Official Challenge Statements

Stewardship Challenges

Mitigate Nutrient Loading and Its Environmental Impacts

The Problem

Phosphorus and nitrogen are essential elements for the growth of all organisms, but when large quantities are added to Lake Erie from external sources they can pose a serious threat to ecosystem health and integrity. Excessive nutrient loads from urban and agricultural activities often lead to the growth of harmful algal blooms (HABs). These mats of blue-green algae can range from a minor nuisance that temporarily interrupts water-based recreation to a massive toxic bloom that chokes the Western Basin, disrupting drinking water supplies and killing wildlife.

Though municipal and industrial activities (e.g. combined sewer overflows and home sewage treatment systems) contribute to nutrient loading, agricultural activities (e.g. manure and commercial fertilizer runoff) have been identified as the main driver in most cases.

The Challenge

Develop practical solutions, such as devices, processes, hardware innovations or digital tools, that enable 1) the measurement, control and/or capture of phosphorus and nitrogen compounds in watersheds, 2) the prevention of excessive agricultural runoff, and/or 3) the measurement, mitigation or elimination of the environmental impacts of HABs.

Reduce and Remediate Urban Pollution

The Problem

Major urban centers in the Lake Erie watershed have a deep-rooted history of industrialism and a complex relationship to current polluting activities. Because of this, a wide range of recently produced and historically accumulated pollutants currently impacts the Lake Erie Basin.

Heavy metals such as mercury, lead, and chromium are widely acknowledged legacy pollutants. Additional pollutants such as PCBs, plastics (including microbeads), pharmaceuticals, microfibers, garbage/debris, microbes, and road salt are also of concern. These substances enter Lake Erie through air and water pathways, harming fish, degrading habitats and impacting human health.

The Challenge

Develop practical solutions, such as devices, processes, hardware innovations, or digital tools that enable 1) measurement and tracking of the presence and/or impacts of urban pollution on Lake Erie and its communities, 2) mitigation of continued ecological and social impact by urban pollution within the Lake Erie Basin, and/or 3) remediation of historical damage done by pollution from Lake Erie cities.

Infrastructure Challenges

Cultivate Resilience in Water Infrastructure Systems

The Problem
With the onset of global climate change, the Great Lakes Region is already experiencing storm events that are more frequent, more intense, and less predictable. These spikes in precipitation often overwhelm our aging stormwater infrastructure and result in erosion, flooding, and combined sewer overflows (CSOs).

CSOs create serious health and aesthetic concerns but are currently unavoidable in many Lake Erie communities because of limited infrastructure capacity. Cities like Buffalo, Cleveland, Detroit, and Toledo are currently exploring a two-pronged strategy of revitalizing and innovating engineered "Grey" Infrastructure solutions and while also developing new "Green" or "Hybrid" Infrastructure solutions which can be cleaner, less expensive, and deliver a range of co-benefits to surrounding neighborhoods.

The Challenge
Develop practical solutions, such as devices, processes, hardware innovations or digital tools that enable 1) the capacity to forecast CSO events patterns, 2) new infrastructure solutions that leverage precipitation for public benefit, 3) modification of existing infrastructure systems to minimize the impacts of storm events, and/or 4) communities to calculate the financial and/or environmental costs of current challenges and future development in the infrastructure space.

Manage Aging Water Infrastructure Systems

The Problem
Lake Erie cities are old cities. Many of them have outdated conveyance and treatment systems for storm, sanitary, and drinking water. Often our water infrastructure was designed for populations very different (in number and distribution) from the current condition. Now, centuries after the founding of our proud cities, we must learn to manage these aging systems.

Monitoring pipe performance and identifying leaks, clogs, and breaks in vast and sometimes incompletely catalogued pipe systems is a challenge unto itself. Lead and other contaminants leaching into drinking water from obsolete pipes and other contaminants entering the system through damaged pipes are critical risks to human health in these older cities. Unfortunately, the location of these risk factors is also often unknown or undocumented.

The Challenge
Develop practical solutions, such as devices, processes, hardware innovations or digital tools that enable 1) comprehensive documentation of lead-based pipes in the drinking water transmission system and/or 2) innovative methods for detecting, mapping, and/or modeling vulnerabilities and pollutants in our water infrastructure as a step toward protecting our most precious resource from waste and future contamination.

Social Awareness Challenges

Connect Communities to the Value of Water

The Problem
The sheer abundance of surface freshwater in the Lake Erie Basin means that many of its communities take this invaluable resource for granted. When water is undervalued, it is often left underprotected, underleveraged, and underenjoyed. This means that we not only unknowingly pollute and overuse the Lake, we often fail to realize its potential as both a generator of economic value and an integral piece of our social fabric.

Public awareness of the impact of human choices on Lake Erie's ecosystems (e.g. burning fossil fuels, dumping pharmaceuticals and other toxics, over-development, draining wetlands and filling flood plains) is low. Some communities have even seen their water become unsafe to drink, a threat to their families' health rather than a vital community asset.

The Challenge
Develop practical solutions, such as devices, processes, hardware innovations or digital tools, that enable 1) the public to become more aware of the ecological and social consequences of their actions with respect to water, 2) industries, policy makers, and citizens to better understand the economic and non-economic value of water, 3) communities with unsafe or inaccessible water resources to meet their basic needs, and/or 4) other innovations that drive us to improve our awareness, perception and understanding of the value of water.

Drive the Creation of Meaningful Data

The Problem
Our understanding of the value of our freshwater resources and the nature of the threats that they face is only as good as the quantity and quality of our watershed data. There are many effective nonprofits, governmental groups, and citizens who collect and share important Lake Erie data, but almost all of them agree there can be major improvements in the leveraging of these data for public benefit.

While there are a lot of data out there, relatively little is packaged as useful information. As a result, dedicated researchers collect a wealth of underused data and much of the populace remains unaware of the problems with our water, let alone how to solve them.

The Challenge
Develop practical solutions, such as devices, processes, hardware innovations or digital tools, that enable 1) all citizens to access useful, accurate, and timely data about the safety of their nearby water sources, 2) new and innovative collection techniques to create strategically important data sets, and/or 3) methods to extract new useful information from the noise of massive existing data sets.

Additional Value to Consider for all Challenge Statements

- **Transform Problems into Opportunities**
  How can this project turn its solution for Lake Erie into a generator for other kinds of value (e.g. economic, natural resource, community)? How can solving a problem involve channeling that problem to create other positive impacts?

- **Make New Connections**
  How can this project build social value in the form of new interdisciplinary collaboration across different sectors and new avenues of resident engagement with water and the Blue Economy?

- **Engage Grassroots**
  How can this project capture the value of a resident/community-based bottom-up vision (i.e. designed and implemented by residents)?

- **Promote Accessibility**
  How can the value of this project be made available to as broad a variety of Lake Erie communities as possible? How can the project emphasize serving historically disinvested or marginalized communities?