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# **Big Data and the Great Lakes: Future Pathways for Watershed Planning and Water Resource Management**

## Overview

- Many unique pressures facing the Great Lakes and its many watersheds
  - a changing climate
  - urban densification and sprawl
  - economic development
  - farming and food production
  - consumer and industrial waste generation
  - increased water and energy use



## Role of data and technology

- Estimated that 463 exabytes of data will be created each day by 2025
- Insights and knowledge that can be derived from this data is significant, even more so when interconnected and combined with historical data



## Role of data and technology

- To properly leverage data we need to overcome data optimization barriers within:
  - data governance
  - multidisciplinary collaborations
  - data availability, accessibility and privacy
  - the applications required to integrate machine learning and AI solutions





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## The Project: Phase 1

- Pollution Probe and the Council of the Great Lakes Region hosted the **Watershed Planning and Big Data workshop** in February to gather stakeholders from the north shore of Lake Ontario to:
  1. Evaluate the effectiveness of LAMPs and other collaborative, integrated water resources management models in planning for and resolving economic, social and environmental trends and issues
  2. Assess the potential to leverage Big Data in water resource planning and management by examining currently available data and analytics tools/practices and highlighting cutting-edge projects and activities planned or underway

## The Workshop



## Workshop Objectives

- Knowledge-sharing that contributes to capacity building and collaboration
- Identify strengths, weaknesses, gaps, and opportunities in the LAMP process
- Determine the role that Big Data and Analytics could play in an improved issue identification and decision-making process
- Determine how socioeconomic and ecosystem data can be connected and analyzed to generate deeper insights about change for policymakers

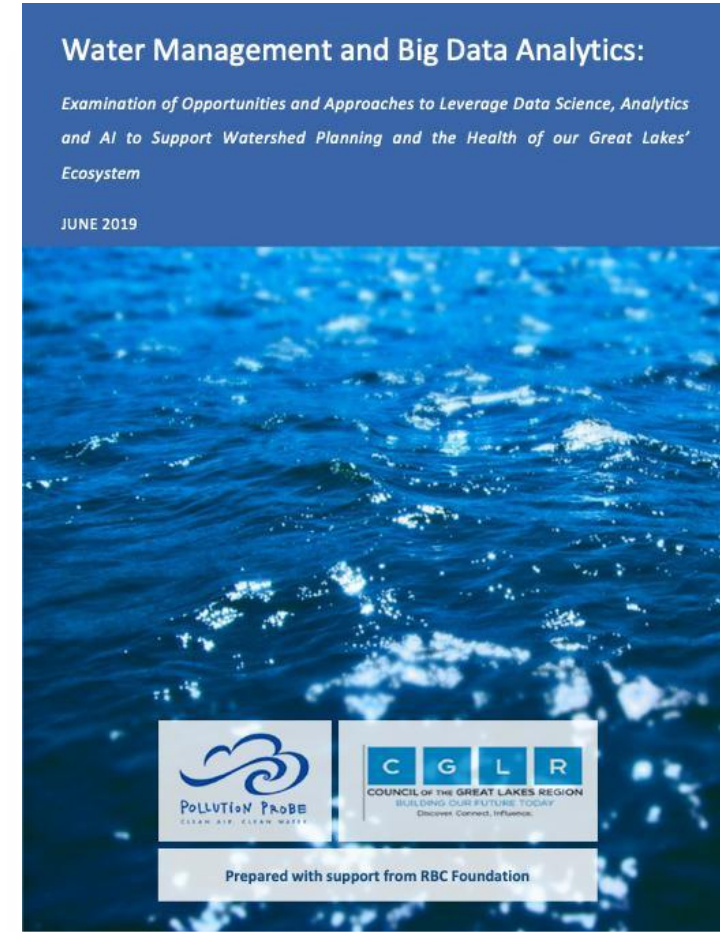
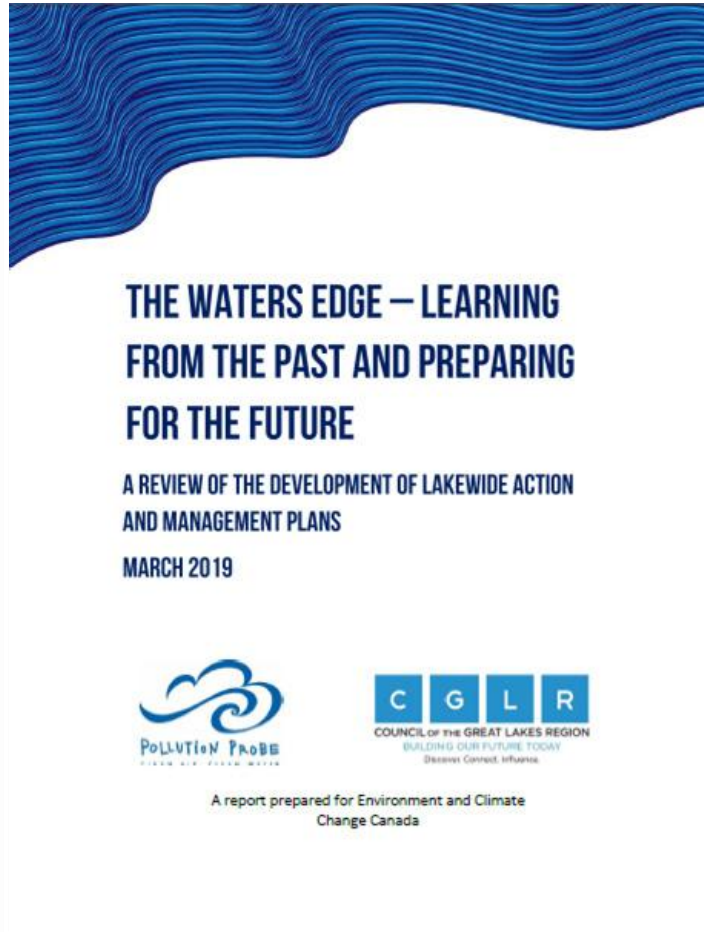




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## The Reports





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## Data Themes and Insights

### Data Gaps and Quality Concerns

- Incompatible, incomplete and/or non-existent data sets
- Insufficient temporal and spatial resolution
- Insufficient or inaccessible historical data

### Applicability of Data:

- Data can be (and has been) used for purposes other than those for which it was collected, raising privacy concerns, but this can be overcome (e.g. data anonymization)
- Misapplication of data can lead to wasted investment, lost resources and inaccurate/misrepresented findings

## Data Themes and Insights (2)

### Variability of Data Science Capability:

- Some places have more and better data than others
- ‘Two birds one stone’ collaborative/data-sharing opportunities should be explored

### Monitoring Techniques and Technologies:

- Budget and resource issues often constrain monitoring and data collection capabilities
- Ecosystem modeling can inform the most efficient use of limited resources



## Data Themes and Insights (3)

### Access and Ownership of Data

- Data controlled by private companies can be hard to access
- Data collectors for third parties can't release the data or even disclose that it exists
- Resources required to process data and make it openly available are often not available

### Data Context

- Socio-economic, legal and political context is essential for understanding the true nature and extent of barriers and to develop effective solutions



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# Water Management and Big Data Analytics: Overcoming Barriers

**NEXT PHASE**

## Phase 2 Overview

- The Council of the Great Lakes Region and Pollution Probe will be hosting a **Design Thinking Workshop** in late January/early February 2020 to discuss data optimization barriers using specific use cases (e.g. climate change/water, nutrients/water, etc.)
- Barriers include:
  - data governance
  - multidisciplinary collaborations
  - data availability, accessibility and privacy
  - the applications required to integrate machine learning and AI solutions
- A report of findings will be released in the spring and feed into the projects multi-year vision

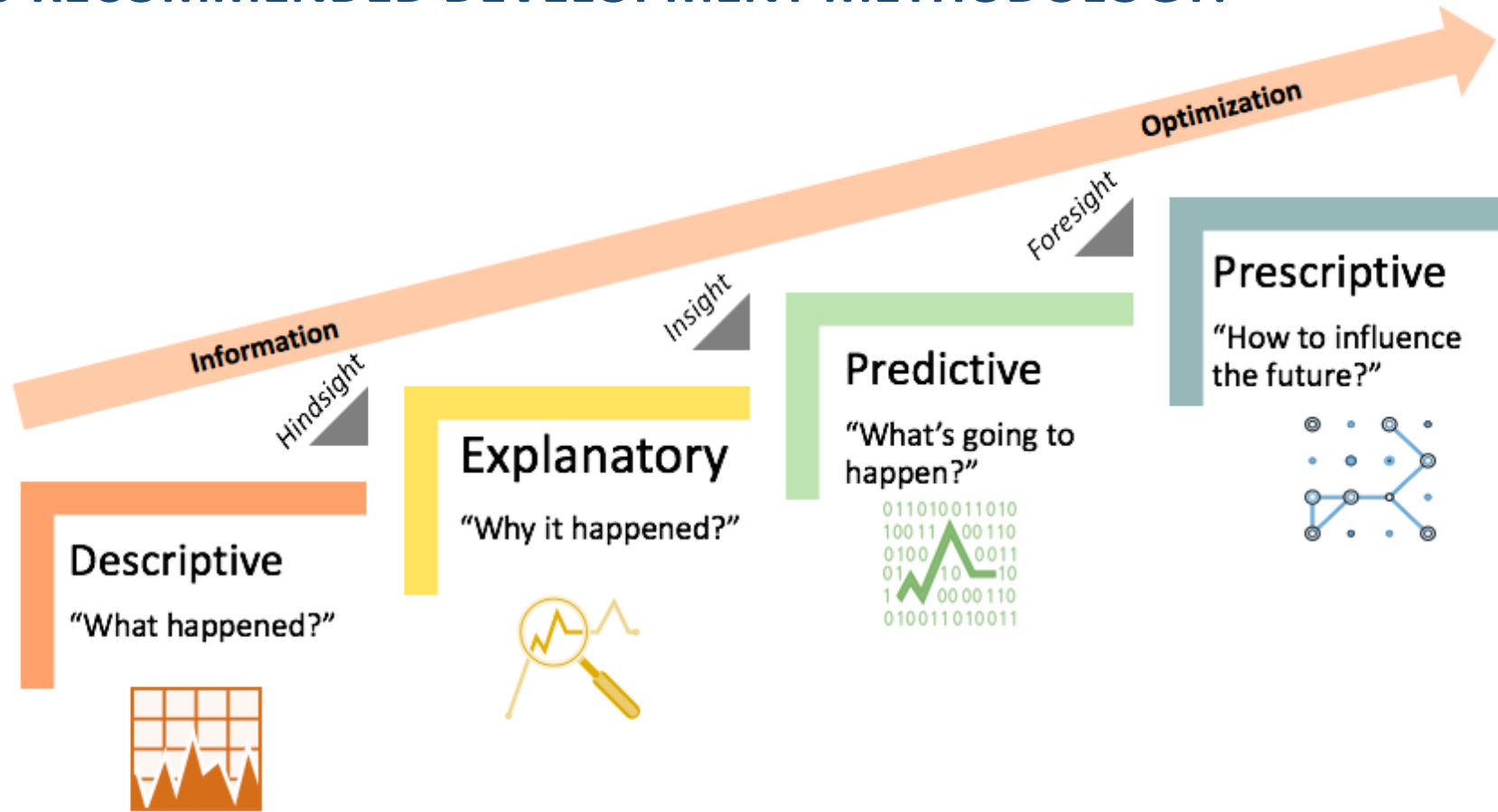
## Multi- Year Vision – DeX, a Great Lakes Data Exchange

- Findings from Phase 2 will help advance the integration and use of machine learning and AI to generate insights using a new cross-sectoral data exchange and analysis solution called “DeX”
  - Leverage the power of smart computing, data analysis and visualization technology
  - Be more predictive and prescriptive in our response to socioeconomic and environmental change (e.g. policy/regulations, conservation/protection, urban planning, etc.)

\*\*See ECCC CIO graphic



# ECCC CIO RECOMMENDED DEVELOPMENT METHODOLOGY:





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## Thank you

For more information please contact:

### **Christopher Hilkene**

Pollution Probe

[chilkene@pollutionprobe.org](mailto:chilkene@pollutionprobe.org)

(416) 926-1907 ext. 259

### **Mark Fisher**

Council of the Great Lakes Region

[mark@councilgreatlakesregion.org](mailto:mark@councilgreatlakesregion.org)

(613) 668-2044