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# Still River Study - Final Report

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Determination of Influence  
By the Still River Tributary  
To the Water Quality  
Of Lake Lillinonah

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# Still River Study

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**Title:** Determination of Influence by the Still River Tributary to the Water Quality in Lake Lillinonah

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**Report By:** Lawrence Paetsch and Curtis Read of Hydro Technologies, Inc

## **Introduction:**

The Towns of Bridgewater, Brookfield, New Milford, Newtown, Roxbury and Southbury all share shoreline and direct recreational opportunities on Lake Lillinonah. Many residents of these towns, along with the general public, use the lake resource for fishing, boating, water sports and other forms of recreation.

For many years the water quality of Lake Lillinonah has been severely impacted by algae blooms and aquatic weeds during the warm summer months when recreational use by the bordering land owners and public should be at its most active time. The algae blooms and aquatic weeds would render the Lake unfit for the use and enjoyment by the public if it were not for timely and expensive applications of Copper Sulfate and Diquat by the Lake Lillinonah Authority.

It is common knowledge that this potentially enjoyable water resource suffers algae blooms due to an infusion of nutrients (primarily phosphorus and nitrogen compounds) from both non-point stormwater and point source pollution. Historic data from the CT DEP and USGS (appendix 2) indicates that significant nutrient loading into Lake Lillinonah is the result of the Still River contribution to the Housatonic River impoundment in New Milford.

The Friends of the Lake organization has a specific mission that includes finding and implementing a solution for the algae problem. Therefore, the proposed Still River Study was designed to pinpoint the primary sources of nutrient loading with current data.

## **Study Design:**

The “Still River Study” was designed to profile the potential sources of pollution along the Still River corridor. The most obvious suspect source was the Danbury Sewage Treatment Plant (STP). The selected sample sites had to isolate the STP by including controls (see GIS map). Samples were taken on approximately monthly intervals from March 1<sup>st</sup> to September to cover months of lake use.

## Sampling:

Almost all samples were “grabs” taken during normal flow conditions to minimize stormwater influences. The last sample series was taken immediately before and then during a stormwater event to compare against normal conditions. Sample times were correlated to USGS stream flow data for flow stage loading calculations. The Still River Gage is located in Brookfield Center which is near the northern end of the Still River Corridor. The nearest gage on the Housatonic River is in Gaylordsville (996 square mile watershed) above the Aspetuck River confluence.

## Site Description:

#	<u>Location</u>	<u>Reason Chosen</u>
1.	Still River above Limekiln Brook tributary	Main stem (6 sub watersheds) control
2.	Limekiln Brook above STP	Control above STP influence
3.	Limekiln Brook below STP	Measure direct influence of 10 mgd
4.	Still River below confluence with Limekiln Brook	Addition of main stem dilution %
5.	Still River at Harrybrook Park	Northern end of Still into Lake Lill
6.	Housatonic River (Lake Lillinonah) at Lovers Leap	Still & Housatonic mixed here
7.	Housatonic River above Still River tributary	Housatonic control pre-Still influence
8.	Housatonic River at Boardman Bridge	Housatonic before New Milford STP

## Parameters Measured:

<u>Parameter</u>	<u>Why Analyzed</u>
pH	Measure of acidity that is not critical but can indicate quality differences
Conductivity	Indicates presence of dissolved salts
Temperature in F	Shows thermal influences from STP and watershed/seasonal variances
Turbidity	Indicative of water clarity used to compare sites (low values are best)
Suspended Solids	Correlates to turbidity to measure particles suspended in water
Chlorides	Measures road salt and/or STP influences
Ammonia	This form of nitrogen can indicate presence of untreated sewage
Kjeldahl Nitrogen-TKN	This captures ammonia and organic nitrogen compounds
Nitrate	From STP effluent and also non-point sources like lawn care & septic
Nitrite	Transition form of nitrogen that could indicate untreated sewage
Total Nitrogen	TKN + Nitrate + Nitrite includes all sources of nitrogen
Ortho Phosphorus	Indicates detergents and other sources as part of available phosphorus
Total Phosphorus	Key parameter causing algae blooms (0.030 mg/L is problem level)
Chlorophyll A	Indicates presence of blue/green algae
Streamflow (USGS)	in cubic feet per second (CFS) from gages. Used to calculate loading and compare flows

## Watershed Information:

- Housatonic at New Milford has 1,022 square miles of contributing watershed (USGS)
- Still River at confluence with Housatonic has 71.3 square mile watershed (GIS) = 7%
- Still River at Brookfield Center USGS gage = 62.3 square miles
- Still River watershed is highly urbanized including downtown, mall, airport and I-84
- See GIS map produced by the Northwest Conservation District

### Historic Flow Data (CFS):

<u>Year</u>	<u>Housatonic</u>	<u>Still River</u>	<u>% of Housatonic Flow</u>	<u>Source</u>
1995	1,424			USGS
1996	2,846			USGS
1997	1,492			USGS
1998	1,509			USGS
1999	1,616			USGS
2000	1,981			USGS
2001	1,376			USGS
2002	1,127	84	7.5	USGS
2003	1,837	148	8.1	USGS
2004	1,342	99	7.6	Hydro

### Danbury STP Information:

- See permit (Appendix 3) Date of Issue: Feb, 2003, Valid for 5 years
- Design capacity = 15.5 mgd. Typical discharge = 9-11 mgd
- At 10 mgd = 1 cu ft = 7.48 gals = 15.5 cfs flow for 24 hours/day
- Permit says “Allocated Zone of Influence” ZOI (Limekiln Brook) = 3.15 cfs
- STP discharge = 88.4% of flow into Limekiln (permit) (80% is more realistic)
- STP flow varied 6% to 42 % of water volume in the Still River at USGS gage
- See STP print out from DEP records submitted to EPA (Appendix 4)
- Permit allows STP to discharge daily average of 1.0 mg/L T-Phos in “season”
- Seasonal removal of T-Phos (April 1 – September 30), no limit other 6 months
- Nitrogen credit program paid by Danbury STP (highest in CT ?) = \$378,000/year

**Result Bullets:** (see attached spreadsheets & graphs in Appendix 1)  
(concentrations are expressed in ug/L for analysis)

- Still River increases Nitrate in Housatonic by 121% (330 to 730 ug/L)
- Still River increases Total N in Housatonic by 80% (800 to 1,440 ug/L)
- Still River adds 1,700 lbs/day of N which = 8 ½ tons of Nitrogen 10% fertilizer
- Still River increases T-Phos in Housatonic by 78% (23 to 41 ug/L)
- T-Phos discharge from STP = 85 lbs/day or 1.3 tons/month in “season”
- T-Phos in Still River = daily input of 1,900 lbs of P2O5 10% fertilizer
- Danbury STP increases Nitrate in Limekiln 20X (740 to 14,990 ug/L) on avg
- Danbury STP increases T-Phos in Limekiln 40X (24 to 933 ug/L) on avg
- Danbury STP increases Temp in Limekiln by > or = 4 F in March-May
- Other parameters show negative influences
- USGS daily flow graphs may show STP has variable flows (see appendix 5)
- As flow (CFS) in Still River drops, concentration of nutrients rise
- STP adds nutrients 24 hours every day far outweighing stormwater impacts

### Conclusions:

Nitrogen and Phosphorus are considered the precursor nutrients that encourage algae and weed growth in Lake Lillinonah and downstream to Long Island Sound. The Still River Study delivered consistent data showing that the Danbury Sewage Treatment Plant effluent is a major source of continuous nutrient loading.

The Still River drains a 72 square mile watershed that is highly urbanized and contributes typically 4-8 % of the Housatonic River as it becomes impounded as Lake Lillinonah in New Milford. It is very significant that the Danbury STP is responsible for nearly doubling the concentrations of phosphorus and total nitrogen entering the lake where summer conditions cause explosive algae blooms.

The Danbury area is growing rapidly and it won't be long that the current average STP discharge will rise from 10 mgd to approach the design capacity of 15.5 mgd. We can predict that the problems affecting Lake Lillinonah and the chain of lakes below will tend to increase accordingly.

The continuous loading of nutrients not only accumulates in the lakes over the winter, but also is present in elevated concentrations when growing conditions are ideal.

**The CT Department of Environmental Protection should consider opening the Danbury STP permit as soon as possible to require:**

- 1. Year around removal of phosphorus, not just seasonal**
- 2. Lower the phosphorus level of 1.0 mg/L allowed by the Danbury STP discharge permit to a "Best Available Technology" level. The DEP should research attainable levels achieved by treatment plants in other states.**
- 3. Accelerate the timetable for correcting Nitrogen emissions and revise permit levels to BAT capability.**

**Qualifications:**

Hydro Technologies, Inc. is a CT Certified Environmental Laboratory based in New Milford. We have fifteen years of experience designing studies and testing water quality in regional water resources including: Candlewood Lake, Lake Waramaug, North & South Spectacle Lakes, the Housatonic River (Source to Sound Study), Shepaug, Bantam, Nonewaug, Weekepeemee and Pomperaug Rivers, and also many regulated discharges to the Housatonic River Basin.