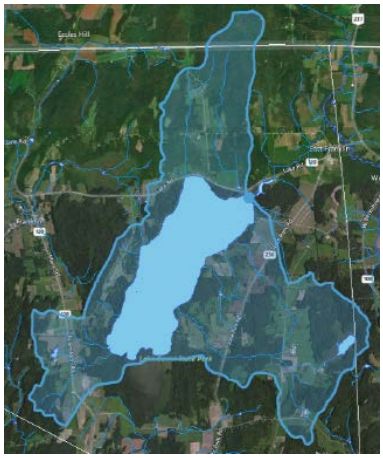
Vermont Department of Environmental Conservation Watershed Management Division

Lake Carmi Phosphorus Pollution Control Plan Question and Answer December 2017

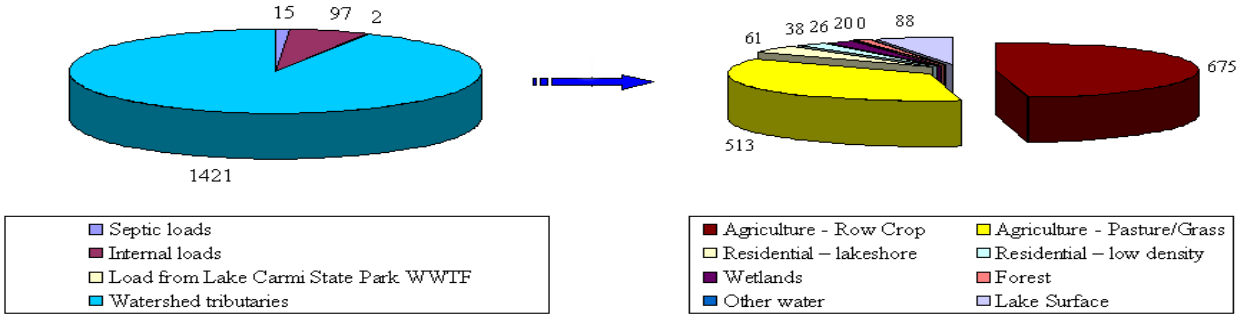


What are the pollution issues at Lake Carmi?
Lake Carmi in Franklin, Vermont is polluted by high levels of phosphorus, which is a plant nutrient that causes proliferation of algae in lakes. Late summer algae blooms, reduced water clarity and heavy aquatic plant growth have been observed at Lake Carmi, and some of the worst cyanobacteria, or blue-green algae ever observed by residents were seen in fall, 2017. In 2008, the Department of Environmental Conservation established, and the United States Environmental Protection Agency approved a pollution control plan to establish required reductions for phosphorus discharges to the lake. This plan is known as a "total maximum daily load" or TMDL plan.

What is the ultimate target phosphorus level in the lake?
Phosphorus in water is measured in parts-per-billion. One part-per-billion, or ppb, is equivalent to one cubic centimeter, or cc, in 1000 liters of water (or one ounce in 7,812.5 gallons). The average summertime phosphorus concentration measured by DEC, in cooperation with Lake Carmi's citizen water quality testing program, was 34 ppb between 2010 and 2016. DEC has determined that an average level of 22 ppb would be necessary to reduce algae blooms and restore the lake waters The TMDL plan sets the maximum amount of phosphorus that can enter the lake and still meet this target. Based on DEC's analyses, the in-lake goal of 22 ppb can be met if total phosphorus loading to the lake is no more than 1,027 kilograms per year, a 611 kg reduction.

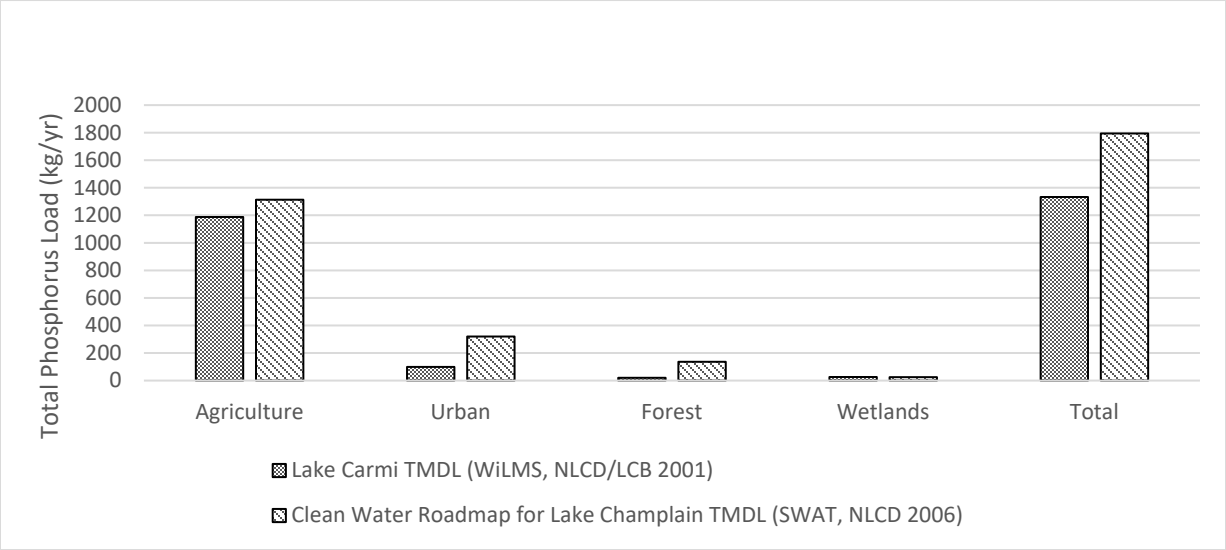
How do we know what the sources of phosphorus are?
The accepted scientific approach to answering this question is to conduct water quality testing, and to use a water quality "model" to determine the most likely contributions from different parts of the lake watershed. These watershed phosphorus loads were calculated using scientifically-accepted approaches for constructing a lake pollution model recommend by several States, and USEPA. The resulting annual loads and breakout by land-use type is shown below.

Estimated annual phosphorus loads (kg) Lake Carmi, with breakout of loads from the watershed.



What assumptions went into the Lake Carmi Phosphorus Control Plan, and are they valid?
The phosphorus loading estimates to Lake Carmi were derived using the best-available land use and phosphorus runoff factors, at the time the Plan was written. Since that time, a new and more precise water quality model was developed for the Lake Champlain TMDL, called the Clean Water Roadmap. To verify that the Lake Carmi water quality model is reasonable, DEC scientists recently compared the total phosphorus loads each model produced. The results are shown in the figure below. The Clean Water Roadmap predicts that loading from agricultural land uses are slightly higher than the original estimates (although acreage has decreased), and that lakeshore and developed sources have increased. Importantly, these changes do not change the fact that over 600 kg/yr of phosphorus loads need to be reduced annually.

Total phosphorus export, by land use, from the Lake Carmi watershed.



How do we know that the TMDL's reduction requirements will produce improvements?
DEC incorporated a 10% margin of safety into the TMDL to account for any uncertainty that the established total loading of 1,027 kg/yr will bring about the necessary in-lake phosphorus concentration of 22 ug/l. The application of this margin of safety means that all contributing phosphorus sources will be "overtreated" so as to ensure that the target concentration will be met.

What do the required reductions mean for me?
The improvements needed will depend on the land-use involved. While the predominant reductions fall to agriculture, there are also required reductions in phosphorus from State and municipal roads, lakeshore properties, and other sectors. The Vermont Department of Forests and Parks recently designed and is building a new wastewater treatment system for the Lake Carmi State Park, which will be constructed during 2017 and 2018. This will all but eliminte any phosphorus discharge from the facilities at the park.

Is the TMDL Working?
The EPA-approved TMDL is an accounting of the relative sources of phosphorus to the lake, and the total load reduction necessary to achieve the in-lake target. The measure of success of the TMDL is in how rapidly and effectively the actual load reductions are implemented, and more importantly, how quickly the lake responds. Given the increased pace of phosphorus reduction in the watershed in the past two years, combined with new regulations requiring phsphorus control from all sectors, the Department is confident that the reductions can be achieved, and that the total identified reduction targets remain valid. Efforts to also conduct an in-lake treatment to address internal re-cycling of phosphorus stored in sediments will accellerate the in-lake response to load reductions.

For additional information on the TMDL, please see the technical fact sheet or the TMDL document located at http://dec.vermont.gov/watershed/map/tmdl.