

DREDGING IN LAKE LURE

Opening: overview

The Town of Lake Lure sits at the base of a ninety- six square mile watershed that reaches more than two thousand feet in elevation and is located mainly in Henderson and Buncombe Counties. It has multiple tributaries contributing sediment to the lake including the largest of them, the Rocky Broad River.

History:

The lake has endured many storm events in the past. In this presentation we will go back as far as 1996. When a storm stalled out off of sugar loaf Mtn. and produced 12" of rain in 3 hours and 17" in 24 hours... Lake lure only received 5-6" of that rain. This is an example of how steep our watershed is. This storm event did not reach the one hundred year flood mark. This storm event washed boulders, camping trailers, debris and tons of sediment into the lake. At the time of this storm a hurricane (Francis) hit the coast and it was tied to this storm event, and the town was able to leverage funds from FEMA to clean-up and dredge out the lake. The Town hired Glover Construction to dredge the lake at a cost of 1.4 Million dollars to remove 250,000 cubic yards of sediment.

The town has done maintenance dredging annually since this flood event with other major storm events happening periodically, like in June 2006 when 6-9 inches of rain fell in about 8 hours. The town has budgeted money annually for dredging to keep sediment from impeding our navigable waterways and hurting our fisheries.

Seventeen years has now passed and the data shows that our efforts have failed to keep the sediment out of our lake. Starting in the river portion where we perform maintenance dredging the water gets as shallow as 2 feet. As the mouth of the river becomes lake at the Washburn marina opening, water is at around 4 feet, and progresses out about $\frac{1}{4}$ to $\frac{1}{2}$ of a mile at 5-7 feet before sloughing off to 30 feet and deeper.

So what's the problem?

Sediment in the lake causes a number of problems,

- Navigational hazards
- Fish and Eco.
- Hydroelectric generation
- Water Quality

Once the sediment reaches a point, it can't be removed. The lake can only be lowered 16 feet, after this point the sediment becomes a permanent part of the lake.

How do we dredge?

There are a few different ways to dredge.

1. Hydraulic Dredging, It's a floating machine that has a long arm with a cutter head on the end that reaches under the water to the sediment and pumps it thru a pipe into a spoils containment pit that the town has located on either side of the river. As it enters the pit the sediment piles up and the water decants from it into a flash board riser, then into a second decanting pit so the finer particulates drop out and then the cleaner water is returned to the river.

Pros:

- No lake lowering required
- Little disturbance to fish/Eco

Cons:

- Expensive, average 50,000 to mobilize and demobilize
- Average of \$10 per cubic yard to remove
- Noisy
- Limited time of year to operate (non-peak season)
- Decanting process can cause high turbidity in lake
- Cost does not include removal of sediment from pits and off-site
- Sediment has to be washed and screened to be made marketable

2. Excavation, this is done thru the use of specialized track hoes, generally with a 75 foot reach and it accesses the lake bottom with the use of mud mats.

Pros:

- Efficient, average cost to remove sediment \$5-6 per cubic yard
- Faster process
- Less turbidity in the water
- Decanting takes place in lake bed
- Typically sediment is taken off-site in the CY price

Cons:

- Lake has to be lowered
- Noisy
- Limited time of year to operate (non-peak season)
- Limited access to areas of the lake

3. Streamside Systems, is a newer technology that is placed in the riverbed and catches the bed load as it creeps down the river and pumps it into a washing plant then water is returned to the riverbed and released, leaving the sediment clean and marketable with little prep.

Pros:

- Clean water, no turbidity
- Quite operations
- Operates with lake up or down
- Removes 95 + % of sediment that enters the lake
- Operates year round with no impact to boaters, fisherman, swimmers or fish

Cons:

- Up front cost expensive
- Operating cost, electricity and maintenance

The need for dredging in Lake Lure sadly will never go away. Streamside Systems will greatly reduce the frequency of dredging needed in our lake, thus reducing the amount of money spent annually to dredge.

How much will Streamside Systems cost?

1. Up-front cost: See **CH2M Proposal**

- \$\$\$\$ This is to pay for a project overview from the engineer to provide a cost analysis... It will include Surveying cross vein of river, data collecting, assumption model for electricity cost, maintenance cost and removal of sediment off-site

How much have we spent on dredging?

- 1997... 1.4 Million
- 1998 ... 0
- 1999 ... 12,305.00
- 2000 ... 109,848.41
- 2001 ... 269,998.69
- 2002 ... 0
- 2003 ... 144,500.00
- 2004 ... 73,777.00
- 2005 ... 234,383.60
- 2006 ... 369,780.50
- 2007 ... 92,273.00
- 2008 ... 330,570.00
- 2009 ... 86,330.00

- 2010 ... 11,275.00
- 2011 ... 49,500.00
- 2012 ... 20,459.00
- 2013 ... 0
- Total.....\$3,205,000.00 in 16 years and we currently have a surplus of \$ 177,645.00

How have we paid for dredging?

- In 1997 the 1.4 million was FEMA dollars due to the storm event
- Since that time the town has budgeted money from Hydro and boat permits, usually \$50,000 from each \$ 100,000 annually

Is this enough to keep the sediment out of our lake?

- Well it has not been... We now look at our lake and see more sediment in there than there was in 1996, so even though we have tried to stay ahead of this problem our efforts have come up short

How can we come up with more revenues to solve this problem?

Possible solutions:

- Continue with boat permit fees and hydro
- Concessions with marinas on the lake
- Annual lake structures fees
- Launch ramp fees
- Dredge tax
- ?

Dredging in Lake Lure

Identified Risks

- Tim Edwards unable to perform
- Environmental risk
- Commodity Price risk
- Complaints by residents of noise and unsightly material
- Technology risk

Dredging in Lake Lure

1998-2013 Qualitative Analysis

- In 1997 we removed 250,000 cubic yards of sediment from the lake
- Since 1998 Lake Lure has invested \$1.8 million in sediment removal
- With the purchase of a dredge, assume average cost of \$8.00 per cubic yard
- $\$1.8\text{mm} / \$8.00 \text{ per cubic yard} = 225,000 \text{ cubic yards removed}$
- If the lake today is like it was in 1996, before the flood, then 475,000 cubic yards of sediment have entered the lake since 1998.
- $475,000 / 15 \text{ years (1998-2013)} = 31,700 \text{ cubic yards per year.}$

Summary of the Upper Broad River Watershed Sediment Inventory

In a sediment inventory of the Upper Broad River Watershed, every source of sediment in the watershed was catalogued and analyzed. For each individual source a calculation of the amount of sediment was determined and the total for the entire watershed has been obtained. Below is a chart showing the estimates for each of the smaller watersheds and the total for the whole. The source of the sediment has been separated into four categories: Urban, Agricultural, Roadside (DOT), and Streambank.

Tons of Sediment

Watershed	Urban	Agriculture	DOT	Streambank
<i>Lake Lure</i>	6686	5341	2372	454
<i>Rocky Broad</i>	542	117	18	131
<i>Broad River (bat cave quad)</i>	1028	647	154	309
<i>Broad River (black mt. Quad)</i>	2266	1084	576	228
<i>Hickory Creek</i>	791	1317	1150	14
<i>Reedy Patch Creek</i>	928	12754	984	600
Total	12241	21260	5254	1736

Total: 40,488 tons of sediment per year.

This total of 40,488 tons is a measure of all the sediment carried into Lake Lure, whether by the Upper Broad river or by small streams and runoff from area surrounding the lake. From the figures it can be determined that the area around Lake Lure and the Reedy Patch Creek are the largest contributors of sediment to the lake, each adding approximately 15,000 tons each year. The largest contributor by category is agriculture followed by urban. Streambanks contribute the least amount of sediment to the watershed.



FEDERAL EMERGENCY MANAGEMENT AGENCY
DAMAGE SURVEY REPORT - DATA SHEET

1. DECLARATION NO.
 FEMA DR- 100

2. DSR NO.
503541

SUPP TO DSR NO.

O.M.B. No. 3067-0223
 Expires December 31, 1995

PART I - PROJECT DESCRIPTION

10. PROJECT TITLE

SEDIMENTS IN LAKE LURE, PUBLIC PROPERTY

11. DAMAGED FACILITY

12. FACILITY LOCATION

13. DAMAGE DIMENSIONS/DESCRIPTION/SCOPE OF ELIGIBLE WORK

DIMENSIONS: REMOVAL OF SEDIMENT FROM AN AREA OF ABOUT 30 ACRES @ U.S. END OF LAKE LURE. AVERAGE DEPTH OF FLOOD CAUSED SEDIMENT 10.2 FEET.
 DESCRIPTION/SCOPE: THE FLOOD CAUSED SEDIMENTATION AT UPPER END OF LAKE LURE IN THE VICINITY OF WHERE BROAD RIVER ENTERS LAKE (WEST END). REMOVE AND DISPOSE OF SEDIMENT. SUBSEQUENT WITH DECISION ON DIRECT ASSISTANCE.

14. INSP NO.

15. NAME OF FEDERAL INSPECTOR (Print)

16. AGENCY CODE

17. NAME OF STATE INSPECTOR (Print)

18. INSP NO.

19. NAME OF LOCAL REPRESENTATIVE (Print)

PART II - ESTIMATED COST OF PROPOSED WORK

ITEM	CODE	MATERIAL AND/OR DESCRIPTION (a)	UNIT OF MEAS (b)	QUANTITY (c)	UNIT PRICE (d)	COST (e)
1		DEBRIS (LAKE SEDIMENT)	CY	75000	4.00	300,000.00
2		ENGINEERING SERVICES	LS	1		20,000.00
3						
4						
5						
6						
7						
8						

20. EXISTING INSURANCE

TYPE - F: \$

G: \$

21.

TOTAL \$ 400,000

4150.00
 200,000 net