Lecture 1: Course Introduction and Background

WMD651: Water Management Systems Design

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School of Environmental And Civil Engineering Technology, Seneca College

Johnathan D. Nault

Course Introduction

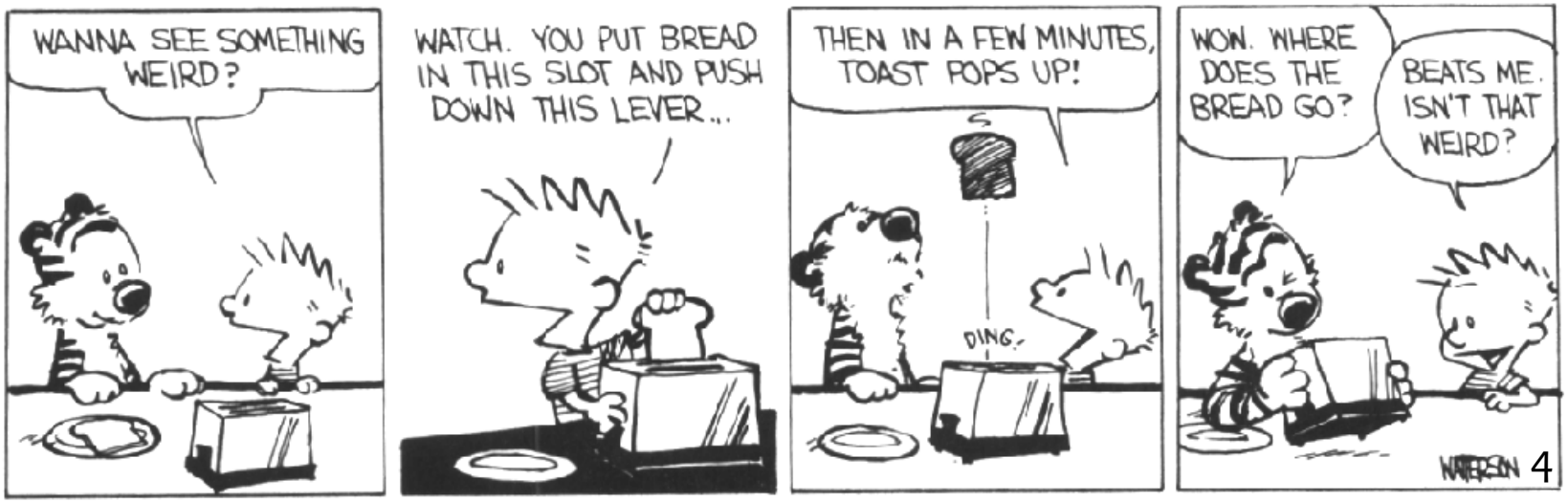
- Course details:
  - **Instructor:** Johnathan D. Nault, Ph.D., P.Eng., Hydraulic Specialist with HydraTek & Associates
  - **Delivery:** synchronous online lectures and tutorials
  - **Assessments:** assignments, project, quizzes, final exam – *more info on following slide*
- WMD651 description:
  - Explore the design, analysis, and management of various water resources systems
  - Models used for analyses (Excel, software) but…
  - Not just about using models – also understand role of models, broader topics, implications

Grading and Assessments

- Assignments – 25%
  - Each worth 5% of overall grade
  - Based on review material/fundamentals, water supply, wastewater collection, and stormwater management
- Design project – 15%
  - Completed in groups of 2-3 students
  - Integrate course materials, more details to be provided later
- Two quizzes – 30%
  - Each worth 15%, roughly 1 h long
- Final exam – 30%

Key Learning Outcomes

- Understand how to apply models for water resources engineering problems
- Learn how to use EPANET and EPA SWMM
- Communication of modeling, analyses, and designs
- Analysis of water supply, wastewater collection, and stormwater drainage systems
- Foster knowledge of current trends and challenges
- Application of design standards for system-level analyses



Water Resources Engineering

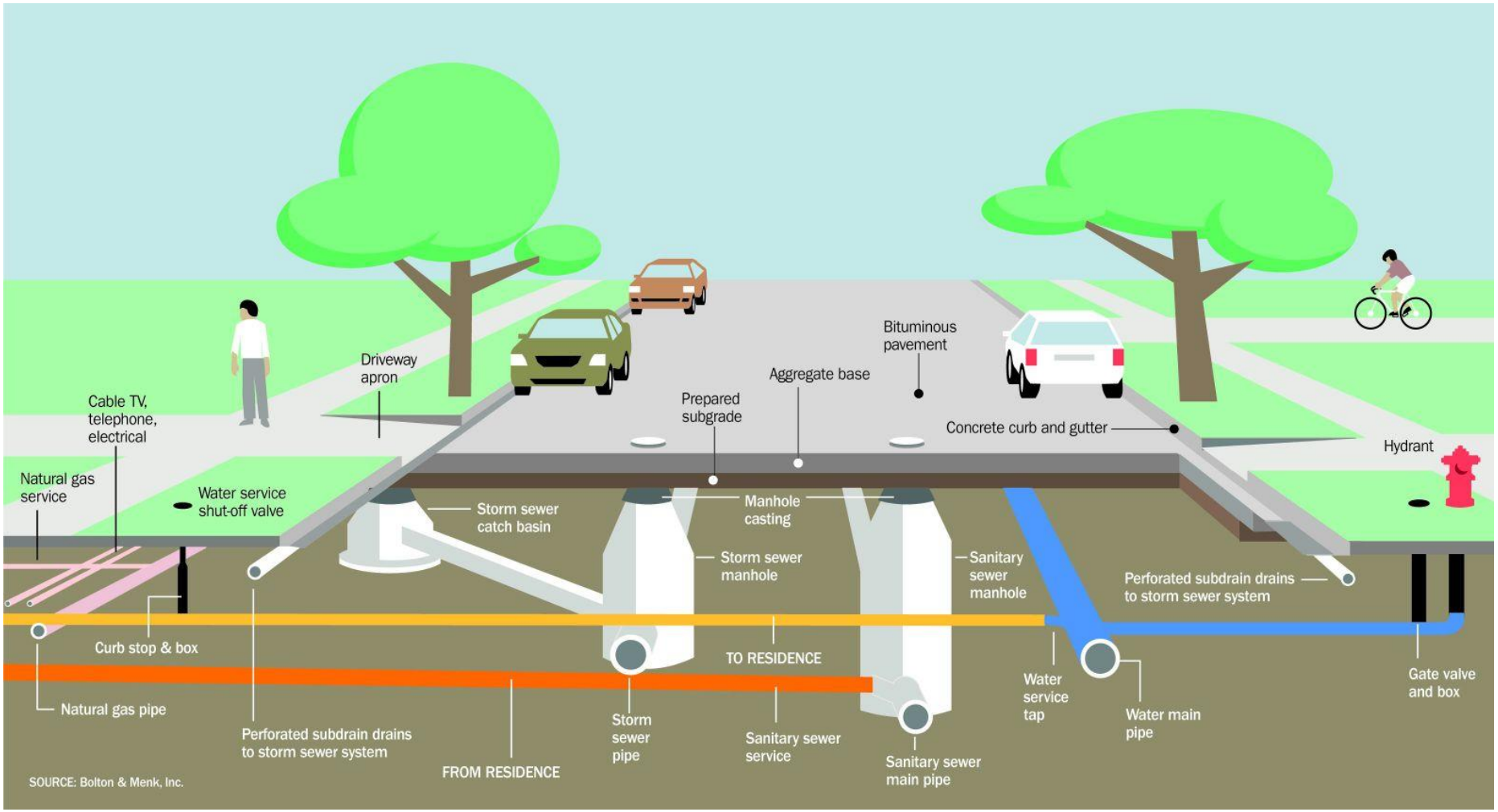
- Design and management of systems to control the **quantity**, **quality**, and **supply** of water
- Also consider socioeconomic, financial, political, and environmental impacts
- In municipal context:
  - Where does tap water come from?
  - How does it get to you?
  - What happens after the drain?
  - Why are roads designed to flood?

http://www.bbc.com/news/20802988

Water Resources Systems

- Water supply – domestic consumption (residential, ICI), firefighting
- Wastewater collection and stormwater drainage
- Agricultural irrigation
- Hydroelectric power generation

A (Partly) Buried Challenge



Podsada (2016): http://www.omaha.com/money/a-mess-of-spaghetti-under-there-maze-of-pipes-and/article_b7b5f89e-639d-5337-8f0a-5b5ddec94493.html

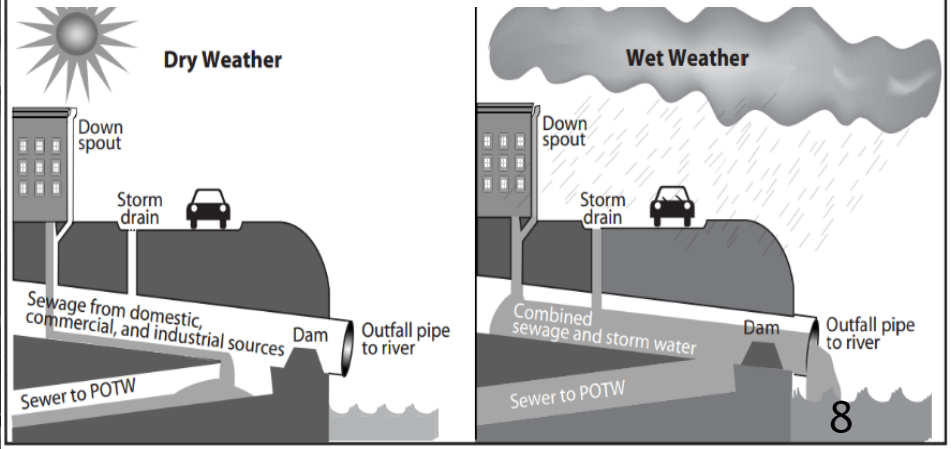
Competing with Nature

York University green roof pilot study (CVC and TRCA, 2006)

Toronto Star (2013). "Go Transit offers riders on flood-stranded Richmond Hill train $100 credit."

Red Hill Valley Neighbourhoods Assoc., http://rhvna.org/

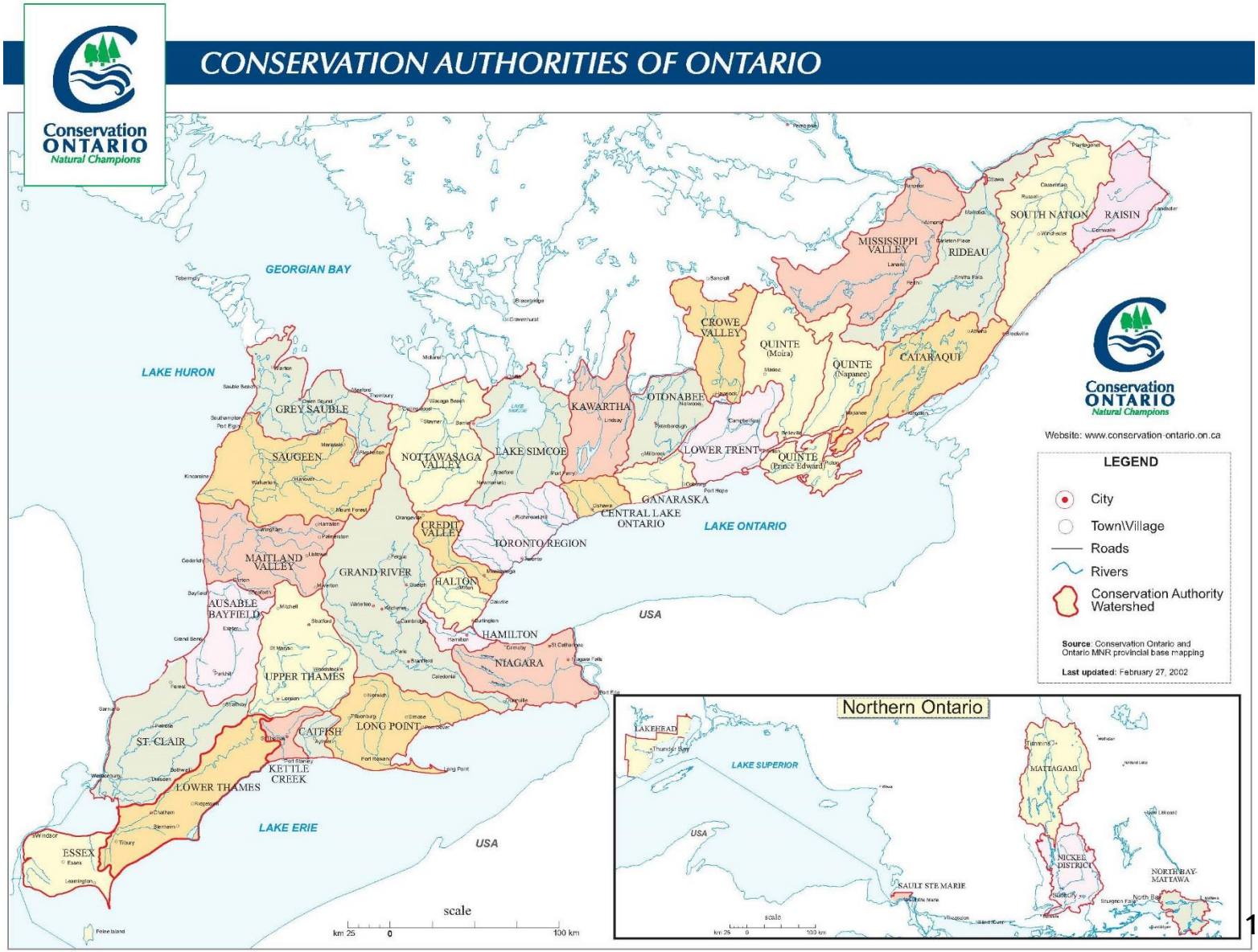
US EPA (2004), "*Report to Congress, Impacts and Control of CSOs and SSOs"*



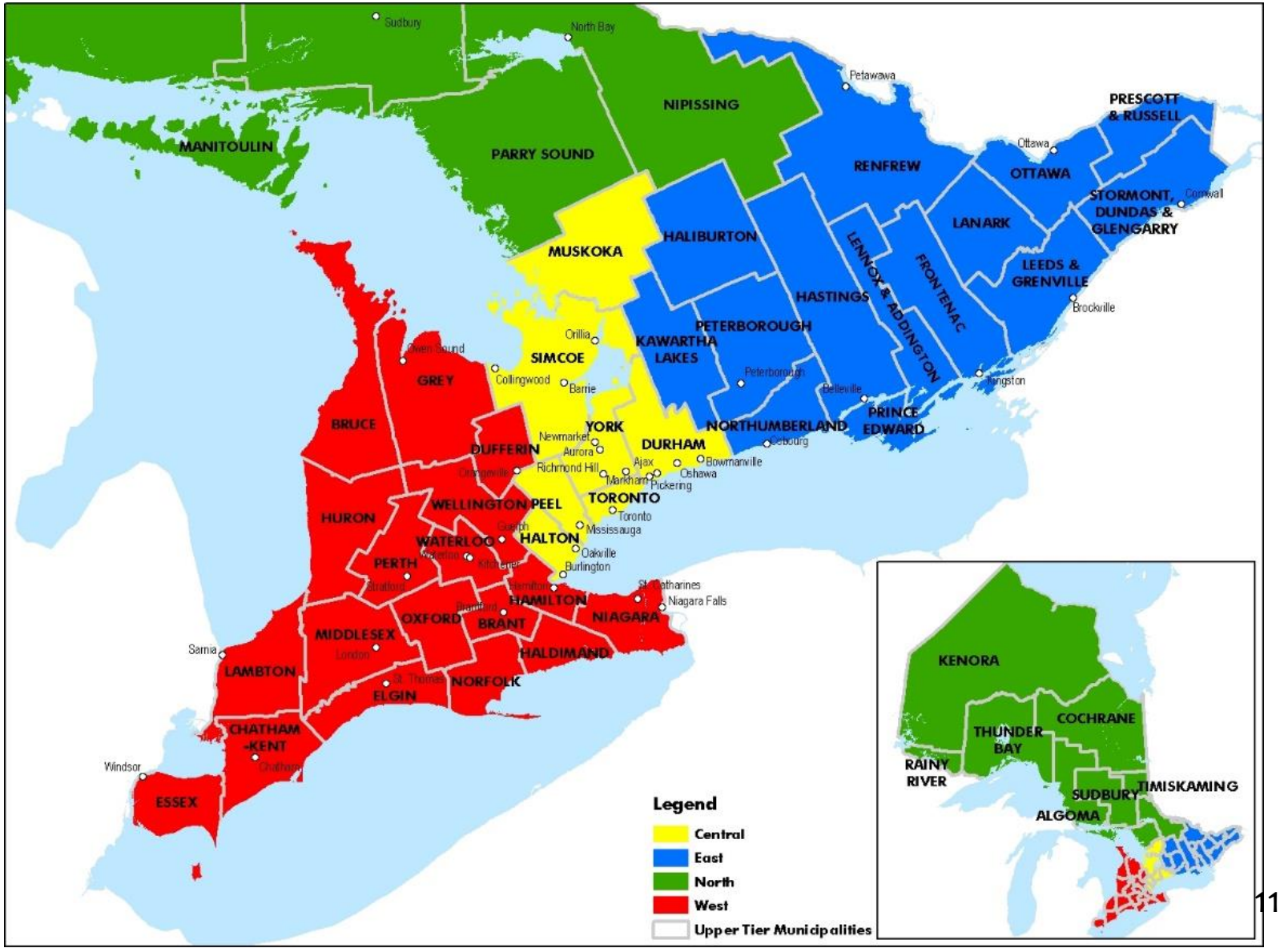
How is water managed in Ontario?

- Ontario Water Resources Act:
  - Oversee conservation, protection, management, and efficient use of Ontario's water resources
- Conservation Authorities Act:
  - Grant local power to Conservation Authorities, delineated by watershed boundaries
  - Safeguard Ontario's water resources
- Municipal Act:
  - Division of public services, including water and wastewater servicing
  - Treatment and supply of water
  - Collection, management, and treatment of wastewater (sewage and stormwater)

Conservation Authorities



Regional Municipalities



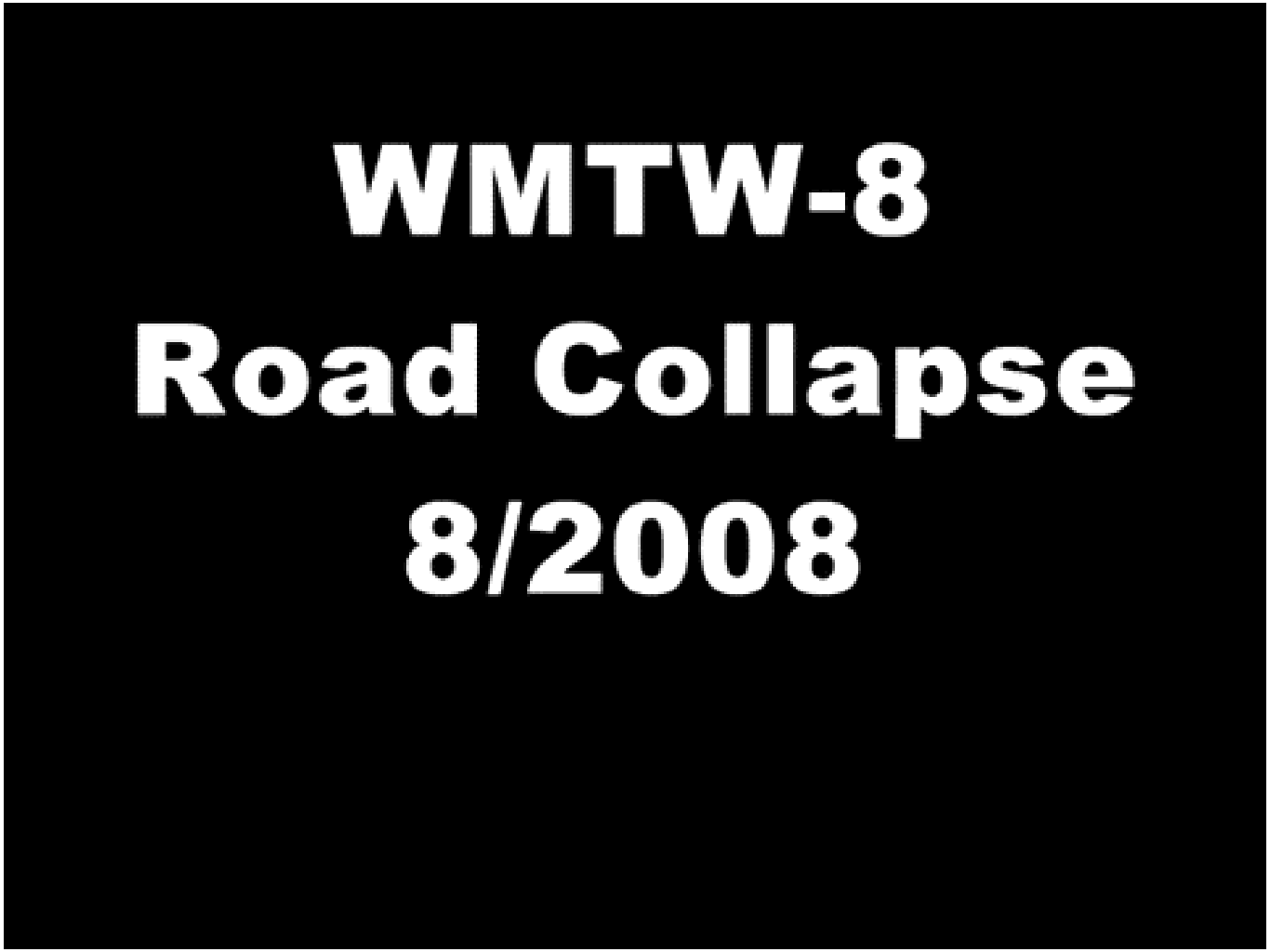
Regional Municipalities – GTA

Current Trends and Challenges

- Sustainability – balancing the triple bottom line
- Design under uncertainty
- Conservation – efficiency, water loss, consumption
- Climate change – extreme events, droughts, flooding, intense storms, water scarcity
- Asset management – renewal, replacement, failure
- Water quality – treatment, emerging contaminants
- Environmental factors – up/downstream impacts
- Design philosophies

Infrastructure Renewal

Extreme Events



Outline of Remaining Lectures

- Review topics:
  - Fundamental concepts
  - Hydraulics, open-channel flow, hydrology
- Water supply systems:
  - Overview, operation, design objectives
  - Modeling using EPANET
- Wastewater collection:
  - Types of systems, design objectives
  - Sewer network modeling using EPA SWMM
- Stormwater management:
  - Design approaches, LID, operation, challenges
  - Integrated system modeling using EPA SWMM
- Advanced topics