LAKE HOPATCONG
WATER QUALITY MONITORING
ANNUAL REPORT 2008

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1.0 INTRODUCTION

Princeton Hydro, LLC conducted general water quality monitoring of Lake Hopatcong during the 2008 growing season (May through September). This monitoring program represents a continuation of the long-term monitoring program of Lake Hopatcong. The current water quality monitoring program is a modified version of the program that was originally initiated in the Phase I Diagnostic / Feasibility Study of Lake Hopatcong (PAS, 1983) and continued through the Phase II Implementation Project. Both the Phase I and Phase II projects were funded by the US EPA Clean Lakes (314) Program.

The current water quality monitoring program is valuable in terms of continuing to assess the overall "health" of the lake on a year to year basis, identifying long-term trends or changes in water quality, and quantifying and objectively assessing the success and potential impacts of restoration efforts. In addition, the in-lake water quality monitoring program will be an important component of evaluating the long-term success of the implementation of the phosphorus TMDL-based Restoration Plan, which was approved by NJDEP in April of 2006.

2.0 MATERIALS AND METHODS

In-lake water quality monitoring was conducted at the following eleven (11) locations in Lake Hopatcong (Figure 1 in Appendix A) during the study period:

Station Number	Location
1	Woodport Bay
2	Mid-Lake
3	Crescent Cove/River Styx
4	Point Pleasant/King Cove
5	Outlet
6	Henderson Cove
7	Inlet from Lake Shawnee
8*	Great Cove
9*	Byram Cove
10	Northern Woodport Bay
11	Jefferson Canals

* *In-situ* monitoring only

The 2008 sampling dates were 20 May, 23 June, 31 July, 19 August and 22 September. A Eureka Amphibian PDA with Manta multi-probe unit was used to monitor the *in-situ* parameters dissolved oxygen (DO), temperature, pH, and conductivity during each sampling event. Data were recorded at 1.0 m increments starting at 0.5 m below the water's surface and continued to within 0.5 m of the lake sediments at each station during each sampling date. In addition, water clarity was measured at each sampling station with a Secchi disk.

It should be noted that due to unforeseen problems associated with the *in-situ* probe and associated software, in-situ data were not collected during the 23 June 2008 sampling event. To compensate for this loss, Princeton Hydro conducted an additional sampling event on 1 July 2008 to collect the *in-situ* data. However, the discrete and plankton samples (for details see below) were still collected during the 23 June 2008 sampling event.

Discrete water quality samples were collected with a Van Dorn sampling device at 0.5 m below the lake surface and 0.5 m above the sediments at the mid-lake sampling site (Station #2). Discrete samples were collected from a mid-depth position at the remaining six (6) original sampling stations (Stations #1, 3, 4, 5, 6 and 7) and additionally at the Northern Woodport Bay and Jefferson Canals site (Stations #10 and #11, respectively) on each date. Discrete water samples were appropriately preserved, stored on ice, and transported to a State-certified laboratory for the analysis of the following parameters:

- total suspended solids
- total phosphorous-P
- nitrate-N
- ammonia-N
- chlorophyll *a*

All laboratory analyses were performed in accordance with *Standard Methods for the Examination of Water and Wastewater, 18th Edition* (American Public Health Association, 1992). Monitoring at the Great Cove (Station #8) and Byram Cove (Station #9) sampling stations consisted of collecting *in-situ* and Secchi disk data; no discrete water samples were collected from these two stations for laboratory analyses. It should be noted that prior to 2005, Station #10 had been monitored for *in-situ* observations only. However, due to observations made at Station #10 by the Lake Hopatcong Commission operations staff, it was decided that this sampling station should be added to the discrete sampling list.

During each sampling event, vertical plankton tows were also conducted at the deep sampling station (Station #2). A 50-µm mesh plankton net was used to sample the phytoplankton, while a

150-µm mesh plankton net was used to sample the zooplankton. The vertical tows were deployed starting immediately above the anoxic zone (DO concentrations < 1 mg/L) and conducted through the water column to the surface.

Additional Water Quality Data Collected in 2008

In addition to the standard, long-term, in-lake monitoring program, additional data were collected in the Lake Hopatcong watershed in 2008. These data were collected for various reasons including refining the lake's phosphorus TMDL, obtaining a better understanding of the baseflow and storm event pollutant loads entering Lake Hopatcong and developing a water quality database to assess the pollutant removal capacity of the structural BMPs that will be installed as part of the existing Non-Point Source (319(h)) grant. Additional stormwater samples were collected for the assessment of the pollutant removal capacity of structural BMPs that will be installed as part of a US EPA Targeted Watershed grant awarded to the Commission. However, results for this stormwater sampling will not be described in this monitoring report.

Baseline Tributary Monitoring Program

In 2006 the Lake Hopatcong Commission received approval from NJDEP through a Quality Assurance Protection Plan (QAPP) to be trained on the collection of baseline (non-storm event) water quality samples from tributaries that drain into Lake Hopatcong. Princeton Hydro trained the operations staff to collect baseline water samples from three selected tributary sampling locations:

1. Jaynes Brook, enters Henderson Cove, along the boarder of the Township of Jefferson and the Borough of Hopatcong.
2. Quarry Brook, enters a small cove just west of the Woodport Cove, within the Township of Jefferson.
3. Great Cove Brook, enters Great Cove within the Township of Jefferson.

Four baseline sampling events were conducted of these three tributary stations between September and November 2006. While no baseline tributary monitoring was conducted 2007, one event was conducted in 2008, on 24 April. These baseline samples were analyzed for TP, TDP, SRP and TSS.

Stormwater Monitoring Program

As part of the 319(h) grant awarded to the Lake Hopatcong Commission the operations staff was trained by Princeton Hydro to collect composite stormwater samples from locations that have been selected for the installation of specific structural BMPs. Again, a QAPP was developed, submitted to and approved by NJDEP so the resulting data will be accepted by the State.

A total of four stormwater sampling stations were established, each one located at a site where stormwater samples will be collected flowing into and out of an installed structural BMP during post-installation events. However, it should be noted that pre-installation stormwater sampling was conducted as well. The four stormwater sampling sites included:

1. Runoff that flows over and under the Hopatcong Beach Club's parking lot, which drains into Crescent Cove, Borough of Hopatcong.
2. Runoff from the Bell Avenue drainage area that flows over and under Lakeside Boulevard and into Crescent Cove, Borough of Hopatcong.
3. Runoff from a roadside swale along Dupont Avenue, which drains into the southern end of Crescent Cove, Borough of Hopatcong.
4. Runoff flow over and under Castle Rock Road, which then enters Lake Hopatcong in the Township of Jefferson.

A minimum of three pre-installation and three post-installation of the BMPs stormwater sampling events were to be conducted by the operations staff. As described in the 2007 Lake Hopatcong Water Quality Report, two pre-installation stormwater sampling events were conducted in 2006, while another two were collected in 2007 for a total of four pre-installation events. Since work associated with the installation of the stormwater BMPs within the Borough of Hopatcong did not commence until November of 2008, the post-installation stormwater monitoring will not be conducted until 2009. Thus, this water quality report does not include any additional information stormwater monitoring associated with the 319 grant. Details on the stormwater monitoring associated with the BMPs that will be implemented under the US EPA Targeted Watershed grant will be provided in a separate document.

Additional In-Lake Monitoring

In addition to stormwater sampling, the long-term in-lake water quality monitoring program was expanded to include near-shore, in-lake sampling stations at locations immediately adjacent to the drainage area that will receive the structural BMPs under the existing 319(h) grant. The three near-shore, in-lake sampling stations include:

1. The southern end of Crescent Cove in the Borough of Hopatcong.
2. Ingram Cove, located in the Borough of Hopatcong.
3. Along the eastern shoreline of the lake, in the Township of Jefferson, just south of Brady's Bridge.

It should be noted that originally one of the 319 structural BMPs was planned to be installed in the Ingram Cove drainage area. However, due to site specific limitations associated with existing utilities, it was decided to move the BMP to the Crescent Cove drainage area. However, monitoring of the Ingram Cove sampling station continued through 2008. From May through September 2008, five sampling events were conducted at each 319 in-lake sampling station. Monitoring included collecting *in-situ* data at 0.5 – 1.0 meters from surface to bottom for temperature, dissolved oxygen, pH and conductivity. Water clarity was also measured at each station with a Secchi disk. Discrete mid-depth water samples were collected and analyzed for TP and TSS.

3.0 RESULTS AND DISCUSSION

Thermal Stratification

Thermal stratification is a condition where the warmer surface waters (called the epilimnion) are separated from the cooler bottom waters (called the hypolimnion) through differences in density, and hence, temperature. Thermal stratification separates the bottom waters from the surface waters with a layer of water that displays a sharp decline in temperature with depth (called the metalimnion or thermocline). In turn, this separation of the water layers can have a substantial impact on the ecological processes of a lake (for details see below). Thermal stratification tends to be most pronounced in the deeper portions of a lake. Thus, for convenience, the discussion on thermal stratification in Lake Hopatcong focuses primarily on the deep, mid-lake (Station #2) sampling station.

In-situ measurements during the 2008-growing season were generally consistent with values recorded in previous years' monitoring programs. On 20 May 2008, Lake Hopatcong was already thermally stratified, demonstrating a very narrow thermocline at a depth between 9 and 11 meters. From surface to bottom (14.5 meters), the temperature decreased from 13.6°C at the surface to 8.0^{o}C at the bottom (Appendix B).

By 1 July 2008, thermal stratification strengthened and was well established at the mid-lake sampling station (Station #2). The epilimnion was located from the surface to 4 meters (13.2 ft). The metalimnion was located between 5 and 10 meters (16.5 and 33.0 ft), while the hypolimnion began at a depth greater than 11 meters. This structure of thermal stratification in Lake

Hopatcong persisted into late July as documented during the 31 July 2007 sampling event (Appendix B).

During the 18 August 2008 sampling event, the epilimnion was located from the surface to 5 meters, while the thermocline expanded to almost the bottom of the lake. For example, from 11 to 12 meters, the change in temperature was 12.6°C to 11.1°C (Appendix B). By 22 September 2008, the epilimnion expanded down to 8 meters, while the thermocline was limited to 6 to 10 meters.

Similar to conditions observed in 2007, the mid-lake sampling station (Station #2) was the only monitoring station that was stratified from May through September in 2008. The other moderately deep sampling stations (> 5 meters), Station #8 (Great Cove) and #9 (Byram Cove), were stratified during the two July sampling events but were well mixed in May, August and September. The remaining eight (8) sampling stations were well mixed through the entire sampling season. These well-mixed conditions were the result of relatively shallow water depths (< 3 meters) and exposure to winds.

It is interesting to note that the three near-shore 319 in-lake sampling stations, particularly the Crescent Cove and Jefferson sampling stations, were periodically weakly stratified, in spite of being generally less than 3 meters in total depth.

Thermal stratification can effectively "seal off" the bottom waters from the surface waters and overlying atmosphere, which can result in a depletion of dissolved oxygen (DO) in the bottom waters. With the exception of a few groups of bacteria, all aquatic organisms require measurable amounts of DO (> 1 mg/L) to exist. Thus, once the bottom waters of a lake are depleted of DO, a condition termed anoxia, that portion of the lake is no longer available as viable habitat.

Dissolved Oxygen

Atmospheric oxygen enters water by diffusion from the atmosphere, facilitated by wind and wave action and as a by-product of photosynthesis. Adequate dissolved oxygen (DO) is necessary for acceptable water quality. Oxygen is a necessary element for most forms of life. As dissolved oxygen concentrations fall below 5.0 mg/L, aquatic life is put under stress. DO levels that remain below 1.0 – 2.0 mg/L for a few hours can result in large fish kills and loss of other aquatic life. Although some aquatic organisms require a minimum of 1.0 mg/L of DO to survive, the NJDEP State criteria for DO concentrations in surface waters is 5.0 mg/L or greater, for a healthy and diverse aquatic ecosystem.

In addition to a temporary loss of bottom habitat, anoxic conditions (DO < 1 mg/L) can produce chemical reactions that result in a release of phosphorus from the sediments and into the overlying waters. In turn, a storm event can transport this phosphorus to the upper waters and stimulate additional algal growth. This process is called internal loading. Given the temporary loss of bottom water habitat and the increase in the internal phosphorus load, anoxic conditions are generally considered undesirable in a lake.

During the 20 May 2008 sampling event, DO concentrations were above the 5.0 mg/L threshold throughout most of Lake Hopatcong. Only the deepest water (> 12 meters) of Station #2 (mid-Lake) had depressed concentrations of DO (< 5.0 mg/L).

The surface waters of Lake Hopatcong were also generally well oxygenated (> 5.0 mg/L) during the 1 July 2008 sampling event. Anoxic conditions (DO concentrations < 1 mg/L) were identified at depths greater than 7 meters. During the 31 July 2008 sampling event, Lake Hopatcong was well oxygenated from the surface to a depth of about 9 meters.

During the 18 August 2008 sampling event, anoxic conditions were found at depths greater than 8 meters. The exception to this was Station #8, where anoxic conditions were observed immediately over the sediments at a depth of 4 meters (Appendix B). By 22 September 2008 anoxic conditions were limited to deepest section of the lake, at depths great than 12 meters.

The three, 319 near-shore sampling stations were well oxygenated from surface to bottom during all five 2008 sampling events. DO concentrations did not fall below 7 mg/L with one exception; anoxic conditions were detected immediately over the sediments at the Jefferson sampling station during the 1 July 2008 sampling event.

pH

The optimal range of pH for most freshwater organisms is between 6.0 and 9.0. For the most part, the pH throughout the water column of Lake Hopatcong was within this optimal range. The exception to this was during the 31 July 2008 sampling event when the pH values at Station #1 (Woodport Bay), Station #3 (River Styx / Crescent Cove), and Station #10 (Northern Woodport Bay) exceeded 9 in the surface waters. Such temporarily elevated pH values in the surface waters can be attributed to high rates of algal and/or aquatic plant photosynthesis. As algae and plants photosynthesize, they produce DO as a by-product, as well as increase the pH of their immediate environment. In spite of these temporarily elevated pH values, the pH of Lake Hopatcong through most of the 2008 growing season was within the optimal range for most aquatic organisms. Similar results were observed in 2007.

The pH values at the Crescent Cove and Jefferson 319 in-lake sampling stations were within the optimal range for most aquatic life during all five 2008 sampling events. In contrast, the pH at the Ingram Cove sampling station exceeded 9 during four of the five sampling events; the May event was the only time the pH was less than 9 at Ingram Cove. It should also be noted that the pH of the bottom waters at Ingram Cove were actually slightly higher relative to the surface waters. Typically, the surface water pH is higher than deeper waters due to algal photosynthesis. However, at Ingram Cove, the submerged rooted aquatic plants and associated filamentous mat algae growing along the bottom created an inverse condition, where the bottom water pH was slightly higher than the surface water pH.

Water Clarity (as measured with a Secchi disk)

Water clarity or transparency, as measured with a Secchi disk, was generally acceptable at all of the sampling stations during the 2008 sampling season. Based on Princeton Hydro’s in-house long-term database of lakes in northern New Jersey, water clarity is considered acceptable for recreational activities when the Secchi depth is equal to or greater than 1.0 m (3.3 ft). Secchi depth measurements throughout most of Lake Hopatcong were greater than 1.0 meter in 2008. For example, at the mid-lake sampling station (Station #2), the Secchi depth varied from 1.9 to 2.5 meters (6.2 to 8.25 ft) through the course of the 2008 sampling season.

There were a few exceptions to the 1 meter threshold at Lake Hopatcong in 2008. For example, with the exception of the May 2008 sampling event, the Secchi depth at Station #3 (Crescent Cove / River Styx) was consistently less than 1 meter. Such low water clarity conditions in this section of the lake are typical and are the result of a combination of algal blooms and high concentrations of suspended sediments. In addition to Station #3, the Secchi depth at Stations #1 and #10 (both located in the northern end of the lake, near Woodport Bay) during the 31 July and 18 August sampling events were less than 1 meters. As will be described below, some substantial algal blooms were experienced in the northern end of the lake from late July into August, which contributed toward the lower water clarity values at Stations #1 and #10.

With the exception of the May 2008 sampling event, the 319 near-shore Crescent Cove station’s Secchi depth was consistently below the 1.0 meter threshold during the 2008 sampling season. This section of the lake was selected for the installation of the majority of the 319 grant structural BMPs due to its low water quality. The first of these basins, an Aqua-Filter[R] should be installed in the Crescent Cove Beach Club parking lot and operating by the end of 2008. In contrast to Crescent Cove, the Secchi depth at the near-shore Jefferson and Ingram sampling stations were consistently greater than 1.0 meters.

Ammonia-Nitrogen (NH_4-N)

Surface water NH_4-N concentrations above 0.05 mg/L tend to stimulate elevated rates of algal growth. During the May and September 2008 sampling events surface water NH_4-N concentrations varied between 0.02 and 0.08 mg/L and 0.03 and 0.06 mg/L. In contrast, surface water NH_4-N concentrations during the two July and August 2008 sampling events generally varied between < 0.01 and 0.02 mg/L. Based on these data, spring and fall storms transport NH_4-N to the surface waters of the lake, while NH_4-N concentrations were generally low during the summer due to the algal assimilation of this nutrient. In addition, it should be noted that as has been identified in past reports, some elevated NH_4-N concentrations were identified in the Canal area of the lake (Station #11), with a measured concentration as high as 0.12 mg/L.

Bottom water NH_4-N concentrations are monitored seasonally at the mid-lake sampling site (Station #2). Bottom water NH_4-N concentrations varied between 0.01 and 0.54 mg/L through the 2008 growing season (Appendix C). Bottom water NH_4-N concentrations are typically elevated during the summer season, as a result of a depletion of dissolved oxygen. Under such conditions, bacterial decomposition of organic matter results in an accumulation of NH_4-N. The severe limitation of light in the bottom waters exacerbates these conditions through the negligible uptake of NH_4-N by algae. Thus, this seasonal accumulation of NH_4-N is common occurrence in Lake Hopatcong.

Nitrate-Nitrogen (NO_3-N)

Surface water NO_3-N concentrations throughout the 2008 sampling season of Lake Hopatcong varied between <0.02 mg/L and 0.11 mg/L. While there was a considerable amount of variation both among the sampling stations and between sampling events, the NO_3-N concentrations measured in July and August were generally lower relative to measurements made in May and September. Again, elevated rates of algal growth and associated nutrient demand resulted in a reduction in NO_3-N concentrations in the surface waters.

It should be noted as has been identified in past reports, NO_3-N concentrations in the Canal section of the lake (Stations #7 and #11) were generally higher than the rest of the lake. As has been identified, this is primarily due to the high concentration of nearshore, on-site wastewater treatment systems (septic systems) in the Township of Jefferson. Elevated NO_3-N concentrations have been measured at Station #11 during previous monitoring events and these historically high concentrations have been attributed to the horizontal movement of leachate from near-shore septic system leachfields.

Total Phosphorous (TP)

Phosphorus has been identified as the primary limiting nutrient for algae and aquatic plants in Lake Hopatcong. Essentially, a small increase in the phosphorus load will result in a substantial increase in algal and aquatic plant growth. For example, one pound of phosphorus can generate as much as 1,100 lbs of wet algae biomass. This fact emphasizes the continued need to reduce the annual phosphorus load entering Lake Hopatcong, as detailed in the lake's revised TMDL and associated Restoration Plan.

Studies have shown that TP concentrations as low as 0.03 mg/L can stimulate high rates of algal growth resulting in eutrophic or highly productive conditions. Based on Princeton Hydro's in-house database on northern New Jersey lakes, TP concentrations equal to or greater than 0.06 mg/L will typically result in the development of algal blooms / mats that are perceived as a nuisance by the layperson.

The State's Surface Water Quality Standard (SWQS, N.J.A.C. 7:9B – 1.14(c) 5) for TP in the surface waters of a freshwater lake or impoundment is 0.05 mg/L. This established TP concentration is for any freshwater lake or impoundment in New Jersey that does not have an established TMDL. Lake Hopatcong has established a phosphorus TMDL, which was revised and approved by NJDEP in June 2006. Based on its refined phosphorus TMDL, the long-term management goal is to maintain an <u>average</u>, growing season TP concentration of 0.03 mg/L within the surface waters of Lake Hopatcong.

During the 20 May 2008 sampling event, TP concentrations throughout the lake generally varied between 0.02 mg/L and 0.05 mg/L.

During the 23 June 2008 sampling event, TP concentrations throughout Lake Hopatcong varied between 0.01 mg/L and 0.04 mg/L, while during the 31 July 2008 event TP concentrations varied between 0.02 and 0.05 mg/L.

During the 19 August 2008 sampling event, TP concentrations in the surface waters were somewhat lower relative to earlier sampling events, generally varying between <0.01 mg/L and 0.14 mg/L. Finally, during the 22 September 2008 sampling event, surface water TP concentrations again varied between 0.01 mg/L and 0.04 mg/L.

As has been well documented in past reports, Station #3 (River Styx / Crescent Cove) consistently had the highest TP concentrations in Lake Hopatcong. Since the long-term monitoring of Lake Hoaptcong was initiated in the 1980's, elevated TP concentrations In the River Styx / Crescent Cove section of the lake is a re-occurring condition. The elevated TP concentrations at this station are most likely the result of the land use activities within the surrounding sub-watersheds, as well as the minimal amount of seasonal hydrologic flushing. Combined, these factors provide the opportunity for algae and aquatic plants to assimilate available phosphorus and produce the nuisance in-lake conditions typically observed in these portions of the lake.

It should be noted that during the 31 July 2008 sampling event, elevated TP concentrations were measured at Station #1 and #10; 0.05 and 0.04 mg/L, respectively. As will be described below, an large algal bloom was experienced in the northern end of the lake, which was probably triggered by an increase in available nutrients such as phosphorus and nitrogen.

Bottom water TP concentrations at the mid-lake sampling station (Station #2) were minimal during the first half of the growing season, consistently at 0.04 mg/L or less. By 31 July the bottom water TP concentration was 0.15 mg/L, decreased to 0.01 mg/L by 19 August and increased to 0.23 mg/L by 22 September 2008 (Appendix C). The elevated TP concentrations in the deep waters in July and September were attributed to the establishment of anoxic conditions (DO < 1 mg/L) during the mid to late summer months.

TP concentrations were generally low at the two of the three 319 in-lake sampling stations. At the Jefferson and Ingram Cove sampling stations, TP concentrations varied between < 0.01 to 0.03 mg/L. In contrast, TP concentrations at the Crescent Cove sampling station varied from 0.04 to 0.08 mg/L during the 2008 monitoring season. Three of the five Crescent Cove TP measurements were out of compliance with the State's Surface Water Quality Standard of 0.05 mg/L. In addition, the mean TP value for Crescent Cove of 0.06 mg/L was also out of compliance with the targeted TP concentration under the lake's TMDL.

Chlorophyll a

Chlorophyll *a* is a pigment possessed by all algal groups, used in the process of photosynthesis. Its measurement is an excellent means of quantifying algal biomass. In general, an algal bloom is typically perceived as a problem by the layperson when chlorophyll *a* concentrations are equal to or greater than 30.0 mg/m^3. Based on the findings of the refined TMDL, the <u>existing</u> average seasonal chlorophyll *a* concentration under existing conditions is 15 mg/m^3, while the maximum seasonal value is 26 mg/m^3. In contrast, the <u>targeted</u> average and maximum chlorophyll *a* concentrations, once Lake Hopatcong is in complete compliance with the TMDL, are predicted to be 8 and 14 mg/m^3, respectively.

Four of the five monthly mean chlorophyll *a* concentrations were less than the existing predicted mean of 15 mg/m^3, while all five were greater than targeted mean of 8 mg/m^3. Thus, based on the 2008 data, the overall water quality of the lake was slightly better than long-term conditions but did not comply with the TMDL's targeted chlorophyll *a* endpoint.

As has been consistently observed over the years, Station #3 had the highest or one of the highest chlorophyll a concentrations during each of the five sampling events. In addition, concentrations at Station #3 also exceed the existing and targeted maximum (bloom) chlorophyll *a* thresholds during each 2008 sampling event. The sustained elevated chlorophyll *a* concentrations and lower overall water quality conditions in the River Styx / Crescent Cove part of the lake is one of the reasons why this section of the watershed has been prioritized in terms of the implementation of stormwater projects.

As has been cited a number of times earlier in this report, an algal bloom was documented on 31 July 2008 in the northern end of Lake Hopatcong. During this sampling event the chlorophyll *a* concentration at Stations #1 and #10, 56 and 63 mg/m^3, respectively, were actually higher than the concentration measured at Station #3 of 48 mg/m^3. In addition, the 31 July 2008 chlorophyll *a* concentrations at Stations #1 and #10 were substantially higher than those measured at a similar time in 2007, where concentrations were 14 and 12 mg/m^3, respectively. Thus, these data, as well as the large nuisance surface scums that were observed along the shoreline of the Lake Forest Yacht Club in Woodport at the same time, indicate that conditions were favorable for high algal growth rates. However, from a long-term management perspective, the key question is will this be a re-occurring problem from year to year or is it an isolated incident due to some large discharge of nutrients entering the lake. Future monitoring and additional stormwater / septic work in that section of the watershed will be required to ensure similar blooms do not have in subsequent years.

Phytoplankton

Phytoplankton are algae that are freely floating in the open waters of a lake or pond. These algae are vital to supporting a healthy ecosystem, since they are the base of the aquatic food web. However, high densities of phytoplankton can produce nuisance conditions. The majority of nuisance algal blooms in freshwater ecosystems is the result of cyanobacteria, also known as blue-green algae. Some of the more common water quality problems created by blue-green algae include bright green surface scums, taste and odor problems and the generation of cyanotoxins.

Table 1 lists the dominant phytoplankton identified in Lake Hopatcong during each water quality monitoring event in 2008. A bloom of chrysophyte *Dinobryon* was identified on the 24 May 2007 sampling date. This algal group tends to bloom in the spring and can give the water a brown, turbid appearance. Two diatoms (*Melosira* and *Fragilaria*), the green alga *Rhizoclonium* and the cyanobacteria *Oscillatoria* were also identified in the May 2007 sample (Table 1).

No dominant alga was observed during the mid-June 2007 sampling event. A diverse mix of algae was observed during this event, where several green algae (*Staurastrum*, *Bulbochaete*, etc.) and diatoms (*Asterionella*) were observed. Additionally, the chrysophyte *Dinobryon* was once again observed along with the dinoflagellate *Peridinium* and the Euglenoid *Trachelomonas*. The major difference observed between the May and June 2007 sampling events was the appearance of several genera of blue-green algae. These identified blue-green algae included *Coelosphaerium*, *Oscillatoria*, *Anabaena* and *Microcystis*; all four genera are well documented to produce nuisance blooms.

By 24 July 2007 the blue-green alga *Anabaena* and the chrysophyte *Dinobryon* were the dominant algae in Lake Hopatcong. Several other blue-green algae, *Microcystis*, *Coelosphaerium*, *Aphanocapsa* and *Oscillatoria*, were also identified in the lake at this time. A variety of green algae, several diatoms and two genera of dinoflagellates were also identified as well as two genera of chrysophytes.

Total algal densities were relatively high in Lake Hopatcong during the 23 August 2007 sampling event. The dominant alga at this time was the diatom *Tabellaria,* which was observed at bloom like densities. Two other genera of diatoms were also observed at relatively high levels of abundance, *Fragilaria* and *Melosira*, in Lake Hopatcong at this time. Three genera of blue-green algae were also common during this sampling event and included; *Anabaena*, *Pseudoanabaena* and *Microcystis*. Several genera of green algae, the dinoflagellate *Ceratium* and the chrysophyte *Dinobryon* were also identified in the lake.

By 27 September 2007 the dominant algal group shifted from the diatoms to blue-green algae. Specially, the blue-green alga *Anabaena* was the dominant genus in Lake Hopatcong at this time. However, several other blue-green algae were also observed including; *Coelosphaerium*, *Microcystis*, *Lyngbya* and *Pseudoanabaena*. A variety of diatoms and green algae were also identified in the late September 2007 sample as well as the chrysophyte *Dinobryon* (Table 1).

Zooplankton

Zooplankton are the micro-animals that live in the open waters of a lake or pond. Some large-bodied zooplankton are a source of food for forage and/or young gamefish. In addition, many of these large-bodied zooplankton are also herbivorous (i.e. algae eating) and can function as a natural means of controlling excessive algal biomass. Given the important role zooplankton serve in the aquatic food web of lakes and ponds, samples for these organisms were collected at Station #2 during each monitoring event. The results of these samples are provided in Table 2.

Similar to past monitoring years, the zooplankton community of Lake Hopatcong was dominated by small-bodied cladocerans such as *Bosmina*, several genera of rotifers and/or predaceous copepods such as *Cyclops* through the course of the 2007 monitoring season. These types of zooplankton tend to feed on bacteria, detritus and in some cases other zooplankton. None of the dominant zooplankton were large bodied herbivores; that is, algae is not their primary source of food.

While herbivorous zooplankton were not common in Lake Hopatcong, two herbivorous genera were identified through the 2007 sampling season, which included the cladocerans *Diaphanosoma* and *Ceriodaphnia* (Table 2). Of these zooplankton, *Diaphanosoma* is the most efficient herbivore; this is primarily due to its potential to attain a larger length than *Ceriodaphnia*. The generally low densities of herbivorous zooplankton in Lake Hopatcong observed in 2007 is similar to conditions measured in 2006 as well as during past monitoring years. The relatively low densities of herbivorous zooplankton may indicate that resident zooplankton-eating fishes (i.e. minnows, alewives, young yellow perch, white perch) were heavily grazing on large-bodied zooplankton in 2007.

Table 1
Phytoplankton in Lake Hopatcong during the 2008 Growing Season

Sampling Date	Phytoplankton
20 May 2008	The dominant algae were the diatom *Fragilaria* and the blue-green alga *Coelosphaerium*. A few green algae were also identified.
23 June 2008	Large diversity of algae was identified; total abundance was high. No one genus dominated the community however, a variety of green algae, diatoms, blue-green algae were observed. The blue-green genera included *Coelosphaerium*, *Oscillatoria*, *Anabaena* and *Microcysti*s.
31 July 2008	The dominant algae were the blue-green algae *Anabaena* and *Lyngbya*. Other blue-green were identified and included *Coelosphaerium* and *Oscillatoria.* Other common algae included the chrysophyte *Dinobryon*, the diatom *Melosira* and the green alga *Staurastrum*.
18 August 2008	The dominant alga was the blue-green alga *Lyngbya*; other common genera identified and included *Anabaena* and *Microcysti*s. The diatom *Tabellaria* was also fairly abundant. Several green algae (*Oocystis*, S*phaeriocystis*) the dinoflagellate *Peridinium* were also identified.
22 September 2008	The dominant alga was the blue-green alga *Anabaena*, with *Lyngbya* being fairly abundant. A number of green algae were identified however *Staurastrum* was the only common genus. Another common alga was the diatom *Tabellaria*.

Table 2
Zooplankton in Lake Hopatcong
during the 2008 Growing Season

Sampling Date	Zooplankton
20 May 2008	The dominant zooplankton were the small-bodied cladoceran *Bosmina* and the rotifer *Asplanchna*. The predatory copepod (*Cyclops*) and juveniles (known as nauplii) were also found in the sample. In addition, other rotifers (*Keratella*, *Conochilus*) were identified as well as the cladoceran *Chydorus*.
23 June 2008	The small-bodied cladoceran *Bosmina* was the dominant zooplankter. Several rotifers (*Trichocera*, *Kellicottia*, *Polyarthra*, *etc.*) and an herbivorous zooplankton (the cladocerans C*eriodaphnia*) were also identified in the sample. In addition, the predaceous copepod *Cyclops* was observed as well as juvenile nauplii.
31 July 2008	Zooplankton abundance was low at this time with no one genus being the dominant zooplankter. Several rotifers were observed including *Conochilus* and *Asplanchna*. The herbivorous cladoceran *Ceriodaphnia* was observed as was *Cyclops* and juvenile nauplii.
18 August 2008	Zooplankton abundance was relatively high at this time where the cladoceran *Bosmina* was the dominant zooplankter. Two herbivorous cladocerans (*Ceriodaphnia*, *Diaphanosoma*) were also observed, where *Ceriodaphnia* was relatively common. The rotifers *Asplanchna*, and *Polyarthra* were also observed as were *Cyclops* and nauplii.
22 September 2008	Zooplankton abundance was relatively low with no one genus being the dominant zooplankter. The copepod *Cyclops* was observed as well as juvenile nauplii. The two cladocerans *Ceriodaphnia* (herbivore) and *Bosmina* were identified in the sample. The rest of the identified zooplankton were rotifers (*Keratella* and *Asplanchna*).

Recreational Fishery and Potential Brown Trout Habitat

Of the recreational gamefish that reside or are stocked in Lake Hopatcong, trout are the most sensitive in terms of water quality. For their sustained management, all species of trout require DO concentrations of at least 4 mg/L or greater. However, the State's designated water quality criterion to sustain a healthy, aquatic ecosystem is a DO concentration of at least 5 mg/L.

While all trout are designated as coldwater fish, trout species display varying levels of thermal tolerance. Brown trout (*Salmo trutta*) have an <u>optimal</u> summer water temperature range of 18 to 24^{o}C (65 to 75^{o}F) (USEPA, 1994). However, these fish can survive in waters as warm as 26^{o}C (79^{o}F) (Scott and Crossman, 1973), defined here as acceptable habitat. The 2008 temperature and DO data for Lake Hopatcong were examined to identify the presence of optimal and acceptable brown trout habitat. As with previous monitoring reports, this analysis focused solely on *in-situ* data collected at the mid-lake sampling station (Station #2).

For the sake of this analysis, sections of the lake that had DO concentrations equal to or greater than 5 mg/L and water temperatures less than 24^{o}C were considered optimal habitat for brown trout. In contrast, sections of the lake that had DO concentrations equal to or greater than 5 mg/L and water temperatures between 24 and 26^{o}C were considered carry over habitat for brown trout.

Io 20 May 2008 optimal brown trout habitat was identified from the surface to a depth of 13 meters (42.6 feet) in Lake Hopatcong (Appendix B). By 1 July 2008, the optimal brown trout habitat was found between 4 and 5 meters (13.2 and 16.5 feet), while carry over brown trout habitat was found from the surface to 4 meters.

By 31 July 2008, optimal brown trout habitat was found between 5.5 and 6.0 (18 and 20 feet), while carry over brown trout habitat was found between 1.0 and 5.5 meters (Appendix B). A similar distribution of brown trout habitat was found during the 18 August 2008 sampling event. The optimal habitat was found between 5 and 6 meters (16.5 and 20 feet), while carry over habitat was found from the surface to 4 meters. Finally, by 22 September 2008 the lake had optimal brown trout habitat from the surface down to 8 meters. Similar to past monitoring years, the *in-situ* data revealed that varying levels of acceptable brown trout habitat persisted through the entire 2008 growing season in Lake Hopatcong.

Mechanical Weed Harvesting Program

Many of the more shallow sections of Lake Hopatcong are susceptible to the proliferation of nuisance densities of rooted aquatic plants. Given the size of Lake Hopatcong, the composition of its aquatic plant community, and its heavy and diverse recreational use, mechanical weed harvesting is the most cost effective and ecologically sound method of controlling nuisance weed densities. Thus, the weed harvesting program has been in operation at Lake Hopatcong since the mid-1980's with varying levels of success. However, one consistent advantage mechanical weed harvesting has over other management techniques, such as the application of herbicides, is that phosphorus is removed from the lake along with the weed biomass. In fact, based on a plant biomass study conducted at Lake Hopatcong in 2006 and the plant harvesting records of 2006 and 2007, approximately 6-8% of the total phosphorus load targeted for reduction under the established TMDL is removed through the mechanical weed harvesting program.

During the 2008 growing season the Lake Hopatcong Commission's Operation Staff removed a total of 1,137 tons of aquatic vegetation from Lake Hopatcong. This roughly equates to 2.3 million pounds of wet plant biomass removed from the lake. This represents a 29% decline in the total amount of plants harvested relative to what was harvested in 2008. This decline in the amount of plants harvested was due primarily to a reduction in the amount of available plant biomass that could be harvested. It should be noted that in many other waterbodies throughout New Jersey, Pennsylvania and New York, aquatic plant biomass in 2008 appeared to be lower relative to previously years. Thus, the relatively lower abundance of aquatic plants through the 2008 growing season in Lake Hopatcong was at least partially attributed to regional climatic conditions.

Using the results of the 2006 plant biomass / phosphorus study, it was estimated that the 2008 mechanical weed harvesting program removed 406 lbs (184 kg) of total phosphorus from the lake. This accounted for approximately 5.6% of the amount of phosphorus targeted for removal under the lake's established TMDL. If this removed phosphorus was utilized by filamentous and planktonic algae, it would have the potential to generate approximately 446,000 lbs of wet algae biomass.

The long-term, 2006-2008 mean annual amount of plant biomass removed from Lake Hopatcong is 1,343 tones, which equates to approximately 479 lbs (217 kg) of total phosphorus removed from the lake. Thus, the mechanical harvesting program of Lake Hopatcong contributes toward improving the water quality of the lake, as well as removing nuisance densities of submerged vegetation.

Inter-annual Analysis of Water Quality Data

Annual mean values of Secchi depth, chlorophyll *a* and total phosphorus concentrations were calculated for the years 1991 through 2008. The annual mean values for Station #2 were graphed, along with the long-term, "running mean" for the lake.

While the 2008 mean Secchi depth was slightly lower than the 2007 mean, it was the second highest value measured over the last five years (Figure 2). In addition, it was slightly higher than the long-term running mean. Since 2006 the mean Secchi depth has been at least twice the value of the 1.0 m threshold for recreational waterbodies. The lowest mean Secchi depth value at Lake Hopatcong was 1.6 meters, measured in both 1994 and 1997.

One of the major factors responsible for the observed water clarity of a lake is the amount of algal biomass in the water; the lower the abundance of algae, the higher the water clarity. An effective way of quantifying algae biomass is to measure the amount of chlorophyll *a* in the water. Chlorophyll *a* is a photosynthetic pigment all algae possess, so measuring chlorophyll *a* provides a measurement of the amount of algae biomass in the open waters of a lake.

The 2008 mean chlorophyll *a* concentration at Station #2 was slightly lower than the 2007 mean value and was the lowest value since 2003 (Figure 3). The 2007 and 2008 mean chlorophyll *a* concentrations were slightly lower than the long-term running mean. In contrast, the highest mean chlorophyll *a* concentrations were measured in 1997, 1994 and 2004 (Figure 3).

For most waterbodies in the northeastern portion of the United States, phosphorus is the primary nutrient limiting algal growth. This means that higher amounts of phosphorus entering a lake or pond, typically translates into more algae being produced. Past studies have demonstrated that phosphorus is the primary limiting nutrient for algae in Lake Hopatcong. Thus, more phosphorus results in more algal and aquatic plant growth, resulting in more nuisance conditions and declines in water quality. The ecological and water quality impacts associated with elevated phosphorus loading is the primary reason the TMDL and associated Restoration Plan focuses on total phosphorus in Lake Hopatcong.

The 2008 mean TP concentration at Station #2 was substantially lower than the mean values measured from 2003 to 2007 and was similar to mean TP values measured in 2001 and 2002 (Figure 4). Additionally, the 2008 mean TP concentration was substantially lower than the long-term running mea for TP.

Baseline and Stormwater Monitoring Program

The results of the 24 April 2008 baseline sampling event were similar to those experienced in 2007. Specifically, all phosphorus concentrations were relatively low; TP concentrations at all three stations were 0.02 mg/L, while TDP and SRP concentrations were below 0.01 mg/L. TSS concentrations were less than or equal to 3 mg/L. These results further emphasize the point that the majority of the phosphorus entering Lake Hopatcong originate from stormwater and/or septic leachate.

As previously stated, details on the stormwater monitoring programs will be provided in NJDEP 319 and US EPA Targeted Watershed grants. These stormwater monitoring programs focus on quantifying the relative pollutant removal capacity of the BMPs that are and will be implemented within the Lake Hopatcong watershed.

Water Quality Impairments and Established TMDL Criteria

As identified in N.J.A.C. 7:9B-1.5(g)2 "Except as due to natural condition, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation or otherwise render the waters unsuitable for the designated uses." For Lake Hopatcong, these objectionable conditions specifically include both algal blooms and nuisance densities of aquatic vegetation.

Given the undesirable water quality conditions experienced in select portions of Lake Hopatcong, NJDEP conducted a Total Maximum Daily Load (TMDL) analysis for total phosphorus, the primary nutrient limiting algal and plant growth in the lake. This TMDL was revised by Princeton Hydro, who also developed a Restoration Plan for the lake and watershed. The revised TMDL and associated Restoration Plan were approved by NJDEP in 2006 and have been used to obtain grant funding through both NJDEP and US EPA to implement various watershed-based projects to reduce the existing phosphorus loads. Since many of these projects will be completed in 2009, the 2008 water quality data will review the existing water quality of Lake Hoaptcong and compare them to the criteria established through the TMDL.

As described in detail in the TMDL Restoration Plan, a targeted mean TP concentration, as well as mean and maximum chlorophyll *a* ecological endpoints, was established to identify compliance with the TMDL. These criteria are located immediately below Table 3 and of the three criteria that one that is critical in the long-term evaluation of progress made toward compliance with the TMDL, is the mean TP concentration. The chlorophyll *a* ecological endpoints provide the guidance and framework needed to translate the TP concentration into a layperson's perspective on how the lake is responding to the Restoration Plan (i.e. algal blooms).

It should be noted that in addition to the TMDL criteria listed below Table 3, each municipality within the watershed has an existing and targeted annual phosphorus load as per the TMDL. Thus, each municipality is responsible for contributing on a proportional basis toward attaining the overall targeted TP load for the Lake Hopatcong watershed. However, the water quality criteria below Table 3 serve as short-term, year-specific indicators on the progress made toward attaining the overall targeted TP load for the TMDL.

For the sake of this analysis, some select 2008 water quality data were compared to the TMDL established criteria for Lake Hopatcong. This included data collected from Stations #1, #2, #3, #10, #11 and the Crescent Cove sampling stations and are summarized in Table 3. While the mean TP concentration at Stations #1 and #2 were at or below the 0.03 mg/L criteria, the remaining sampling stations were all above this criteria. In addition, the 319 Crescent Cove sampling stations was also above the State's Surface Water Quality Standard of 0.05 mg/L (Table 3).

The targeted mean chlorophyll *a* endpoint for Lake Hoaptcong is 8 mg/m^3. The mean chlorophyll *a* for Station #11 was below this criteria value, while the mean for Station #2 was slightly above the criteria. In contrast, the mean chlorophyll *a* for Stations #1, #3 and #10, were all greater than 20 mg/m^3, being more than twice the targeted criteria value. A similar pattern was observed for the targeted maximum chlorophyll *a* endpoint.

It should be noted that the six in-lake sampling stations not listed on Table 3 (#4, #5, #6, #7, 319 Ingram Cove and 319 Jefferson, were all in compliance with the TMDL, each having a mean 2008 TP concentration less than or equal to 0.03 mg/L. Again, these data continue to aid in the prioritization and selection of locations for stormwater implementation projects, as described in the Lake Hopatcong Restoration Plan.

Table 3
Summary of 2008 water quality data for select sampling stations at Lake Hopatcong

Station	**Mean TP**	**Mean chl. *a***	**Maximum chl. *a***
Station #1 (Woodport Bay)	0.03	**22.3**	**56.2**
Station #2 (Mid-Lake)	0.015	**9.3**	12.3
Station #3 (River Styx)	**0.04**	**27.8**	**47.7**
Station #10 (Northern Woodport Bay)	**0.04**	**25.1**	**63.0**
Station #11 (Jefferson Canals)	**0.05**	7.4	9.6
Crescent Cove	**0.06***	Not sampled	Not sampled

Please note, any parameter in red indicates the value is above (in violation) the threshold identified under the targeted conditions as described in the TMDL. The * for the mean TP concentration for Crescent Cove indicates that the value is also above the State's established Surface Water Quality Standard for TP, which is 0.05 mg/L (N.J.A.C. 7:9B – 1.14 (c)5.)

TMDL Criteria for Lake Hopatcong

Targeted mean TP concentration	0.03 mg/L
Targeted mean chlorophyll *a* concentration endpoint	8 mg/m^3
Targeted maximum chlorophyll *a* concentration endpoint	14 mg/m^3

4.0 SUMMARY

This report documents the findings of the 2008 Lake Hopatcong water quality monitoring program. This section provides a summary of the 2008 water quality conditions, as well as recommendations on how to preserve the highly valued aquatic resources of Lake Hopatcong.

1. Based on the 2008 water quality database, and similar to past monitoring years, the water quality conditions of Lake Hopatcong were generally consistent with those of a meso- to slightly eutrophic ecosystem.

2. Overall, the surface waters (to approximately 5 meters) of Lake Hopatcong remained well oxygenated (dissolved oxygen concentrations > 4 mg/L) throughout the monitoring season. An anoxic zone (waters with DO concentrations less than 1 mg/L) developed along the lake's bottom by late June / early July. This is in contrast to some of the previous monitoring years, when anoxic is typically first detected in May. By early July, this layer of anoxic water had reached a depth of 9 meters from the surface.

3. It has been well documented that phosphorus is the primary limiting nutrient in Lake Hopatcong. That is, a slight increase in phosphorus will result in a substantial increase amount of algal and/or aquatic plant biomass. TP concentrations in the surface waters of Lake Hopatcong typically varied between <0.01 mg/L and 0.08 mg/L, consisting of concentrations both above and below the 0.06 mg/L bloom threshold. Station #3 (River Styx/Crescent Cove) and the 319 Crescent Cove station displayed the highest TP concentrations.

4. While the chlorophyll *a* concentrations were not excessive at the mid-lake sampling station, other sections of the lake experienced nuisance algal blooms. As is typical each year, Station #3 (Crescent Cove / River Styx) experienced nuisance algal blooms through the summer months. The northern end of the lake, Stations #1 and #10, also experienced nuisance algal blooms during the summer months. Blooms of the magnitdue measured in Stations #1 and #10 were unusual for the northern end of the lake. Thus, monitoring in 2009 should continue in order to determine if these northern lake blooms were an isolated incident or if they are a re-occurring problem that will need to be addressed.

5. Based on the *in-situ* conditions, carry over brown trout habitat was available throughout the entire 2008 growing season. Such results are consistent with those measured in previous monitoring years at Lake Hopatcong.

6. The 2008 Secchi depth mean at the mid-lake sampling station slightly lower than the 2007 value but was still considered acceptable since it was greater than 2.0 meters.

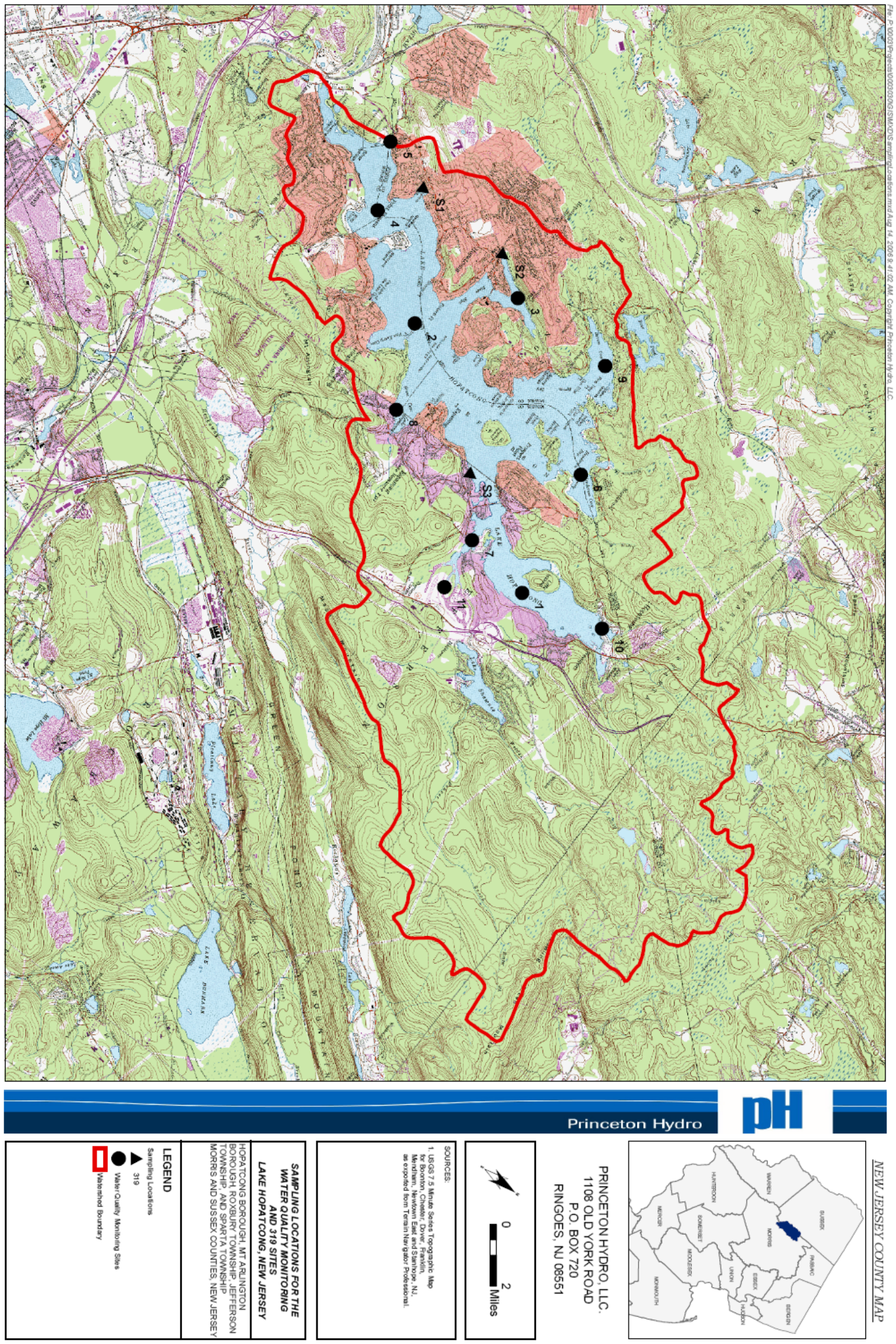
7. The mean TP concentrations were above the TMDL criteria for four of the in-lake stations and one of the 319 in-lake stations.

8. Approximately 1,137 tons of aquatic plant biomass was removed in 2008, an approximately 29% decrease relative to the amount of plant biomass removed in 2007. The mechanical weed-harvesting program increases the recreational and ecological value of Lake Hopatcong, as well as removes a phosphorus source from the lake. Thus, this in-lake management technique should continue to be used at Lake Hopatcong.

9. The 2006 aquatic plant-biomass TP study revealed that the plants appear to have more phosphorus per unit weight early in the growing season relative to later. In addition, based on the 2006-2008 aquatic plant database, approximately 7% of the TP load targeted for removal under the TMDL was removed through the mechanical weed harvesting program per year.

APPENDIX A

FIGURES


NEW JERSEY COUNTY MAP
PRINCETON HYDRO, LLC.
1108 OLD YORK ROAD
P.O. BOX 720
RINGOES, NJ 08551
Princeton Hydro
0
2
Miles
SAMPLING LOCATIONS FOR THE WATER QUALITY MONITORING AND 319 SITES
LAKE HOPATCONG, NEW JERSEY
HOPATCONG BOROUGH, MT ARLINGTON BOROUGH, ROXBURY TOWNSHIP, JEFFERSON TOWNSHIP AND SPARTA TOWNSHIP
MORRIS AND SUSSEX COUNTIES, NEW JERSEY
LEGEND
Sampling Locations
319
Water Quality Monitoring Sites
Watershed Boundary

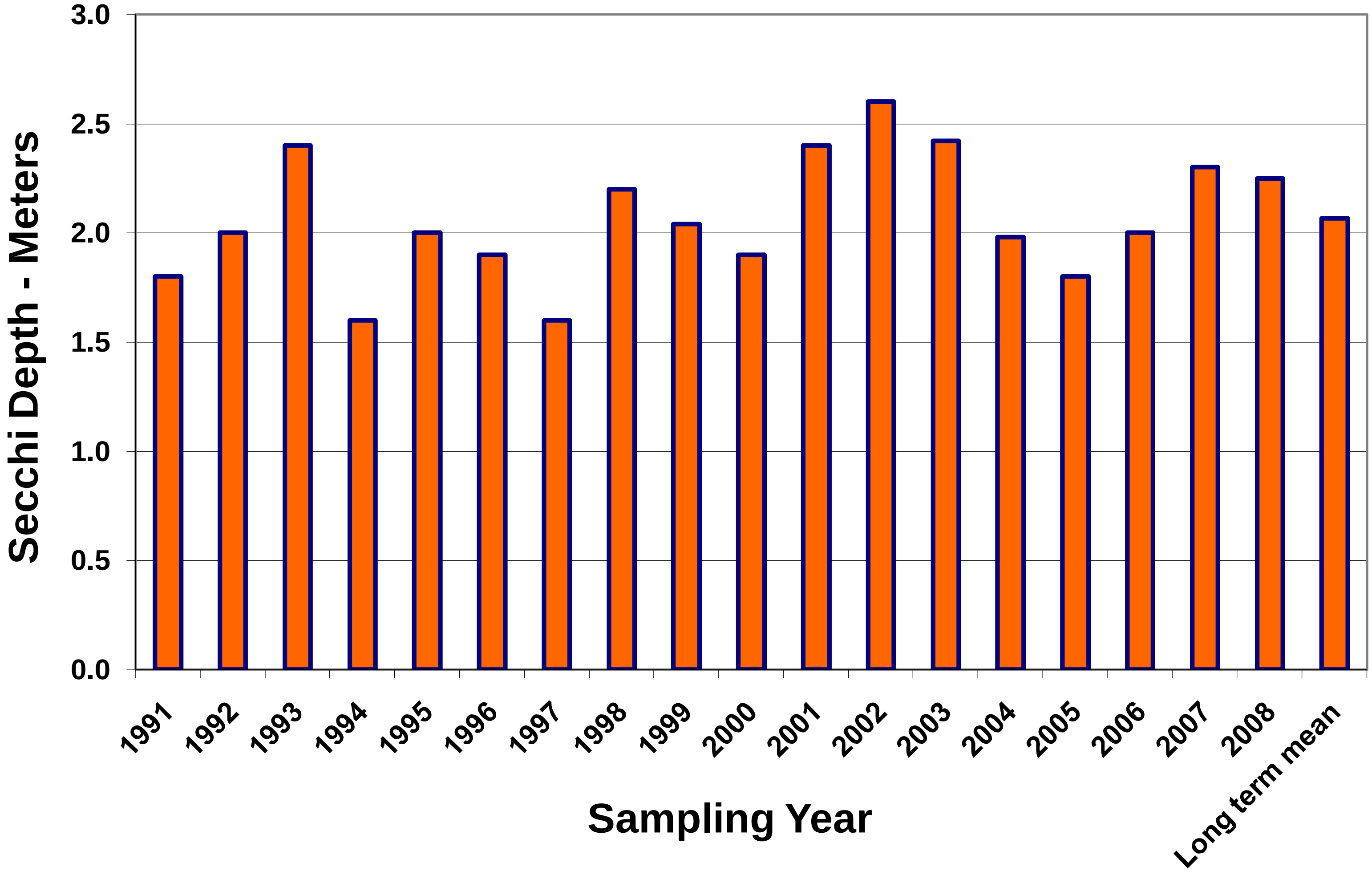


Figure 2 - Lake Hopatcong Long Term
Secchi Depth Values at Station #2

Princeton Hydro, L.L.C.
1108 Old York Road
Ringoes, N. J. 08551

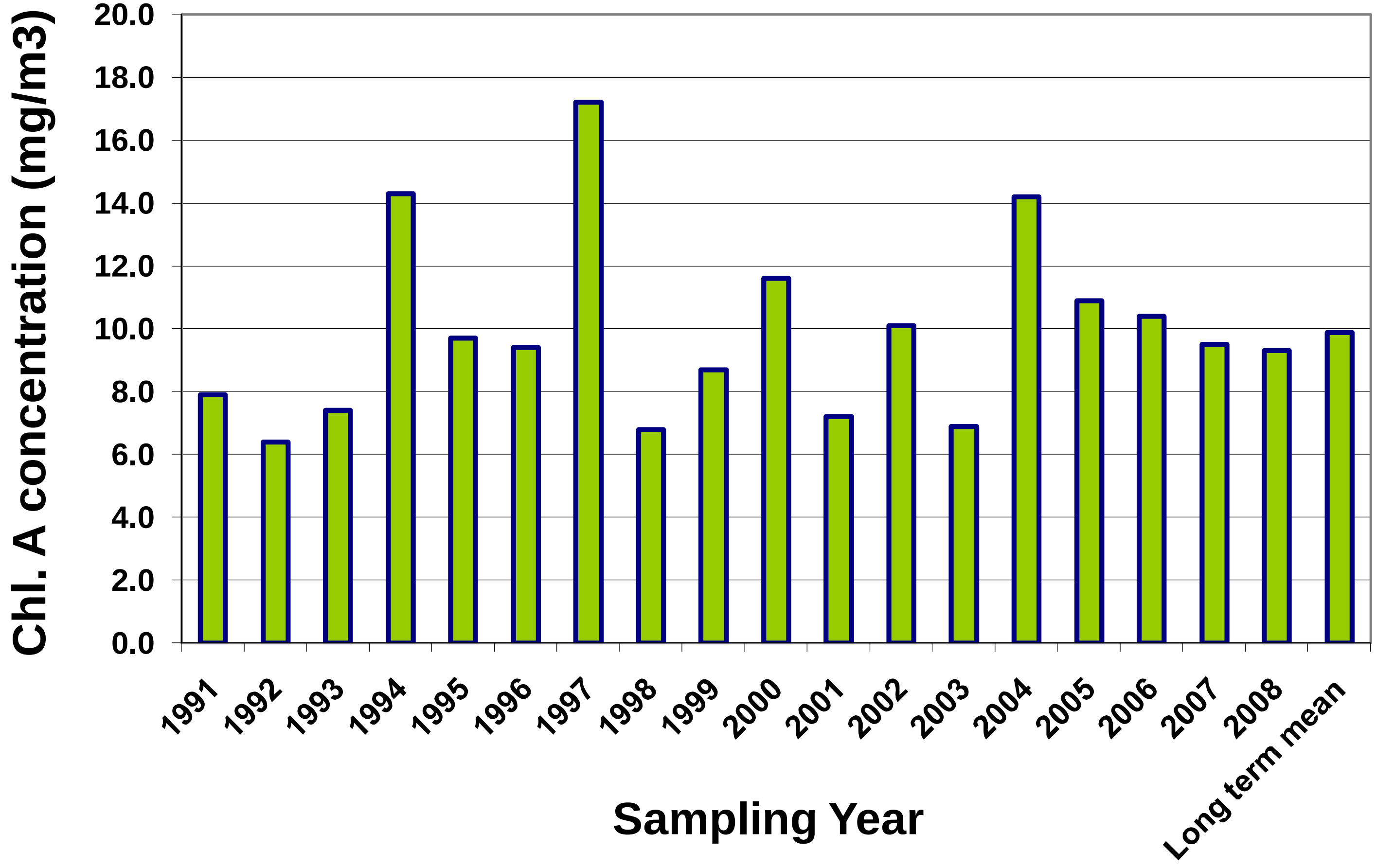


Figure 3 - Lake Hopatcong Long Term Chl A concentrations at Station #2

Princeton Hydro, L.L.C.
1108 Old York Road
Ringoes, N. J. 08551

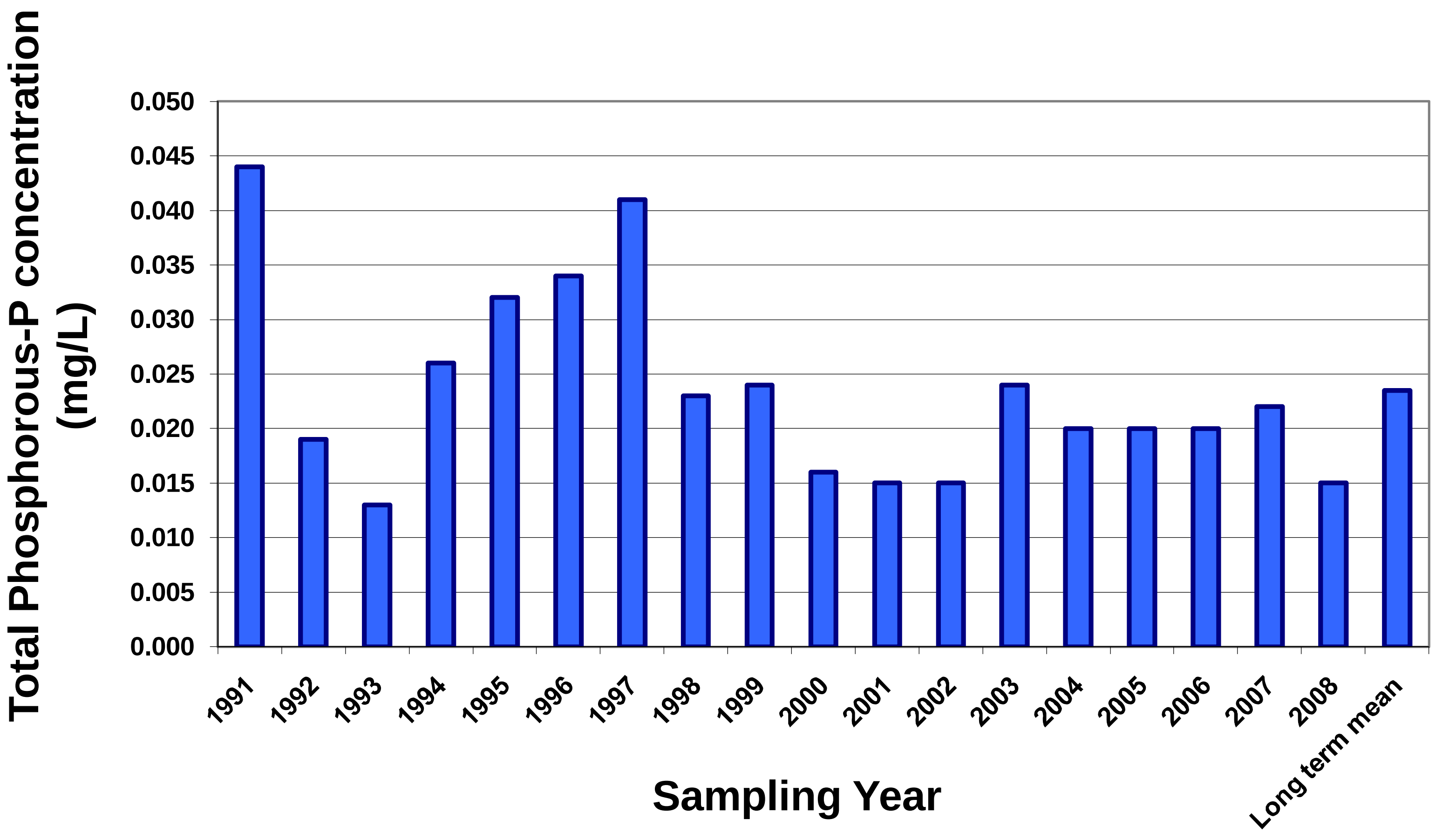


Figure 4 - Lake Hopatcong Long Term TP concentrations at Station #2

Princeton Hydro, L.L.C.
1108 Old York Road
Ringoes, N. J. 08551

APPENDIX B

IN-SITU DATA

In-Situ Monitoring for Lake Hopatcong 5/20/08

Station	DEPTH (meters)			Temperature	Conductivity	pH	Dissolved Oxygen
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(units)	(mg/L)
ST-1	**2**	**1.4**	**Surface**	14.22	0.319	7.92	9.76
			1.0	14.19	0.319	7.88	9.49
			2.0	14.18	0.32	7.85	9.37
ST-2	**15**	**1.9**	**Surface**	13.58	0.355	7.69	9.61
			1.0	13.58	0.355	7.72	9.53
			2.0	13.57	0.355	7.71	9.44
			3.0	13.37	0.355	7.67	9.34
			4.0	13.34	0.355	7.65	9.18
			5.0	13.31	0.355	7.62	9.1
			6.0	13.27	0.355	7.61	8.91
			7.0	12.83	0.356	7.55	8.84
			8.0	12.27	0.355	7.37	7.99
			9.0	11.52	0.354	7.26	7.01
			10.0	10	0.356	7.17	6.34
			11.0	9.11	0.356	7.08	5.94
			12.0	8.66	0.356	7.04	5.12
			13.0	8.26	0.358	7.03	3.95
			14.0	8.18	0.359	7.02	4.15
			14.5	8.01	0.375	7.33	2.68
ST-3	**2.4**	**1.2**	**Surface**	14.29	0.417	8.65	10.23
			1.0	14.28	0.417	8.63	10.44
			2.0	14.29	0.417	8.38	10.15
ST-4	**3.2**	**1.2**	**Surface**	13.51	0.363	7.19	9.37
			1.0	13.55	0.363	7.57	9.56
			2.0	13.52	0.361	7.74	9.47
			3.0	13.41	0.358	7.65	9.1
ST-5	**1.5**	**1.2**	**Surface**	13.87	0.364	7.12	9.1
			1.0	13.78	0.363	7.79	9.31
ST-6	**2.8**	**2.2**	**Surface**	13.58	0.346	7.92	10.04
			1.0	13.58	0.347	7.9	9.84
			2.0	13.59	0.347	7.88	9.79
			2.5	13.59	0.347	7.88	9.75
ST-7	**1.6**	**1.2**	**Surface**	13.86	0.173	7.54	9.03
			1.0	13.51	0.16	7.34	8.97
			2.0	13.5	0.16	7.25	8.65
ST-8	**7.5**	**1.7**	**Surface**	13.66	0.352	7.76	9.41
			1.0	13.67	0.353	7.79	9.28
			2.0	13.62	0.353	7.76	9.28
			3.0	13.61	0.352	7.73	8.77
			4.0	13.56	0.354	7.73	8.95
			5.0	13.52	0.354	7.72	8.72
			6.0	13.47	0.355	7.66	9.02
			7.0	13.23	0.355	7.61	8.52
ST-9	**7.2**	**1.9**	**Surface**	13.34	0.354	7.84	9.78
			1.0	13.36	0.354	7.76	9.45
			2.0	13.33	0.354	7.73	9.35
			3.0	13.28	0.355	7.69	9.21
			4.0	13.22	0.355	7.66	9.09
			5.0	13.19	0.355	7.64	9.01
			6.0	13.17	0.355	7.62	8.95
			7.0	13.11	0.355	7.61	8.89
			8.0	12.55	0.381	7.56	8.87
ST-10	**1.5**	**1.3**	**Surface**	14.1	0.336	8.05	9.7
			1.0	14.12	0.336	8.02	9.81
ST-11	**1.2**	**1**	**Surface**	13.43	0.131	7.11	8.27
			1.0	13.46	0.131	7.06	8.6

In-Situ Monitoring for Lake Hopatcong 7/01/08							
Station	DEPTH (meters)			Temperature	Conductivity	pH	Dissolved Oxygen
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(units)	(mg/L)
ST-1	1.9	1.5	Surface	26.59	0.313	7.74	8.21
			1.0	26.42	0.314	7.71	8.09
			1.9	26.23	0.314	7.7	8.07
ST-2	14.5	2.1	Surface	24.76	0.344	8.57	8.54
			1.0	24.73	0.344	8.52	8.55
			2.0	24.61	0.344	8.5	8.57
			3.0	24.33	0.344	8.45	8.52
			4.0	24.09	0.343	8.34	8.51
			5.0	22.62	0.34	8.06	5.42
			6.0	19.23	0.337	7.81	2.42
			7.0	16.1	0.335	7.65	1.72
			8.0	14.52	0.335	7.51	1.09
			9.0	13.52	0.336	7.5	0.99
			10.0	12.1	0.341	7.48	0.94
			11.0	11.7	0.345	7.47	0.92
			12.0	11.13	0.348	7.46	0.89
			13.0	10.78	0.351	7.45	0.87
			14.0	10.39	0.353	7.44	0.86
ST-3	2.0	0.7	Surface	25.32	0.425	7.74	7.75
			1.0	24.9	0.426	7.64	5.72
			2.0	24.75	0.418	7.57	4.63
ST-4	2.7	1.7	Surface	24.99	0.349	7	7.99
			1.0	24.97	0.349	7.86	7.95
			2.0	24.74	0.348	7.83	7.86
			2.7	23.88	0.344	7.68	5.62
ST-5	2.3	1.4	Surface	25.11	0.352	7.7	7.18
			1.0	24.9	0.352	7.67	7.11
			2.0	24.82	0.352	7.65	7.08
ST-6	2.1	1.5	Surface	27.11	0.342	8.15	9.14
			1.0	26.11	0.341	8.34	9.6
			2.0	24.85	0.341	8.14	8.46
ST-7	1.2	1.2	Surface	26.27	0.256	7.84	8.28
			1.0	25.59	0.256	7.97	9.25
ST-8	3.3	2.2	Surface	25.29	0.345	8.22	8.35
			1.0	25.3	0.345	8.24	8.34
			2.0	25.18	0.346	8.26	8.35
			3.0	24.9	0.348	8.26	8.26
ST-9	8.0	2.1	Surface	26.05	0.342	8.56	9.51
			1.0	25.5	0.342	8.64	9.67
			2.0	24.8	0.341	8.76	9.88
			3.0	24.42	0.341	8.71	9.57
			4.0	23.55	0.341	8.34	7.72
			5.0	20.71	0.337	8.03	3.57
			6.0	18.94	0.336	7.85	2.05
			7.0	15.91	0.335	7.69	1.05
			8.0	15.09	0.336	7..56	0.57
ST-10	1.4	1.4	Surface	26.32	0.324	8.19	9.12
			1.0	26.07	0.324	8.21	9.1
ST-11	1.2	1.2	Surface	25.32	0.205	7.49	7.3
			1.0	24.44	0.204	7.43	7.3

In-Situ Monitoring for Lake Hopatcong 7/31/08

Station	DEPTH (meters)			Temperature	Conductivity	pH	Dissolved Oxygen
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(units)	(mg/L)
ST-1	**2.0**	**0.8**	**Surface**	27.31	0.331	10.25	9.04
			1.0	26.95	0.33	10.29	9
			2.0	26.5	0.327	9.4	8.62
ST-2	**13.8**	**2.5**	**Surface**	26.36	0.358	7.92	8.06
			1.0	26.11	0.358	7.87	8.03
			2.0	25.98	0.358	7.91	8.01
			3.0	25.89	0.358	7.93	7.98
			4.0	25.75	0.358	7.87	7.92
			5.0	24.99	0.357	7.02	7.71
			6.0	23.68	0.355	4.97	7.45
			7.0	19.95	0.352	2.57	7.25
			8.0	15.15	0.351	1.45	7.13
			9.0	13.6	0.352	1.04	7.05
			10.0	12.57	0.356	0.89	6.92
			11.0	11.76	0.36	0.82	6.89
			12.0	10.97	0.366	0.8	6.87
			13.0	10.3	0.376	0.8	6.87
ST-3	**2.0**	**0.8**	**Surface**	27.71	0.388	10.81	9.16
			1.0	26.65	0.381	11.13	9.02
			2.0	26.03	0.388	6.95	7.9
ST-4	**2.9**	**1.8**	**Surface**	26.55	0.362	8.54	8.4
			1.0	26.4	0.362	8.67	8.37
			2.0	26.22	0.362	8.72	8.36
			2.5	26.16	0.361	8.78	8.42
ST-5	**3.0**	**1.5**	**Surface**	26.95	0.365	8.59	8.39
			1.0	26.5	0.364	9.2	8.6
			2.0	26.17	0.365	8.35	8.23
			3.0	25.13	0.377	0.81	7.05
ST-6	**2.2**	**2.2**	**Surface**	27.24	0.357	8.99	8.39
			1.0	27.2	0.357	8.95	8.4
			2.0	26.91	0.357	9.1	8.51
ST-7	**1.5**	**1.5**	**Surface**	27	0.322	8.16	7.82
			1.0	26.47	0.32	8.6	7.8
ST-8	**7.0**	**3.2**	**Surface**	27.02	0.358	7.99	7.97
			1.0	26.74	0.358	8.18	7.99
			2.0	26.54	0.359	8.21	7.95
			3.0	26.43	0.359	8.12	7.93
			4.0	26.31	0.358	8.06	7.91
			5.0	25.12	0.357	7.72	7.75
			6.0	21.74	0.353	2.27	7.2
			7.0	20.54	0.352	1.24	7.01
ST-9	**8.1**	**3.0**	**Surface**	27.22	0.358	8.15	8.17
			1.0	27.08	0.359	8.37	8.15
			2.0	26.54	0.359	8.4	8.13
			3.0	26.17	0.358	8.19	8.01
			4.0	25.84	0.358	8.03	7.93
			5.0	25.35	0.358	7.31	7.78
			6.0	21.4	0.352	3.75	7.48
			7.0	17.36	0.359	1.87	7.24
			8.0	15.8	0.365	1.05	7.1
ST-10	**1.5**	**0.7**	**Surface**	27.64	0.349	11.81	9.33
			1.0	26.83	0.338	10.11	8.96
ST-11	**1.0**	**1.0**	**Surface**	26.09	0.263	8.97	7.69

In-Situ Monitoring for Lake Hopatcong 8/18/08							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**pH**	**Dissolved Oxygen**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(units)**	**(mg/L)**
ST-1	**3.2**	**0.8**	**Surface**	24.81	0.289	7.58	8.65
			1.0	24.7	0.289	7.58	8.61
			2.0	24.09	0.289	7.57	8.18
			3.0	23.92	0.288	7.62	7.23
ST-2	**14.0**	**2.3**	**Surface**	24.52	0.310	8.01	9.59
			1.0	24.52	0.310	8	9.56
			2.0	24.5	0.310	7.94	9.35
			3.0	24.36	0.310	7.91	9.34
			4.0	24.3	0.310	7.84	9.25
			5.0	24.1	0.310	7.61	9.1
			6.0	23.07	0.310	7.12	7.21
			7.0	21.95	0.309	6.93	3.94
			8.0	20.71	0.306	6.86	1.1
			9.0	18.46	0.303	6.88	0.38
			10.0	14.48	0.303	6.92	0.34
			11.0	12.63	0.314	6.97	0.33
			12.0	11.07	0.322	6.98	0.37
ST-3	**1.2**	**0.8**	**Surface**	25.83	0.331	8.02	8.87
			1.0	25.24	0.331	7.85	7.97
			2.0	23.83	0.331	7.78	6.28
ST-4	**2.8**	**1.5**	**Surface**	24.81	0.313	8.37	9.53
			1.0	24.81	0.312	8.37	9.5
			2.0	24.72	0.311	8.39	9.58
ST-5	**1.5**	**1.25**	**Surface**	25	0.317		10.7
			1.0	24.65	0.316	8.91	11.01
			1.2	24.4	0.317	8.77	10.71
ST-6	**3.2**	**2.0**	**Surface**	24.76	0.310	7.79	9.16
			1.0	24.75	0.310	7.83	9.16
			2.0	24.56	0.310	7.84	9.3
			3.0	24.72	0.310	7.82	9.19
ST-7	**1.5**	**1.5**	**Surface**	23.47	0.278	7.45	7.45
			1.0	23.43	0.287	7.34	7.46
			1.5	23.32	0.287	7.57	7.56
ST-8	**4.1**	**2.25**	**Surface**	24.04	0.307	7.84	8.41
			1.0	24.03	0.307	7.87	8.45
			2.0	23.68	0.312	7.87	8.6
			3.0	23.7	0.313	7.64	6.78
			4.0	23.71	0.314	7.49	0.74
ST-9	**8.5**	**2.25**	**Surface**	24.37	0.311	8.02	9.13
			1.0	24.31	0.311	7.98	9.14
			2.0	24.23	0.310	7.96	9.16
			3.0	23.93	0.310	7.9	9.19
			4.0	23.65	0.310	7.81	9.09
			5.0	23.59	0.310	7.73	8.96
			6.0	23.48	0.311	7.49	8.59
			7.0	23.31	0.311	7.32	7.2
			8.0	22.33	0.309	7.27	4.33
ST-10	**1.2**	**0.8**	**Surface**	24.83	0.292	7.8	8.91
			1.0	24.48	0.294	7.95	9.34
ST-11	**1.3**	**1.25**	**Surface**	22.83	0.222	7.41	7.76
			1.0	22.85	0.222	7.54	7.77

In-Situ Monitoring for Lake Hopatcong 9/22/08							
Station	DEPTH (meters)			Temperature	Conductivity	Dissolved Oxygen	pH
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(mg/L)	(units)
ST-1	**1.3**	**1.0**	**Surface**	20.66	0.335	8.79	7.99
			1.0	20.37	0.333	8.96	8.06
			1.3	20.44	0.335	9.01	8.09
ST-2	**13.0**	**2.5**	**Surface**	20.94	0.355	8.54	8.03
			1.0	20.93	0.355	8.52	8.01
			2.0	20.94	0.355	8.51	8
			3.0	20.91	0.356	8.52	7.99
			4.0	20.84	0.355	8.51	7.97
			5.0	20.78	0.356	8.41	7.95
			6.0	20.73	0.356	8.36	7.92
			7.0	20.67	0.356	8.29	7.89
			8.0	20.63	0.353	8.23	7.84
			9.0	19.46	0.353	4.36	7.29
			10.0	14.67	0.363	1.64	7.03
			11.0	11.99	0.565	1.35	7.01
			12.0	11.26	0.385	1.02	7.07
			13.0	10.72	0.59	0.84	7
ST-3	**1.8**	**0.8**	**Surface**	20.3	0.364	8.8	7.79
			1.0	20.19	0.364	8.76	7.85
			1.5	19.75	0.363	8.48	7.76
ST-4	**2.5**	**2.5**	**Surface**	20.38	0.357	9.46	8.83
			1.0	20.38	0.36	9.66	8.86
			2.0	20.35	0.356	9.74	8.87
			2.5	20.41	0.356	9.74	8.85
ST-5	**2.0**	**2.0**	**Surface**	20.16	0.354	9.81	8.59
			1.0	20.11	0.354	9.8	8.67
			2.0	20.12	0.355	9.78	8.7
ST-6	**2.0**	**2.0**	**Surface**	20.71	0.354	9.08	8.36
			1.0	20.67	0.354	9.25	8.45
			2.0	20.64	0.354	9.41	8.51
ST-7	**1.0**	**1.0**	**Surface**	19.08	0.293	8.43	7.36
			1.0	18.82	0.294	8.48	7.36
ST-8	**7.0**	**2.7**	**Surface**	20.86	0.355	8.41	7.81
			1.0	20.77	0.354	8.42	7.83
			2.0	20.73	0.355	8.34	7.82
			3.0	20.71	0.355	8.3	7.8
			4.0	20.69	0.355	8.27	7.78
			5.0	20.69	0.355	8.14	7.75
			6.0	20.67	0.355	8.1	7.73
			7.0	20.52	0.355	6.73	7.43
ST-9	**8.0**	**2.5**	**Surface**	21.21	0.356	8.68	8.07
			1.0	21.22	0.356	8.74	8.08
			2.0	21.16	0.356	8.78	8.07
			3.0	21.03	0.356	8.8	8.04
			4.0	20.77	0.356	8.47	7.91
			5.0	20.71	0.355	8.12	7.8
			6.0	20.63	0.356	7.81	7.72
			7.0	20.21	0.358	5.44	7.4
			8.0	20.17	0.361	3.21	7.08
ST-10	**1.1**	**1.1**	**Surface**	19.99	0.337	8.95	7.59
			1.0	19.82	0.337	9.04	7.66
ST-11	**1.0**	**1.0**	**Surface**	18.38	0.265	8.75	7.61

In-Situ Monitoring for Hopatcong 319 Stations 5/20/08							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**pH**	**Dissolved Oxygen**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(units)**	**(mg/L)**
Crescent Cove	**1.3**	**1**	**Surface**	13.37	0.593	8.19	10.47
			1.00	12.34	0.856	7.81	11
Jefferson	**3.5**	**1.2**	**Surface**	13.62	0.314	7.49	8.79
			1.00	13.63	0.314	7.52	8.69
			2.00	13.55	0.313	7.52	8.64
			3.00	13.38	0.315	7.49	8.43
Ingram Cove	**1.6**	**1.5**	**Surface**	12.85	0.388	7.29	9.11
			1.00	12.89	0.408	7.31	9.11
			1.50	12.91	0.426	7.36	9.3

In-Situ Monitoring for Hopatcong 319 Stations 7/1/08							
Station	DEPTH (meters)			Temperature	Conductivity	Dissolved Oxygen	pH
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(mg/L)	(units)
Crescent Cove	1.25	0.7	Surface	25.12	0.448	8.02	7.79
			1.00	24.25	0.465	7.34	7.69
Jefferson	3.3	2.2	Surface	26.24	0.319	8.28	8.72
			1.00	25.62	0.319	7.58	8.6
			2.00	25.11	0.319	6.47	8.36
			3.00	22.9	0.323	0.65	7.81
Ingram Cove	1.3	1.3	Surface	24.56	0.366	10.7	9.16
			1.00	24.26	0.365	11.1	9.25

In-Situ Monitoring for Hopatcong 319 Stations 7/31/08							
Station	DEPTH (meters)			Temperature	Conductivity	pH	Dissolved Oxygen
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(units)	(mg/L)
Crescent Cove	1	0.5	Surface	27.19	0.404	10.17	8.96
			1.00	26.17	0.397	10.27	8.79
Jefferson	3	2 (SAV)	Surface	27.29	0.349	7.55	7.83
			1.00	26.81	0.349	7.74	7.83
			2.00	26.05	0.348	6.5	7.59
Ingram Cove	1.3	1.3	Surface	26.6	0.386	9.04	8.25
			1.00	26.22	0.388	9.25	8.18

In-Situ Monitoring for Hopatcong 319 Stations 7/31/08							
Station	DEPTH (meters)			Temperature	Conductivity	pH	Dissolved Oxygen
	Total	Secchi	Sample	(^{0}C)	(mmhos/cm)	(units)	(mg/L)
Crescent Cove	1.3	0.5	Surface	24.45	0.335	7.82	7.79
			1.00	24.17	0.335	7.95	7.52
Jefferson	1	1	Surface	24.93	0.292	7.87	8.9
			1.00	24.94	0.292	8.04	8.94
Ingram Cove	1.4	1.3	Surface	25.82	0.339	9.41	13.11
			1.00	25.8	0.34	9.36	13.15

In-Situ Monitoring for Hopatcong 319 Stations 9/22/08							
Station	**DEPTH (meters)**			**Temperature**	**Conductivity**	**Dissolved Oxygen**	**pH**
	Total	**Secchi**	**Sample**	**(^{0}C)**	**(mmhos/cm)**	**(mg/L)**	**(units)**
Crescent Cove	**1**	**0.9**	**Surface**	20.66	0.395	9.38	8.11
			1.00	20.64	0.394	9.46	8.12
Jefferson	**2.2**	**2**	**Surface**	20.31	0.307	8.66	7.81
			1.00	20.04	0.305	8.7	7.77
			2.00	19.54	0.308	8.45	7.66
			2.20	19.37	0.309	7.92	7.5
Ingram Cove	**1**	**1**	**Surface**	19.97	0.386	10.54	9.41
			1.00	19.68	0.387	11.29	9.54

APPENDIX C

WATER QUALITY DATA

HOPATCONG
20-May-2008

STATION	Chlorophyll (mg/M3)	NH3-N (mg/L)	NO3-N (mg/L)	TP (mg/L)	TSS (mg/L)
ST-1	8.6	0.02	0.03	0.03	ND <3
ST-2	9.0	0.04	0.03	0.02	ND <3
ST-3	14.3	0.02	0.04	0.05	ND <3
ST-4	15.4	0.05	ND <0.02	0.03	ND <3
ST-5	19.6	0.10	ND <0.02	0.03	ND <3
ST-6	8.7	0.05	0.06	0.04	ND <3
ST-7	10.6	0.09	0.10	0.03	ND <3
ST-10	11.6	0.04	0.05	0.04	ND <3
ST-11	6.8	0.08	0.11	0.03	3
ST-2 DEEP		0.41	0.14	0.04	
MEAN	11.6	0.09	0.07	0.03	3.0

HOPATCONG
23-Jun-08

STATION	Chlorophyll (mg/M3)	NH3-N (mg/L)	NO3-N (mg/L)	TP (mg/L)	TSS (mg/L)
ST-1	14.1	0.01	0.02	0.02	ND <3
ST-2	12.3	0.02	0.03	0.01	ND <3
ST-3	26.8	0.02	0.04	0.04	ND <3
ST-4	17	ND <0.01	ND <0.02	0.03	ND <3
ST-5	9.9	ND <0.01	0.03	0.04	ND <3
ST-6	10.3	ND <0.01	ND <0.02	0.01	ND <3
ST-7	1.4	0.02	0.07	0.02	ND <3
ST-10	15.3	0.02	0.02	0.02	ND <3
ST-11	9.6	0.02	0.07	0.04	ND <3
ST-2 DEEP		0.40	ND <0.02	0.01	5
MEAN	13.0	0.07	0.04	0.02	5.0

HOPATCONG
31-Jul-08

STATION	Chlorophyll (mg/M3)	NH3-N (mg/L)	NO3-N (mg/L)	TP (mg/L)	TSS (mg/L)
ST-1	56.2	ND <0.01	0.04	0.05	5
ST-2	8.4	0.01	ND <0.02	0.02	ND <3
ST-3	47.7	0.01	0.06	0.05	6
ST-4	12.5	ND <0.01	ND <0.02	0.03	ND <3
ST-5	15.8	0.03	ND <0.02	0.04	3
ST-6	6.2	0.02	ND <0.02	0.02	ND <3
ST-7	3.2	0.04	0.04	0.03	ND <3
ST-10	63	ND <0.01	0.10	0.04	11
ST-11	7.2	0.12	0.03	0.02	ND <3
ST-2 DEEP		0.54	0.03	0.15	8
MEAN	24.5	0.11	0.05	0.05	6.6

HOPATCONG
19-Aug-08

STATION	Chlorophyll (mg/M3)	NH3-N (mg/L)	NO3-N (mg/L)	TP (mg/L)	TSS (mg/L)
ST-1	23.2	ND <0.01	0.03	0.02	ND <3
ST-2	7.5	ND <0.01	0.02	ND <0.01	ND <3
ST-3	28.2	ND <0.01	0.03	0.03	3
ST-4	8.7	ND <0.01	ND <0.02	ND <0.01	ND <3
ST-5	10.4	0.02	ND <0.02	0.01	ND <3
ST-6	10.6	ND <0.01	0.02	ND <0.01	ND <3
ST-7	2.1	ND <0.01	0.03	ND <0.01	ND <3
ST-10	24.4	ND <0.01	0.08	0.04	ND <3
ST-11	8.1	0.01	0.06	0.02	3
ST-2 DEEP		0.01	0.04	0.01	7
MEAN	13.7	0.01	0.04	0.02	4.3

HOPATCONG
22-Sep-08

STATION	Chlorophyll (mg/M3)	NH3-N (mg/L)	NO3-N (mg/L)	TP (mg/L)	TSS (mg/L)
ST-1	9.4	0.04	0.04	0.03	3
ST-2	9.4	0.03	ND <0.02	0.02	ND <3
ST-3	22.2	0.05	0.04	0.04	8
ST-4	4.3	0.06	0.02	0.01	ND <3
ST-5	3.8	0.06	0.05	0.01	ND <3
ST-6	6.8	0.03	ND <0.02	0.01	ND <3
ST-7	4.2	0.04	0.04	0.02	ND <3
ST-10	11.4	0.04	0.05	0.03	ND <3
ST-11	5.1	0.05	0.07	0.01	ND <3
ST-2 DEEP		0.72	0.09	0.23	15
MEAN	8.5	0.11	0.05	0.04	8.7

319 Sampling

5/20/2008

Station	TP (mg/L)	TSS (mg/L)
Crescent Cove	0.05	ND <3
Jefferson	0.03	5
Ingram Cove	0.03	ND <3

319 Sampling

6/23/2008

Station	TP (mg/L)	TSS (mg/L)
Crescent Cove	0.06	ND <3
Jefferson	0.02	4
Ingram Cove	0.03	ND <3

319 Sampling

7/31/2008

Station	TP (mg/L)	TSS (mg/L)
Crescent Cove	0.08	13
Jefferson	0.03	ND <3
Ingram Cove	0.04	ND <3

319 Sampling

8/19/2008

Station	TP (mg/L)	TSS (mg/L)
Crescent Cove	0.08	48
Jefferson	ND <0.01	ND <3
Ingram Cove	ND <0.01	3

319 Sampling

9/22/2008

Station	TP (mg/L)	TSS (mg/L)
Crescent Cove	0.04	8
Jefferson	0.02	ND <3
Ingram Cove	0.02	ND <3