

# Lake Zumbro Siltation Bathymetry Study

Ray Romon

05/04/09

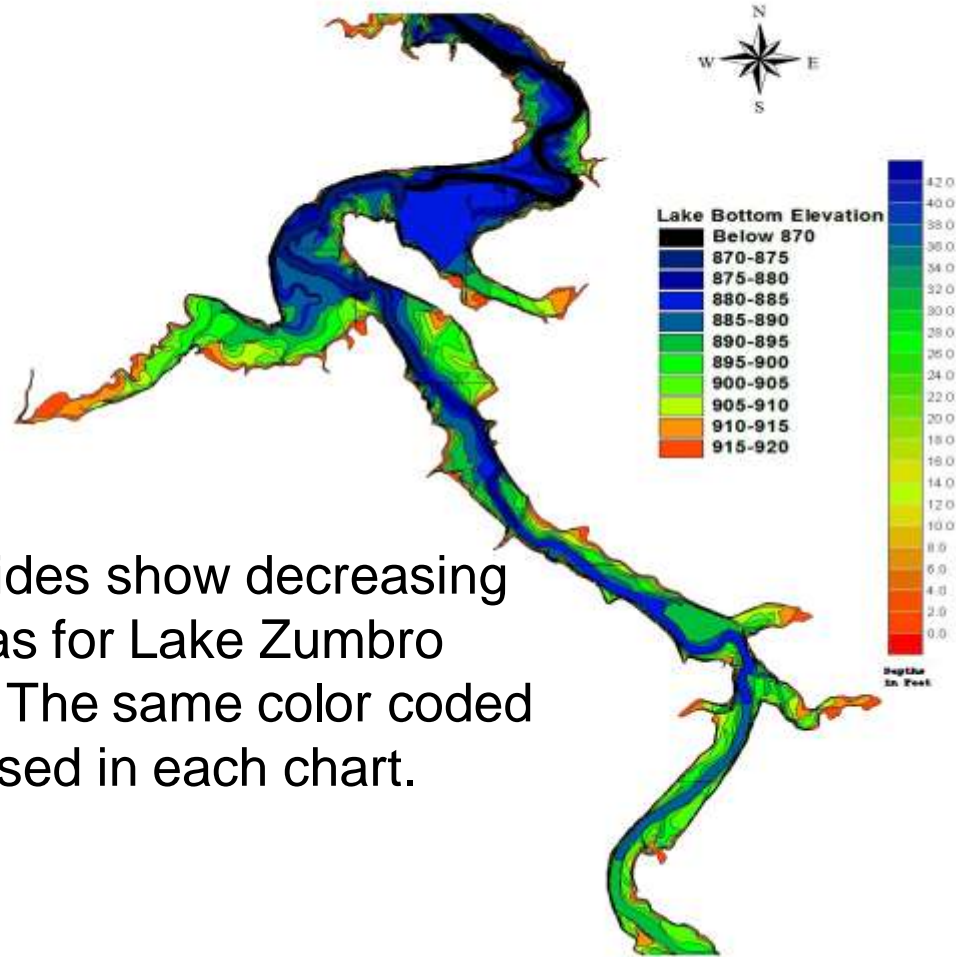
For Lake Shady Stakeholders

# Lake Zumbro Siltation history

The following slides are from historical lake maps, including the original dam design survey, circa 1916. Planimetric methods were used to determine depth contours and volumes from this data. A bathymetric GPS/sonar study was done in 2005 and a subset study repeated in 2007, with projected water volume reduction at current sedimentation rates.

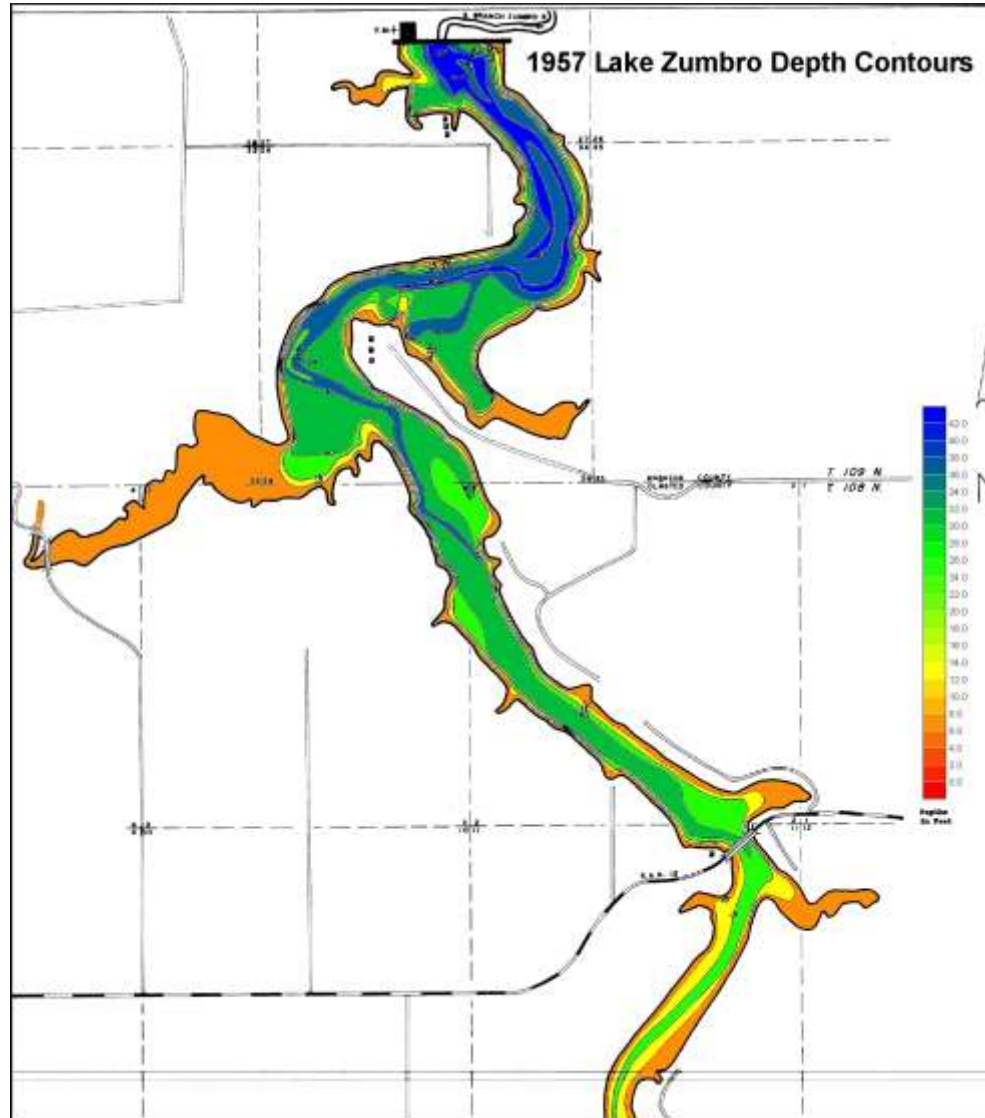
# 1916 Original Depths

1916 Lake Bottom Elevations

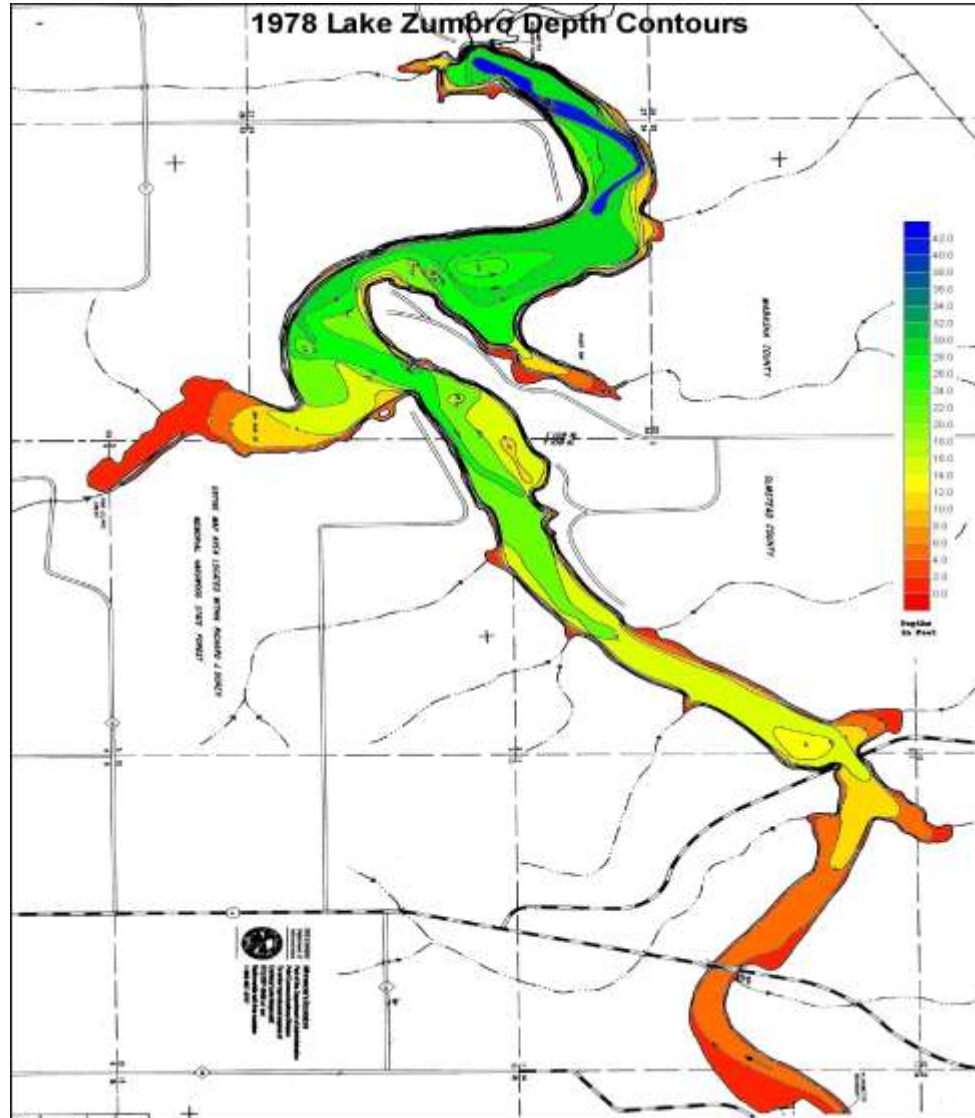


The following slides show decreasing depths and areas for Lake Zumbro over the years. The same color coded depth scale is used in each chart.

# 1957 depths



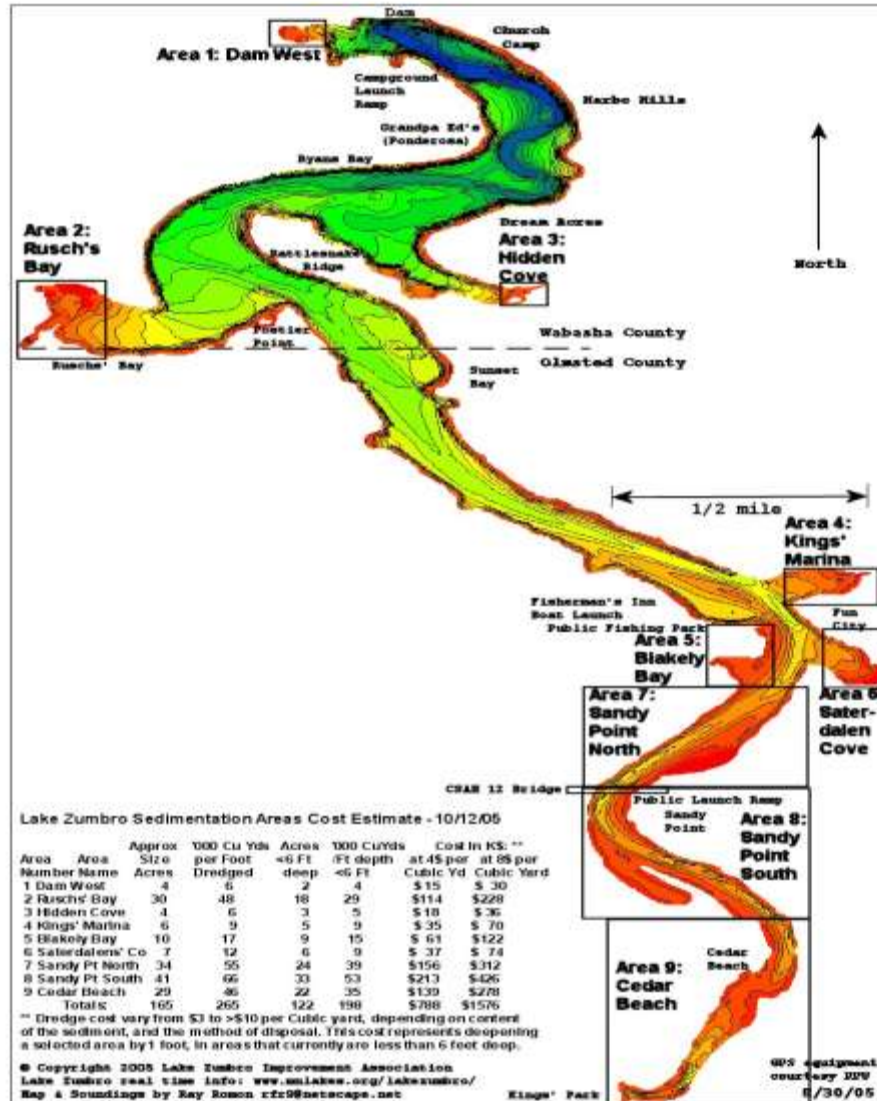
# 1978 Depths

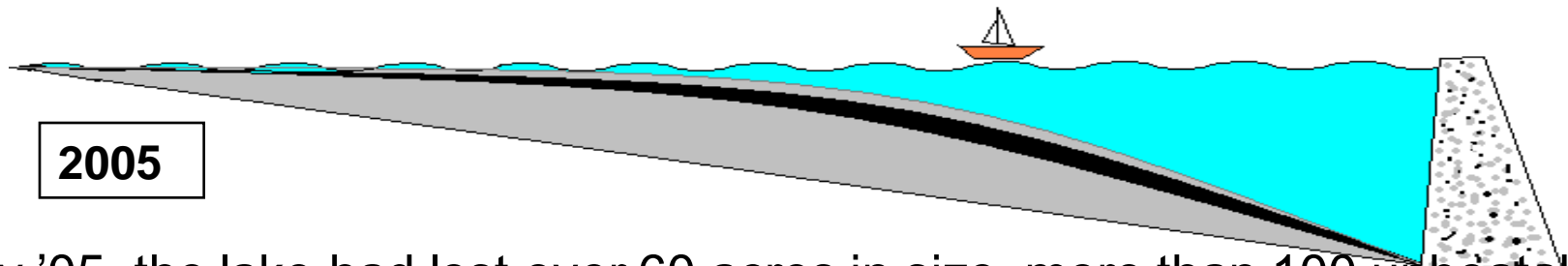
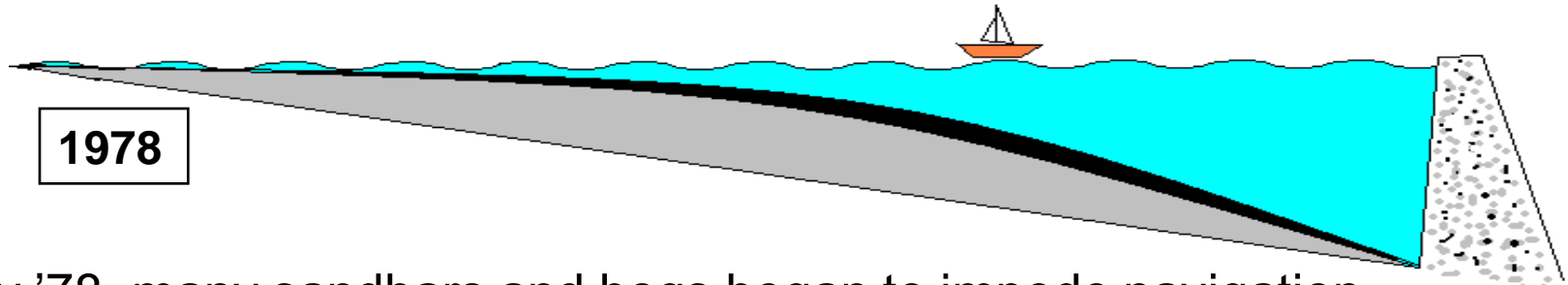
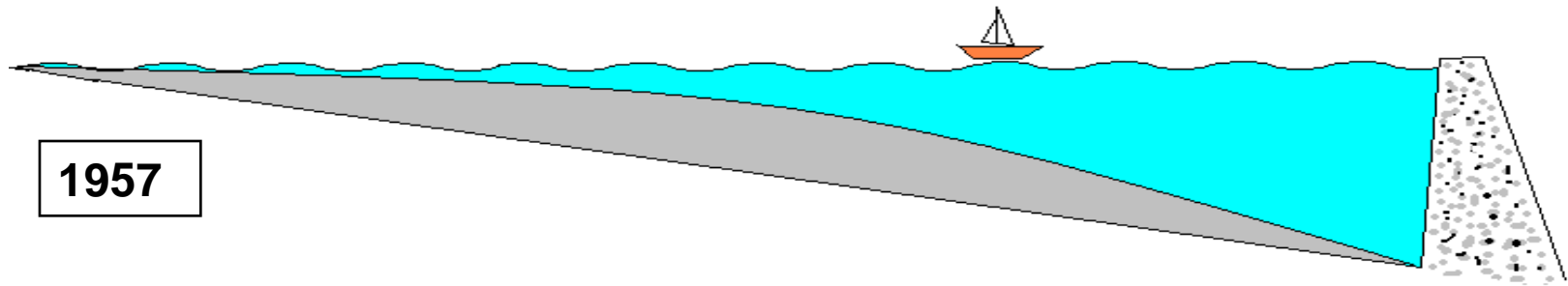
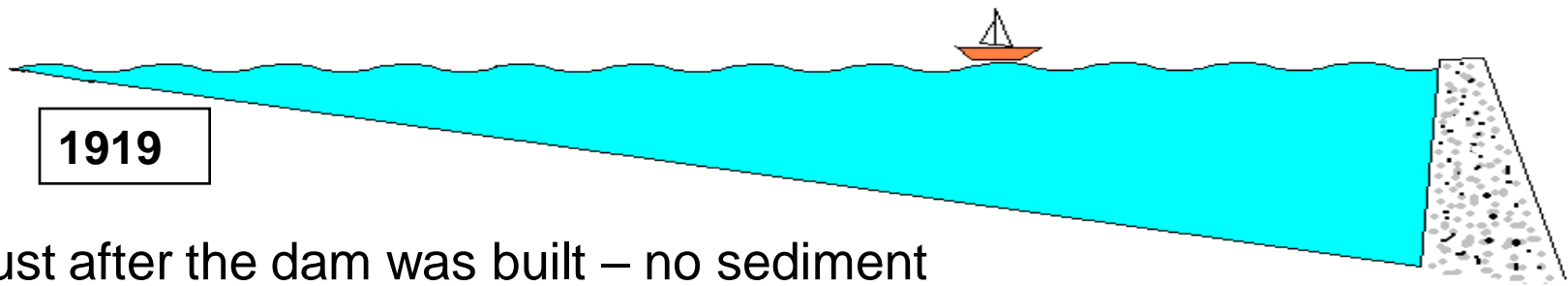


# 2005 Depths

## Lake Zumbro Siltation Areas

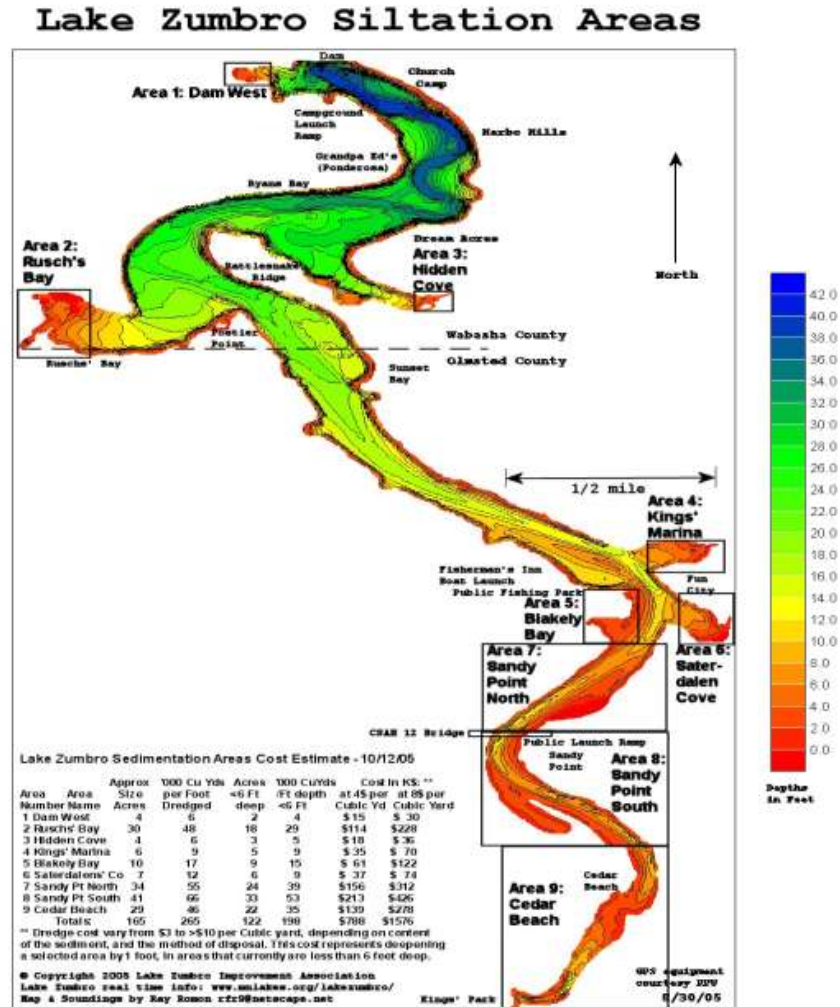
The boxes show potential dredging sites. The table gives the amount of silt to be removed per foot of new, recovered depth beyond 6 feet.





# Dredging Estimates

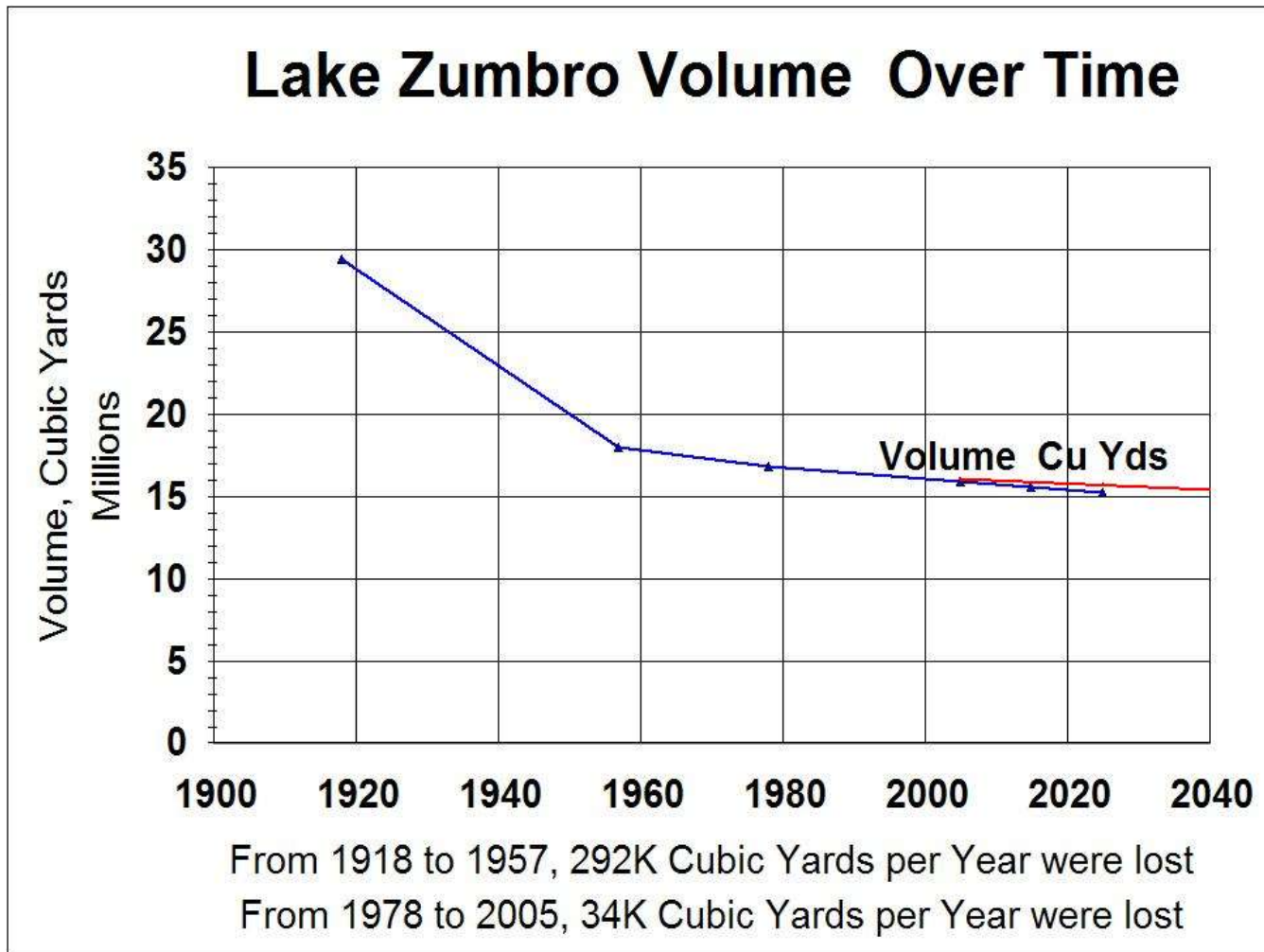
- When we dredge 1 Million Cubic Yards:
  - We re-open 120+ acres to navigation/fisheries
  - 6 foot minimum depths in the dredged areas
- Dredge area candidates are on the map to the right--→



# Water volume is decreasing

- Current projected decrease is about 34,000 Cubic Yards, per year, over the entire lake

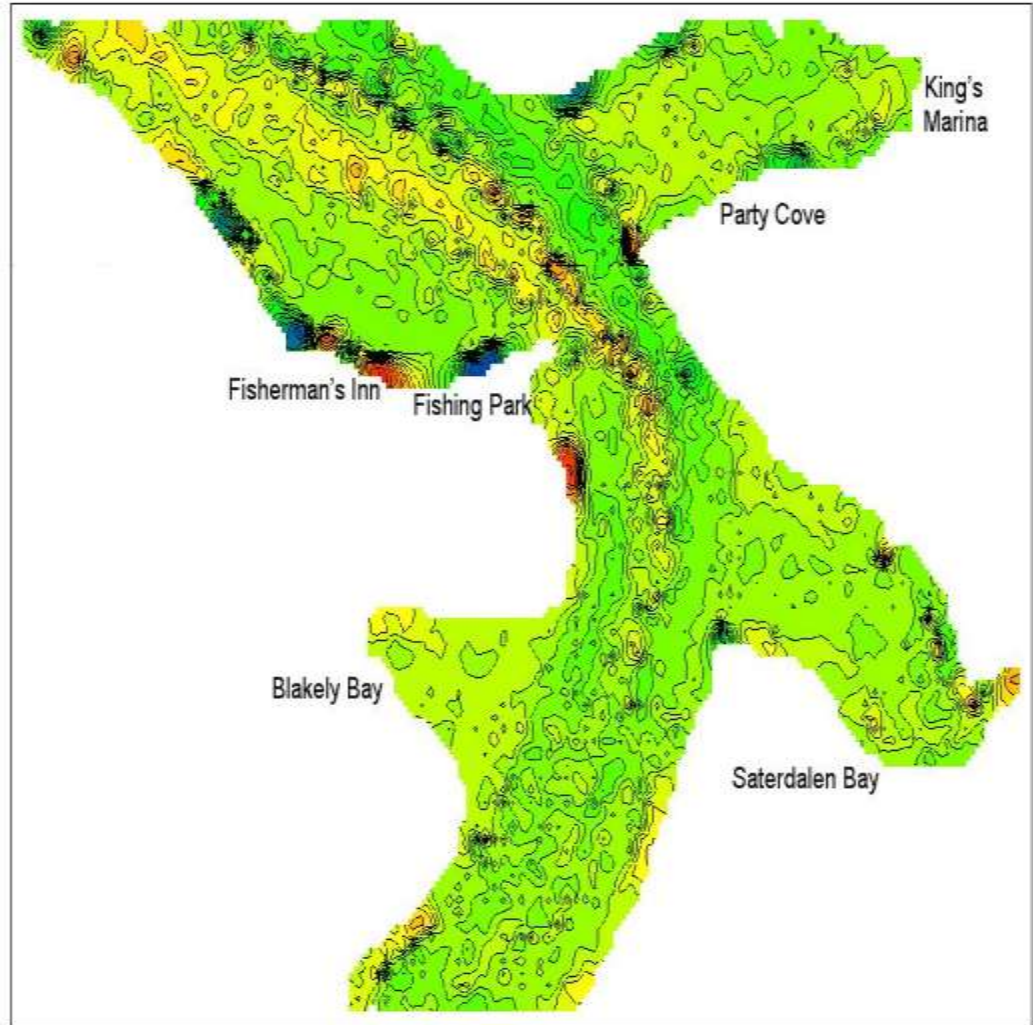
- Lake Zumbro has lost nearly 1/2 its original volume



Red line is projection if ZWP stated goal of 30% siltation reduction is met

# 2007 New Subset Survey

- 60 acres subset
- First survey ended 09/05
- 2nd survey in 08/07
- Average depth change was 1/10 foot
- Several spots showed 2+ feet shallower
- 10K Cubic yards of new sediment in 2 years
- 5K Cu Yds per year
- 500 dump trucks with 10 CuYds per year !



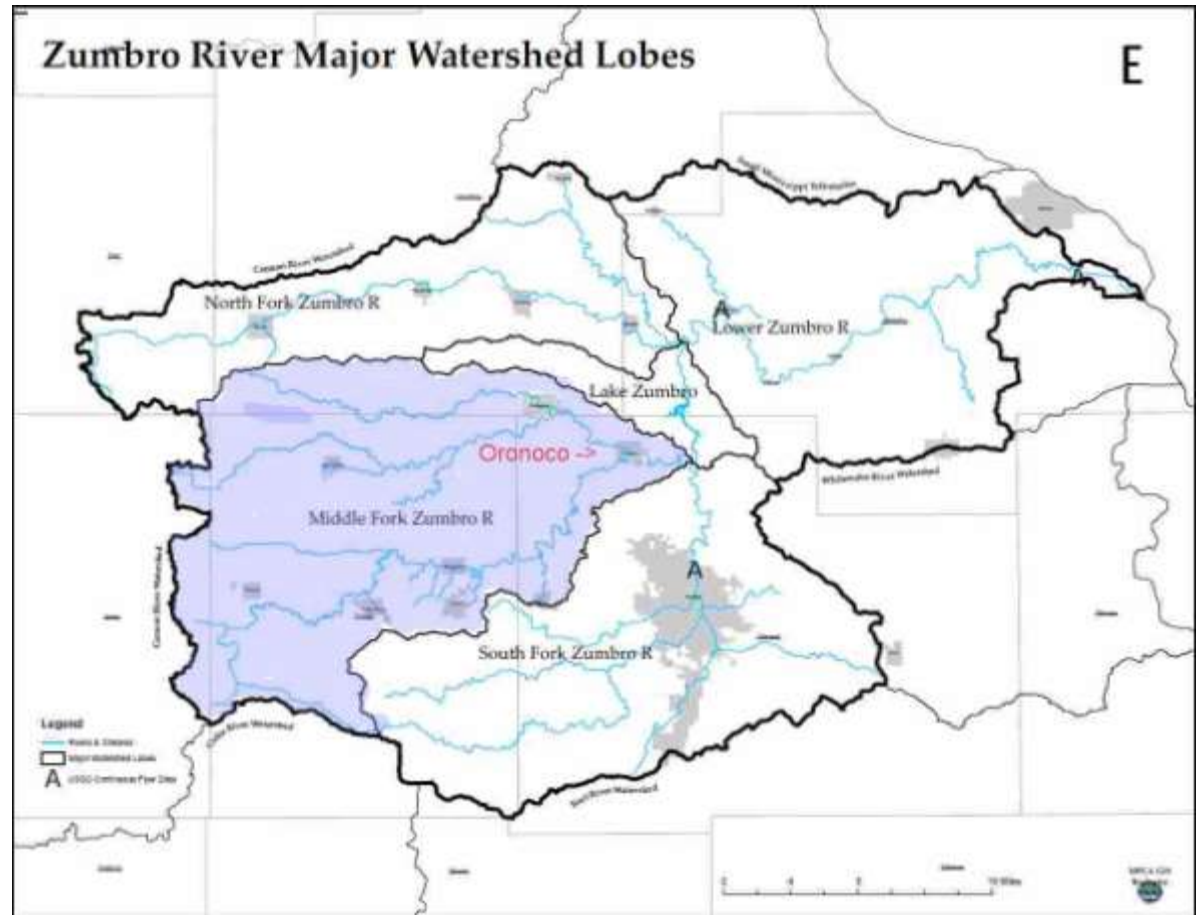
Lake Zumbro 2007 vs 2005 depth differences, feet

# Dredge Estimates

- If we dredge 1 Million Cubic Yards:
  - We re-open 120+ acres to navigation/fisheries
  - 6 foot minimum depths in the dredged areas
  - At current rate of 34K Cubic Yards/year, we gain back approx 30 years of sedimentation
  - If ZWP goals are met (30% rate reduction in 5 years) we gain back nearly 40 years of sedimentation loss.

# Middle Fork Flows thru Oranoco

- Largest sub-watershed on the Zumbro watershed area.
- Largely agricultural
- Few upstream impoundments



# Maintenance Estimates

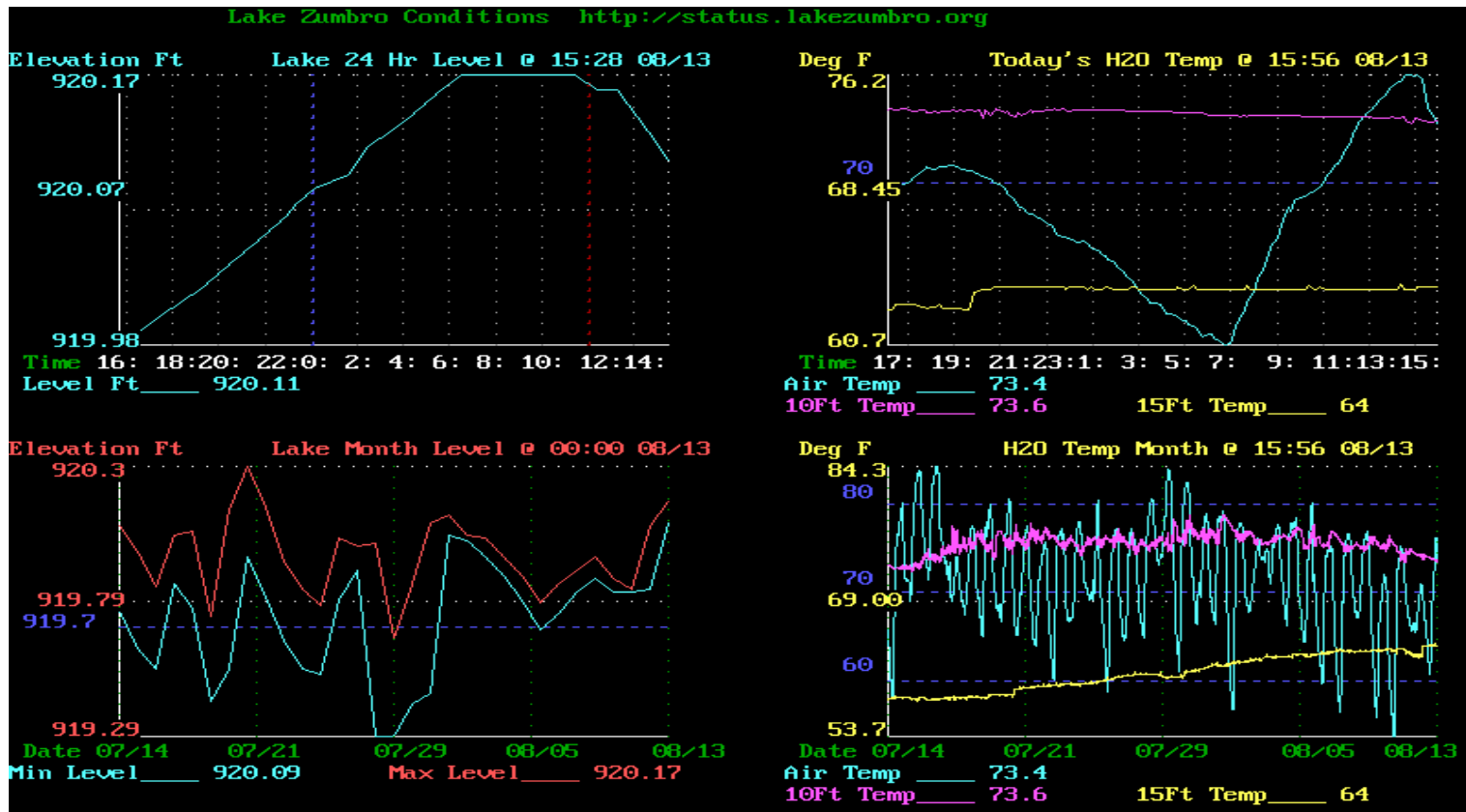
- Current sedimentation rates are estimated to be 34,000 Cubic Yards per year.
- If nothing is done to reduce sedimentation rates, after dredging, yearly average maintenance costs to keep up with sediment inflow, will average at least \$136,000 at a low range estimate of \$4 per cubic yard removed.
- This could be over twice that much, if high range estimates of \$10 per cubic yard is used.
- Maintenance dredging operations would be conducted every 30-40 years, and require another 1 Million yards removed, at \$4-10 Million in 2008 dollars equivalent
- Dredging operations are energy intensive, with diesel fuel costs rising faster than average inflation rates

# Summary

- 2007 Survey results are consistent with 2005 and earlier surveys as to rate of sedimentation
- Lake Shady currently offers little to no silt impoundment.
- A major source of silt is Zumbro's Middle Fork
- Dam removal may cause added downstream siltation into Lake Zumbro
- Lake Shady restoration will restore the silt buffer on the Middle Fork to Lake Zumbro

# Website update

- Lake Zumbro real time and historical graphical data website URL has changed:
- <http://status.lakezumbro.org>



# Lake Zumbro Restoration Info

- <http://lakezumbro.org>

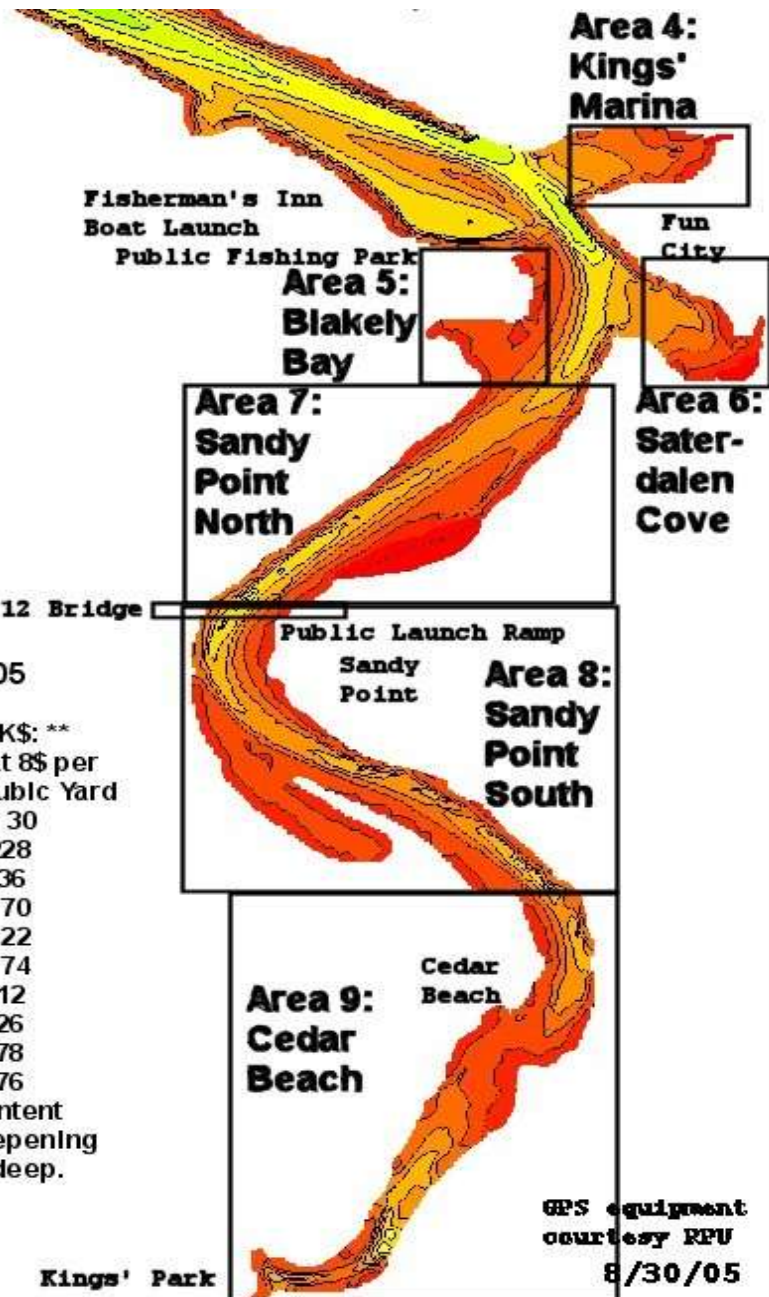


Backup Charts follow

# Sedimentation Economics

- Assume no reduction in sedimentation rate
- Dredge costs per cubic yard \$8-12 (Diesel fuel inflation rate)
- 34000 Cu Yds per year -> ~\$340K per year
- Approximately 300 households with LZ shoreline
  - Over \$1100 per year for sediment maintenance
- Approximately 50,000 households in watershed
  - About \$7 per year for sediment maintenance
- Assume ZWP goal: 30% sediment reduction in 5 yrs
- 24000 Cu Yds per year -> ~\$240K per year
  - ~\$770 for local apportionment per year
  - ~\$5 for watershed wide apportionment per year

Apportionment should include all potential silt sources across the entire watershed.



**Lake Zumbro Sedimentation Areas Cost Estimate - 10/12/05**

Area Number	Area Name	Approx Size Acres	'000 Cu Yds per Foot Dredged	Acres <6 Ft deep	'000 CuYds /Ft depth <6 Ft	Cost In K\$: **	
						at \$4 per Cubic Yd	at \$8 per Cubic Yard
1	Dam West	4	6	2	4	\$15	\$30
2	Ruschs' Bay	30	48	18	29	\$114	\$228
3	Hidden Cove	4	6	3	5	\$18	\$36
4	Kings' Marina	6	9	5	9	\$35	\$70
5	Blakely Bay	10	17	9	15	\$61	\$122
6	Saterdalens' Co	7	12	6	9	\$37	\$74
7	Sandy Pt North	34	55	24	39	\$156	\$312
8	Sandy Pt South	41	66	33	53	\$213	\$426
9	Cedar Beach	29	46	22	35	\$139	\$278
<b>Totals:</b>		<b>165</b>	<b>265</b>	<b>122</b>	<b>198</b>	<b>\$788</b>	<b>\$1576</b>

\*\* Dredge cost vary from \$3 to >\$10 per Cubic yard, depending on content of the sediment, and the method of disposal. This cost represents deepening a selected area by 1 foot, in areas that currently are less than 6 feet deep.

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 Lake Zumbro real time info: [www.mnlakes.org/lakezumbro/](http://www.mnlakes.org/lakezumbro/)  
 Map & Soundings by Ray Romon rfr9@netscape.net

Kings' Park

GPS equipment  
courtesy RPV

8/30/05