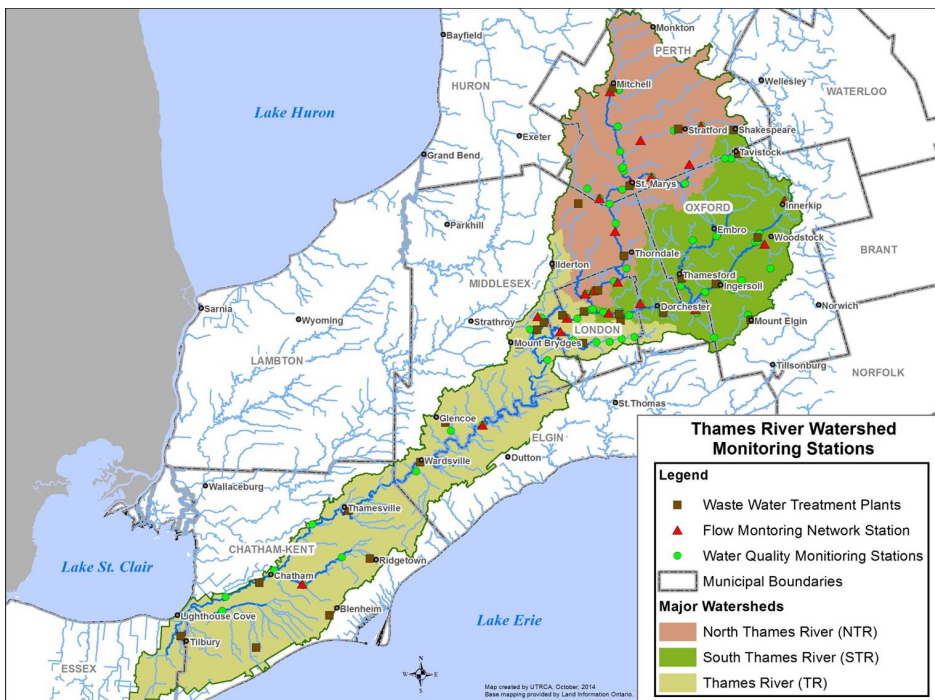


1.19 Upper Thames River Conservation Authority

1.19.7 Water quality assessment in the Thames River watershed – phosphorus loadings

Project Goals

In 2015 an assessment of available water quality and flow data for the Thames River was completed to determine loadings of phosphorus and sediment at Thames River and tributary locations across the watershed. The goal was to provide information, based on water quality data, to assist in understanding the source areas and timing of delivery of nutrient and sediment contributions to the Thames, for the purpose of informing ideas on implementation.



Thames River monitoring stations (photo credit: UTRCA)

Project Description

- This study assessed long-term monitoring data for the entire Thames River system. Freshwater Research (G. Nurnberg Ph.D. and B. LaZerte Ph.D.) conducted the water quality assessment providing data analysis, and scientific assessment. A large temporal (24 years of data within 1986-2012) and spatial (83 stations) sampling of water quality combined with daily flows from 26 flow gauges made it possible to describe and assess the variation of nutrients and sediments throughout the Thames River watershed. The study assessed available data sources including:
 - 83 water quality monitoring stations. This includes Provincial Water Quality Monitoring Network, City of London river data, Environment Canada tributary loading data, subwatershed studies data (e.g. Nissouri Creek), and data collected during runoff conditions specifically for this study.
 - 26 stream gauge stations for continuous flow data (Water Survey Canada, and UTRCA data)
 - 30 wastewater treatment plants (discharge monitoring data)

Location

Thames River Watershed, Thames River and tributaries

Partners

- City of London
- ECCC
- Freshwater Research
- LTVCA
- OMAFRA
- MOECC
- UTRCA
- Western University

Funders

MOECC: Showcasing Water Innovation program

Transferability

Information obtained through this study was used to inform recommendations in the Thames River Shared Waters Approach to Water Quantity and Quality (2018), where one key goal is the reduction of phosphorus loadings in the Thames.

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Next Steps

This study was an initial assessment of available water quality and quantity data with the goal of furthering the understanding of nutrient loadings, specifically for the Thames watershed, to help to inform priorities for implementation. Ideally future studies will build on this initial assessment to expand the understanding of loadings and further inform best actions to meet the phosphorus reduction goals for the Thames.

For More Information

[Water Quality Assessment in the Thames River Watershed – Phosphorus and Sediment Sources](#), G. Nurnberg and B. LaZerte Freshwater Research, 2015.

- The time period of 1986 - 2012 was analysed to assess relatively recent conditions and still have enough data available to conduct a detailed analysis. Previous studies found that total phosphorus concentrations were significantly higher prior to this time period, in the 1970's
- The assessment of data focused on the three main sections of the Thames. A number of tributaries within these main river sections were also evaluated based on data availability
 - North Thames River from headwaters in Mitchell and Stratford to the forks in London
 - South Thames River from Tavistock to the forks in London
 - Thames River drainage area from the forks in London to the outlet of the Thames at Lake St. Clair
- Analyses Methods: The study assessed both loads and flow weighted concentrations. Three different models were used to calculate flow-weighted average concentration and loads depending on data availability. Both EGRET (model based on U.S. Geological Survey program of Weighted Regressions on Time, Discharge and Season) and GAM (General Additive Model based on an optimally weighted regression with smoothing) include a relationship between flow and concentration.



Highest loads occur during high flows in the winter and spring - North Thames River February 2018 (photo credit: UTRCA)

Results Summary / Expected Outcomes

- The study shows that the total load of phosphorus and sediment in the river that eventually reaches Lake St. Clair is highly dependent on water flows. Annual loads vary, influenced by annual flows. Loads follow the seasonal pattern of flows so that the highest loads occur during wet periods in the winter and spring. Approximately 75% of loadings occur during wet weather and snowmelt events (EC data).
- Phosphorus loadings are contributed from across the Thames River watershed, with:
 - 60% of the average annual total phosphorus load contributed upstream of the forks in London in the Upper Thames River watershed (North Thames branch and South Thames branch)
 - 40% of the load is added to the river from the Forks in London to the outlet at Lake St. Clair.

- Sediment loads are contributed from across the Thames River watershed, with:
 - 35% of the load contributed upstream of the forks in London in the Upper Thames River watershed (North Thames branch and South Thames branch),
 - 65% of the average annual sediment load contributed from the Forks in London to the outlet at Lake St. Clair.
- Results suggest that all tributaries across the watershed contribute to the phosphorus load in the Thames. Loads are cumulative, increasing from the headwaters towards the Forks in London, where the North Thames and South Thames Rivers combine, and further increase towards the mouth. Data was deemed adequate to determine load estimates for some locations including: about half of the 28 watersheds in the Upper Thames and main branches; and main Thames River sites and McGregor Creek in the Lower Thames. This data gives a general understanding of phosphorus loading from tributaries/watersheds in the Thames, many of which have similar land use.
- The study estimated the annual export of nutrient and sediment loads from the Thames River into Lake St. Clair at 342 tonnes/year TP, 187 t/yr SRP, and 113,000 t/yr total suspended sediment.
- Non-point sources (runoff from rural and urban areas) dominate total phosphorus loads, contributing approximately 85% of the load in the Thames. The 30 wastewater treatment plants in the Thames River watershed contribute approximately 15% of the total phosphorus load.
- The numerous small and larger dams and reservoirs along the Thames River and its tributaries can affect the timing of phosphorus and sediment load delivery through the watershed. During times of high load delivery (major flow events) much of the load can move through the small and large reservoirs; however, some of the phosphorus load will be temporarily retained in bottom sediment and later released into the water.

Section of the Thames River	Area km ²	TP Average Annual Load %	TSS Load %	TP Load tonne/km ²	TSS Load tonne/km ²
South Thames River Tavistock to Forks in London	1346	28%	16%	0.06	13.46
North Thames River Mitchell, Stratford to Forks in London	1427	32%	18%	0.07	14.25
Thames River Forks in London to Lake St. Clair	3089	40%	65%	0.04	23.97