



the Beacon

of the Lake Sunapee Protective Association

December 2010



Teaching Teachers: Kathleen Stowell gets the teachers outdoors during her workshop that was part of the Kearsarge district pre-school professional development. (See page 3.)

Weather and Water

We all know that weather patterns affect water quantity and quality. This is true for both surface and groundwater resources. High surface flows from storms carry a heavier total sediment and/or contaminant load, while very low surface water flows in streams may carry no sediment but very high concentrations of certain contaminants such as chlorides (salts). Low precipitation levels impact groundwater/water table levels which can impact groundwater chemistry which in turn impacts surface water chemistry. This year's weather, including this past summer's near-drought conditions, was no exception.

Abnormally Dry Summer in 2010

One-third of New Hampshire was classified as "abnormally dry" by the National Drought Mitigation Center in early August, a step away from a drought declaration. As of late August, state records indicated that precipitation levels in Merrimack, Hillsborough and Belknap counties were down about 66 % from normal for the previous four months. Two other counties were down about 62%. However, the summer's drought-like conditions were preceded by a wet spring, and followed by a very wet fall. So, despite the near-drought during summer, precipitation levels are near normal for the year. It seems that there is a developing seasonal pattern of high precipitation in spring and fall with dryer summers.

(*Weather, Cont. Page 4*)

Hearings Underway for LSPA's Appeals of Wild Goose Permits

Hearings are in process for the three appeals LSPA and the Town of Newbury made of permits issued by the NH Department of Environmental Services (DES) for NH Fish & Game's (F&G) double ramp boat launch at the Wild Goose site in Newbury.

As these permits were issued, LSPA and Newbury appealed wetlands, shoreland and alteration of terrain permits for the boat launch and parking area. (See *the Beacon*, October 2009.)

DES Councils Hear the Appeals

Two of the permits, shoreland and wetlands, have been combined for one hearing before the Wetlands Council since it will rule on both these appeals. The Alteration of Terrain (AO/T) permit appeal is heard separately before the Water Council. Both these councils are established within DES with the authority to hear and decide all appeals. They are composed of 12 (Wetlands) and 16 (Water) members about half of whom come from state agencies and half from the public, with specific relevant background. About half the members have been seated for the LSPA appeals.

Hearings Are Like a Court Case

The hearings work like a court, with both sides, LSPA and Newbury, and the state (DES and F&G) having attorneys, an established witness list,

(*Wild Goose, Cont. Page 6*)



From the Helm: The Warmth and Welcome of Window Candles

LSPA is proud to have its home overlooking Sunapee Harbor and to be an integral part of the Sunapee community. LSPA was founded more than 100 years ago in 1898. Our home, the Moses Knowlton House, with the symbol of the flying goose at the top of its weathervane, is a historical landmark in the harbor, also dating back close to 100 years. Midge Eliassen once said, in relation to her research on old Lake Sunapee cottages, that many seem to end up in the hands of the right owners, who cherish and steward them for the sake of their pasts and for the future generations. Somehow, the merging of the history of LSPA and the history of the Moses Knowlton House seems just right.

The 46 candles in the windows of the Knowlton House at winter time symbolize a warm welcome to all Sunapee residents and visitors from surrounding communities. The candles also suggest security, and serve as a gentle reminder of our mission to protect the lake for future generations. The tiny little glow from each of the windows quietly speaks to us of peace and hope to preserve the lake, “the one jewel that calls in all here” as Colonel W.S.B. Hopkins stated at LSPA’s first annual meeting 112 years ago.

As your thoughts are filled with the sights, sounds, and smells of the holiday season, may the lights in the windows of LSPA’s headquarters also remind you of our past, present, and future responsibility in preserving the lake for generations to come. One of the greatest gifts we have to enjoy is a clean, Class A lake.

An LSPA membership for 2011 is a lasting gift to put under the tree. This is the best “jewel” of all for Christmas.
Happy Holidays

Tanya Wilkie, President



Memorial Contributions

LSPA has recently received contributions honoring the memory of:

Betsy Alexander
Joan Wight

Our sincere thanks to the families and friends who thought LSPA an appropriate recipient for these memorial gifts.

Officers, 2010-2011:

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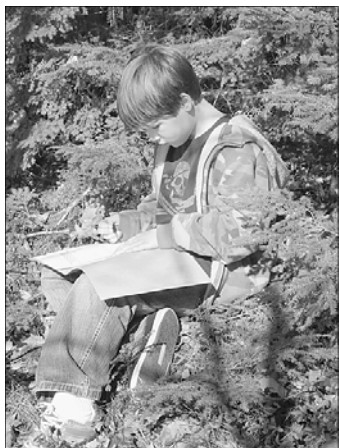
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All articles prepared by Staff, Officers, *Beacon* committee or *Beacon* Editor Midge Eliassen unless noted. Photos by Midge Eliassen unless credited otherwise.

It Was a Very Busy Fall for LSPA's Educator Kathleen Stowell

Kathleen Stowell kicked off a very full fall of LSPA Education programs by running a three-day workshop for the Kearsarge Regional School District professional development institute. Before school opened, over 50 teachers spent three full days with Stowell, indoors and out, learning tips, techniques, strategies and exercises to bring environmental education into their classrooms. They played games, walked in the woods, and discussed various aspects of integrating ecological learning into their curricula.

As a result of their exposure to Stowell and LSPA's programs, new teachers and grade levels in the Kearsarge system invited Stowell into their classrooms this fall. LSPA provides its education programs at no charge, with the goal of exposing both teachers and students to a broad range of environmental topics to foster greater understanding and stewardship of the world around us. Many of Stowell's programs are focused on water resources.



Moments from fall education programs:

Above: A time of quiet reflection and writing during a field trip at The Fells.

Right: Newport 4th graders work with the Enviroscape model to understand runoff from land into water bodies

Far right: Cooperative learning on a Fells watershed ecology unit, as students work together to make observations about transitional habitats.



Kathleen Stowell enjoying being out in the woods with a class of children.

Ongoing LSPA Fall School Programs

River Quest, Newport Richards School fourth grade (4 classes)

Building on the success of our first time through this unit last fall, LSPA provided three classroom visits: What is a Watershed? What is Erosion? and What are Macroinvertebrates? The school visits were followed by LSPA-led field experiences in Sunapee Harbor and the Wendell Marsh.

Watershed Ecology at The Fells, New London Elementary fourth grade, Sutton Elementary fourth and fifth grade (6 classes)

This long standing full day field experience has become a favorite for all involved. Students spend the day exploring the interrelationships of the forest, meadow, stream and lakeshore habitats.



New Programs Fall 2010

Exploring the Fall Season with our Five Senses, Bradford Newbury Elementary and Sutton Elementary Kindergarten (3 classes)

Kindergarten students and teachers explored the outdoor classroom beyond their playgrounds at Bradford Newbury School and Sutton school. Complementing their unit on the five senses, our outdoor adventure had students listening, looking, touching and smelling the changes that come with the fall season. Much the same way Kindergarten students work on the foundations of reading, this type of program builds observational skills needed for future environmental learning.

Plants and Animals Get Ready for Winter, New London Elementary, first grade (4 classes)

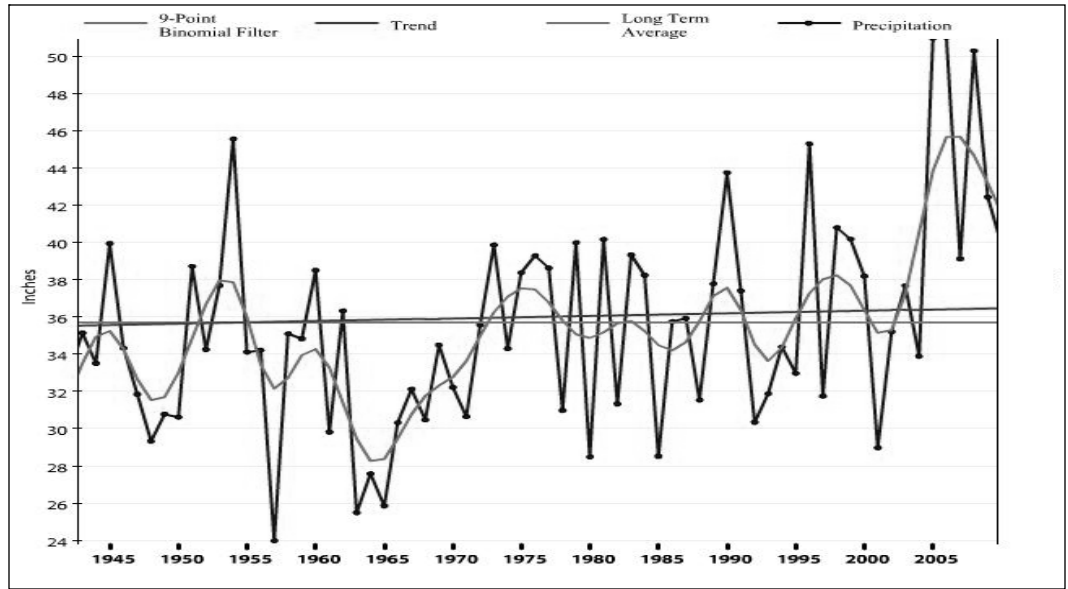
Children spent time in the schoolyard investigating the strategies plants and animals use to prepare to cope with our New Hampshire winter.

Get to know a Tree, Get to Know a Forest, New London Elementary and Sutton Elementary Second grade (5 classes)

This program highlights foundational information about our regional trees and their forest habitats. Students in New London participated in classroom activities designed to familiarize them with our most common tree species. Sutton students participated in field experiences at Muster Field farm learning about how trees function and their importance to people and animals.



Annual NH Precipitation, 1945-2009



Increase in Heavy Rain Events

A University of New Hampshire study, “Trends in Extreme Precipitation Events for the Northeastern United States 1948-2007”, indicates an increase in annual rainfall (see graph from report, right) and an increasing trend of heavy rain events with the most significant increases occurring most recently. The study also concluded that the increase in extreme precipitation and in annual precipitation is occurring primarily during the spring and fall. According to the researchers, several stations, especially in coastal regions of Massachusetts and New Hampshire, are experiencing twice the number of extreme precipitation events compared to 50 years ago.

More Flooding in the Future

“This is of particular concern as development increases in our watersheds because the combined impacts of more impervious surfaces and increases in extreme precipitation will lead to more flooding in the future,” say the researchers.

Noting that “the impacts of changing climate on our infrastructure and ecosystems has become more apparent,” the researchers cited an increase in freshwater flooding events as having more frequent impacts not only on water quality but also on infrastructure and the health and quality of life of people in the region.

Weed Watchers and Lake Hosts, Summer 2010

Weed watching, monitoring plant growth along the shoreline and looking for invasive vegetation, is LSPA’s most volunteer-dependent program. This year there were just over 100 Weed Watchers on the roster, and about half of them submitted reports on what they were seeing. Overall, there was little change in plant growth, except for more tape grass or water celery in a few spots.

Ophrydium

A new discovery this year was the Ophrydium consortium, a green jelly-like glob from 1" to 3" in diameter.

These gelatinous balls are living colonies of a variety of microorganisms that have formed symbiotic relationships. They can be found lying on the sediment or in the water column, and are not of particular concern.

Lake Hosts

Lake Hosts monitored four boat launches, inspecting 2274 boats and making no “catches” of invasive plant species on these boats. High school student Patrick Dellinger completed his second summer of volunteering to do this job; seven other Lake Hosts were employed by LSPA.

Invasive Milfoil Management

LSPA staff continue to monitor closely areas (Georges Mills and Sunapee Harbor) where invasive milfoil has been present. Staff hand pull any new growth, and add bottom barrier where necessary to keep the milfoil under control.

Plant fragments from the large bed of milfoil located partially within the State Beach swim area were identified as native milfoil by the NH Department of Environmental Services. The milfoil has spread dramatically in this area over the last several years and LSPA continues to monitor the area.



Ophrydium consortium, many microorganisms living symbiotically. *Google Images*



An LSPA Lake Host checks for aquatic plant fragments.

The State of the Lake: Water Quality 2010

Specific Conductivity (SC) can vary widely throughout the watershed and is impacted most significantly by road salt application. But precipitation or lack thereof also is significant. Specific Conductivity increased as the summer progressed. This was probably due to near drought conditions, resulting in low flow levels in streams. The lower flow volumes result in higher concentrations of ions in the water. The SC range in lake tributaries was 28 – 1,244 μS while the average tributary was about 150 μS .

The in-lake range was 88-102 μS , with an average in-lake reading at about 93 μS . This level is above the state-wide average but lower than the high levels in Lake Sunapee in 2005 (105 μS).

The in-lake average **Total Phosphorus (TP)** concentration was 7.8 $\mu\text{g/L}$. This included the deep sampling sites and near-shore sampling sites. Deep-site only samples averaged slightly over 6 $\mu\text{g/L}$. These numbers are very comparable to last year's levels. The near-shore sampling sites tend to have higher TP numbers because of their proximity to tributaries. Tributaries tend to have higher phosphorus concentrations than lake water due to higher levels of inputs from the landscape – Sunapee's streams are no exception. But Sunapee's three highest volume streams had relatively low average concentrations – from 9 to 15 $\mu\text{g/L}$.

The **pH** of a water body is not expected to change significantly from year to year. If any longer-term observation can be made about the acidity level of the lake or its tributaries, it is that the pH has increased slightly (i.e., has become less acidic). This is more of an observation over time rather than a statistically significant trend. The pH of rainwater varies but still tends to be acidic in this region. The observed decrease in acidity, as with other parameters, may also be due to the low precipitation levels and fewer storms over the sampling season. The average in-lake pH was 6.62. The average in tributaries was about 6.5 while

Water Quality Parameters

- Specific Conductivity*: a measure of overall ion concentrations, which include salts, dissolved metals, etc. (measured in microSiemens - μS)
- Total Phosphorus (TP)*: controlling nutrient for aquatic plant and animal production, (micrograms per liter - $\mu\text{g/L}$)
- pH*: acidity or hydrogen ion concentration [0 (most acidic) to 14 (basic); 7 is neutral]
- ANC*: acid neutralizing capacity (milligrams per liter calcium carbonate – mg/L Ca CO_3)
- Dissolved Oxygen (DO)*: necessary at certain concentrations for aquatic life (mg/L)
- Chlorophyll-a*: a measure of overall algal productivity (mg/L)
- Secchi Disc*: a measure of water clarity (in meters)
- Turbidity*: suspended solids, measured in Nephelometric Turbidity Units (NTU's)

the pH range in tributaries was 5.5 – 7.2.

The **ANC** in Lake Sunapee has historically been in the 3-4 mg/L range. The average for deep-sites this season was 4.34 mg/L . Again, less rainfall and fewer storm events during the sampling season resulting in less acidic inputs into the lake may have resulted in the slightly increased acid neutralizing capacity of the lake water.

Colder waters can hold more **dissolved oxygen (DO)** than warmer water. DO levels of less than 5 mg/L begin to stress organisms and levels of 1 mg/L severely impact organisms. These low levels also trigger release of phosphorus from bottom sediments into the water. Considering the higher air temperatures and the deeper than normal epilimnion (warm upper layer of water) this past season, DO numbers remained satisfactory. Only the very deepest waters at the warmest time of year got to extremely low DO levels.

Based on samples from deep and near-shore sites **Chlorophyll-a**, the overall algal abundance, was in the normal range for Lake Sunapee. At an average of 1.44 mg/L , Sunapee was well within the “good” range and well below the average level for lakes state-wide. The cyanobacterium *Gloeotrichia echinulata* was observed in the lake from mid-spring through late summer at varying densities. Early observations were spotty and densities were low. Late summer observations

were more widespread and of higher densities. Research is continuing regarding the ecology and impacts of this cyanobacterium.

Due to overall low rainfall and relatively few summer storms, **turbidity**, or the amount of suspended matter in the water, was down. As a result, transparency (as measured with a **Secchi disk**) at LSPA's 4 deep-site stations averaged 9.2 meters for July through September, much better than the state-wide average. This year's clarity was counter to the longer-term trend of decreasing clarity.

NOAA Stormwater Grant Update

During the fall, LSPA's Robert Wood and Board member Gerry Shelby, a retired surveyor, did additional field measurements of bridges in the Lake Sunapee watershed. These data were added to all the data collected last fall on locations and measurements of culverts in the watershed. The technical experts are now studying all the data and will make projections regarding the adequacy of the watershed's stormwater management infrastructure (culverts and bridges) to manage stormwater in times of heavy rain and flooding.

During the winter, town boards in each of the watershed towns will be given presentations on the findings.

(Wild Goose, Cont. from Page 1)

and the right to cross examine. LSPA is represented by attorney Gregory Smith, an environmental lawyer with McLane, Graf, Raulerson and Middleton. Experts for LSPA and Newbury include an engineering consultant with soils expertise (Jim Gove); a hydrologist (Muriel Robinette); the Town of Newbury's Police Chief and Planning Board chairman; and June Fichter and Robert Wood of LSPA.

DES (the permit issuing authority) and F&G (the applicant) are both represented by assistant Attorney General Evan Mulholland, and their witnesses include Kevin Gagne of contractor Fay, Spofford and Thorndike; Lee Carbonneau of Normandeau Associates, a subcontractor to the contractor who prepared the permit applications; and two DES employees, Collis Adams (wetlands) and Darlene Forst (shoreland).

As *the Beacon* goes to press there have been three days before the Wetlands Council, with another day scheduled in mid-December, and one day before the Water Council, with another day scheduled in early January.

LSPA's Technical Arguments

LSPA's case is based on engineering and scientific points after analysis of the F&G plans, some of which arguments were made at the hearings held by DES.

Some of the points LSPA has made before the councils:

- F&G dug test pits approximately 3' deep for their analysis, but earth will be removed and most of the actual work will be done in soils that are now 12' deep.
- The F&G soils analysis used incorrect soil types (more absorptive) than the actual soil types most likely on the site.
- There are factual errors in F&G's required looking at alternative sites (the width of the State Beach boat launch channel, that it needs frequent dredging when it has not been dredged in 50 years, where the State Beach property line is).
- The designed "dewatering" system of drainage is not a filtration system,

and will permit runoff from the site and the hillside behind it to go through pipes and enter directly into the lake unfiltered. Also, groundwater and water table were not given adequate consideration.

- The plans include no provisions for onsite storage of materials during construction.
- The permits allow pervious pavement to count for the required undisturbed woodland buffer.

LSPA's Commitment

LSPA's employees and volunteers have committed many, many hours to this effort, and LSPA's Board has voted (unanimously) more than once to continue and finance this important test of the provisions of the new Comprehensive Shoreland Protection Act, as well as other protective regulations.

Stay tuned ...

Note: All documents for both Council hearings are available on line: www2.des.state.nh.us/Legal/index.htm?

Click on Appeals, choose Water or Wetlands Council. In Water Council, choose Docket No. 09-24 WC for the AOT appeal, or in Wetlands Council, choose Docket No. 09-07 WtC.

Newbury's "Declaratory Judgment" Requests

The Town of Newbury has petitioned for a ruling from Merrimack County Superior Court that NH Fish & Game (F&G) is required to apply for a driveway permit to build the proposed boat launch facility on Birch Grove Road, a road that is owned and maintained by the town. Towns have the authority to impose conditions on driveway permits to access Town owned roads that are necessary for "the safety of the traveling public". The town's studies show that the intersection of Birch Grove Road and Route 103 is unsafe for boat trailers.

Newbury has also asked the Court to rule that F&G's proposed two acre parking lot on the three acre property violates a deed restriction placed on the property when it was acquired in 1990 by the Land Conservation Investment Program (LCIP) requiring that the property be used "exclusively for conservation purposes". In 1990, Governor and Council approved the acquisition based on a proposal to keep the area "as natural as possible".

LSPA Adventures In Learning Course

LSPA offered a five session class for Adventures in Learning during the fall. June Fichter gave background on early geology and settlement of the area. Bonnie Lewis welcomed the class to the LSPA Water Quality Lab at Colby-Sawyer College to learn how water samples are tested. Kathleen Stowell talked about stewardship and education of adults and children. Nancy Dutton and Midge Eliassen gave a slide presentation on early settlement, tourism, and summer cottages, and their impact on Lake Sunapee. Robert Wood discussed current environmental challenges and defense strategies. For the last class, Kak Weathers spoke on today's scientific research, and what it means for the future.



Gloeo researchers make their weekly collection of the cyanobacterium colonies from traps that collect the Gloeo colonies as they leave the sediment and move into the water column.

Scientific Research at Lake Sunapee Summer 2010

As the active season for data collection for the various ongoing studies of Lake Sunapee comes to an end, long hours in the lab are ahead for the scientists. Here are updates on the work done this summer, and some preliminary overviews of the results from field season 2010.

Tributary Research

Building on LSPA's regular monitoring and research begun in 2004 to more fully describe the chemical characteristics of the streams feeding Lake Sunapee, the stream team has continued its monitoring of the major tributaries. Holly Ewing of Bates College, Kak Weathers of the Cary Institute, Dave Richardson of SUNY New Paltz, and Nick Baer of Colby-Sawyer College (and students working with them) sampled several times. The samples will be analyzed for chloride, nitrate, sulfate, dissolved organic compounds, phosphorus, suspended solids, and cations such as sodium, calcium, potassium, magnesium, and aluminum.

Ewing and her students installed gauges and transducers in six of the major tributaries. They will be recording steam flow data, which Ewing downloads regularly. The Sunapee Highway Department provided some metal posts for these installations. Other sources of funding for the stream team's work include the National Science Foundation (the "Pandora's Box" Gloeo grant), a Hughes grant through Bates College, and Bates College, SUNY New Paltz, the Cary Institute, and Colby-Sawyer College.

Lake Sunapee Gloeo Research

Work continued under the National Science Foundation grant "Pandora's Box" to study this cyanobacterium that blooms in Lake Sunapee. The summer lake research is a collaboration among Kathy Cottingham's lab at Dartmouth College, Ewing and Weathers. The data collection continues, builds on and expands data collected since Cayelan Carey started it for her undergraduate thesis in the summer of 2005.

In 2010, the team working locally included Dartmouth students, research technician Elizabeth Traver and LSPA Research in Education summer employee Teriko MacConnell, a Newport elementary school teacher.

The data collection was expanded in 2010 by adding a fifth site for underwater traps that collect the Gloeo colonies as they rise from the sediment, and a sixth site where various measures of water chemistry are taken weekly. The team also added, with MacConnell's SCUBA diving skills, three traps at deeper depths to see if Gloeo rises from the sediment at deeper points in the lake.

Gloeo appeared early in 2010, with the first colonies in the water column on May 25, and the first colonies found in the traps on June 15. The bloom peaked in mid August, creating a surface scum in Herrick Cove August 21. Gloeo was still appearing in surface tows in early October.

Citizen scientists continued to add to the Sunapee Gloeo data, with Midge Eliassen taking a daily plankton net tow from her dock from June 1 to early October. The Lake Sunapee Yacht Club citizen science team led by Kristen Begor took an entire set of tows and samples out by the LSPA water quality buoy twice a week from late June to mid September.

Carey's Graduate Research

Cayelan Carey studies Gloeo for her PhD work at Cornell University. This summer she set up large (1000L) tanks in Hanover, NH and filled them with lake water with varying amounts of nutrients, and then added Gloeo. Her goal was to study the effect of Gloeo blooms on plankton communities and on water column nutrient concentrations.

Carey found that her results supported her conclusions from her last two summers of conducting similar experiments in large contained plastic bags in Lake Sunapee. In the low nutrient tanks, like Lake Sunapee, there was an increase in phytoplankton biomass with the presence of Gloeo.

(And Gloeo decreased phytoplankton biomass in high nutrient tanks.) Carey's data indicate that the effect of Gloeo blooms is strongly nutrient dependent, and if nutrient levels in Sunapee change, "we can expect to see more inhibitory effects of Gloeo blooms".

International Data Too

Carey also carried out an international piece of research this summer, arranging for water samples to be taken at many of the sites of GLEON buoys throughout the world. The LSYC citizen science team collected these integrated tube samples twice a week at the LSPA buoy. Carey will analyze them all for phytoplankton species and biomass response to cyanobacterial blooms like Gloeo.



Gloeo researchers take weekly water chemistry readings at one of the six sites where they collect this data.



Natalie Ruppertsberger works in one of Cayelan Carey's 1000L tanks with nutrients and Gloeo.



LSPA President Tanya Wilkie enjoys a moment at the helm of the Mount Sunapee, captained by LSPA board member Kara Obey for the LSPA cruise to watch the full moon rise over the lake in September.

An LSPA “App”

There is now an “app” for smart phones, the LSPA Recorder, which permits the user to record and transmit ecological data, ranging from precipitation amounts to the density of the cyanobacterium Gloeo in the lake, from a sign of the changing of seasons to the sighting of a loon.

The app was designed by graduate student Brett Taylor at SUNY Binghamton, under the National Science Foundation grant supporting the work of the Cyberinfrastructure Team (including LSPA) to display accessible data on the web.

LSPA’s scientific researchers and staff members are now testing the recorder. By next summer, it will be in full use by the citizen scientists collecting data for LSPA, for whom it is really designed, as well as LSPA staff and scientists.

Blodgett Sewer

On November 14, the Town of Newbury and its community of Blodgett’s Landing celebrated the upgrade of the Blodgett Landing Wastewater Treatment Facility. First installed in 1959, as a seasonal plant only, to serve the densely populated Blodgetts area, and upgraded once in 1970, the system discharges treated wastewater into the groundwater near the plant. For several years the Blodgett facility was unable to meet the NH Department of Environmental Services standard for the discharge of nitrates (less than 10mg/L) so in 2008, the upgrade was begun.

The total project included work to cut down on leaks into and out of the collection system, a new pump station, state-of-the-art piping in the sand filtration beds, and a new IMHOFF sludge separation tank so that there is built in redundancy in case of problems.

The cost of the upgrade was covered by grants (\$1,365,000, including stimulus funds applied for by Dennis Pavilicek, Newbury Town Manager) and by 20 year DES low interest loans (\$1,698,600) to be paid off by the users.

In 2006, LSPA contributed \$9,000 for engineering studies. The \$9,000 was directed to LSPA when the Baker Hill Golf Club was fined for negative water quality impacts during construction; LSPA wanted the fine to benefit Blodgetts.

This issue of *the Beacon* has been sponsored by:



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LSPA appreciates this support.

The Lake Sunapee Protective Association, founded in 1898, is a member-supported nonprofit educational organization. We are dedicated to preserving and enhancing the environmental qualities of the Lake Sunapee region. We strive to achieve this mission through education, research and collaborative action.