



Cockeast Pond Assessment Project

WESTPORT RIVER WATERSHED ALLIANCE—JULY 2018

Summary Report by WRWA based on technical memo from



University of Massachusetts Dartmouth
The School for Marine Science and Technology



Project Glossary

- **Bathymetry**—*depth, measured with acoustic fathometer*
- **Benthic grabs**—*sampling sediments to determine species and populations of inhabitants, an indicator of pond health*
- **Benthic nitrogen regeneration in bottom sediments**—*determine how nitrogen is cycled within the pond sediments and water column determines sinks (uptake) and sources (release) of nitrogen*
- **Macroalgal studies**—*a look at the populations of large algal species within the pond*
- **Tide gauges**—*to measure tidal influence (water levels over time) and understand exchange of water between pond and Westport Harbor*
- **Time-series water column oxygen measurements**—*measurement of oxygen levels, an indicator of pond health*

An in-depth scientific study to determine the health of the coastal pond

Cockeast Pond provides a unique habitat for numerous species of plants and animals. It is also a buffer for flooding, storm surges, and climate change effects. Equally important, the pond also has aesthetic, recreational, and economic benefits for those who see and use it.

What Are the Issues?

WRWA has examined pond water quality since 2008 to create baseline data. It was a cooperative effort between WRWA, UMass Dartmouth, and community stakeholders.

Pollution due to increased nitrogen loading is of particular concern.

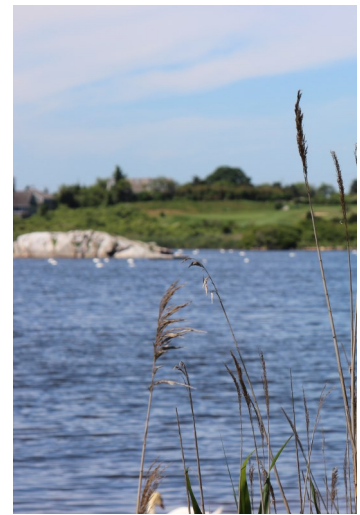
More frequent and dense algal blooms, as well as increased

growth of submerged aquatic plants have recently been observed. These degrade the pond ecosystem and affect its use.

Our goal was to determine how tidal flushing, hurricanes/storms, surrounding land use, and other factors may be affecting the pond's health and then understand potential management options.

This study was a multi-step, extended project done to determine the extent of yearly changes in the pond's basic water chemistry and ecological health.

WRWA contracted the Coastal Systems Program to identify causes of the change



and to recommend actions for remediating, restoring and maintaining the pond's health. To read the full report visit our website:

<http://westportwatershed.org/whats-being-done/cockeast-pond/>

Too Much Nitrogen is the Problem

Nitrogen enrichment occurs when the rate of nitrogen input to a salt pond is higher than the rate of output through tidal flushing and removals from within the pond itself.

Many different ecological indexes were evaluated to assess the pond's condition

including—chlorophyll-a analysis, direct nitrogen measurements, and other tropic indicators.

Generally as watersheds become developed the nitrogen load from human activities in the watershed to the pond is increased and the nitrogen levels within the

pond water increases as the tidal flushing remains constant. This is the case for Cockeast Pond.

The pond also contributes nitrogen to the Westport River, which is already above its healthy limit for that nutrient.

Cockeast Pond

Cockeast Pond has a relatively small watershed that includes a nine-hole golf course, a number of single family homes and some agriculture that all contribute to the level of nitrogen enrichment observed by this study.



Man-made channel connects pond to the estuary

Due to the restricted tidal exchange this salt pond is more sensitive to nitrogen inputs than the adjacent estuary, so that the relatively low levels of watershed nitrogen input are still sufficient to cause habitat impairment as seen in the levels of macroalgal accumulation and phytoplankton blooms.

Based on the water quality monitoring, it appears that long-term increases in nitrogen loads to the poorly flushed Cockeast Pond from activities within its associated watershed are creating adverse impacts to the ecosystem, limiting its value as an estuarine resource.



Cockeast Pond's watershed and assessors parcels

Analytical Work Completed

Data was collected over multiple years to determine water circulation and exchange, pond biology, and nutrient loading.

Tide gauges—multiple deployments over three years to provide circulation measurements.

Tidal Flux—Measurements of tidal inflow and outflow through the herring ditch connecting Cockeast Pond to the lower portion of the Westport River estuary was undertaken to provide direct

measurements of tidal volume exchange as well as to estimate residence time of water in the pond given the pond volume calculated from the bathymetry data.

Benthic grabs—sampling of sediments to determine species and populations of inhabitants, which is an indicator of pond health.

Land use data—determines site-specific land uses and the associated nitrogen loads using geographic information programs.

Habitat assessment—determine the health and diversity of flora and fauna of the pond ecosystem.

Nitrogen and Phosphorus levels in the pond and stream loads into the pond.

Time-series water column oxygen measurements— measurement of oxygen levels, an indicator of pond health.

Benthic nitrogen regeneration in bottom sediments— to determine sources and sinks of nitrogen and complete a nutrient mass balance for the pond.

Very Little Tidal Exchange

Cockeast Pond generally acts as an exporter of lower quality, high nutrient water to the Westport River. Given the short flood tide and the much longer ebb tide, freshwater entering the pond from the watershed via groundwater as well as the small surface water flow entering on the northern shore **results in a greater volume of water leaving the pond than what enters** the system on the flood tide.

After multiple tidal flux measurements a clear, but weak tidal signal was measured in Cockeast Pond where the overall change in water level in the pond was merely 0.10 meters, small compared to the ~1.4 meter change in water level as measured by the "offshore" gauge deployed in Westport Harbor.

After three different flux studies it was learned that the change in pond water

level ranged from 0.10 m to 0.30 m. This is important as it indicates low exchange of water between the harbor and the pond, a critical finding in assessing alternatives for improving water quality in Cockeast Pond.

"THERE IS NO SINGLE SOLUTION FOR RESTORING THE HEALTH OF COCKEAST POND"

Nitrogen Load Reduction

How can the Pond be restored to a healthy system? **There are ecologically two choices for action.**

1. Remove nutrient load to what it was 50-60 years ago and close the herring ditch and return it to a purely freshwater pond. This is very unlikely from a permitting and physical side as it may still get saltwater into it during big storms—and the herring fishery would disappear or 2. Increase the circulation and exchange and make it a more stable, healthy, brackish coastal pond with the ecological service that it can provide.

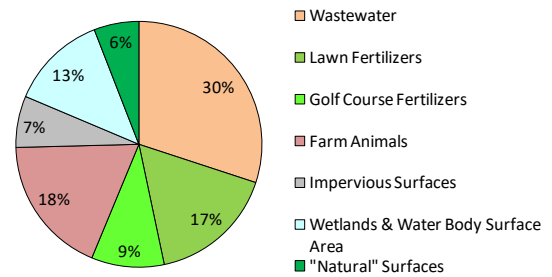
Cockeast Pond was made tidal at some point in the past and it is now an

anadromous fish run. This is the current condition to which the pond must be managed.

In its history it was once a freshwater pond with no connection to Westport Harbor but that is not the case today and even then it may have periodically gotten saltwater into it during over-wash from storms.

The study’s land use analysis shows the majority of the Cockeast Pond nitrogen load coming from septic systems, agriculture, and fertilizers (residential and golf course). Keeping

Cockeast Pond: Watershed Nitrogen Loads



the limited exchange as it is today and significantly reducing load alone will not be enough to restore the habitat of Cockeast Pond. The report recommends that reductions in nitrogen load needs to be considered after enhancing tidal exchange.

The Study Looked Beyond Water Quality

We now know Cockeast Pond is a nitrogen impaired salt pond, as evidenced in its high total nitrogen levels, large phytoplankton blooms, accumulations of macroalgae and severely impaired benthic animal habitat quality.

The benthic community has very low diversity and very low species numbers. In the northern region of the pond, the number of individuals is so low that the contribution as a food

source for fish is minimal, while the southern region supports similarly impaired habitat but with moderate numbers of individuals.

WRWA is committed to protecting the future of anadromous fish passage into the Pond.

WRWA will work with the Coastal Systems Program at UMASS Dartmouth, the MA Division of Marine Fisheries and other

stakeholders to seek out funding and begin the process determining the preliminary steps necessary to help restore the ecological health of Cockeast Pond.



Proposed Management

There are only 3 options for lowering the nitrogen levels to restore Cockeast Pond: (1) increase the rate at which nitrogen leaves the pond via tidal flushing, (2) reduce the amount of nitrogen entering from the watershed, (3) increase the rate of nitrogen removal within the pond through direct removals (plant or animal harvest) or enhanced denitrification. An overall management plan is based upon a temporally staggered

implementation approach combining **increased flushing as a top priority**, followed by nitrogen load reducing measures (septic system upgrades and fertilizer reduction) and oyster aquaculture will be necessary to restore Cockeast Pond to a non-eutrophic state. A phased approach will required continued low level monitoring to determine the necessity and/or magnitude of each successive management option. At present,

USEPA has deemed this “adaptive management” an efficient approach to restoration.

The Coastal Systems Program is continuing to work with WRWA on analysis monitoring and assessment of Cockeast Pond to further refine the recommended specific management options presented above.

Westport River Watershed Alliance

WRWA
1151 Main Road
PO Box 3427
Westport, MA 02790
Phone: 508-636-3016
E-mail: water@wrwa.com



To restore, protect, celebrate and sustain the natural resources of the Westport River and its watershed

VISIT US ONLINE:

WESTPORTWATERSHED.ORG

The Westport River Watershed Alliance (WRWA) is a nonprofit environmental education and advocacy group formed in 1976 to protect and improve the natural resources of the Westport River watershed. The 100 square mile watershed is located in Southeastern Massachusetts and includes the communities of Westport, Dartmouth, Fall River, and Freetown in Massachusetts; Little Compton and Tiverton in Rhode Island. WRWA's mission is to protect the environmental integrity of the Westport River watershed and its coastal environs on Buzzards Bay, and to advocate for the wise use and preservation of natural resources for the aesthetic, recreational and economic benefit of area citizens; and to educate the general public about the interrelationship of our waters, soils, plants, animals, and people. WRWA has been working for over 40 years to educate people in sound ecological ways of co-existing with nature and to educate watershed residents about what they can do to protect these natural resources. We advocate for environmental solutions with the local, state and federal regulators who make critical decisions about our environment. And finally, we assess water quality parameters that document the condition of the river and watershed.

Restoration Work Will Take Support

Cockeast Pond is currently hydraulically connected to Westport Harbor via a culvert passing underneath River Road. Relieving the tidal restriction to achieve more effective flushing with low nutrient water from Buzzards Bay and Westport Harbor



Cockeast Pond's inlet from the Westport River.

becomes a significant management consideration for lowering nutrient concentrations in the water column and improving impaired habitat. Though within the last decade the culvert was redesigned and rebuilt to try and improve flushing, it appears that the placement was at a higher elevation, such that tidal inflows are restricted to all but the highest tides in Westport Harbor, resulting in very little flushing most of the time. Based on the detailed loading analysis, sampling program and hydrodynamic modeling, it has become apparent that enhancing flushing of Cockeast Pond should be a top priority in the sequence of steps that can be taken to manage nitrogen concentrations in the

system. Of the various nitrogen management options, increasing tidal exchange is the most direct and least expensive. However, Cockeast Pond is a herring spawning area, so preliminary discussions were conducted with Mass Division of Marine Fisheries. It appears that the present culvert not only is restricting tidal flows, but also is impeding herring migration. Therefore, for both lowering the level of nitrogen enrichment for habitat restoration and to support the herring run, it is recommended that the inlet culvert be redesigned to improve tidal exchange with Westport Harbor. However, care must be taken to maintain pond salinity within acceptable ranges to support herring spawning.