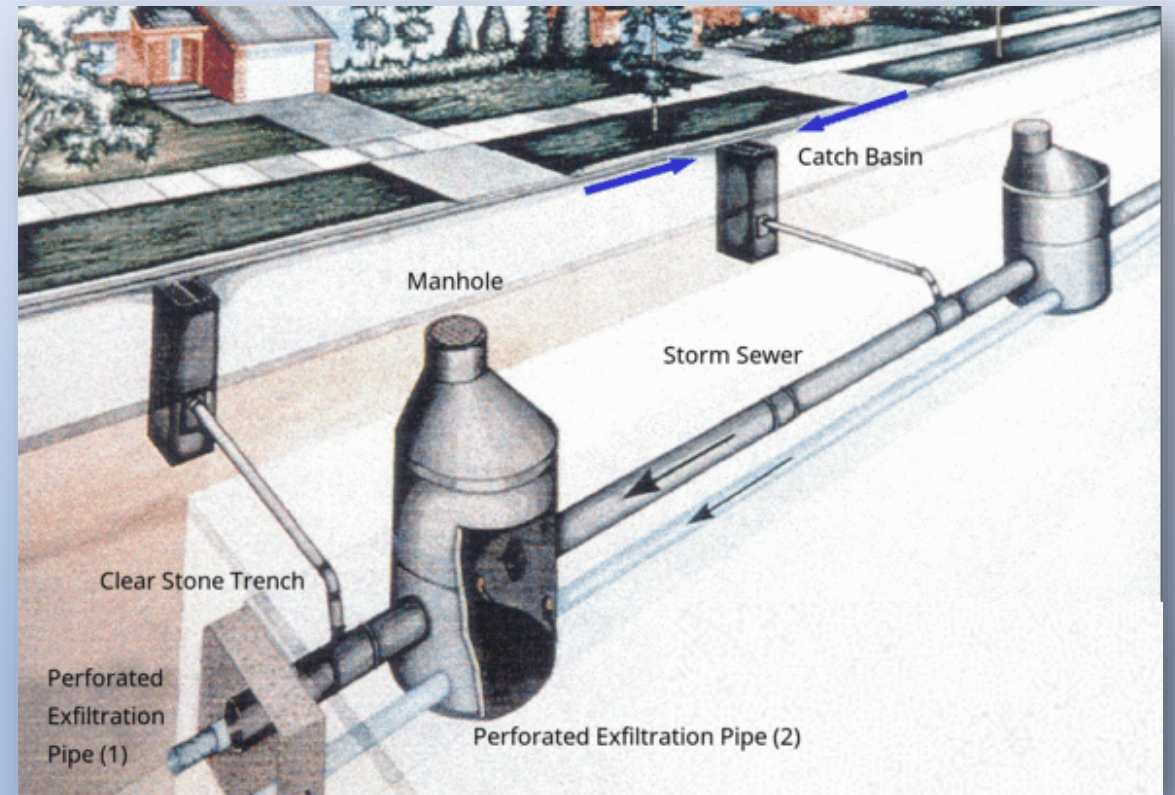
Environmental Action Committee Presentation

City of Mississauga

September 5, 2023

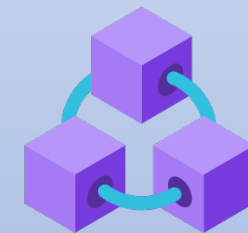
What's the problem?

- Lack capacity to monitor, design & build Low Impact Development
- Older communities, aging stormwater pipes
- Significant cost to replace and retrofit
- Economic considerations with environmental protection
- Stormwater systems fail during extreme events



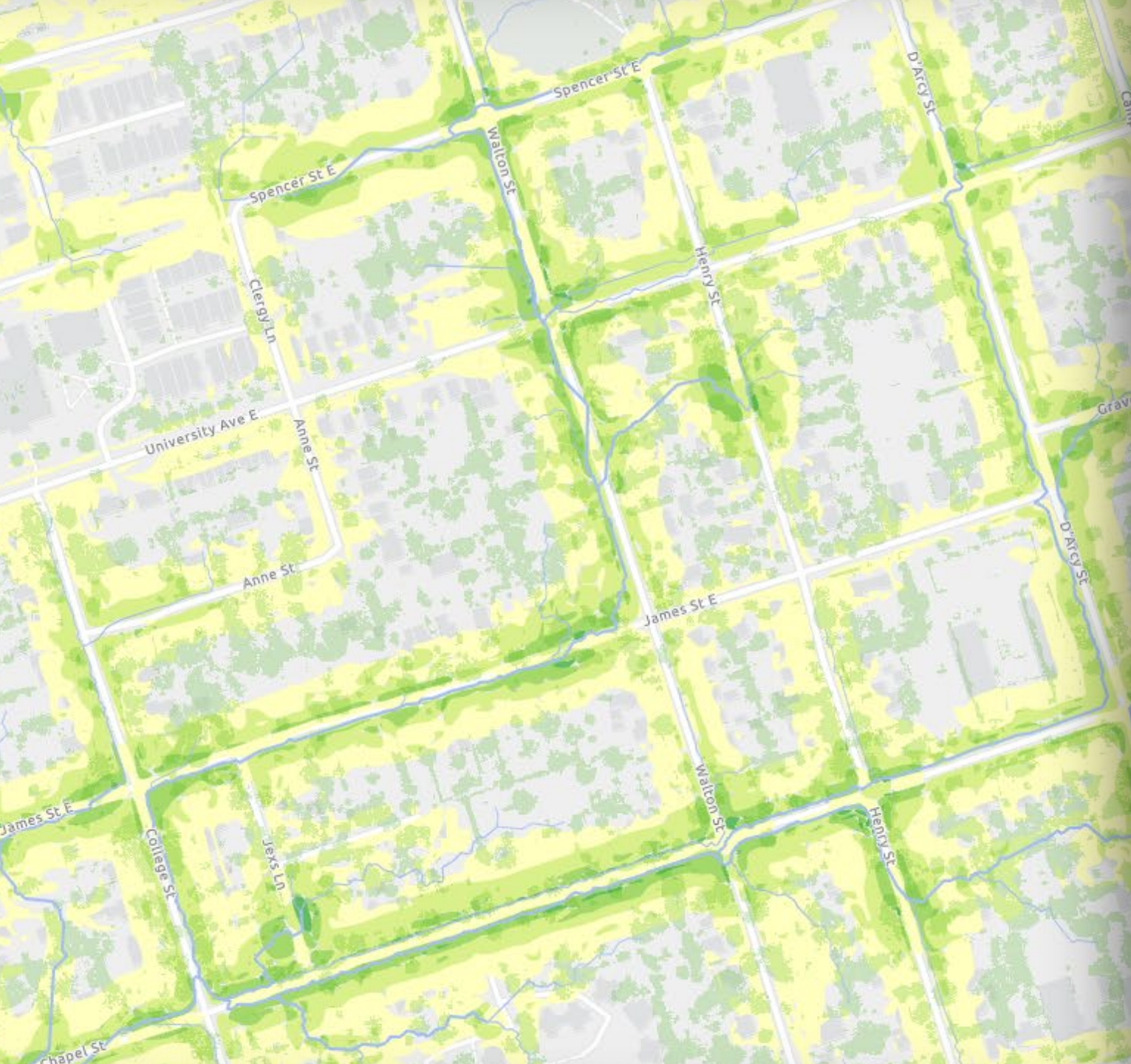
Our Solution

- Use sensors to collect data
- Internet of Things (IoT) to communicate
- Blockchain technology to validate
- Provides live tracking and monitoring
- Predict and prepare for events

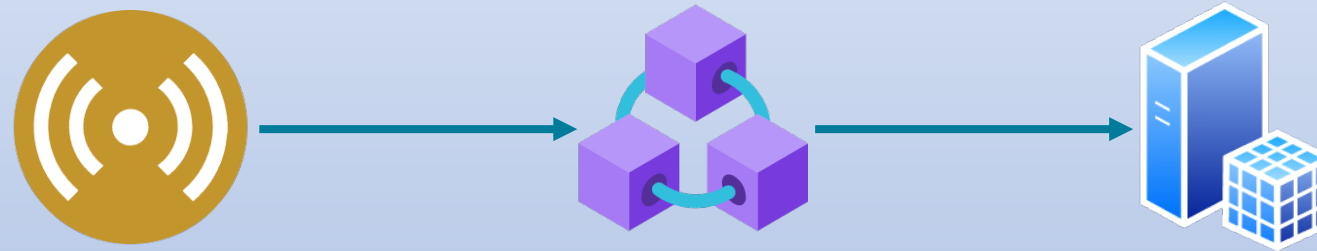


Our Solution

- Most suitable and cost-effective locations
- Private and public properties
- Simulate a quantifiable before-snapshot



Our Solution

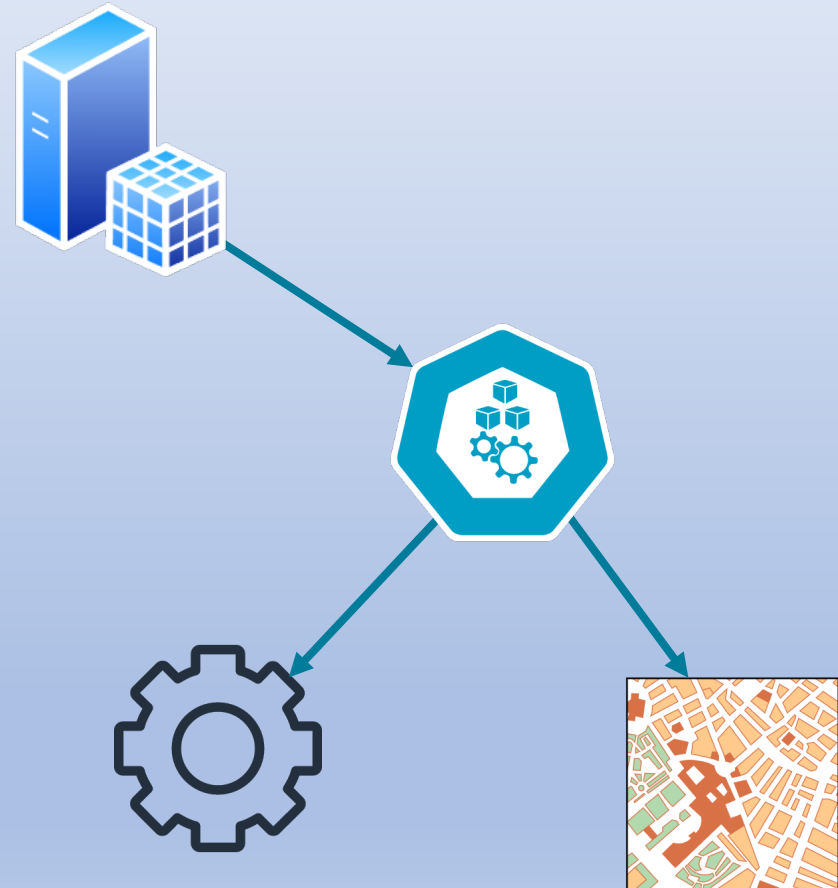


- Collect data and monitor
- Status and performance with real near-time data
- Sent through secured mesh network to open source platform

What we do with the data?

- Feedback through secure network
- Asset Identification, location & cross-functional performance
- 3D visualization to run simulation of natural/built asset performance at neighbourhood level

Mesh Network



What we do with the data?

- User set measured alerts
- Minimize damage through preparedness
- Manage stormwater at the source

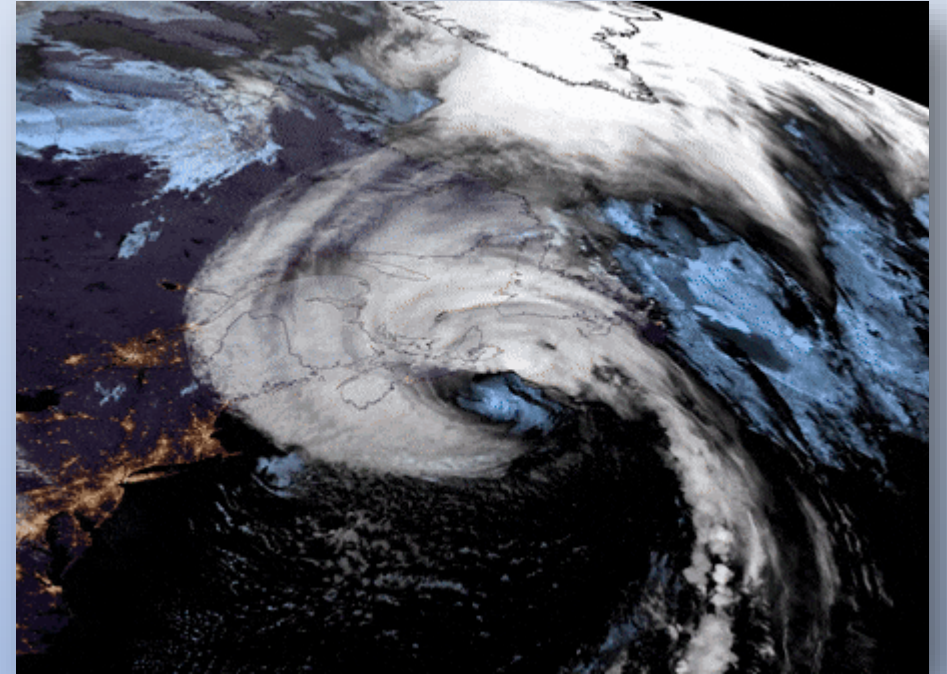
Our Solution



What we do with the data?

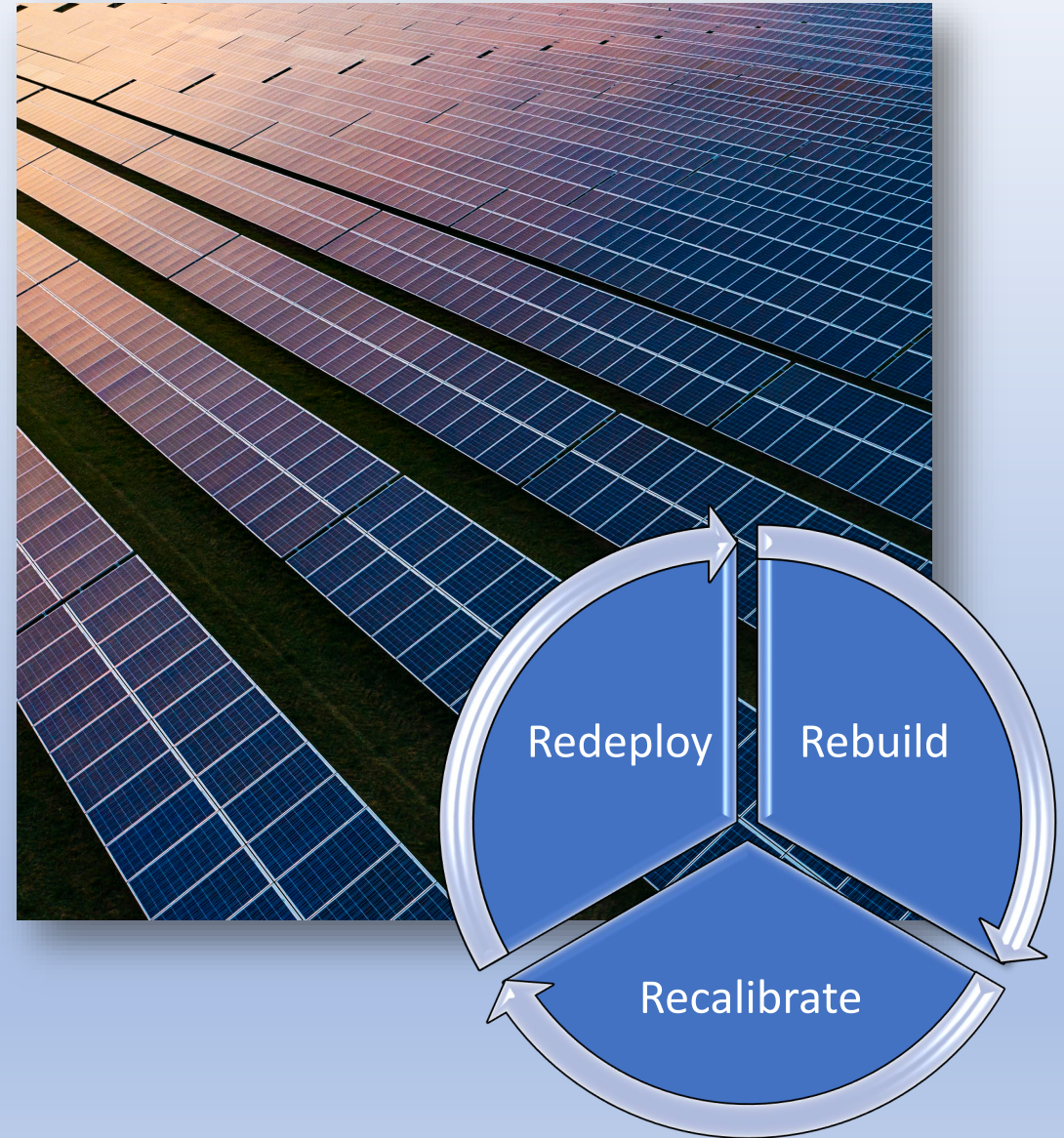
- Integrated with real-time weather data
- Optimize the natural hydrological cycle
- Residential, commercial and industrial sites

Our Solution



Business Case

- Sensors cost \$300 per unit
- Solar Powered
- 5 Year lifecycle
- Zero waste plus carbon credits

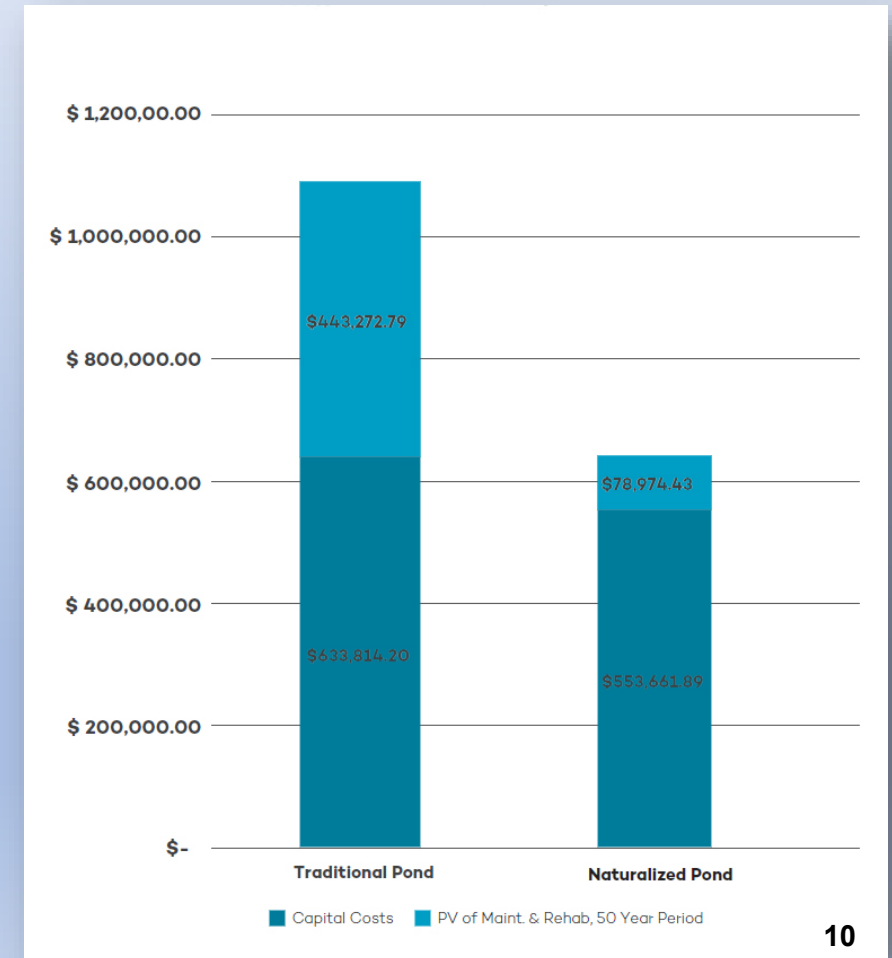


Potential Savings for LID Retrofits

Conventional vs Green Infrastructure Methods (*50-year period*)

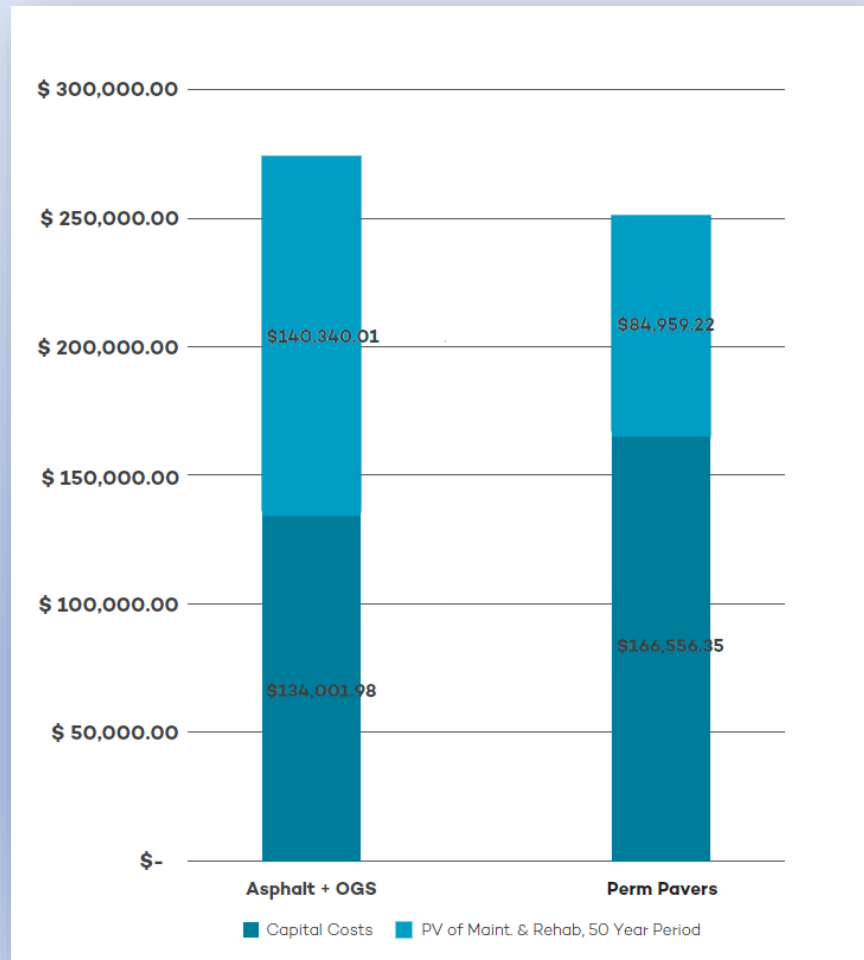
Conventional vs Naturalized Stormwater Ponds

- Savings of ~41%
- Similar CO₂/m² absorbed



Potential Savings for LID Retrofits

Conventional vs Green Infrastructure Methods (*50-year period*)



Asphalt vs Permeable Pavers

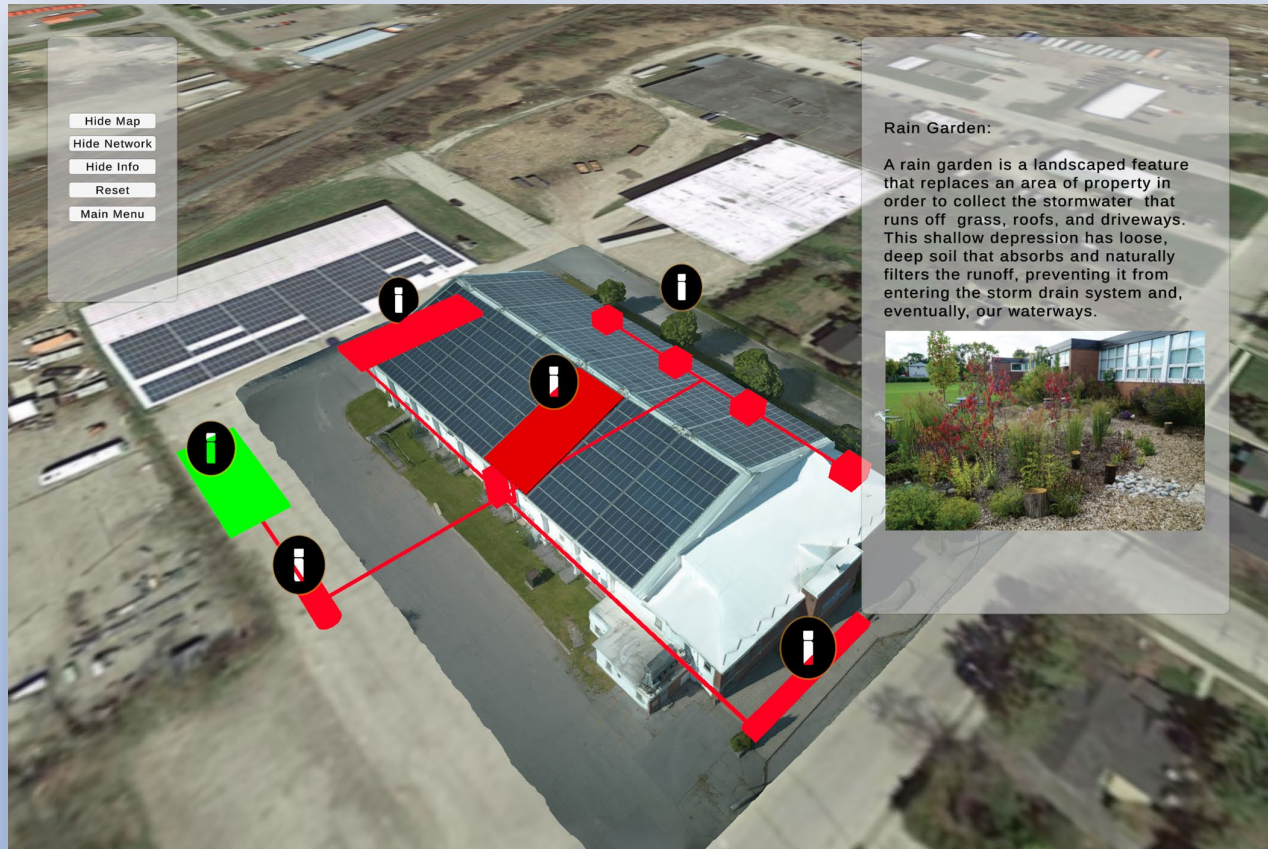
- Savings of ~8%
- 662 kg of CO₂/m² absorbed

Where are we now?

- Neighbourhood Pilot Project – Hampton, NB
- Simulated data for testing algorithms
- First location for real-time data link
- Student drone mapping in Cobourg, ON



Where are we now?

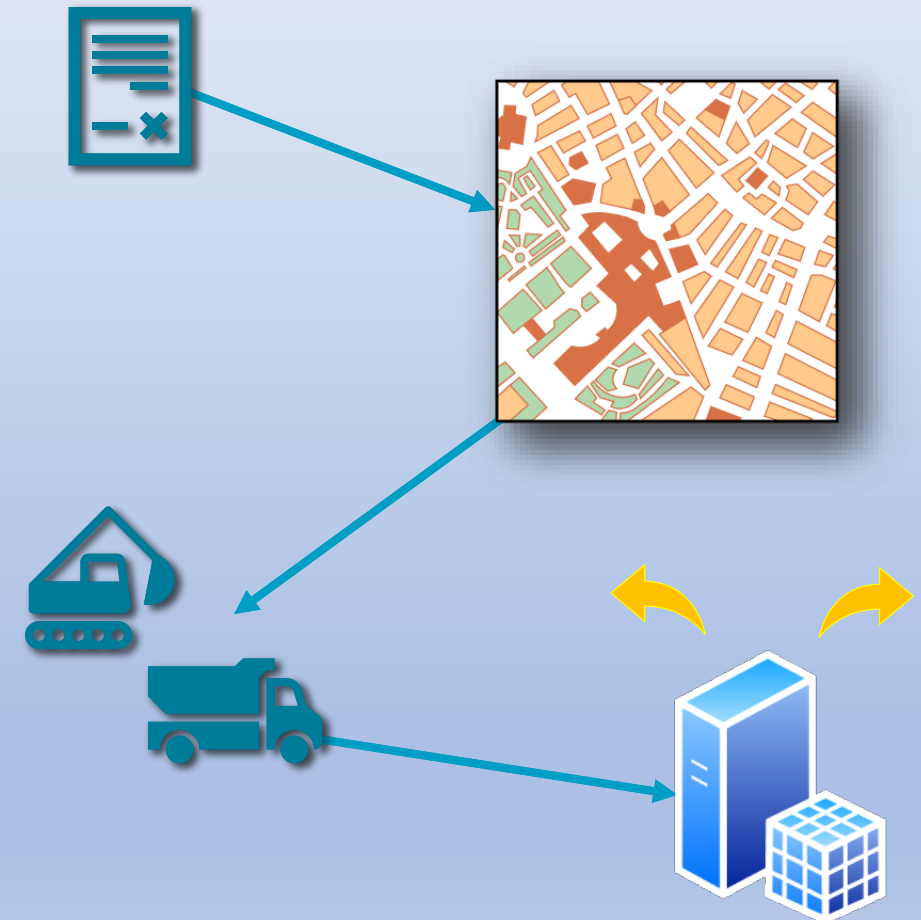


- Sustainable Cobourg
 - 3D test model of Memorial Arena
 - Accurate data of natural and built infrastructure
- Included
 - Half-day workshop on *Digital Twin Modelling of Green Infrastructure*
 - Demonstration of open data flood risk assessment using AI
 - Demonstration of scientific hardware and IoT climate network

Digital Twin

Phase One

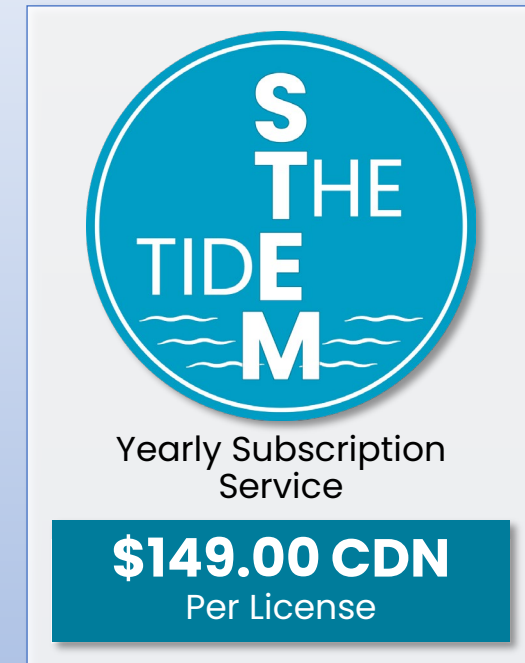
- User research and design
- Obtain data to build 3D model of natural and built assets
- Design simulation scenarios
- Build prototype to evaluate LID performance
- Pilot digital twin with other municipalities



Phase Two

- Demonstrate Return on Investment to municipalities and tax payers
- For those without LID projects
- Applied science and research
- Community-based digital twin private public partnership

Digital Twin

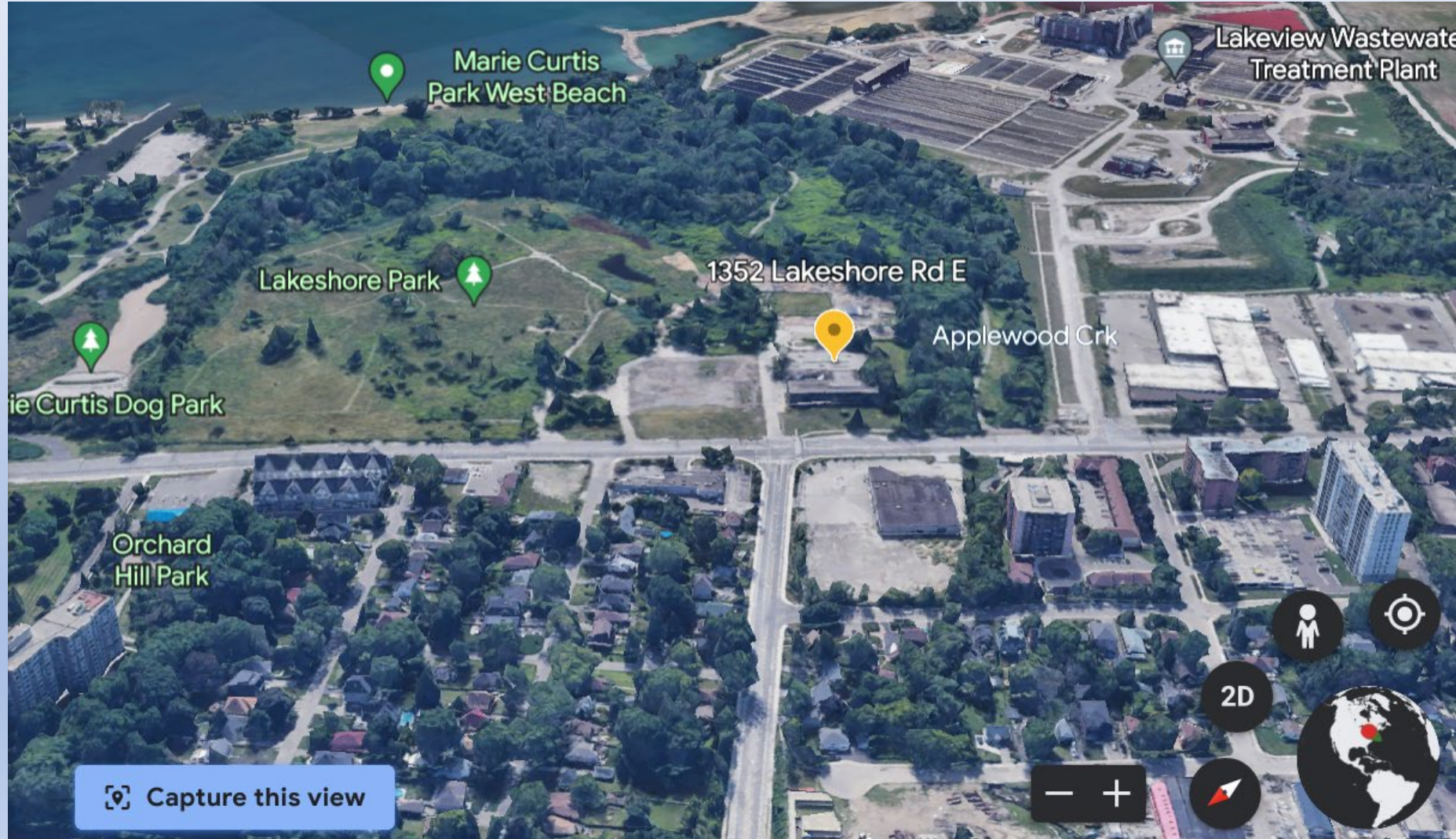


Adaptive Asset Management

- Works with:
 - Municipal Staff
 - Researchers
 - Community Partners
 - Businesses
 - Engineers
- Finding solutions to their problems
- Standardized data asset management systems
- Support digitization towards digital twins

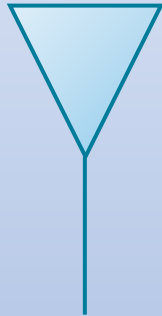


Future City of Mississauga Digital Twin LID Pilot



Future Timeline

Fall 2023



Complete Memorial
Arena 3D model

Winter 2024



Develop LID
simulation

Spring 2024



Pilot Digital Twin LID
with municipalities





Thank You!

References

GIS creates digital twins of the natural and built environments



United State Environmental Protection Agency (EPA) database on the performance of green infrastructure



Storm water management ponds— the natural way



References

Does the future of water utilities include digital twins?



Operating and Maintaining a Living City

