



**Northwest Conservation District**

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Friends of the Lake, Inc.  
P.O. Box 403  
Bridgewater, CT 06752

June 18, 2009

Dear Friends of the Lake,

I toured Lake Lillinonah during the November 2008 draw down and I was able to get a close look at the height, extent and texture of all the bars that exist at the head of the lake. It appeared that the water level had been dropped approximately 10 feet. As requested by Friends of the Lake, I have completed all the tasks listed in NCD February 2009 proposal letter. At FOTL request, I would welcome the opportunity to attend one of your meetings to present our finding. Otherwise please see the project report attached.

The NCD appreciates this opportunity to provide the Friends of the Lake with our interpretive environmental services. We appreciate Friends of the Lake's proactive approach to managing problems in the lake. If you would like us to attend a meeting to explain our findings please do not hesitate to ask. If Friends of the Lake have additional questions on the sediment bar problem we would welcome the opportunity to research them.

Sincerely,

Sean Hayden  
Certified Soil Scientist - (Society of Soil Scientist of Southern New England)  
Certified Wetlands Soil Delineator - (Army Corps of Engineers, 1987 Method)  
Certified Professional in Erosion and Sediment Control - (CPESC # - 2181)

**Lake Lillinonah Sediment Bar Assessment**  
Existing Conditions and Mitigation Options Map and Report



*Prepared for*

Friends of the Lake, Inc.  
P.O. Box 403, Bridgewater, CT 06752

*Prepared by*



June, 2009

## **Background**

I toured Lake Lillinonah during the November 2008 draw down and I was able to take a close look at the height, extent and texture of all the bars that exist at the head of the lake. It appeared that the water level had been dropped approximately 10 feet. I was also able to estimate the spatial extent of the bars from Lovers Leap Park in New Milford (see photos on title page above). After researching the site, existing high resolution aerial photos from 2004, historic aerial photos from 1934, contour maps supplied by First Light and Natural Resource GIS Data supplied by the CT Department of Environmental Protection, we created a Study Area Map (see map on next page).

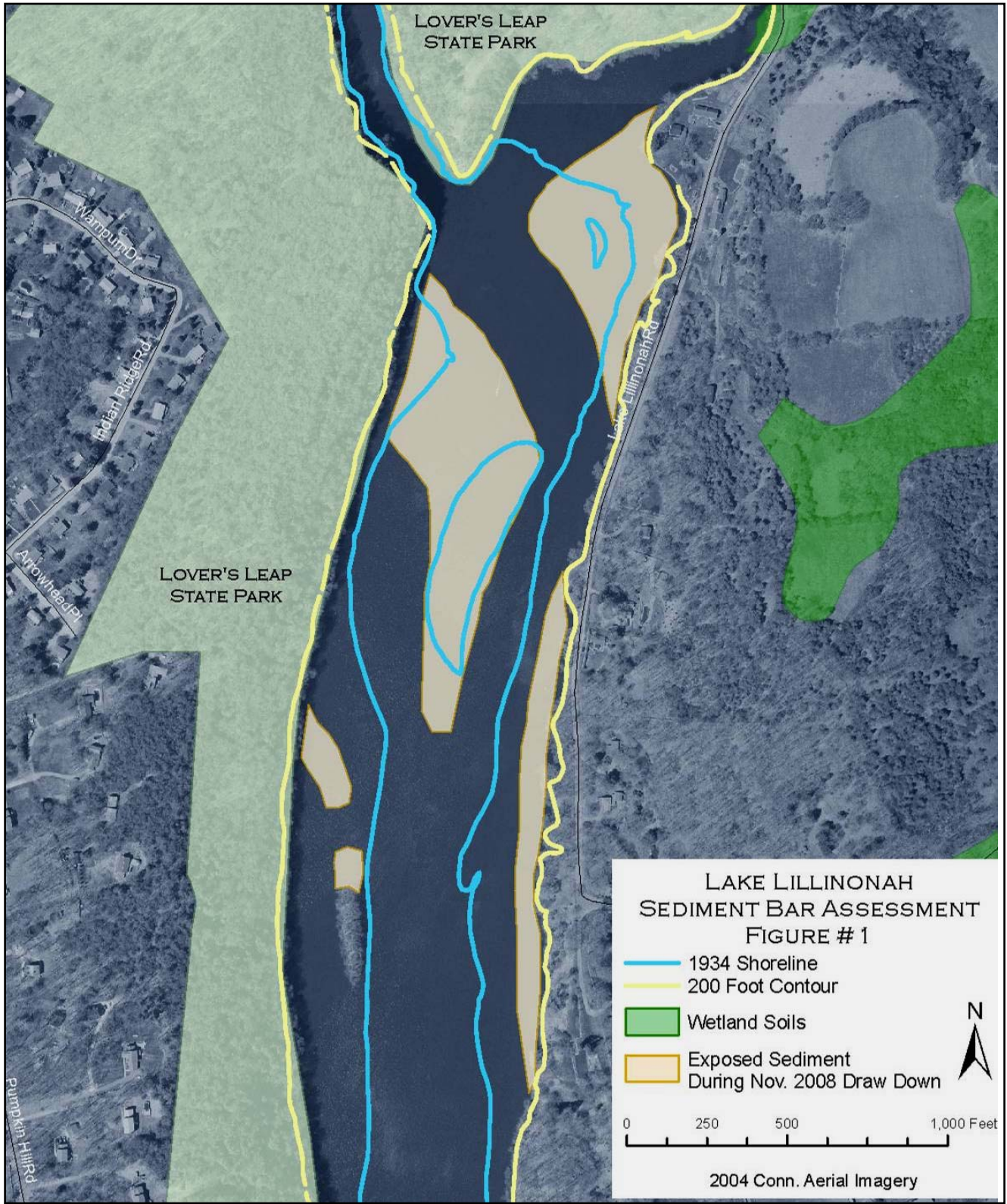
In looking back at historic photos I realized that the original Goodyear Island (1 to 2 acres in size) is now buried underneath the largest of the sediment bars (see Study Area Map below). The 1934 aerial photos show a house and a few farm out buildings that existed on the island before the creation of the lake. The small island now known as Goodyear Island was once part of the shoreline / flood plain. A small elevated portion of the historic shoreline / floodplain became an island (now called Goodyear Island) when the lake was created.

## **Sediment Texture and Nutrient Loading**

During my site I was hoping to be able to hop out of the boat and onto the sediment bars to core samples for texturing. However, my initial probes made with a soil auger from the boat showed that the consistency of the sediments would not be able to support my weight. It has the consistency and texture of the USDA soil classification "Peat and Muck". I was able to access the large central sediment bar by walking along the rocky west shore of the lake just below where the Housatonic River exits Lovers Leap Gorge. Only then was I able to excavate a number of sediment cores. The sediment bars consist of mostly silt (particle size that mostly range from 0.005 mm to 0.05 mm) and decomposing organic mater, with a smaller fraction consisting of fine sand and clay. A high percentage of organic matter and fine mineral component (silts and clays) contained in the sediments enables them to hold significant amounts of nutrients. When conditions are right the sediments are likely supplying the water column with growth promoting nutrients. As the sediment bars increase in size, they decrease water column depth and increase the shallow areas. Therefore lake water will warm more easily during low flow periods promoting invasive aquatic weed growth and longer larger algae blooms.



*Photo courtesy of Lake Lillinonah Authority*



**Study Area Map**

### **Approximate Size of Sediment Bars**

In November 2008, a 10 foot draw down exposed approximately 12 to 15 acres of sediment. (see Study Area Map above). If we assume an average sediment depth of 5 feet, then at least 120,000 cubic yards of deposited materials were exposed during draw down. It is important to note that the current sediment bars seemed to have formed on old islands, flood plain and shorelines (see Study Area Map). In other words, when the lake was created the island and shallow areas “attracted” sediments first and the bars formed on and around them. Therefore, the 120,000 cubic yard number might be smaller if the previously existing cores of the sediment bars are close to the surface of the deposited sediments. During the sediment core sampling I augered all the way to the “T” handle on my auger and pulled up very similar material to what existed at the surface. Therefore, the sediment depth in the area I collected samples was at least 4 feet (the length of my auger shaft).

### **Sediment Bar Management Options**

The sediments bars are starting to affect boat navigation at the top of the lake. Evidence of the problem was clearly visible during the draw down where engine gouge striations can be seen marked across the largest of the sediment bars (see cover page photos). Currently there is a deep channel approximately 200 foot wide at the top of the lake where fast moving waters maintain navigable depths. Because First Light uses the flood impact mitigation practice of dropping the level of the lake before large storm events (ex. Hurricanes and Tropical Depressions), fast moving water regularly scours a 200 foot wide navigable channel through the top part of the lake. Even though the sediment bars will continue to increase in length, width and elevation (thickness), river flow energy will always keep a deep, navigable channel cut through sediments at the top of the lake. The navigable channel may narrow at the head of the lake, but powerful scouring action during high flows have more than enough energy to keep a navigable area open. If no action is taken to manipulate sediments, clearly marking the deeper water at the head of the lake is the easiest alternative.

### ***Dredging***

Removing sediments bars from the top part of the lake would require the following:

- 1) Sediment samples would need to be collected from all the areas that are targeted for removal. The sediments should then be analyzed for a wide spectrum of compounds of concern (COC). The list of COCs that should be sampled for in the sediments include Metals, Semivolatile Organic Compounds, Pesticides, PCBs and Cyanide.
- 2) Once it is know what the sediments contain (or don't contain) an Engineered Plan for Sediment Removal should be drafted for permit applications. The Engineered design should also include a hydraulic flow analysis of existing conditions and post sediment removal.
- 3) Permits from Local State and Federal Agencies listed below would likely be required.
  - a) New Milford and Bridgewater Inland Wetland Agencies
  - b) Bridgewater Planning and Zoning Commission
  - c) New Milford Planning and New Milford Zoning Commissions
  - d) CT Department of Environmental Protect Flood Plain Certification
  - e) US Army Corps of Engineers “Individual Permit” (which requires the most detail).
  - f) Given the large amounts of material that has collected at the top of the lake, the Friends of the Lake may also need to acquire a special “Earth Extraction” permit form the adjacent municipalities.
  - g) Permission from First Light Inc.

- 4) Dredging sediments can cost from \$30 to \$60 per cubic yard of removed material. This assumes that sediments are free of any toxic material and does not include permitting, engineering fees or disposal costs. Material removal alone would likely run into the millions of dollars if all the approvals were secured from relevant Federal, State and Local agencies. Therefore dredging and removing material from the lake does not seem like a feasible alternative.

### ***Replicate Natural Resources Areas, Flood Plains and Wetland Areas***

Because the cost of dredging and material removal can be prohibitively expensive, the US Army Corps of Engineers frequently uses an alternative to sediment removal (dredging) that is called Natural Resource Replication. The cost of moving materials in this manner would be less than dredging and less sediments would need to be manipulated. This method places dredged sediments on top of existing sediments in an effort to create new natural resource areas in the river (or adjacent to the river) reducing the number of cubic yards moved. The top of Lake Lillinonah would be a good candidate for this type of sediment consolidation because currently most of the sediment bars exist where dry upland areas existed before the lake was created. Upland Riparian and Wetland areas could be recreated with sediments in areas where they previously existed. Recreating these types of environments may also help in nutrient removal from the water column. While the raw cost of moving the sediments in this scenario would be less than trucking them off site, all the permitting and engineering cost would be similar. An additional advantage of this alternative is that it would stabilize existing sediments so they can never be resuspended and create more problems further down the lake. Also, large reservoirs of nutrient rich sediments would be cut off from the internal loading process which is suspected of creating algae and invasive weed problems in the lake. Sediment Sampling, Engineering and Permitting requirements would be similar to the dredging alternative.

### ***Summary and Conclusion***

Physically moving sediments would be such a large and expensive project that the FOTL should first consider a Sediment Bar Monitoring Program to evaluate the rate of growth of all the sediment deposits at the top of the Lake and at the confluence with the Shepaug River. This could be accomplished by measuring the size (special extent) of the bars every year when the water level in the lake is dropped. It will be important to take measurements of the bars at the same lake elevation each year. Size could be assessed by tracing the perimeter of all the sediment bars with a GPS unit that measures location to an accuracy of 1 meter. A trace of all the bars could be accomplished every year when the water level has dropped to a specific elevation. The sediment bar traces could then be plotted on an aerial photo and any trends would become immediately apparent.

A high percentage of organic matter and fine mineral component (silts and clays) were noted in the sediments during the bar investigation. Organic material and clay are extremely efficient at absorbing nutrients. When chemical and physical conditions are right, organic matter and mineral clays also release nutrients to the surrounding environment. The process of absorption and release commonly occur in organic soil. Therefore, when conditions are right, the sediments are likely supplying the water column with growth promoting nutrients. It will be important to track the growth of the sediment bars because as they become larger and shallower they will likely contribute even more nutrients and aquatic weed problems in the water column.

The large elbow shaped central sediment bar at the top of the Lake squeezes boat traffic into a 200 foot wide channel that runs for about 1000 feet between the sediment bar and the shore along Lake Lillinonha Road. Boat Traffic is also squeezed between the large sediment bar located in Farm Brook Cove and the large central sediment bar. Together, the bars create over 2000 feet of lake where larger boats only have an approximately 200 foot wide channel to pass to and from Lover Leap Gorge at the top of the Lake. To keep boaters from beaching on the bars during low water periods, navigable depth should be delineated with floating markers in these areas. Given the high flows that intermittently occur shooting out of Lovers Leap Gorge, I do not believe this channel will narrow to less than a 200 foot width anytime soon.