IRONDEQUOIT BAY

NUTRIENT LEVELS AND TROPHIC STATE

Monroe County Department of Environmental Services

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County Executive

Monitoring Highlights

- *Epilimnion phosphorus levels remain below the long term average*
- *Cyanobacteria (blue-green algae) is notably absent from the bay*
- *Data shows that nitrogen could be the limiting nutrient in some years*

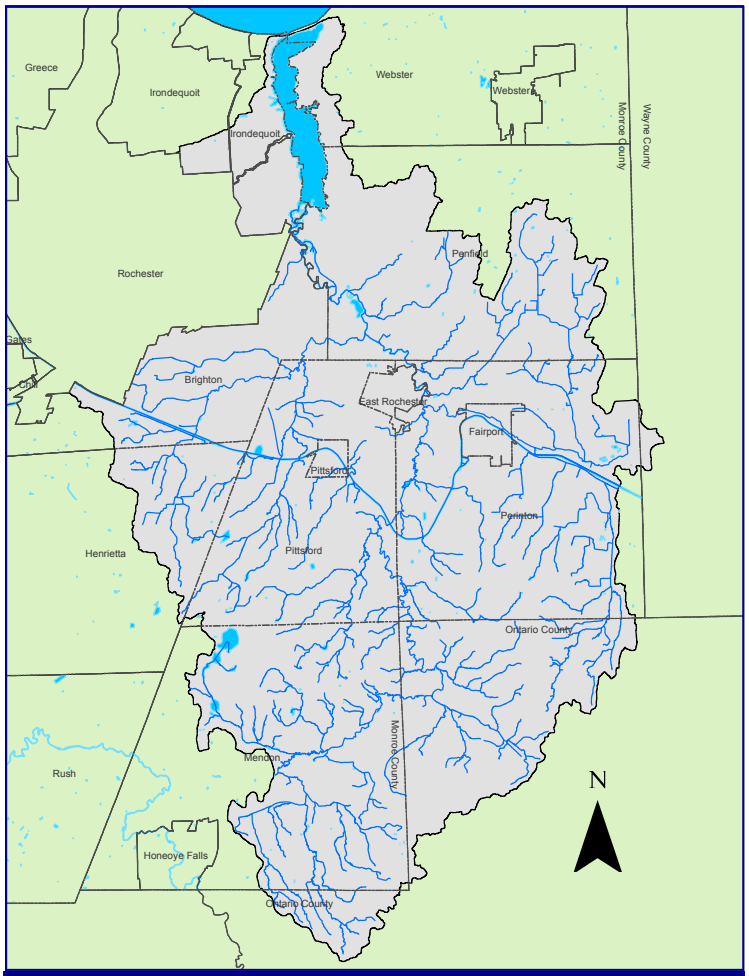
Irondequoit Bay has 40 years of water quality data going back to 1978. The frequency of monitoring has varied over this period ranging from daily, weekly, bi-weekly, monthly and bi-monthly during winter ice cover. For example, in 1993 the bay was monitored on 25 different days at 11 locations. In 2016, staff visited the bay on 17 days and in 2017 monitoring was conducted on 14 days at 1 location, Station 1, located in the bay's north basin.

Annual monitoring is planned to utilize staff and resources to continue the decades long effort to provide the specific data required to determine the health of the bay. This data is also used to help develop effective management strategies for nutrient pollutant reduction in the watershed

THE BAY - PAST AND PRESENT

As long ago as 1968, plans were undertaken to improve the water quality of the bay. The bay had been in a hypereutrophic state for several decades. It has been subjected to many of the problems of advanced eutrophication such as algal blooms, organically rich deep sediments, and hypolimnetic oxygen depletion during summer stratification.

In 1978-79, point source nutrient loadings from wastewater were diverted from Irondequoit Creek to the Frank E. Van Lare Water Resource Recovery Facility. This was followed by significant work to reduce sewer overflow discharges into the bay. Subsequent monitoring indicated a significant reduction in phosphorus loading from Irondequoit Creek to the bay. The improved water quality was sufficient enough to classify the bay trophic state as eutrophic rather than hypereutrophic.



The black outline shows the bay's 151square mile watershed area. This is all the land area where rain, snowmelt, streams or runoff flow into the bay.

What's Inside

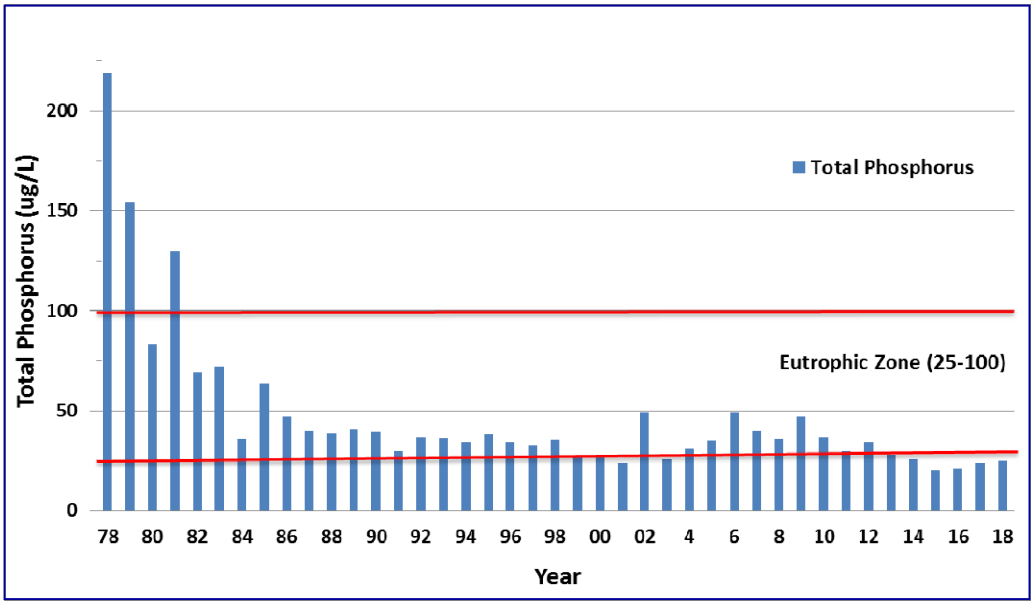
IRONDEQUOIT BAY

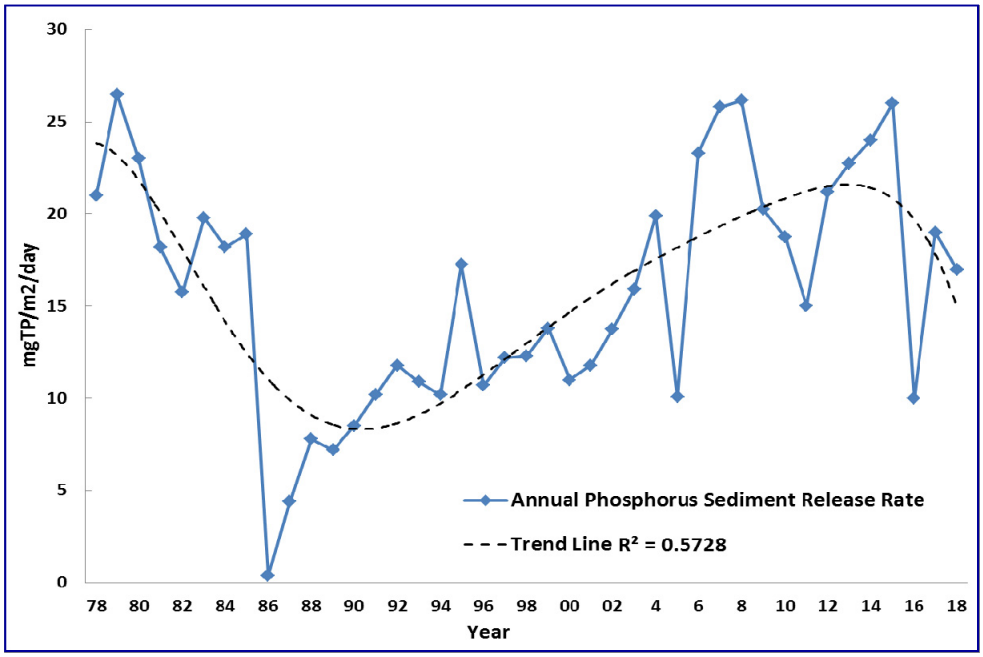
PHOSPHORUS LEVELS

Long term trends show lower levels of phosphorus in the epilimnion for the past nine years. Determining the amount of phosphorus is important as high levels can result in excessive algae growth known as eutrophication. The successful effort to reduce the amount of wastewater entering the bay resulted in large phosphorus reductions. Watershed contributions from stormwater runoff as well as the loading from internal processes still have the potential to fuel eutrophication. In recent years the bay has met the long term goals for phosphorus concentration and has not experienced large algal blooms.

A measure of the internal loading from bottom sediments can be estimated by looking at the release of phosphorus from the bottom sediments during the summer months. Dissolved phosphorus is released from the sediments and has the potential to diffuse into the upper waters and becoming available for plant uptake.

Epilimnion phosphorus levels plotted for 40 years shows tremendous reductions since 1978 and a recent downward trend since 2009.





During the summer months phosphorus is released from the bottom sediments. The amount is calculated and referred to as the sediment release rate.

NITROGEN LEVELS

Definitions:

Epilimnion-
Depth from the surface to 6meters

Metalimnion-
Depth from 6 to 12 meters

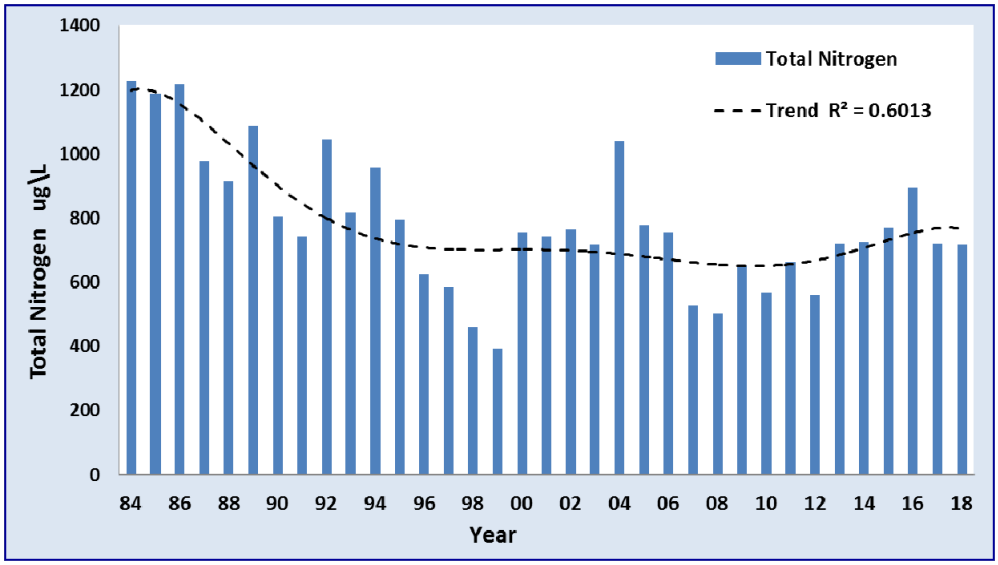
Hypolimnion-
Depth from 12 to 23 meters (bottom)

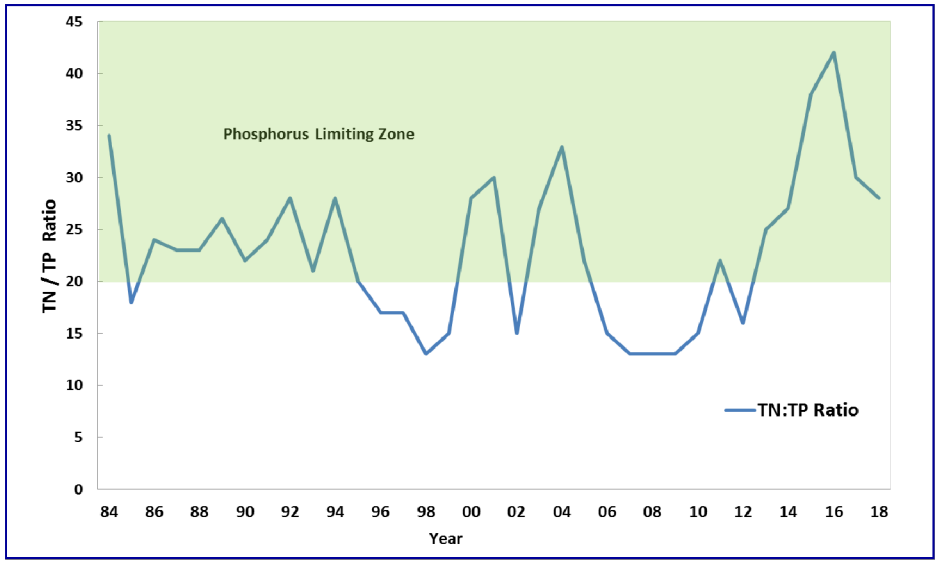
Eutrophication-
The enrichment of bodies of water by inorganic plant nutrients

Nutrients, such as nitrogen and phosphorus are essential for plant growth and nourishment, but the overabundance of certain nutrients in water can cause a number of adverse health and ecological effects. Nitrogen, in the forms of nitrate, nitrite, or ammonium, is a nutrient needed for plant growth and is measured regularly during bay monitoring. Although nitrogen is abundant naturally in the environment, it is also introduced into surface waters through sewage and fertilizers. Excess nitrogen can cause overstimulation of growth of aquatic plants and algae. In general it has been found that Irondequoit Bay algae growth has been influenced by the levels of available phosphorus and not nitrogen. However, from year to year the amount and ratio of phosphorus and nitrogen varies.

The ratio of Total Nitrogen to Total Phosphorus is often used to assess the limiting nutrient. Most often, phosphorus is the "limiting" nutrient. This means there is less of it available than nitrogen to sustain continued algae growth.

Mean epilimnion summer total nitrogen from 1984-2018.





The nitrogen/phosphorus ratio can be used to determine which nutrient is limiting. Numbers over 20 generally indicate phosphorus limiting conditions while values less than 10 indicate nitrogen limiting.

WATCHFUL FOR HARMFUL ALGAL BLOOMS

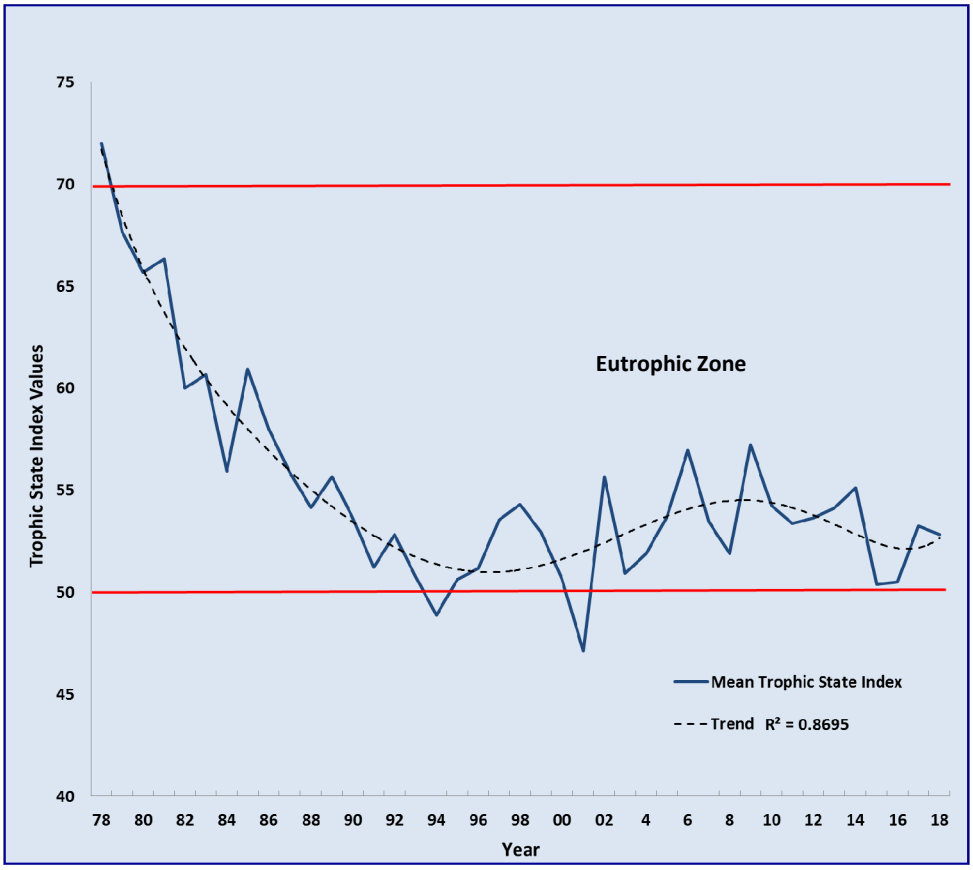
Most algae are harmless and are an important part of the food web. Certain types of algae can grow quickly and form blooms, which can cover all, or portions of a lake. But even large blooms are not necessarily harmful. However some species of algae can produce toxins that can be harmful to people and animals. Blooms of algal species that can produce toxins are referred to as harmful algal blooms (HABs). HABs usually occur in nutrient-rich waters, particularly during hot, calm weather.

Harmful algal blooms in ponds and lakes in New York have become an increasing problem. Across the state, four factors were determined to be sufficiently correlated with the occurrence of HABs, namely, average total phosphorus levels in a lake, the presence of dreissenid mussels, the maximum lake fetch length (the maximum length of open water wind can travel) and the lake compass orientation of that maximum length. Irondequoit Bay meets three of the four factors, only lacking a northwest compass orientation of its longest section. NYS data suggests that elevated nitrogen and phosphorus levels are significant associates with the occurrence of toxic blooms. Continued monitoring of nutrients and frequent surveys for HABs are important parts of future management of the bay along with efforts to reduce the impacts of stormwater runoff.

TROPHIC STATE ANALYSIS

The Carlson Trophic State Index (TSI), is a tool used by many, including the US Environmental Protection Agency, for lake trophic categorization. The TSI is based on a unitless scale from 0 to 100, with each 10 point increment representing a doubling of biomass. A TSI score over 50 would indicate eutrophic conditions.

The figure shows the mean TSI scores for Irondequoit Bay calculated by using Phosphorus, Chlorophyll-a and Secchi Disk measurements from 1978 - 2017. The downward trend from hypereutrophic conditions in the late 70's can largely be attributed to the near total removal of wastewater discharges from the bay. There has been a more recent downward trend since 2009 that is thought to be a result of improved water quality from stormwater runoff.



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