TAINTER LAKE SEDIMENT STUDY

- TAINTER MENOMIN IMPROVEMENT ASSOCIATION
- DUNN COUNTY LAND CONSERVATION DIVISION
- UW-EAU CLAIRE GEOGRAPHY DEPARTMENT
- WISCONSIN DEPARTMENT OF NATURAL RESOURCES

PROJECT PURPOSE

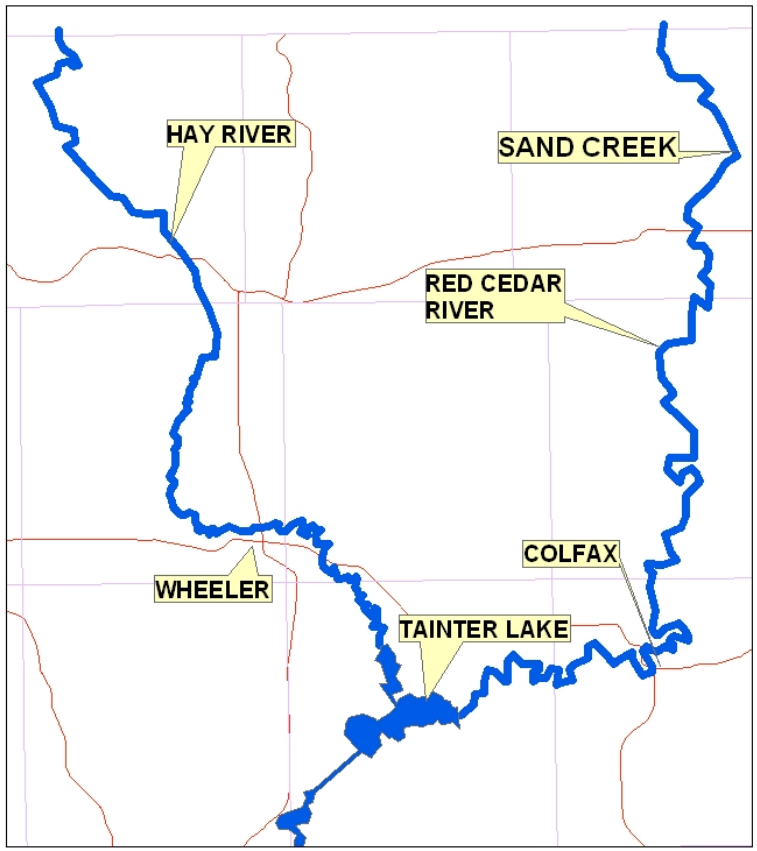
- DETERMINE THE SOURCES AND EFFECTS OF SEDIMENTATION ON UPPER TAINTER LAKE

PROJECT GOALS

- DOCUMENT THE VOLUME OF WATER THAT HAS BEEN DISPLACED BY SEDIMENT SINCE 1960 AT THE MOUTH OF THE RED CEDAR AND HAY RIVERS
- IDENTIFY THE SOURCES OF SEDIMENT
- ESTIMATE THE INFILL RATE OF THE LAKE
- CREATE A NEW BATHYMETRIC LAKE MAP

DUNN COUNTY

TAINTER LAKE SEDIMENT STUDY



TAINTER LAKE LOOKING S.W. TO LAKE MENOMIN

TAINTER LAKE AT RED CEDAR INLET, 2005 DRAW DOWN

TAINTER LAKE AT HAY RIVER INLET, 2005 DRAW DOWN

AREAS OF STUDY

- STREAMBANK EROSION
- SEDIMENT IN RUNOFF FROM CROPLAND
- SEDIMENT IN THE LAKE BED IN 2005 COMPARED TO 1960

STREAM BANK EROSION

- FLOATED THE RIVERS
- DETERMINE LENGTH AND LOCATION OF ERODING BANKS VIA GPS POINTS
- ESTIMATED HEIGHT
- CLASSIFIED THE ERODING BANKS

FLOATING THE RIVER

GPS DATA COLLECTOR

CANOE SKILLS REQUIRED

HAY RIVER- ONE OF MANY LOG JAMS

Flat bottom boat with go devil motor

CLASS I - (DEFINITION)

- ACTIVELY ERODING
- VOID OF ESTABLISHED VEGETATION
- RECEDING AT ONE FOOT PER YEAR

CLASS I BANK (600 FT. X 25 FT.)

CLASS I BANK (1,200 FT. X 50 FT.)

- HAY RIVER CLASS I

CLASS I (EROSION SUMMARY)

- HR 9,135 FT. 15.2’ AVG.HEIGHT
  - 5,140 CUBIC YARDS PER YEAR
    - (340 DUMP TRUCKS)
- RC 13,670 FT. 24.5’ AVG.HEIGHT
  - 11,451 CUBIC YARDS PER YEAR
    - (760 DUMP TRUCKS)

CLASS II – (DEFINITION)

- INTERMITTENTLY ERODING
- 50% OR LESS ESTABLISHED VEGETATION
- RECEDING AT 0.5 FEET PER YEAR

CLASS II BANK – HAY RIVER

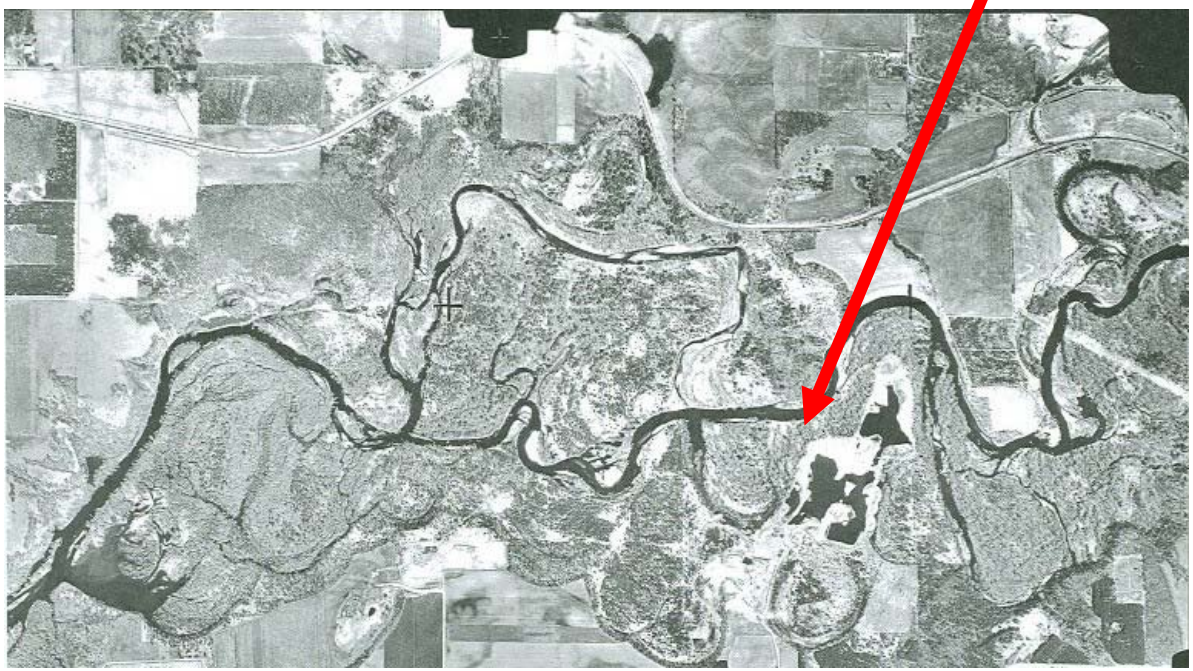
CLASS III- (DEFINITION)

- INTERMITTENTLY ERODING
- 75% OR GREATER VEGETATION
- RECEDING 0.2 FEET PER YEAR

CLASS III BANK

CLASS II & III (EROSION SUMMARY)

- HR 14,705 FT. 13.3’ AVG.HEIGHT
  - 2,838 CUBIC YARDS PER YEAR
    - (189 DUMP TRUCKS)
- RC 11,010 FT. 15.0’ AVG.HEIGHT
  - 2,820 CUBIC YARDS PER YEAR
    - (188 DUMP TRUCKS)



1958 vs 1986

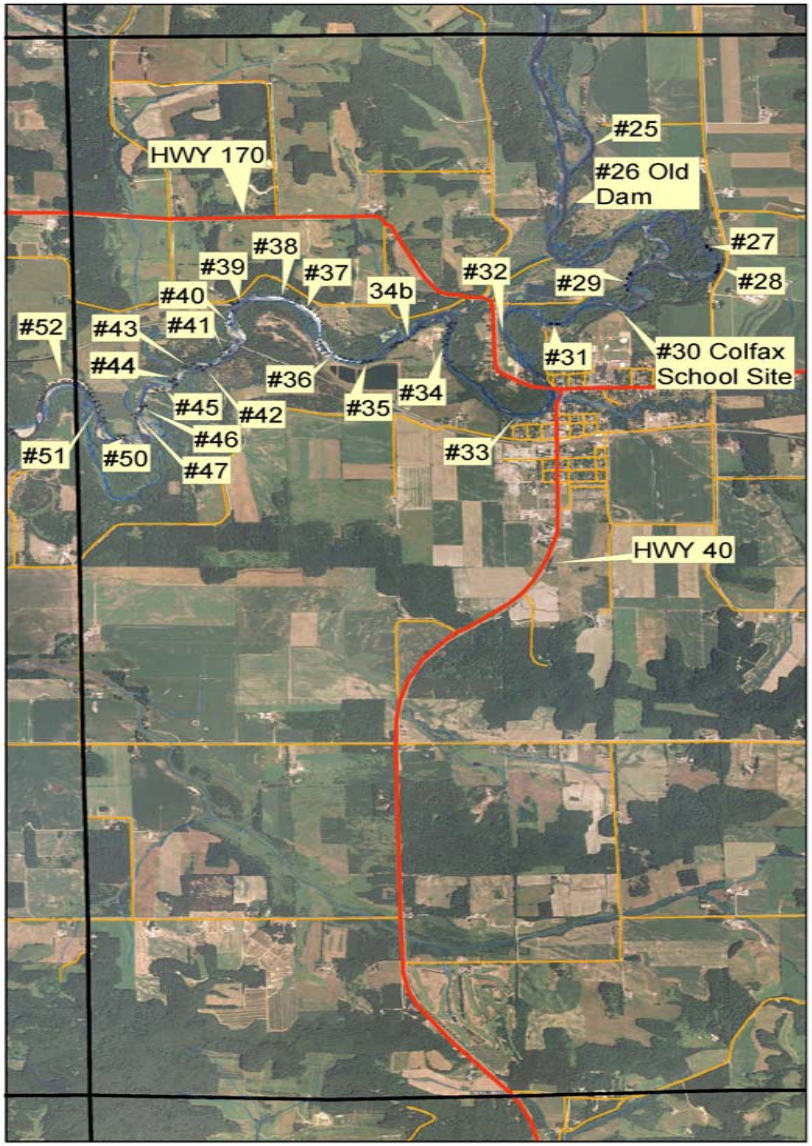
CHANNEL CHANGES ITS COURSE

LENGTH OF CHANNEL GOES FROM 8,000 L.F. TO 4,000 L.F. RAISING VELOCITY OF FLOW.

THIS CAN PRODUCE A HEAD CUTTING EFFECT ON STREAM CHANNEL CREATING UNSTABLE BANKS.

EST. 113,600 CU. YDS. OF SOIL DISPLACED FROM NEW CHANNEL.

Name : Red Cedar River
Location: Colfax Township
Site Numbers: 25 to 52



ERODING BANK LOCATIONS.

BANK MOVES 100 FEET

1992

Name : Adrian Smith Bank 1992
Location: T.29N. R11W. Sec. 12
Township: Colfax
Site Number 51-52 GPS 67-80
Class 1 1000Feet@ 25 Feet high 1200 Feet @ 50 Feet High

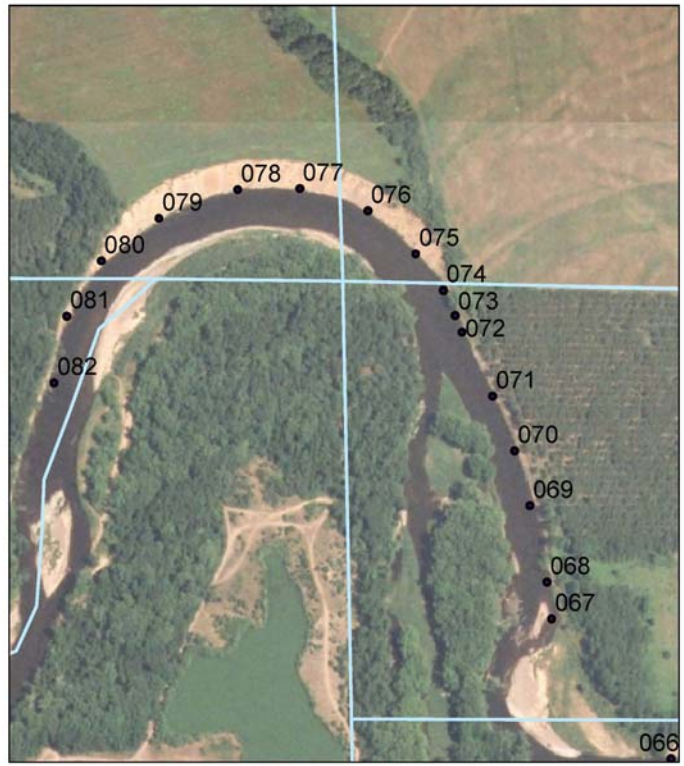
0 165 330 660 Feet

2005

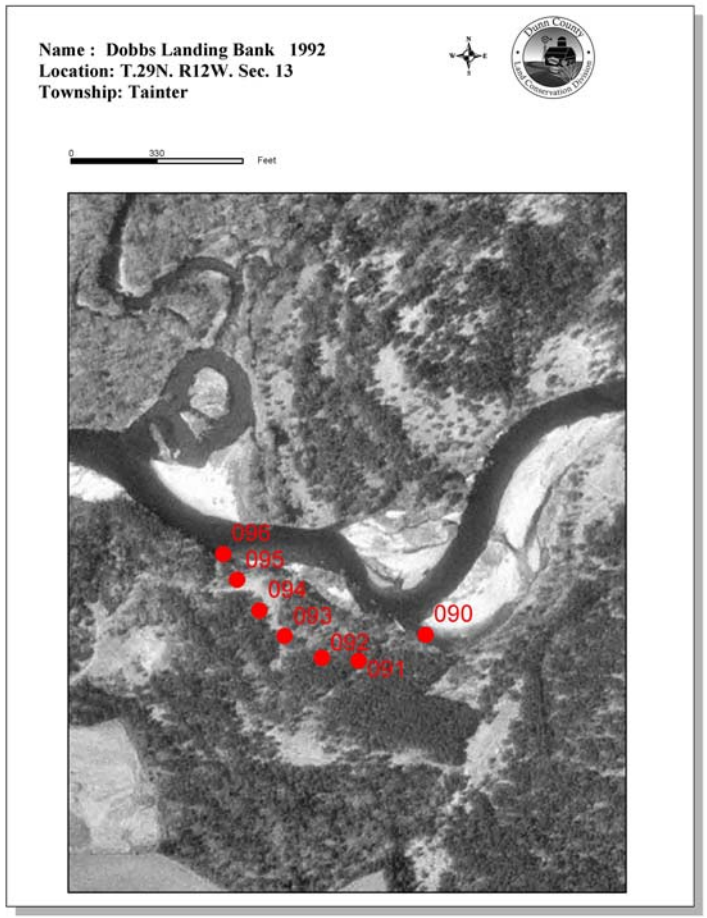
PLAN MAP

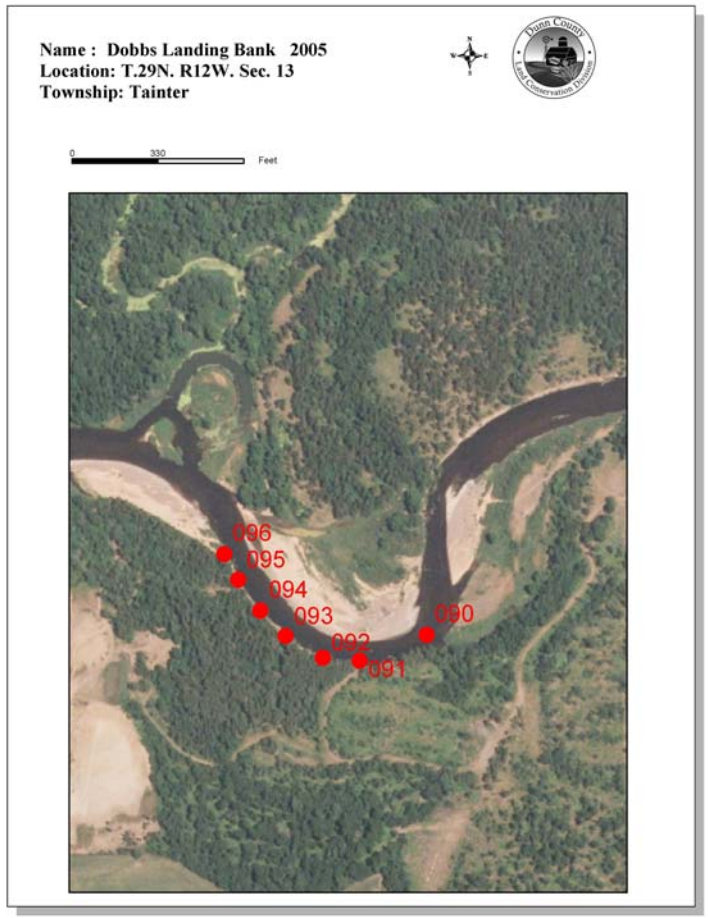
Name : Adrian Smith Bank
Location: T.29N.-R.11W. Sec 12
Township: Colfax
Site Number 51-52 GPS 67-80
Class 1 1000 Feet @ 25 Feet High 1200 Feet @ 50 Feet High

0 330 660 Feet



BANKS MOVED 120 FEET





CROPLAND

- ANNUAL TRANSECT SURVEY DATA WAS USED TO ESTIMATE SEDIMENT DELIVERY FROM CROPLAND.

SEDIMENT DELIVERY FROM CROPLAND

RED CEDAR	32,826 AC. CROPLAND 4,242 CUBIC YARDS (282 DUMP TRUCKS)
HAY RIVER	36,415 AC. CROPLAND 9,022 CUBIC YARDS (601 DUMP TRUCKS)

SEDIMENT FROM CROPLAND (DUNN COUNTY DATA ONLY)

	Ac of Cropland	Transect Survey Soil Loss (TONS / AC.)	Delivery Rate Est.	Cubic Yards of Sediment Per Year
Red Cedar River	32,000	2.4	7.7%	4,200
Hay River	37,000	4.3	7.7%	9,000

SEDIMENT DELIVERY

- Red Cedar
- Streambank 14,271
- Cropland 4,242
- Total 18,513 Cu. Yards/Yr.

- Hay River
- Streambank 7,978
- Cropland 9,022
- Total 18,000 Cu. Yards/Yr.

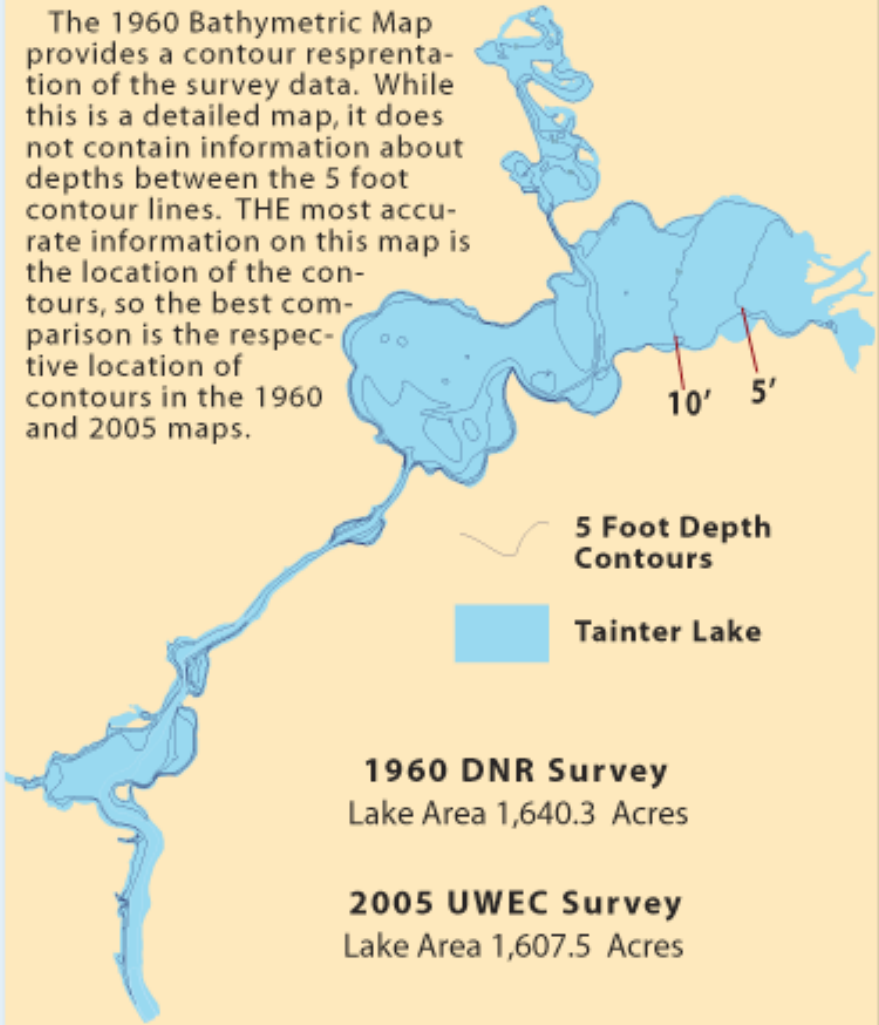
BATHYMETRIC SURVEY COMPARISON 1960 → 2005

Comparison of 1960 DNR Bathymetric Survey and 2005 UWEC Survey

Lake Area and 5 Foot Depth Contour Lines

1960 DNR Survey

The 1960 Bathymetric Map provides a contour resprentation of the survey data. While this is a detailed map, it does not contain information about depths between the 5 foot contour lines. THE most accurate information on this map is the location of the contours, so the best comparison is the respective location of contours in the 1960 and 2005 maps.



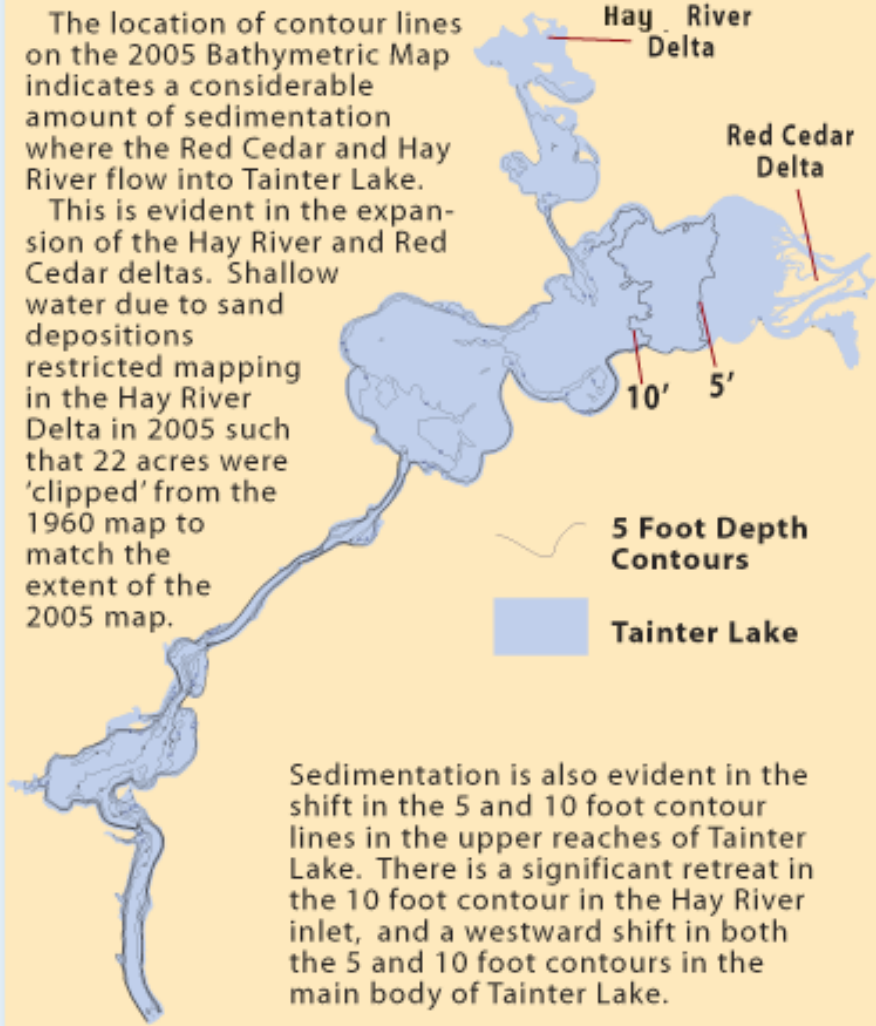
1960 DNR Survey
Lake Area 1,640.3 Acres

2005 UWEC Survey
Lake Area 1,607.5 Acres

2005 UWEC Survey

The location of contour lines on the 2005 Bathymetric Map indicates a considerable amount of sedimentation where the Red Cedar and Hay River flow into Tainter Lake.

This is evident in the expansion of the Hay River and Red Cedar deltas. Shallow water due to sand depositions restricted mapping in the Hay River Delta in 2005 such that 22 acres were 'clipped' from the 1960 map to match the extent of the 2005 map.



Sedimentation is also evident in the shift in the 5 and 10 foot contour lines in the upper reaches of Tainter Lake. There is a significant retreat in the 10 foot contour in the Hay River inlet, and a westward shift in both the 5 and 10 foot contours in the main body of Tainter Lake.

Sean Hartnett Geographer
University of Wisconsin - Eau Claire

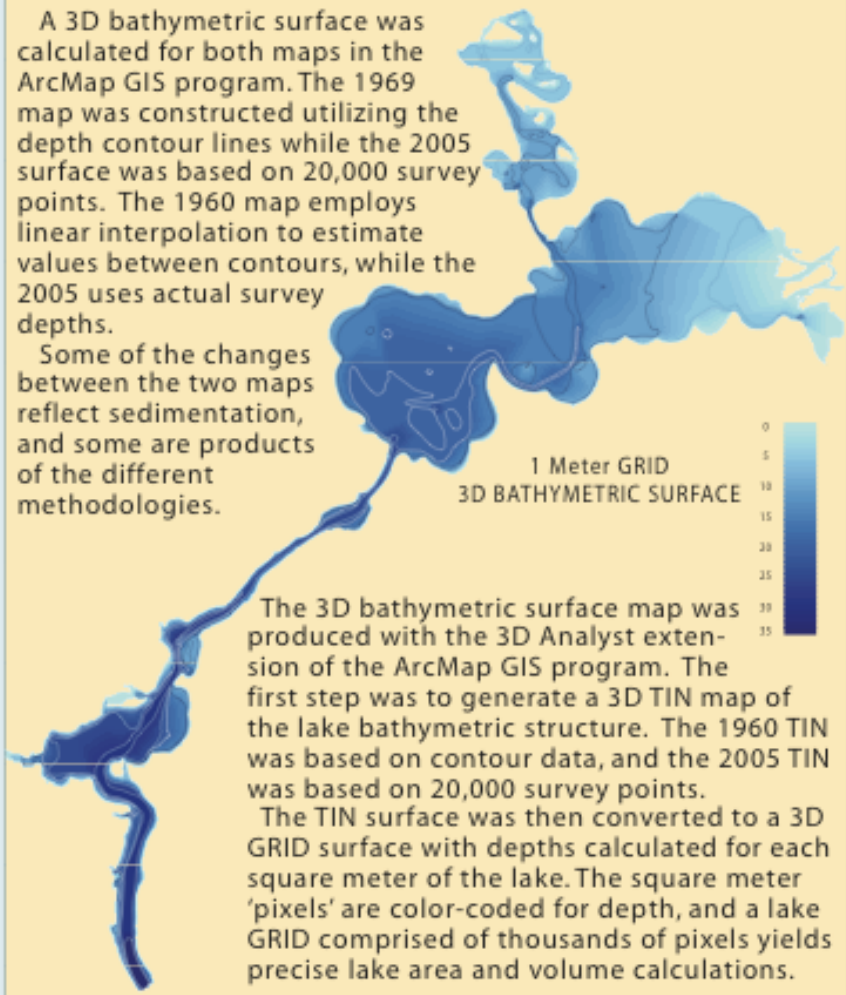
Comparison of 1960 DNR Bathymetric Survey and 2005 UWEC Survey

Lake Volume and 3D Bathymetric Surface

1960 DNR Survey

A 3D bathymetric surface was calculated for both maps in the ArcMap GIS program. The 1969 map was constructed utilizing the depth contour lines while the 2005 surface was based on 20,000 survey points. The 1960 map employs linear interpolation to estimate values between contours, while the 2005 uses actual survey depths.

Some of the changes between the two maps reflect sedimentation, and some are products of the different methodologies.



The 3D bathymetric surface map was produced with the 3D Analyst extension of the ArcMap GIS program. The first step was to generate a 3D TIN map of the lake bathymetric structure. The 1960 TIN was based on contour data, and the 2005 TIN was based on 20,000 survey points.

The TIN surface was then converted to a 3D GRID surface with depths calculated for each square meter of the lake. The square meter 'pixels' are color-coded for depth, and a lake GRID comprised of thousands of pixels yields precise lake area and volume calculations.

2005 UWEC Survey

1960 DNR Survey

Calculated in ArcMap

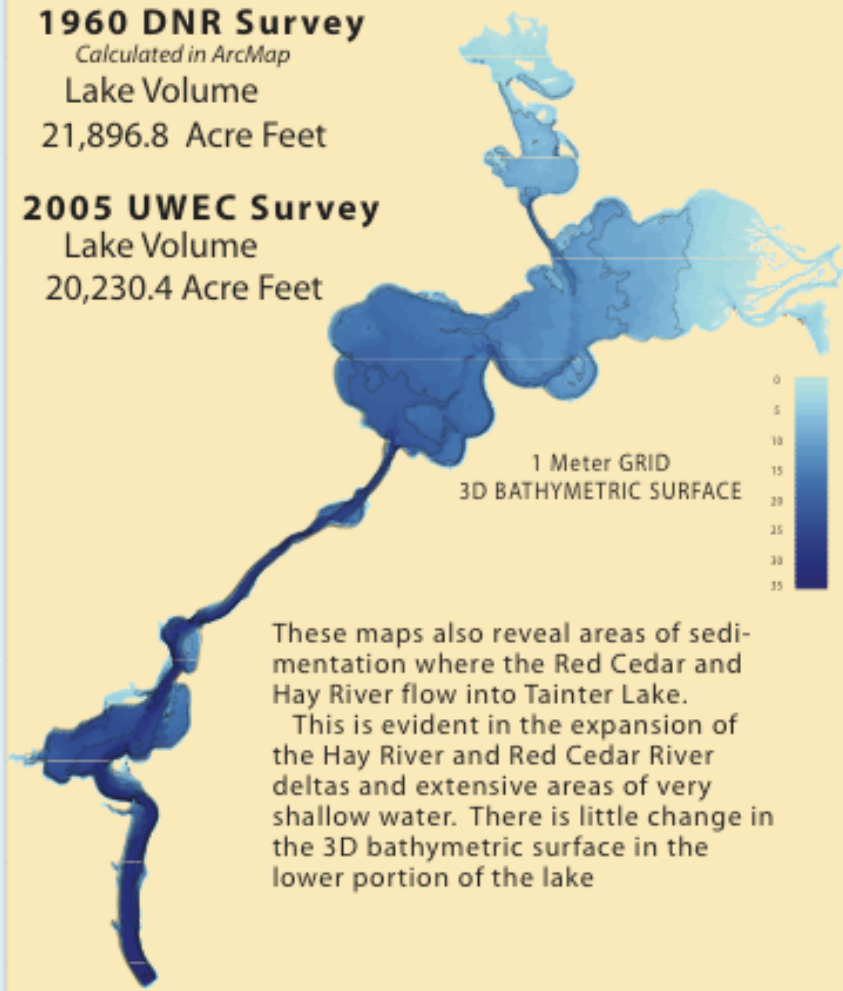
Lake Volume

21,896.8 Acre Feet

2005 UWEC Survey

Lake Volume

20,230.4 Acre Feet



These maps also reveal areas of sedimentation where the Red Cedar and Hay River flow into Tainter Lake.

This is evident in the expansion of the Hay River and Red Cedar River deltas and extensive areas of very shallow water. There is little change in the 3D bathymetric surface in the lower portion of the lake

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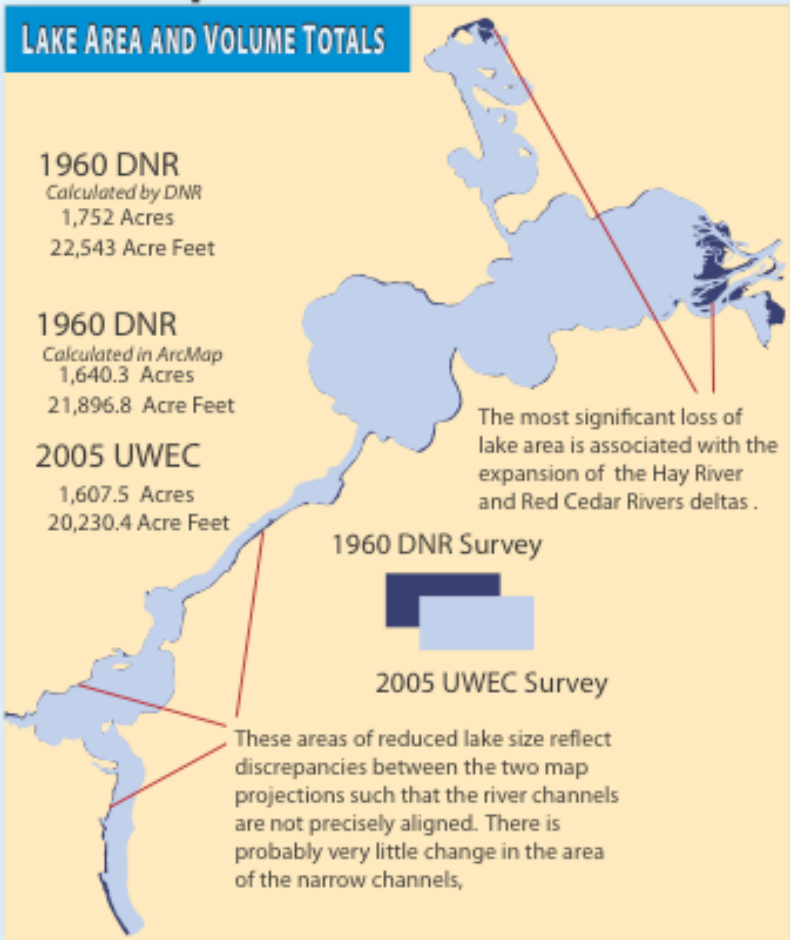
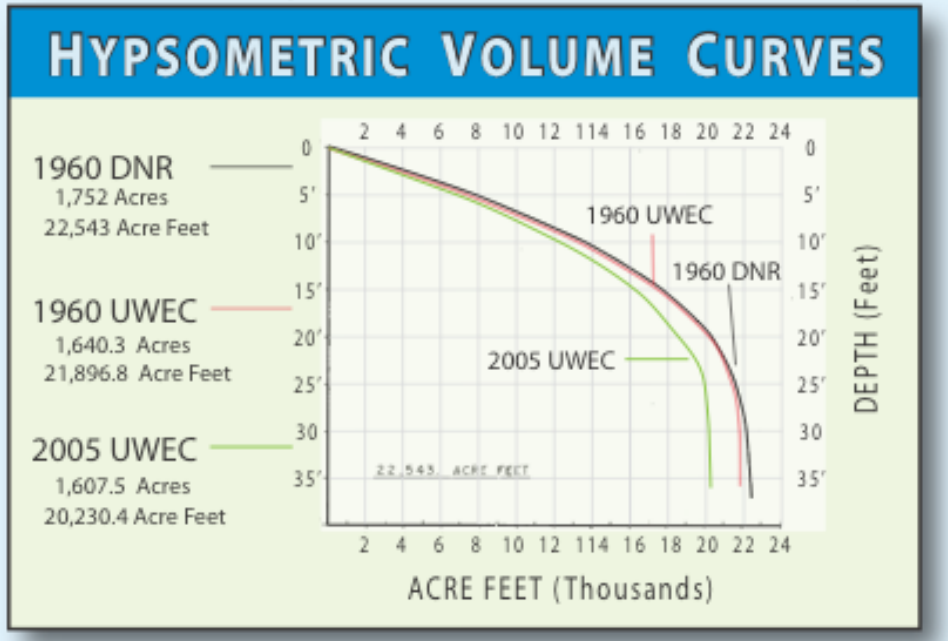
Comparison of 1960 DNR Bathymetric Survey and 2005 UWEC Survey

Lake Area and Volume Totals



Hypsometric Volume Curves



Three different Hypsometric Volume graphs were constructed to compare changes in lake volume:

- The 1960 DNR Bathymetric map included a graph that was scanned and used as the 'base' for the graph above.
- The 1960 UWEC curve represents data derived from the 3D bathymetric surface based on the 1960 contour data.
- The 2005 UWEC curve represents data derived from the 3D bathymetric surface based on the 2005 lake survey.

1960 Survey - 1 Meter GRID Surface Area and Volume Statistics

	Volume Below Plane		Cumulative Frustrum Totals		
Depth	Cubic Meters	Acre Feet	Acre Feet	Sq Meters	Acres
0	27,009,768.57	21,896.8			
5	17,756,831.18	14,395.5	7,501.3	990,308.94	244.7
10	10,527,114.57	8,534.3	13,362.5	2337,012.29	577.5
15	5,207,856.87	4,222.0	17,674.8	3577,244.28	884.0
20	1,906,147.72	1,545.31	20,351.49	4933,661.86	1,219.1
25	493,546.07	400.12	21,496.68	6162,944.24	1,522.9
30	63,092.34	51.15	21,845.65	6400,439.10	1,581.6
			21,896.8	6638,058.00	1,640.3

2005 Survey - 1 Meter GRID Surface Area and Volume Statistics

	Volume Below Plane		Cumulative Frustrum Totals		
Depth	Cubic Meters	Acre Feet	Acre Feet	Sq Meters	Acres
0	24,954,221.14	20,230.4			
5	16,377,759.08	13,277.4	6,953.0	1,601,687.86	395.8
10	9,667,512.84	7,837.5	12,392.9	2,712,607.97	670.3
15	4,910,434.24	3,980.9	16,249.5	3,883,663.97	959.7
20	1,990,686.91	1,613.8	18,616.6	5,296,035.09	1,308.7
25	527,515.61	427.7	19,802.7	6,027,661.20	1,489.5
30	97,251.87	78.8	20,151.6	6,279,560.41	1,551.7
			20,230.4	6,505,464.56	1,607.5

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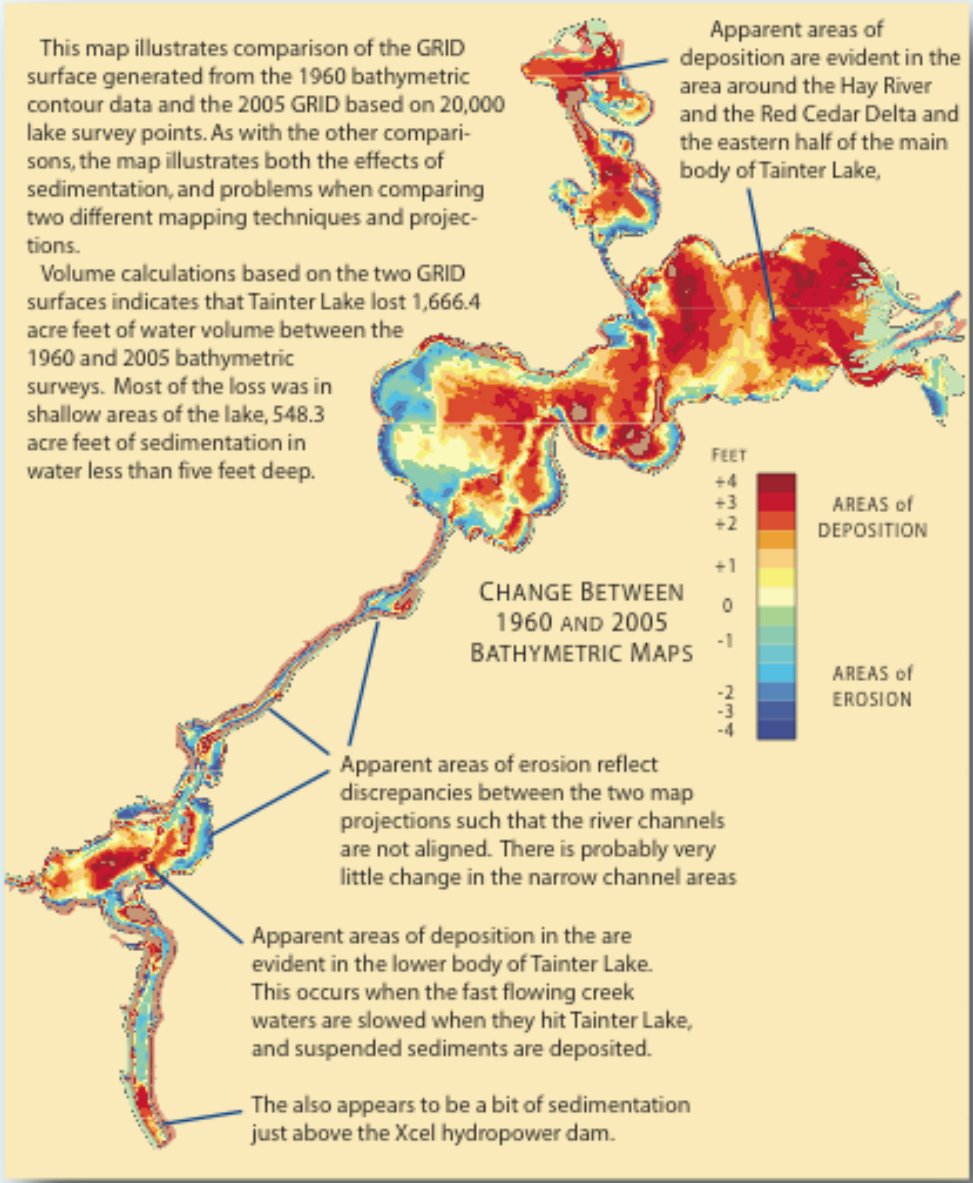
Comparison of 1960 DNR Bathymetric Survey and 2005 UWEC Survey



1960 Survey - 1 Meter GRID Surface

CUMULATIVE FRUSTRUM TOTALS

Depth	Acre Feet	Acres
0 - 5	7,501.3	244.7
5 -10	13,362.5	577.5
10-15	17,674.8	884.0
15-20	20,351.4	1,219.1
20-25	21,496.6	1,522.9
25-30	21,845.6	1,581.6
30+	21,896.8	1,640.3

2005 Survey - 1 Meter GRID Surface

CUMULATIVE FRUSTRUM TOTALS

Depth	Acre Feet	Acres
0 - 5	6,953.0	395.8
5 -10	12,392.9	670.3
10-15	16,249.5	959.7
15-20	18,616.6	1,308.7
20-25	19,802.7	1,489.5
25-30	20,151.6	1,551.7
30+	20,230.4	1,607.5

CHANGE IN FRUSTRUM TOTALS

1960 Survey - 2005 Survey

Depth	Acre Feet	Acres
0 - 5	- 548.3	+151.1
5 -10	- 969.6	+ 92.8
10-15	- 1,425.3	+ 75.7
15-20	- 1,734.8	+ 89.6
20-25	- 1,693.9	- 33.4
25-30	- 1,694.0	- 29.9
30+	- 1,666.4	- 32.8

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BATHYMETRIC SUMMARY (45 YRS.)

- BATHYMETRIC STUDY
- 1960- 21,897 AC. FT.
- 2005- 20,230 AC. FT.
- VOL. LOST 1,667 AC. FT.

- = 2,689,427 CU. YDS. (2.69 MILLION) DEPOSITED IN TAINTER LAKE

EROSION GRAND TOTAL (STREAM BANKS AND CROPLAND)

- 35,513 TOTAL CUBIC YARDS PER YEAR
- 2,368 DUMP TRUCK LOADS
- STREAM BANK INVENTORY
- ESTIMATED 1.6 MILLION CU. YDS. ERODED OVER THE 45 YEARS
- LAKE STUDY SHOWS 2.7 MILLION CU. YDS. DEPOSITED OVER 45 YEARS

OTHER SOURCES OF SEDIMENT

- NON INVENTORIED TRIBUTARIES
  - STREAM CHANNEL REDIRECTIONS
    - SOUTH FORK OF HAY RIVER

COLFAX SCHOOL BANK

50 FEET HIGH, 300 FEET LONG, EST. 556 CU. YDS./YR.

COLFAX SCHOOL BANK LOOKING DOWNSTREAM

SEDIMENT DEPOSITS DOWNSTREAM (STABLE BANK AND FLOOD PLAIN)

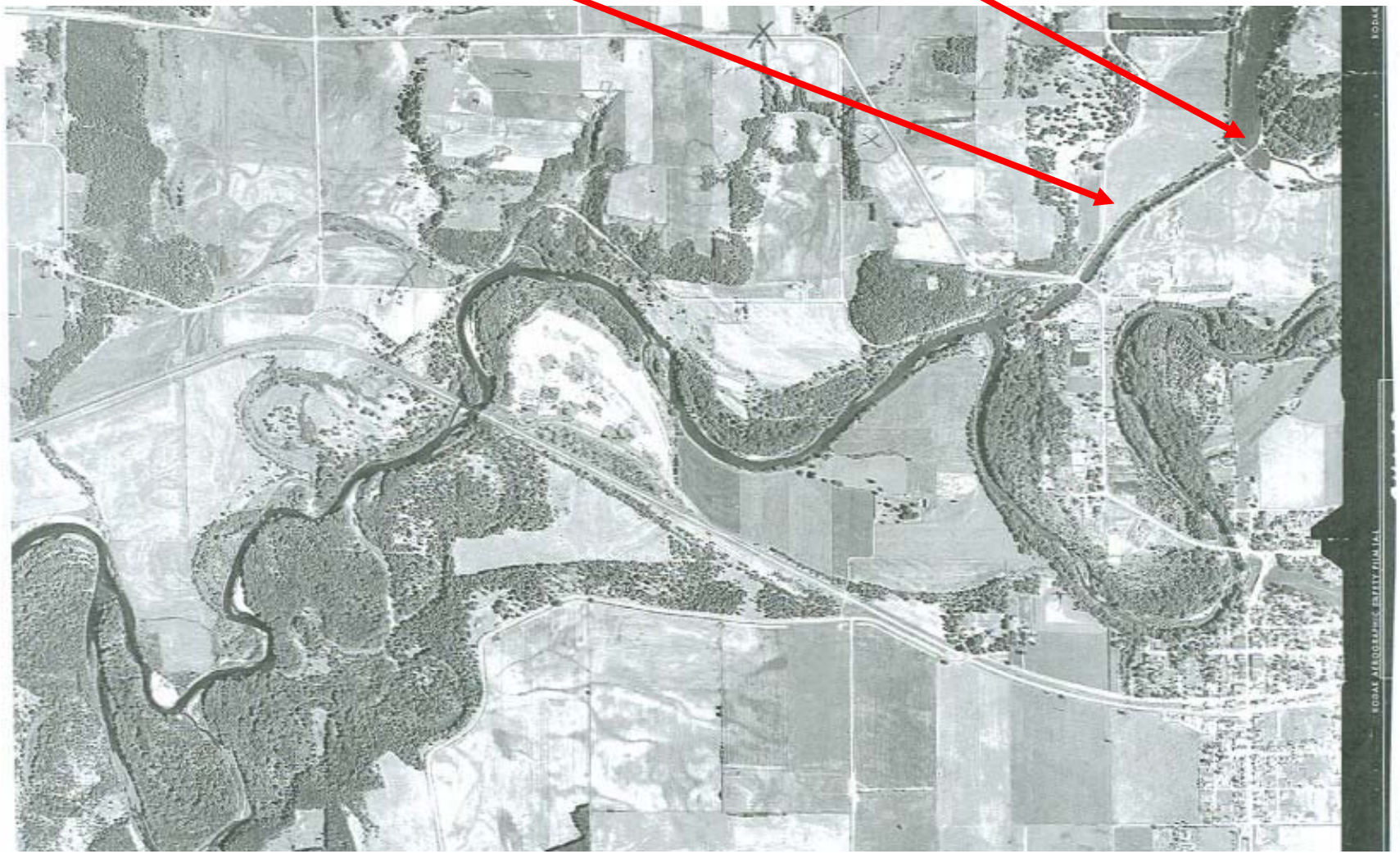
BANK STABILIZED WITH RIPRAP IN 1991
EST. COST $70 - $100 PER LIN. FT. IN 2007

CLOSE UP VIEW

HAY RIVER, RIP RAP INSTALLED IN 2005

AN OLD NSP DAM ABOVE COLFAX

COLFAX CANAL AND OLD DAM (1958 PHOTO)



- COLFAX RAILROAD BRIDGE

- COLFAX SEWAGE TREATMENT PLANT DISCHARGE