

Cayuga Lake Watershed Network

Special Project: Northern Creeks

Stormwater Runoff Nutrient Testing at Creeks at the North End of Cayuga Lake

Proposal Submitted by William Ebert and John Abel
on behalf of the CLWN Water Quality Committee
and
Approved by the CLWN Board of Directors
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Background

This special project has been formulated by the Water Quality Committee during the late spring and summer of 2019, including the securing the initial donations and pledges to support it. The CLWN Executive Committee agreed to accept the project in order for the WQ Committee to proceed with the purchase of the necessary stream velocity measuring device, to begin learning how to use the new equipment, and to accept donations to support both the purchase and the planned activities. However, the EC's acceptance was conditioned on: (1) eventual formal confirmation of the project (named and booked as "Northern Creeks") by the full Board of Directors; and (2) clarification of how the new special project is related to the existing special projects on monitoring of north-end tributaries, Canoga-Burroughs Creek and Yawger Creek. Actual data gathering has not yet begun but is to be initiated in 2020. The Finance Committee has already included 2020 budget estimates for the project.

Objectives

The objective of this work is to identify and estimate nutrient loadings of the northern inflows to Cayuga Lake, with particular focus on Phosphorus (P) and Bioavailable Phosphorus (BAP). BAP is immediately available for algae/cyanobacteria use and is of concern in runoff waters. This work will focus on collecting data after quantifiable rainfall events with volume estimates at the mouth of nine creeks. Secondly, the work will possibly expand upon gathering baseflow data that will complement those already being obtained from the separate Canoga-Burroughs and Yawger Creek projects. With this stormwater and baseline information the streams that might be nutrient "hotspots" and rich targets for nutrient-reduction programs will be identified so that further actions can be taken to work with property owners and local governments (e.g., County Soil and Water Conservation organizations). Further upstream investigation of these selected creeks may be initiated. This project is intended also to provide a reference for the effectiveness of future water quality management changes for the NY DEC Total Maximum Daily Load (TMDL) program.

Rationale

Continued increases of harmful algal blooms and of filamentous algae and aquatic plants that decay and produce offensive odors pose major problems for the enjoyment and use of the shallow north end of Cayuga Lake. For example, the blooms pose major public health problems if they get into the public and private water supplies. Elevated algal and macrophyte levels are associated with elevated nutrient levels. There have been a number of studies and observations of water quality at the north end of

Cayuga Lake, and all since 2006 seem to point toward considerable annual increases in average nutrient levels – in particular, phosphates and nitrogen. In chronological order:

- “Water Quality of the North End of Cayuga Lake: 1991-2006” by Joseph C. Makarewicz, et al., at the Dept. of Environmental Science & Biology, SUNY College Brockport (Ref. 1)
- Creek samplings from 2015 to 2019 in CLWN special projects Canoga-Burroughs Creek (Seneca County) and Yawger Creek (Cayuga County), not typically at high-flow times
- Studies conducted by the CSLAP volunteers for the NYDEC since 2017 (Ref. 2)
- HABs observation conducted systematically since 2018, culminating in a record of 103 reports in 2019 with the majority of incidents, and particularly the majority of high-toxin occurrences, in the northern end of the Lake

Most recently, an October 2019 publication by Niamh O’Leary, et al., (Ref. 3) addressed the problem of soluble reactive phosphorus entering the Lake, a key driver of eutrophication and a potential contributor to the emerging problem of harmful algal blooms (HABs). A main recommendation of this refereed journal publication is to monitor nutrient levels in stormwater flows of the Northern tributaries of Cayuga Lake.

Scope

The sampling will be done by local volunteers, and the testing costs will be reimbursed by contributions made by local donors and from local governments. The creeks to be sampled are:

- Sheldrake Creek Seneca County
- Johnsons Creek Seneca County
- Burroughs Creek Seneca County
- Williamson Creek Seneca County
- Canoga Creek Seneca County
- Canoga Creek (North) Seneca County
- Yawger Creek (North) Cayuga County
- Yawger Creek (South) Cayuga County
- Great Gully Cayuga County

For each or the nine creeks, the WQComm is working on procedures to update 2006 land-use data for the sub-watershed. These data are an important component of analysis of the data to be sampled.

Planned Activities

Many aspects of this project have been influenced by similar studies that have been successfully carried out by the Owasco Watershed Lake Association (Ref. 4). For example, a Quality Assurance Program Plan (QAPP), which will provide details on all aspects of sample collection, handling and chemical analysis is in preparation in accordance with the NY DEC template.

Volunteers will be trained in sample collection and handling by staff from the Upstate Freshwater Institute (UFI). All chemical analyses will be performed at the certified lab of the UFI. The following summarizes the proposed methodology:

1. Streamflow rating curves for each sampled creek will be developed based on U.S. Geological Survey (USGS) procedures. Rating curves integrate sectional creek velocity, to be measured with an approved USGS velocity meter (already purchased), with area estimates of each creek section to estimate overall creek flow at specific creek depths.

2. Sampling teams for each creek will be mobilized preceding anticipated significant stormwater runoff events. Sampling will be initiated immediately following a significant rainfall onto moderately saturated ground.
3. At each sampling event at each creek the following will be collected:
 - a. To estimate creek flow at the time of sampling, creek depth will be measured, and velocity will be either inferred from the streamflow rating curves or measured directly.
 - b. Water temperature along with current weather conditions.
 - c. A water sample per UFI procedures in bottles that will be transported to the UFI Lab.
4. From the samples the UFI Certified Lab will determine the total phosphorous (TP), total dissolved phosphorous (TDP), soluble reactive phosphorous (SRP), total nitrogen (TN), Ammonia (NH₃), Nitrate (NO_x), and total suspended solids (TSS).
5. The team will analyze the test data to estimate the Total Creek Bioavailable Phosphate (BAP), an indicator of the available phosphates for algae consumption, according to the following algorithm (Ref. 4):
 - a. From the measured test results, the following parameters will be derived
 - i. Dissolved Organic Phosphorus, $DOP = TDP - SRP$
 - ii. Particulate Phosphorous, $PP = TP - TDP$
 - b. The fractional amount of DOP and PP that is also available as Bioavailable Phosphorus will be estimated or inferred based on the percent of land use in agriculture using data from previous studies of the Lake such as those in Ref. 5.
 - i. Bioavailable DOP = DOP x Fraction available
 - ii. Bioavailable PP = PP x Fraction available
 - c. The Total Creek Bioavailable Phosphate = SRP + Bioavailable DOP + Bioavailable PP.

The results of this testing will be summarized in an annual report and made publicly available on the CLWN website: www.Cayugalake.org.

Budget for 2020

Subject to a sufficient occurrence of stormwater runoff events, it is planned to sample all nine creeks eight times during 2020. The preliminary plan is to sample 3 runoff events in the spring, 2 events in the summer and 3 events during the fall (although fall is typically a low-flow period of the year).

Actual Income & Expenses for 2019

<u>Income</u>	
Special Project Income (Seneca Cty 2.5k, Seneca Meadows 2.5k, private 5k)	10,000.
Transfer from Watershed Protection Fund (Mel Russo memorial	<u>1,000</u>
Total Income	11,000
<u>Expenses</u>	
Planning meeting expenses	73
Anticipated depreciation of equipment *	<u>669</u>
Total Expenses	742
 <u>Available to carry forward from the 2019 year</u>	 <u>10,258</u>

Budgeted Income & Expenses for 2020

Income

Carry over from 2019	10,258
Special Project Income (Seneca County 5k, Seneca Meadows 2.5k)	<u>7,500</u>
Total Income	17,758

Expenses

8 Instances of Samplings @ UFI Lab testing of 9 creeks \$1,275	10,208
CLWN Administrative costs (estimated)	2,000
Anticipated depreciation of equipment *	<u>669</u>
Total Expenses	12,877

Available in 2020 for contingencies or carry over to 2021 **4,881**

*Note that the velocity meter has already been purchased over summer 2019 at a cost of \$3,345 and is booked as a depreciable fixed asset of the CLWN. It is anticipated that this will be (straight-line) depreciated over a period of 5 years, with the 20% annual depreciation booked retroactively as a charge to the Northern Creeks project.

Parallel Activities (Relation to other CLWN special projects)

The WQComm will continue its participation in both the Canoga-Burroughs Creek and Yawger Creek projects; and these provide some baseline data for those creeks that are a continuation of the records begun in 2015 and published by CSI. The Canoga-Burroughs Creek project is funded by grants to the CLWN to pay for lab testing by CSI, while the Yawger Creek project is funded by Cayuga County grants made directly to CSI. [Note: For these two parallel projects, the parameters TDP, NH3 and NOx are not analyzed and reported by CSI, and the SRP samples are not collected according to the NY DEC standards that will be used by the Northern Creeks project.]

The Northern Creeks project may elect to take (low-flow) baseline water samples on northern creeks other than Canoga-Burroughs and Yawger, and these samples will be analyzed by UFI and published together with the other testing of the project. This testing is not included in the above budget.

References

1. "Water Quality of the North End of Cayuga Lake: 1991-2006", Joseph C. Makarewicz, et al., Dept. of Environmental Science and Biology, SUNY College at Brockport.
2. CSLAP Data at: <http://NYSFOLA.org/CSLAP-report-search>
3. "Long-Term Study of Soluble Reactive Phosphorus Concentration in Fall Creek and Comparison to Northeastern Tributaries of Cayuga Lake, NY: Implications for Watershed Monitoring and Management", Niamh O'Leary, et al.; *Water* **2019**, *11*, 2075; doi:10.3390/w111002075.
4. 2017-OWLA-Stream-Sampling-Technical-Report-1
5. "Apportionment of Bioavailable Phosphorus Loads Entering Cayuga Lake, New York". Anthony R. Prestigiacomo, et al.