



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

# Massachusetts

## Reducing Nutrients from Cranberry Bogs Improves White Island Pond

### Waterbodies Improved

Cranberry farming contributed excess total phosphorus (TP) to Massachusetts' White Island Pond, which is comprised of two separate basins. Poor water quality prompted the Massachusetts Department of Environmental Protection (MassDEP) to add the pond to the state's list of impaired waters in 1992 for non-attainment of its primary recreation designated use. Project partners conducted studies to document the current nutrient loading from the commercial cranberry bogs and studied the feasibility of using low-phosphorus fertilizers to maintain yields while reducing nutrient loading. Partners implemented best management practices (BMPs) to reduce nutrient inputs. As a result, conditions in both basins of White Island Pond have improved. MassDEP expects the pond to meet all designated uses by late 2015.

### Problem

White Island Pond is in the towns of Plymouth and Wareham in southeastern Massachusetts' Buzzards Bay watershed. This 291-acre freshwater natural seepage pond is comprised of two major basins: the 124-acre West White Island Pond (West Basin) and the 167-acre East White Island Pond (East Basin) (Figure 1). Land use in the contributing watershed is 57 percent forest, 16 percent residential, and 27 agricultural (primarily consisting of cranberry growing operations that discharge into the East Basin).

Monitoring in the East Basin conducted by the state of Massachusetts in 1976 through 1978 showed TP levels ranging from 0.01 to 0.05 milligrams per liter (mg/L). Similar water quality problems have been observed in the West Basin to a lesser degree. Algal blooms and occasional fish kills were noted at that time. As a result, MassDEP included both the East (segment MA95166) and West (segment MA95173) basins of White Island Pond on the state's 1992 list of impaired waters (Category 5 in the state's Integrated List of Waters) for TP, excess algal growth, dissolved oxygen, and non-native aquatic plants. The East Basin's 1992 list of impairments also included turbidity.

Data collected in 2000 and 2007 showed continued nutrient-related problems in the pond. Fertilizer applied on nearby commercial cranberry operations contributed nutrients to the East Basin, which experienced elevated levels of TP concentrations, exhibited frequent algal blooms that caused some



Figure 1. Southeastern Massachusetts' White Island Pond is comprised of two main basins: the West Basin (lower left) and the East Basin (upper right).

beach closures (due to the presence of toxic cyanobacteria), and failed to meet Massachusetts' water quality standard for transparency. Other sources of nutrients included home septic systems and natural releases from sediment.

## Project Highlights

MassDEP awarded a Clean Water Act (CWA) section 319 grant in 2001 to the University of Massachusetts (UMass) Cranberry Experiment Station to conduct a multi-year field study of phosphorus dynamics in commercial cranberry bogs. The study focused on low-phosphorus fertilizer trials, crop yields, testing procedures, floodwater management, and developing a budget of the nutrient inputs to the bogs and exports to the East Basin. By combining these data with internal sediment loading estimates, septic system estimates, and other watershed land use source information, a total maximum daily load (TMDL) for phosphorus was developed and approved in 2010. It was determined that 24 percent of the phosphorus load was from direct cranberry bog floodwater discharges and an additional 49 percent was associated with legacy phosphorus inputs being released from the sediments each summer.

Before the sediment source could be addressed, project partners needed to reduce the nutrient inputs from the cranberry bogs. The Cape Cod Cranberry Growers Association (CCCGA) received a CWA section 319 grant in 2009 to implement BMPs such as reducing phosphorus fertilizer applications, conducting tissue testing to determine plant nutrition needs, and managing harvest water to avoid anoxic conditions that can cause phosphorus to be released from bog soils into the harvest flood water. In 2012 the UMass Cranberry Experiment Station used a third CWA section 319 grant to further evaluate fertilizer reductions and develop iron sand filters and other BMPs for cranberry bogs. MassDEP worked closely with the UMass Cranberry Experiment Station and cranberry growers and determined that lower rates of fertilizer could be applied to the cranberry bogs and still maintain productivity. In addition, a variety of alternatives for water management (e.g., diversion of cranberry discharge water) by the two growers have decreased fertilizer inputs to the pond.

## Results

Reducing the amount of phosphorus fertilizer applied to bogs and diverting nutrient-laden discharge have improved water quality in White Island Pond. Data collected since 2008 have shown improved water clarity and a decline of more than 40 percent in TP concentrations (Figure 2). Cranberry-related nutrient sources were reduced by over 90 percent.

The rate of decline has leveled off as TP from sediment diffuses and is flushed out. An alum treatment was carried out in April 2013, and is expected to

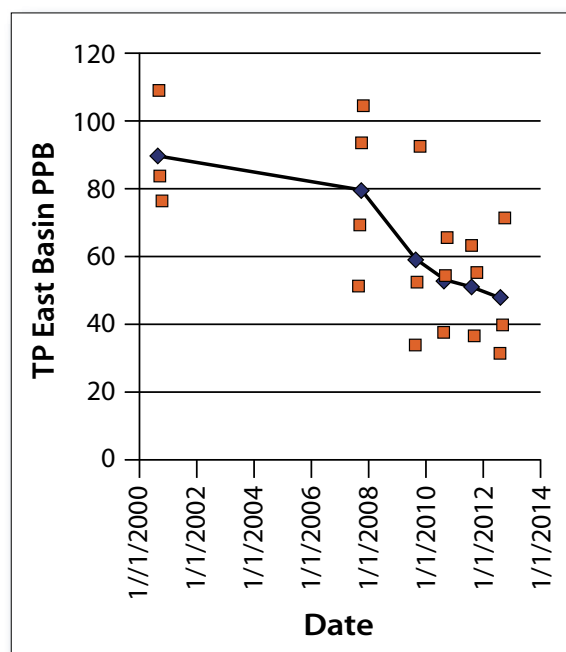


Figure 2. Total phosphorus concentration (parts per billion) in the East Basin of White Island Pond (2000–2014).

further reduce TP in the water column. MassDEP continues to monitor the system and will make further adjustment through adaptive management. Additional CWA section 319 funding has been requested to further improve the pond water quality. MassDEP expects the pond to meet all of its designated uses by late 2015.

## Partners and Funding

In addition to the MassDEP Nonpoint Source Program and the MassDEP Southeast Regional Office, other contributing partners include the UMass Cranberry Experiment Station, the CCCGA, and two commercial cranberry growers (A.D. Makepeace and Federal Furnace Companies). A total of \$216,913 in CWA section 319 funds supported this project, including (1) \$187,197 to UMass Cranberry Experiment Station in 2001, (2) \$29,716 to the CCCGA in 2009, and \$346,767 to UMass in 2012.

In 2009 the Town of Carver used a \$16,500 CWA section 604(b) award to update and distribute the cranberry growers' BMP guide. The partners for this project included the CCCGA, UMass Cranberry Experiment Station, and the Coalition for Buzzards Bay. MassDEP also worked cooperatively with the Massachusetts Department of Food and Agriculture and UMass to establish a memorandum of agreement that specified the studies, BMPs, and reports needed to obtain water quality improvements.



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