Environment and Climate Change Canada
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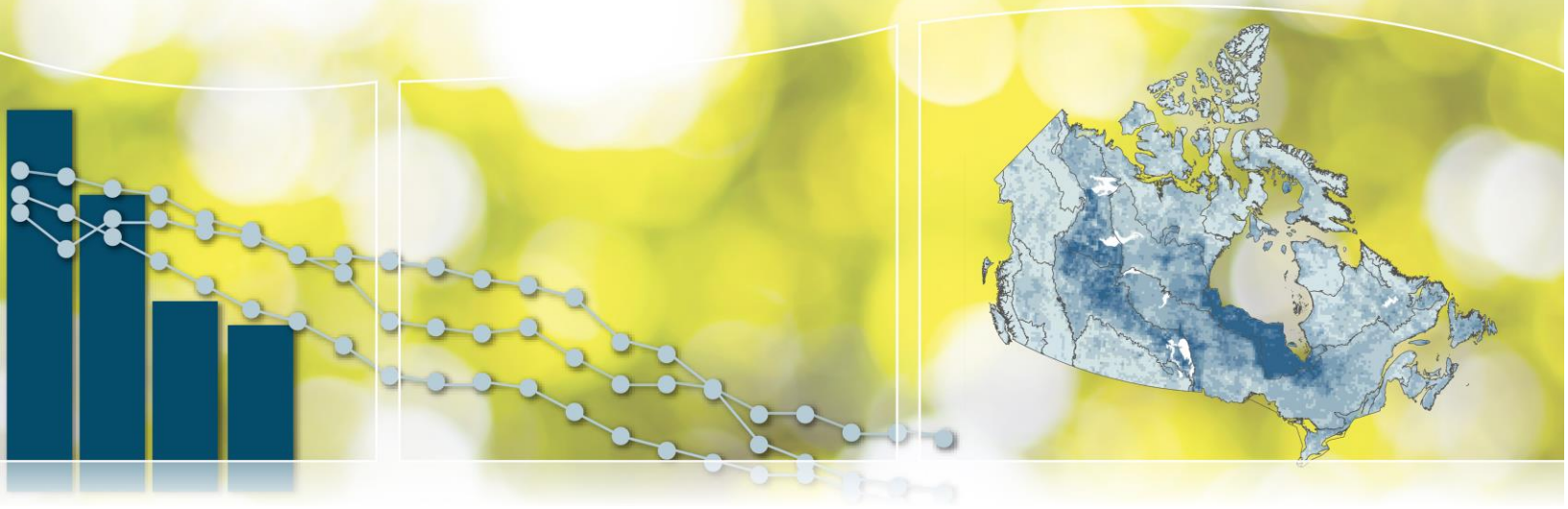
Canadian Environmental Sustainability Indicators

Reducing phosphorus loads to Lake Simcoe and south-eastern Georgian Bay



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Reducing phosphorus loads to Lake Simcoe and south-eastern Georgian Bay

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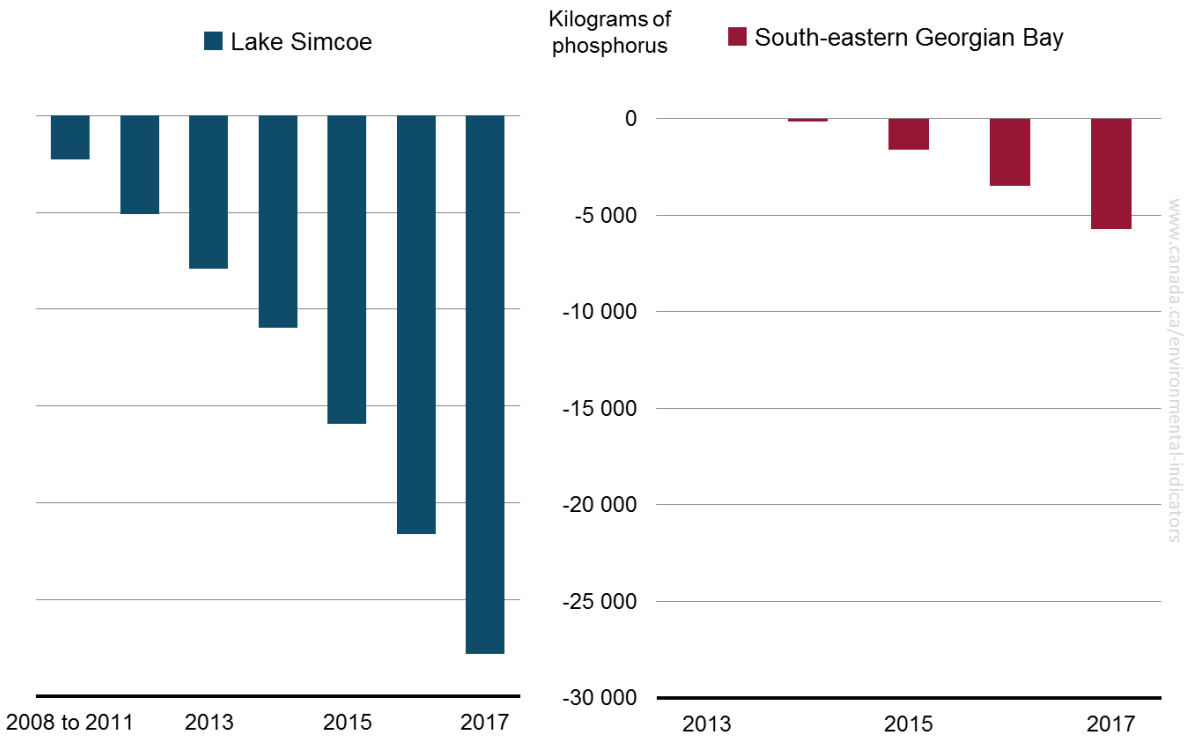
Reducing phosphorus loads to Lake Simcoe and south-eastern Georgian Bay indicator

Phosphorus is an essential plant nutrient. When too much phosphorus reaches a lake from human activity it can have harmful impacts on a lake's food web.

Key results

- Stewardship projects completed between 2008 and 2017 have prevented an estimated 27 800 kilograms of phosphorus from reaching Lake Simcoe and its tributary rivers.
- Similar projects completed between 2013 and 2017 have prevented an estimated 5 700 kilograms of phosphorus from reaching south-eastern Georgian Bay and its tributary rivers.

Figure 1. Cumulative, estimated reduction in the amount of phosphorus reaching Lake Simcoe, 2008 to 2017, and south-eastern Georgian Bay, 2013 to 2017, due to stewardship projects



Data for Figure 1

Note: The reduced phosphorus load estimates are calculated using data from all projects completed between April 1, 2008 and March 31, 2017. Data are presented by fiscal year; for example, data for 2017 represents projects implemented between April 1, 2016 and March 31, 2017. Figures for each project type are rounded and then summed to calculate the total.
Source: Environment and Climate Change Canada (2017) Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund Office.

The amount of phosphorus reaching Lake Simcoe and south-eastern Georgian Bay is reduced through the following measures:

- stream bank erosion is controlled
- livestock are stopped from directly accessing water course
- manure is properly stored
- trees and plants are planted along river corridors
- milk-house washwater is contained
- stormwater ponds are upgraded
- wetlands are restored or new ones are built

The target for both Lake Simcoe and south-eastern Georgian Bay is to put projects in place to reduce phosphorus loading by 2 000 kilograms of phosphorus per year by 2017.

Lake Simcoe is the largest lake in southern Ontario outside of the Great Lakes. Located north of Toronto, the lake is a major recreational area. It is surrounded by productive agricultural land and supplies drinking water to 8 municipalities. Rapid population growth, urban development, and fewer, but larger, farms with more crops and livestock have resulted in elevated phosphorus levels in the lake, causing oxygen concentrations in the lake to fall to levels that are too low for fish to survive. They are also causing overall water quality in the lake to deteriorate. Scientists estimate the annual phosphorus loading rate for the lake has more than doubled to 77 tonnes of phosphorus per year[1] since the major period of settlement and land clearing that took place around Lake Simcoe in the 1800s.

Similar to Lake Simcoe, excessive inputs of phosphorus are putting stress on water quality and ecosystem health in sections of south-eastern Georgian Bay. Phosphorus in runoff from small urban developments and rural areas are contributing to nuisance and toxic algal growth in the bay. The area includes the United Nations Educational, Scientific and Cultural Organization (UNESCO)-designated Georgian Bay Biosphere Reserve.

The work to reduce phosphorus loads to Lake Simcoe is being led by the Province of Ontario, working with partners such as the Lake Simcoe Region Conservation Authority, local stakeholders, municipalities and other partners. Environment and Climate Change Canada's Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund contributes to Ontario's overall goals to reduce phosphorus in the lake by providing funding for priority clean-up projects at the community, lake-wide or watershed-wide level.

About the indicator

What does the indicator measure

The indicator reports the contribution projects funded by the Lake Simcoe Clean-Up Fund (April 2007 to March 2012) and Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund (April 2012 to March 2017) are making toward reducing the amount of phosphorus reaching the water bodies from their watersheds. Changing how land is managed in the watershed helps to reduce the amount of phosphorus from rural and urban sources reaching Lake Simcoe and south-eastern Georgian Bay and to restore the lakes' health.

[1] Ontario Ministry of the Environment (2010) Lake Simcoe Phosphorus Reduction Strategy. Retrieved on June 22, 2016.

Why is this indicator important

Clean freshwater is an essential resource. It protects the biodiversity of aquatic plants and animals. We use it for drinking, manufacturing, energy production, irrigation, swimming, boating and fishing. Degraded water quality damages the health of freshwater ecosystems and can disrupt economic activities, such as fisheries, tourism and agriculture. When phosphorus levels in water become too high, aquatic plant growth can become excessive and harmful. The decay of excess plant material can reduce the amount of oxygen available for fish and other aquatic animals. High phosphorus levels can also lead to harmful algal blooms, which can kill animals that use the water and affect human health.

This indicator is used to provide information about the state of the Lake Simcoe and south-eastern Georgian Bay basin and Canadian environment. It is also used to assess progress towards implementing the 2016–2019 Federal Sustainable Development Strategy.

What are the related indicators

Reducing phosphorus loads to Lake Winnipeg reports the amount of phosphorus no longer reaching Lake Winnipeg due to completed stewardship projects.

Phosphorus levels in the offshore waters of the Canadian Great Lakes, Nutrients in the St. Lawrence River, and Nutrients in Lake Winnipeg report the status of total phosphorus and total nitrogen levels in these three ecosystems.

Freshwater quality in rivers ranks water quality at monitoring sites across Canada where human activity is likely to harm a river's ability to support aquatic plants and animals.

Pristine lakes and rivers

This indicator supports the measurement of progress towards the following 2016–2019 Federal Sustainable Development Strategy long-term goal: Clean and healthy lakes and rivers support economic prosperity and the well-being of Canadians.

Data sources and methods

What are the data sources

The amount of phosphorus diverted from the lakes is estimated by Environment and Climate Change Canada's Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund using data from the final reports of funded stewardship projects.

More information

Data for all beneficial management projects funded and completed between December 2008 and March 2017 are included. The year associated with a project reflects the year the project was initiated, not the year the work was done.

The Lake Simcoe Clean-Up Fund (April 2007 to March 2012) and the Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund (April 2012 to March 2017) funded 193 projects designed to reduced phosphorus loading to the two lakes. Of these, 80 projects had a direct impact on phosphorus loading through point-source phosphorus removal. Another 113 projects had an indirect impact through non-point source phosphorus removal and/or aquatic habitat restoration or creation (Table 1). This indicator only reports on projects that resulted in phosphorus reductions to Lake Simcoe and south-eastern Georgian Bay watersheds.

Table 1. Number of phosphorus remediation projects funded by the Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund

Year	Lake Simcoe point-source phosphorus reduction	Georgian Bay point-source phosphorus reduction	Lake Simcoe non-point source phosphorus removal / habitat restoration	Georgian Bay non-point source phosphorus removal / habitat restoration	Both watersheds non-point source phosphorus removal / habitat restoration	Total number of projects
2007 to 2012	74	n/a	64	n/a	n/a	138
2012 to 2013	0	0	0	0	0	0
2013 to 2014	1	1	8	4	3	17
2014 to 2015	1	0	8	4	1	14
2015 to 2016	3	0	9	3	1	16

Year	Lake Simcoe point-source phosphorus reduction	Georgian Bay point-source phosphorus reduction	Lake Simcoe non-point source phosphorus removal / habitat restoration	Georgian Bay non-point source phosphorus removal / habitat restoration	Both watersheds non-point source phosphorus removal / habitat restoration	Total number of projects
2016 to 2017	0	0	5	2	1	8
Total	79	1	94	13	6	193

Note: n/a = not applicable.
Source: Environment and Climate Change Canada (2017) Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund Office.

How is this indicator calculated

Estimates of how much new stewardship projects reduced phosphorus loading to Lake Simcoe and south-eastern Georgian Bay are calculated using generic land use models collected from the scientific literature. The results for each year were summed to estimate the total loading reduction. The indicator is calculated using the most recent data available.

More information

Estimates of reductions in phosphorus loading to Lake Simcoe and south-eastern Georgian Bay resulting from the implementation of beneficial management practices were calculated by either the Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund program or its partners.[2] These estimates were generated using performance measurement data provided in the final reports of all projects receiving funding. These data were then applied to phosphorus-loading equations taken from the scientific literature. These equations are used by other water management agencies in Ontario to estimate the amount of phosphorus removed though management practices. Projects were grouped into 3 source types:

- research and monitoring
- non-point source phosphorus removal/habitat restoration
- point-source reduction

Research and monitoring projects do not result in phosphorus reductions and are not included in reporting.

In general, the amount of phosphorus reaching a watercourse is based on factors including sediment load, form and chemical nature of the phosphorus compounds, soil pH, soil texture, soil type and aerobic conditions. Beneficial management practices to reduce phosphorus inputs include limiting livestock access to streams through fencing, providing alternate watering sources, reducing/controlling run-off from fields, decreasing storm water run-off from parking lots and other hard surfaces, controlling erosion in ditches, and restoring wetlands to buffer stormwater flows.

Once a stewardship project is completed, its impact of removing phosphorus from water running off the landscape is expected to continue into the future. The reduction

[2] Sealock L (2011) Lake Simcoe Clean-Up Fund: Phosphorus Reduction Calculation Report. Great Lakes Management and Reporting Section, Environment Canada.

associated with the project is accounted for yearly. Loading reductions from beneficial management practices completed over the life of the program add to projects initiated since 2008 in the Lake Simcoe basin and 2013 in the south-eastern Georgian Bay basin. In this way, the reductions in phosphorus runoff due to stewardship projects aggregate on the landscape.

Given that the results are estimates, the figures for the total of each project type were rounded and these rounded figures were summed to produce the final number.

What has recently changed

This indicator has been updated to include data from stewardship projects that submitted their final reports between April 1, 2016 and March 31, 2017. For the Lake Simcoe and south-eastern Georgian Bay projects, loading reductions were calculated from the year the project was initiated, rather than the year the final project report was submitted.

What are the caveats and limitations

The indicator assumes that each management project completed through the Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund results in a permanent reduction in phosphorus loads to Lake Simcoe and south-eastern Georgian Bay.

The indicator does not compare results to actual measures of annual phosphorus loads or to overall land use and activity changes in the basin that might affect phosphorus loading.

The indicator relies on the most appropriate equations to predict phosphorus loading reductions from the implementation of the stewardship projects. Despite the rigour behind them, uncertainty exists when using these equations.

Resources

References

Environment and Climate Change Canada (2015) Lake Simcoe / South-eastern Georgian Bay Clean-Up Fund. Retrieved on June 22, 2016.

Sealock L (2011) Lake Simcoe Clean-Up Fund: Phosphorus Reduction Calculation Report. Great Lakes Management and Reporting Section, Environment Canada.

Related information

Lake Simcoe Phosphorus Reduction Strategy

Annex

Annex A. Data tables for the figures presented in this document

Table A.1. Data for Figure 1. Cumulative, estimated reduction in the amount of phosphorus reaching Lake Simcoe, 2008 to 2017, and south-eastern Georgian Bay, 2013 to 2017, due to stewardship projects

Lake	Year	Non-point source phosphorus removal / habitat restoration (kilograms of phosphorus/year)	Point-source phosphorus reduction (kilograms of phosphorus/year)	Estimated phosphorus removal over all years (kilograms of phosphorus)
Lake Simcoe	2008 to 2011	-1 105	-1 162	-2 267
Lake Simcoe	2012	-550	<1	-5 084
Lake Simcoe	2013	0	0	-7 900
Lake Simcoe	2014	-251	0	-10 968
Lake Simcoe	2015	-1 896	0	-15 931
Lake Simcoe	2016	-721	-5	-21 619
Lake Simcoe	2017	-367	-131	-27 805
South-eastern Georgian Bay	2013	0	0	0
South-eastern Georgian Bay	2014	-163	-5	-168
South-eastern Georgian Bay	2015	-1 263	0	-1 599
South-eastern Georgian Bay	2016	-456	0	-3 487
South-eastern Georgian Bay	2017	-321	-11	-5 706

Note: Numbers may not add up due to rounding.

Additional information can be obtained at:

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