Agenda for February 13, 2018

Interest/attendance in Thunder Bay Field Naturalists Talk/Dinner on Feb. 25: *Climate Change and Lake Superior*

Dr. Thomas Beery, University of Minnesota Sea Grant College Program, located in Duluth

Water news

Lecture: Concerns and Threats to Drinking Water (cont.)

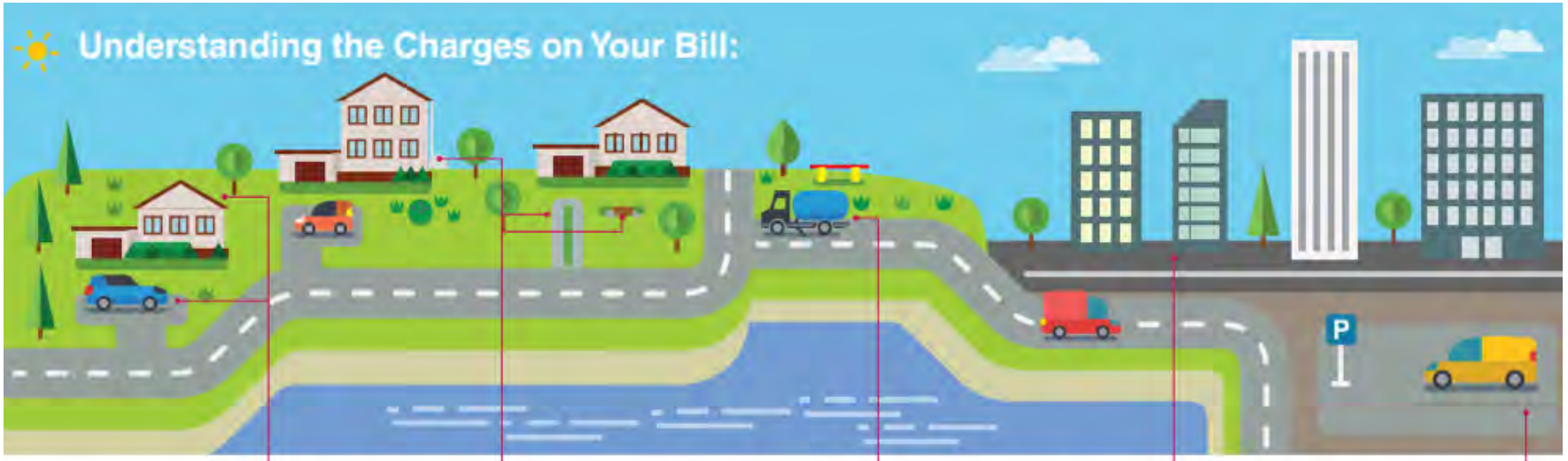
Water news

Photo credit: Morgana Wingard

City of **Victoria** replaced its property-tax model with **stormwater-user fees** in 2016

Stormwater-user fees

- Victoria replaced its property-tax method in 2016
- Separate stormwater utility exclusively responsible for planning, financing, and operating the system
- Rates are based on: impervious surface area on property, street cleaning services and building type. Some properties with large parking lots pay an additional fixed fee to help clean stormwater before it leaves the property.
- Rewards program helps offset the cost of installing rainwater management technologies.



Impervious Area

Rainwater flows off these hard surfaces (e.g. roof or driveway) and is diverted into the stormwater management system.

These areas have been measured by building plans and mapping technology.

Rainwater Rewards Program

The new utility offers financial incentives for sustainable rainwater management, including rain gardens, cisterns and permeable (absorbent) paved areas.

Street Cleaning

Keeping our streets clean goes a long way to keeping pollutants out of our stormwater system. Rates are based on the frequency of street cleaning and street frontage length, measured by mapping technology.

Intensity Code

The impact a property has on the stormwater system, based on the property type assigned by BC Assessment.

Codes of Practice

A program to clean stormwater before it leaves the property, to preserve and protect our local waterways and ocean. Properties with 10 or more parking spaces and certain business or property uses are registered in this program.

Source: City of Victoria

WATER SUPPLY AND WATER QUALITY

1. Water Supply Management
2. Water Quality Management
3. Municipal Water Quality
4. Walkerton and related threats
5. Concerns and Threats to Drinking Water (cont.)

5. Concerns and Threats to Drinking Water

Concerns and Threats to Drinking Water

- Introduction
- Pharmaceuticals and Personal Care Products
- Chlorine Byproducts (THMs)
- Waterborne Diseases
- Water Terrorism
- What Can We Do? / Future Outlook

Introduction

- Canadian water treatment and infrastructure has high standards . . . but
- Many problems exist *within* and *beyond* the existing water management systems from a local, national and international scale.
- “Business As Usual” is not an option.
- Threats are still poorly addressed because of common failure to understand the scope of the problem.

Pharmaceuticals

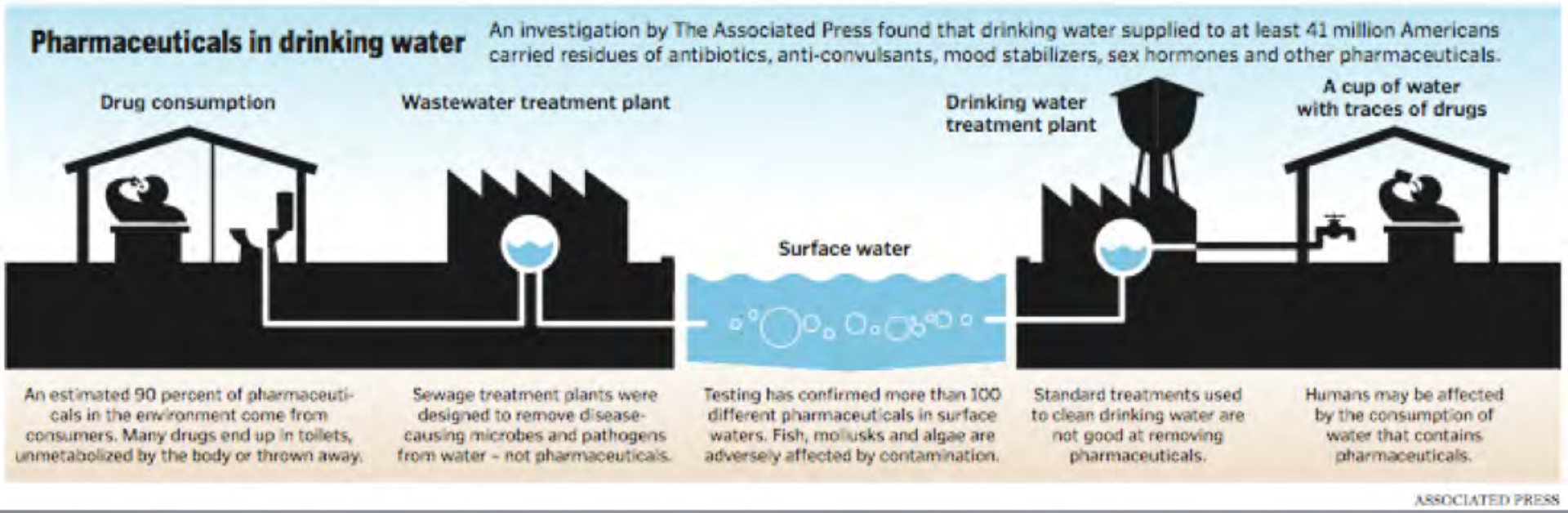
Pharmaceuticals play an important role in our everyday life. These substances can and will eventually end up in our waters.

These include medicines, minerals and vitamins in our diets, to energy drinks

Surplus down the toilet

Medication often dumped down the drain if it expires or not needed.

Pharmaceuticals and Personal Care Products (PPCP) in the Water



17α-Estradiol

Estra-1,3,5(10)-triene-3,17β-diol

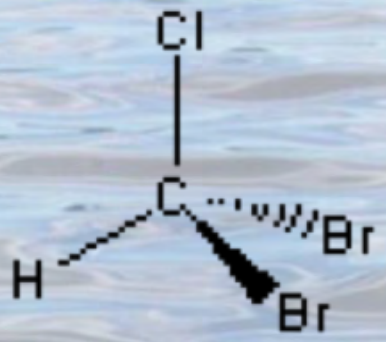
Thousands of different active molecules:

- Various therapeutic classes
- Different chemical structures environmental behavior
- Persistence

have resulted in complex issues involving environmental pollution from PPCPs.

Chlorination Disinfectant Byproducts

TRIHALOMETHANES (THMs)



- Chlorine is a disinfectant added to drinking water
- Reduces and eliminates microorganisms such as viruses and bacteria
- CDBPs are chemical compounds that form when water, containing natural organic matter, reacts with chlorine
- THMs are a major subgroup of chlorination by-products

PROBLEM?

Evidence of close relationships between bladder cancer and exposure to THMs

Case Studies

- One study in Ontario, Canada examined the relationship between bladder cancer and exposure to chlorination byproducts in public water supplies (King and Marrett, 1996).
- Thunder Bay has also done studies on the rate of bladder cancer in Loch Lomond water supply

Solutions:

- A carbon filter can remove chlorine and its byproducts
- Alternatives to chlorine disinfectants
  - Ozonation
  - Chloramines
  - Chlorine dioxide
- Better knowledge and application of more precise methods
- Ontario drinking water quality standard (ODWQS)

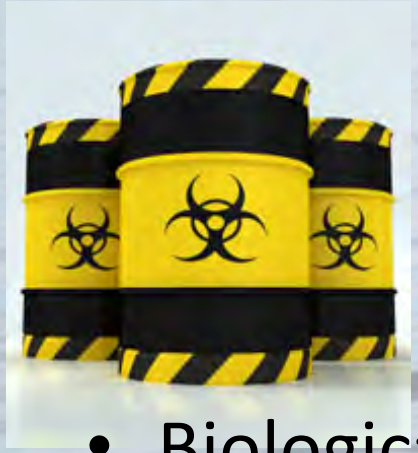
Waterborne Diseases

Waterborne Diseases

- Types of diseases linked to water
  - Water-based diseases
  - Water-washed diseases
  - Water-related diseases
  - Water-borne diseases
    - typhoid
    - cholera

Solutions

- Vaccinations
- Oral Rehydration Therapy
- Need to be Proactive
  - Education
  - Water Treatment Facilities (urban)
  - Safe Water System (rural)
  - Wells vs Surface Water



Water Terrorism

- Biological, chemical, cyber and physical threats
- Risks to infrastructure, human health, economy
- Biological
  - potential to do the most harm
  - Anthrax, salmonella, Q fever, pneumonic plague, human waste
  - Contaminate reservoirs, bottling plants
- Chemical
  - Pesticides, chlorine, prussic acid (large quantities)
  - Some available in stores, others on the black market

Water Terrorism

- Cyber Threats
  - The use of computer network tools to shut down critical national infrastructure
  - Energy, transportation, dams
  - The most likely form of water terrorism (Lewis 2002)
- Physical Threats
  - Destruction of infrastructure from explosives

Water Terrorism

- Examples:
  - Romania 1944 German military polluted a Romanian towns drinking water with human waste (biological)
  - 1985- A cult in the Ozark mountains were planning to poison the water supply of New York, Chicago, Washington D.C., with potassium cyanide (chemical)
  - 2000 Australian man gained control over the waste water system, releasing sewage into parks, rivers, and private properties. Did this using a laptop and radio transmitter (Cyber)
  - U.S. security heightened post 9/11

Strategies to Increase Public Education and Awareness

- Educate citizens to engage and inspire to permanently change behaviour
  - Websites
  - Newsletters
  - Annual water quality report and fact sheets
- Information should help public understand guidelines, conservation issues, costs of providing services, improvements, further research needs, pollution mitigation

Lakehead Region Conservation Authority
Conserve Today...For A Better Tomorrow

Education

- Educating land owners on regular water testing and well maintenance
- Land owners should be aware of best management practices
  - Stream banks
  - Buffer strips
  - Tree planting
  - Fencing

Research & Science

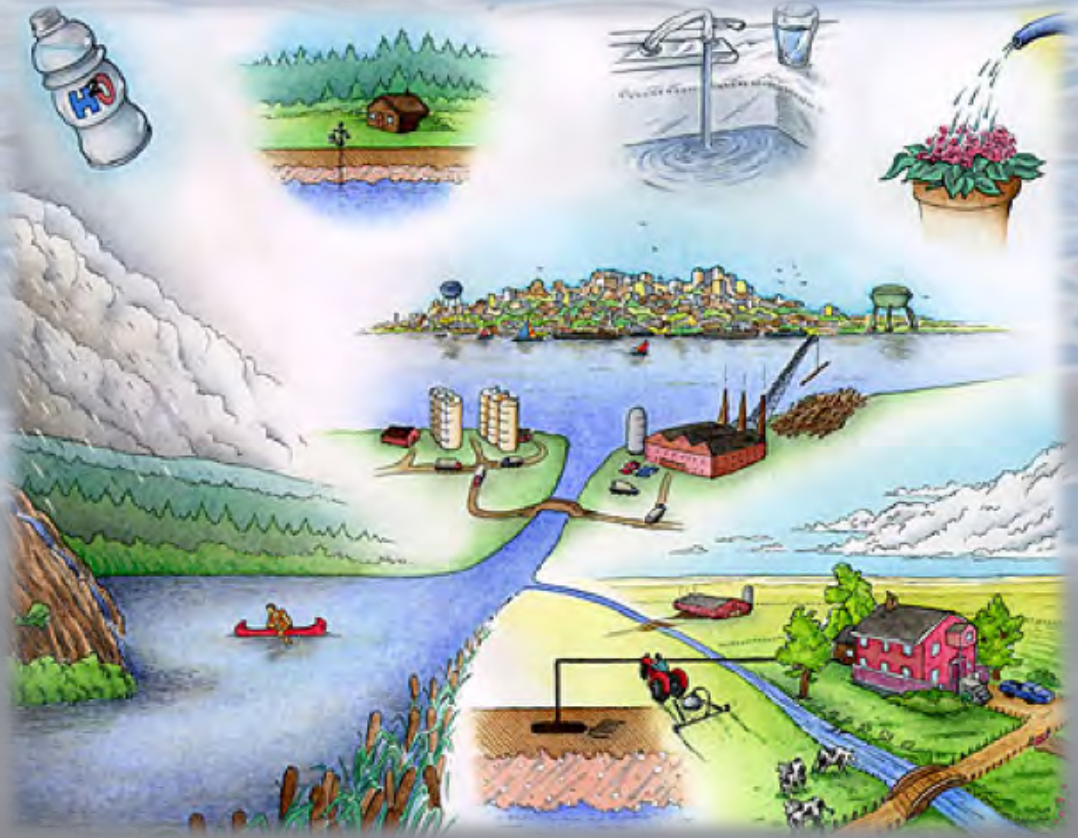
- Science-based decisions should be made - rather than on policies and assumptions which could result in measures that are overly or under-protective of human and ecological health.
- Research and development must be supported – it is not a cost, it is an investment in the future.
- Science is usually only 10-20% of the solution. The remaining management requires partnerships across jurisdictions, industry, commerce and the community.

Responsibility and Management

- Political Issues – Up/Downloading of responsibility
- Stewardship of landowners
- Preventive Risk Management Approach
  - Understanding water supply from beginning to end
  - Know the ways it can be contaminated and the required treatments
- Example: The Multi-Barrier Approach
  - Identifies all known and potential hazards
  - Ensures barriers are in place to reduce or eliminate risk of contamination

Closing Remarks

- Better knowledge of who is responsible
- Recognizing tomorrow's threats and finding the solutions today, rather than looking to solve today's problems tomorrow

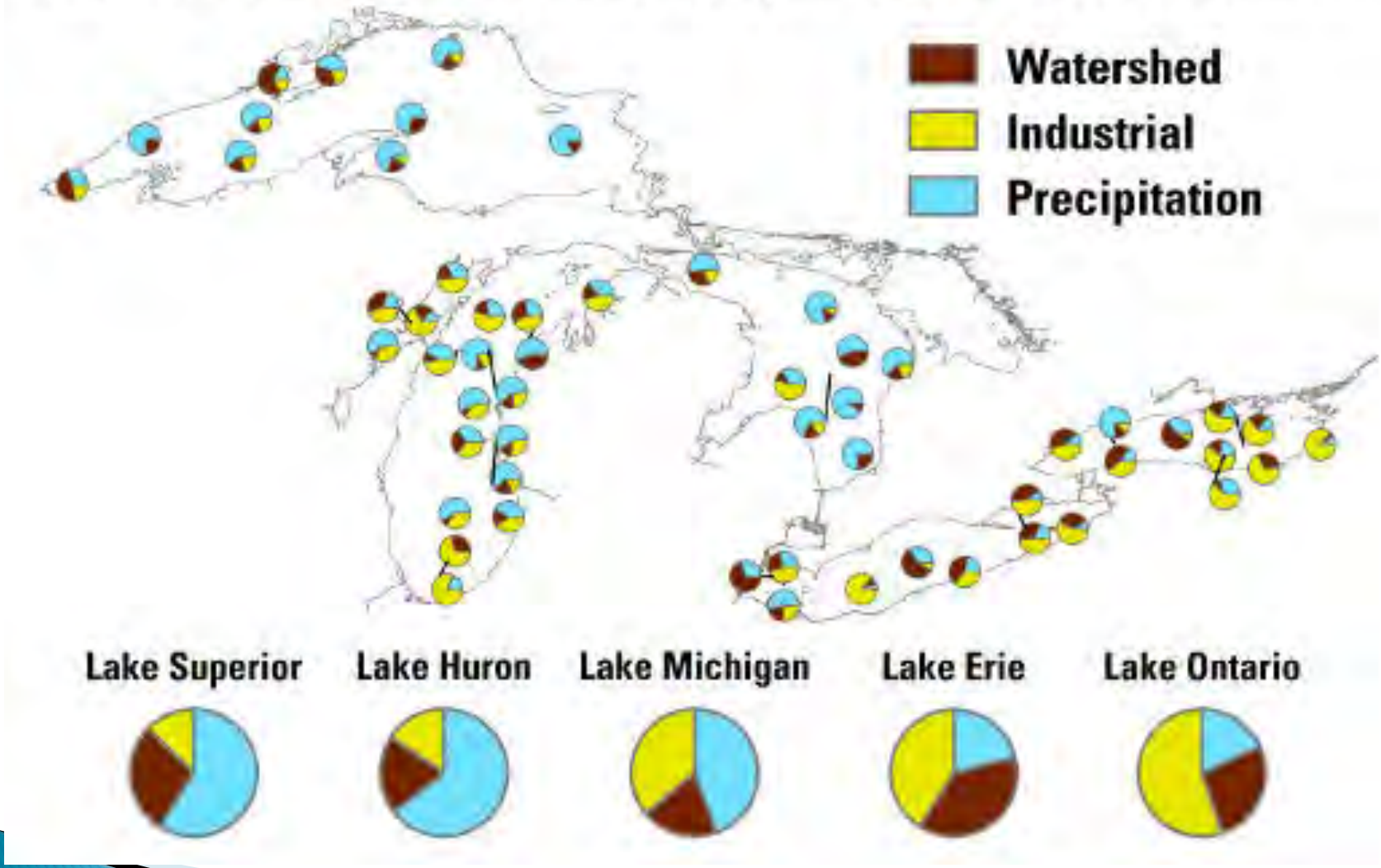


MINISTRY OF THE ENVIRONMENT
DRINKING WATER ONTARIO

What do you think is the best way to manage threats?

What other threats may exist to our drinking water supply?

Source Contribution of Mercury in Great Lakes Sediment



Four main global surface temperature measurement datasets

- HadCRUT4 86 per cent coverage
- NCDC 90
- GISTEMP 99
- JMA 85
- Satellite: University of Alabama

- Kriging: **Can we really extrapolate temperatures?**