

The Dam Facts: Water Levels in the Antrim Chain of Lakes

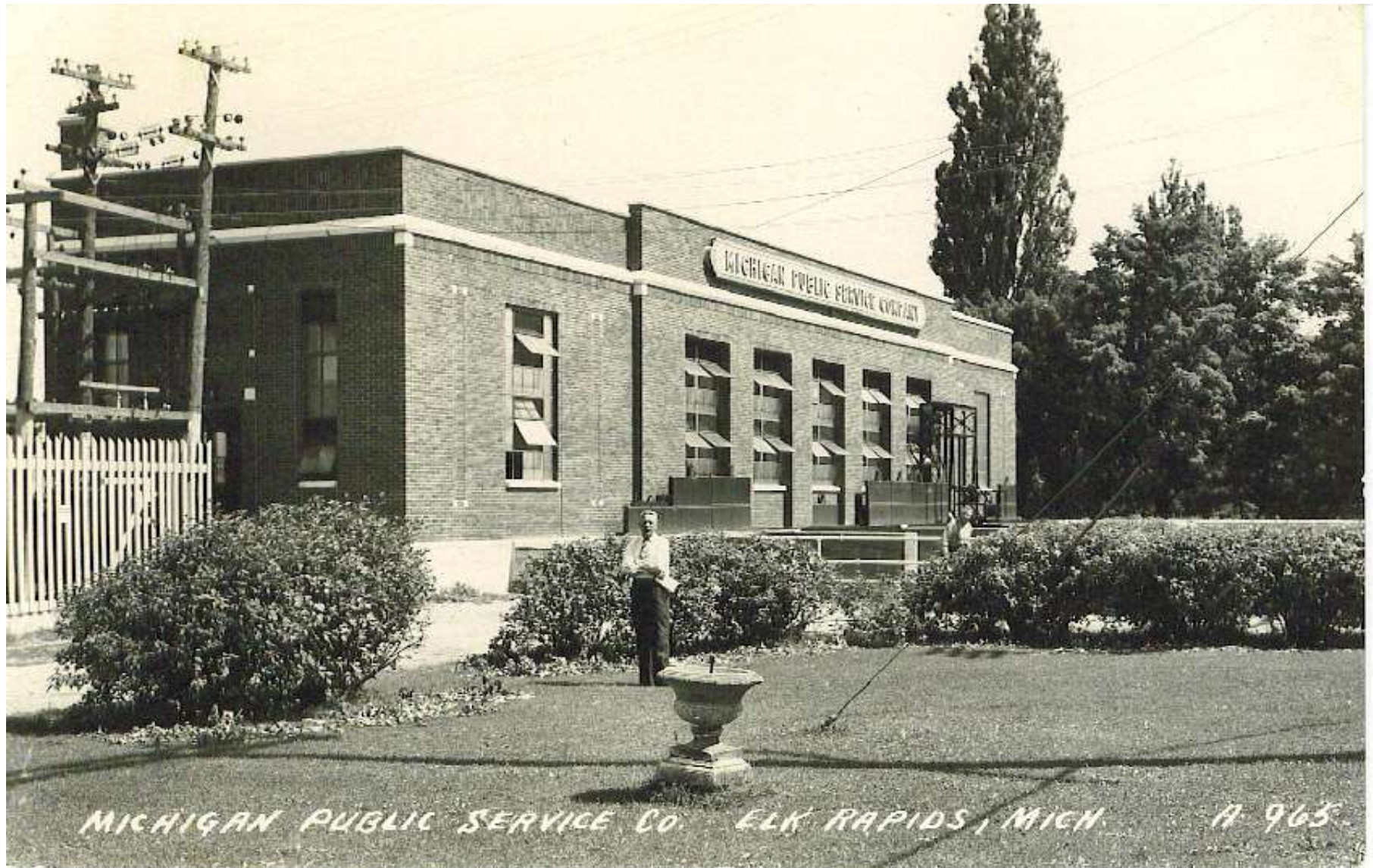
Prepared by
Mark Stone, Antrim County Operator of Dams
& Antrim County Drain Commissioner

Antrim Chain of Lakes

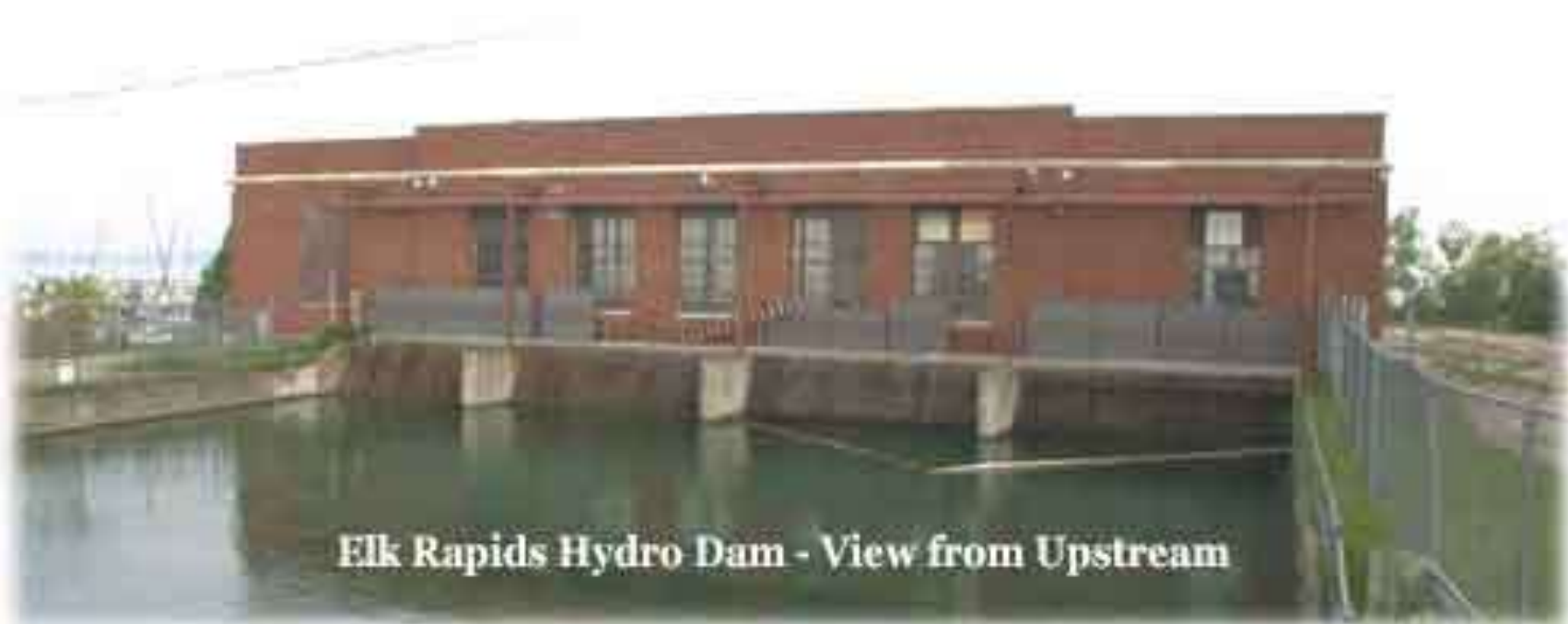
Part 1.

How
Antrim County
Got Into
The Lake Level
Business





The Elk Rapids Hydroelectric Dam – Circa 1940



Elk Rapids Hydro Dam - View from Upstream



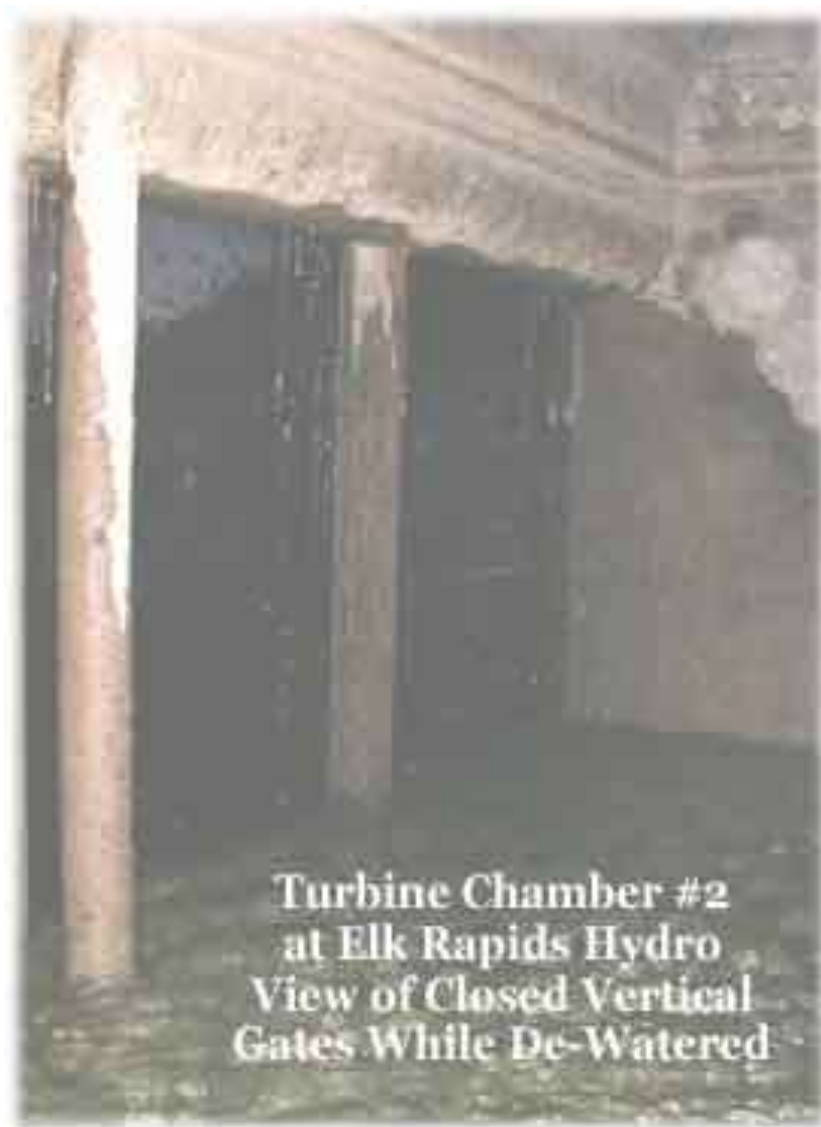
**Elk Rapids
Hydroelectric Dam
View from Downstream**

Elk and Skegemog Lakes Court-Ordered Lake Level (1973)

- Summer Lake Level at 590.8
(April 15–November 1)
- Winter Lake Level at 590.2
(November 1–April 15)

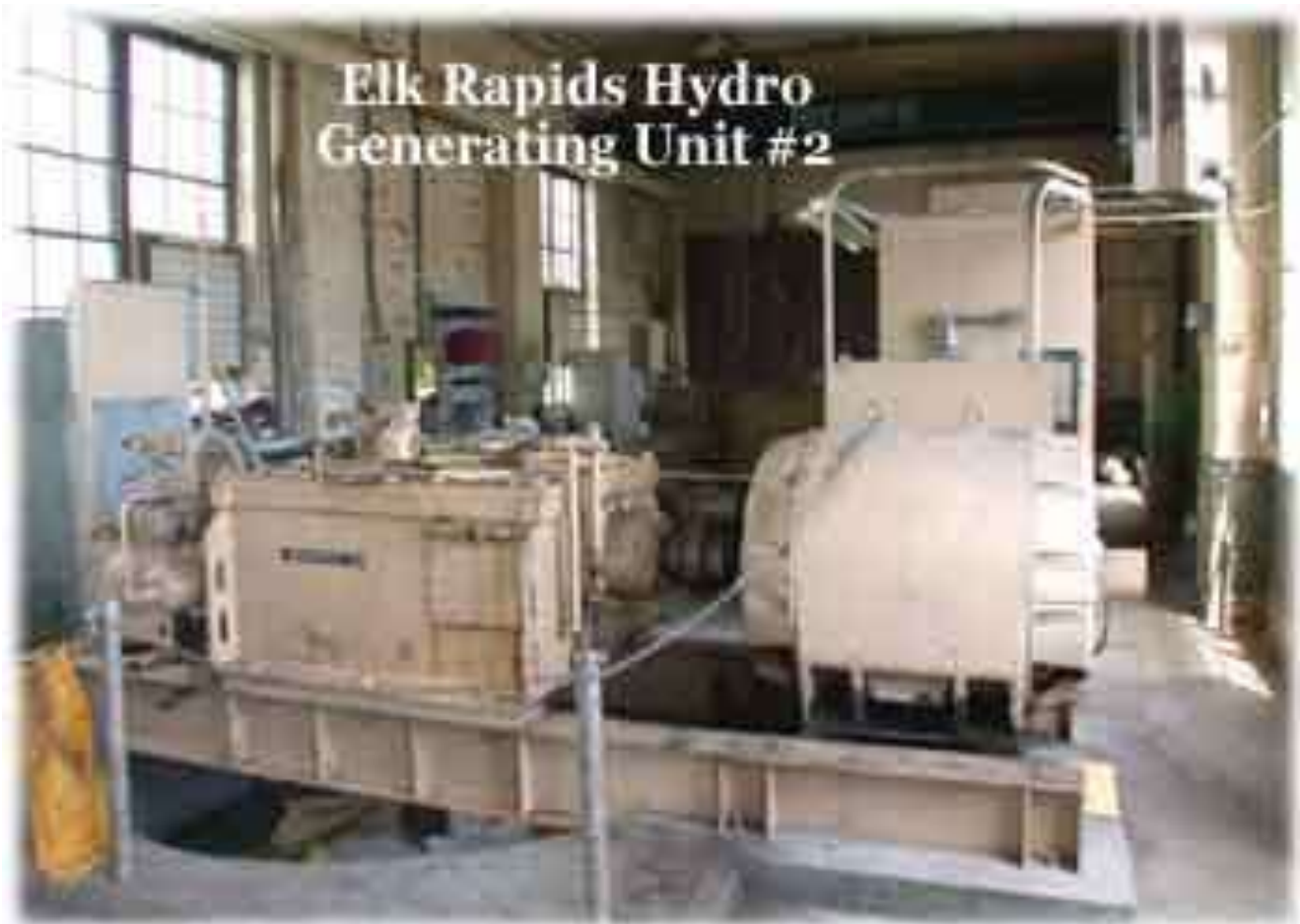


**Turbine Chamber #2
Elk Rapids Hydro
View of the Turbine Housing
with Wicket Gates Open**



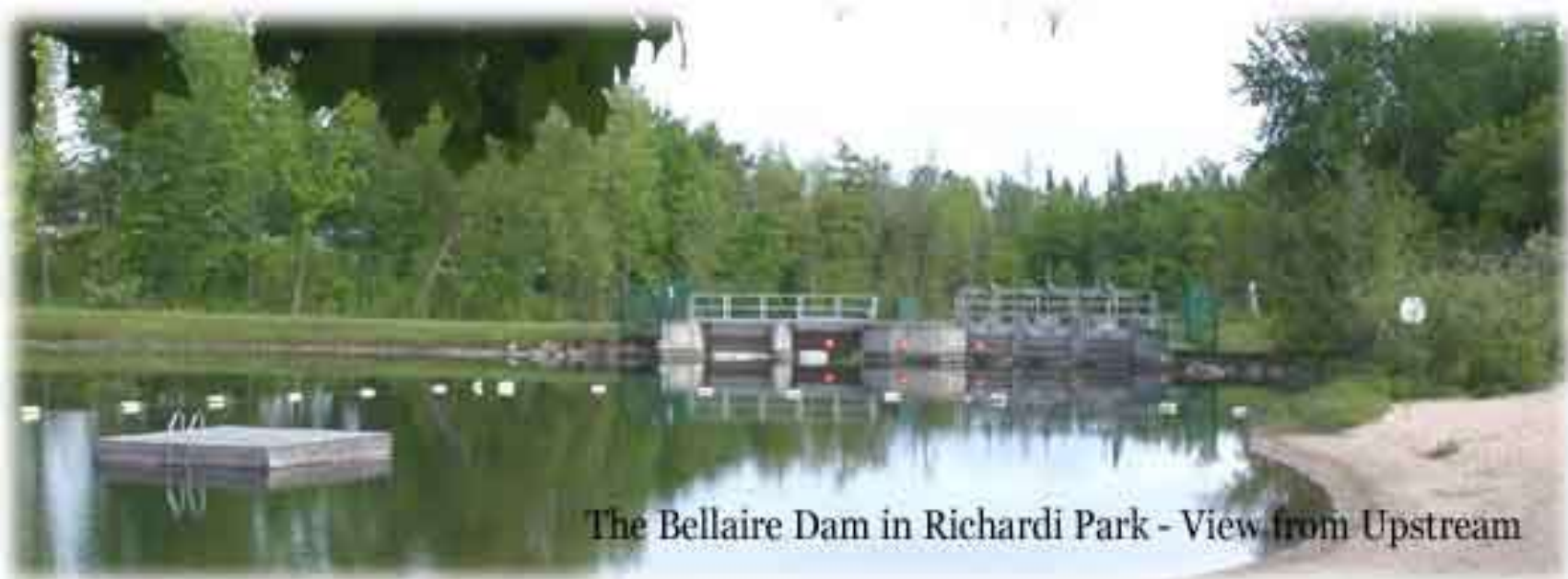
Turbine Chamber #2
at Elk Rapids Hydro
View of Closed Vertical
Gates While De-Watered

Elk Rapids Hydro
Generating Unit #2

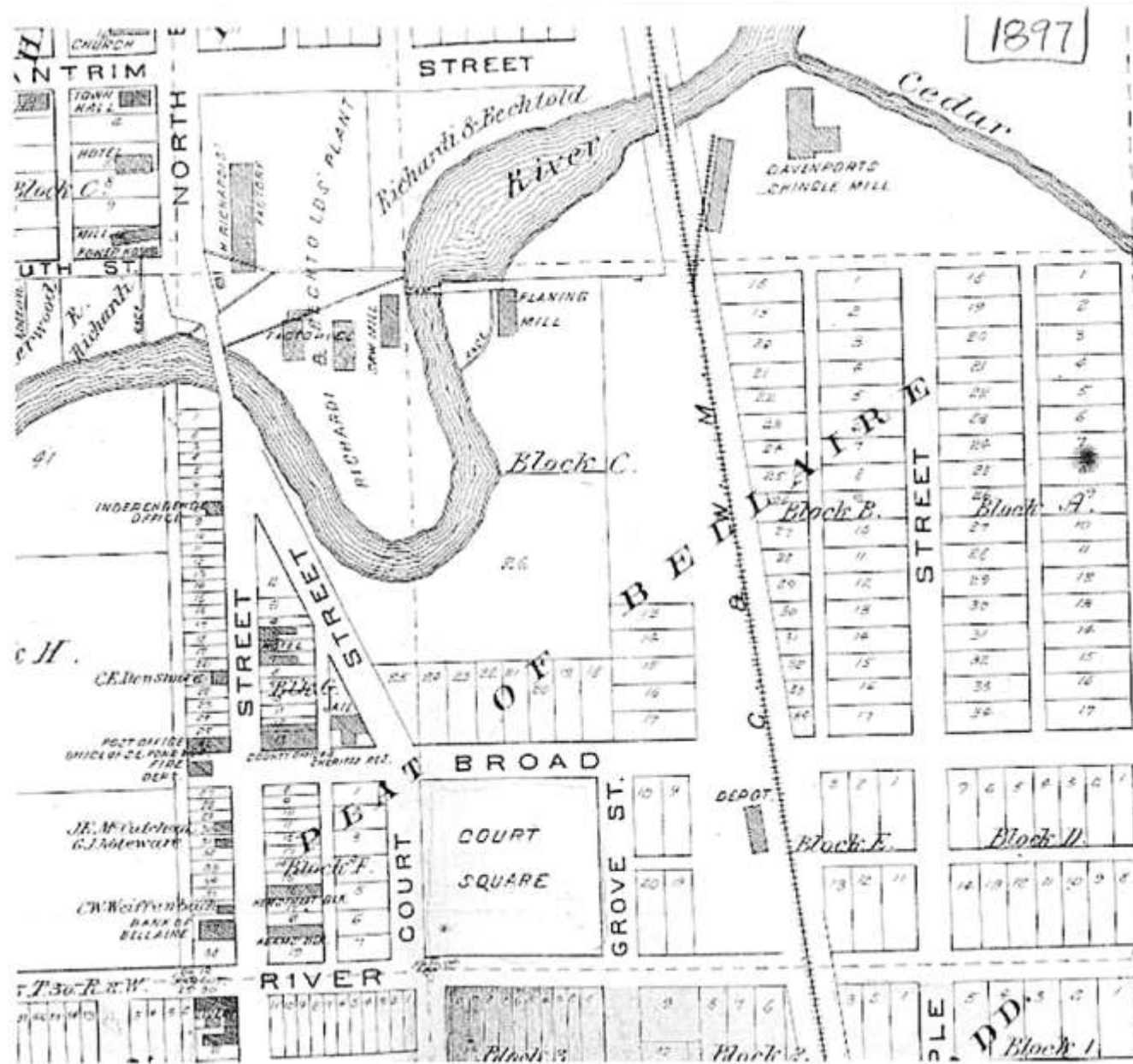




Antrim County Takes Direct Control of the Hydro - 2001



The Bellaire Dam in Richardi Park - View from Upstream



Plat Showing Several Dams at Current Site in Bellaire in 1897



Plat Showing Hydraulic Light & Power Co. Dam at Current Site in Bellaire in 1910

Charlevoix Light Plant

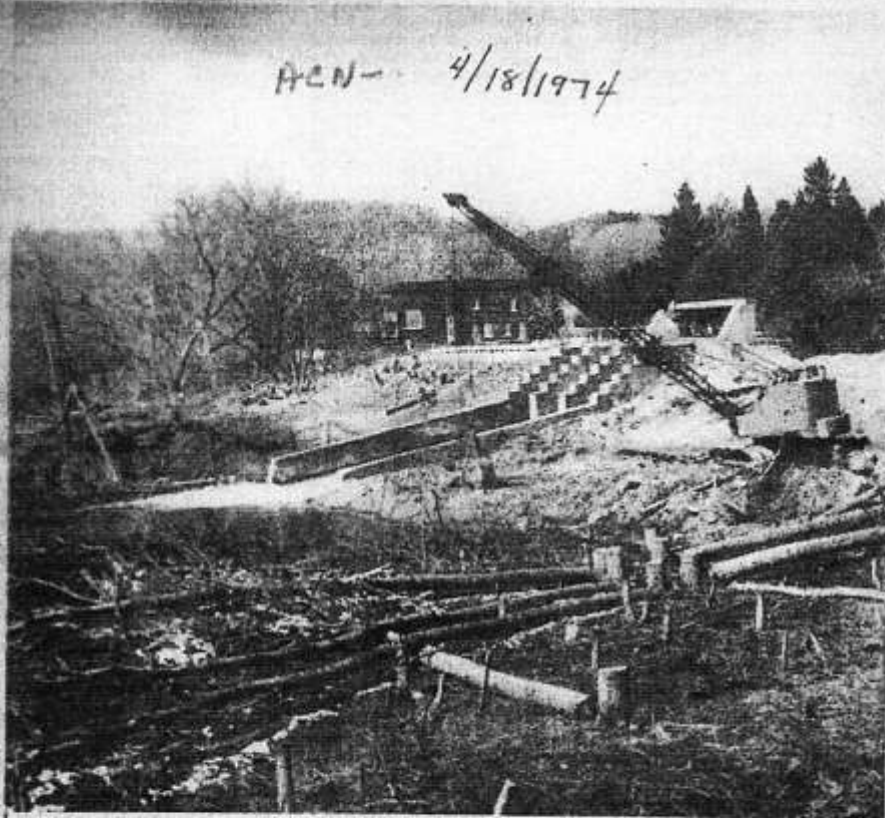
Dam and plant were built in 1906 by Henry Richardi. 1000 poles were strung over the 25 miles to Charlevoix to supply city street lighting.



View Looking at Bridge Street from East
Earthen Berms Show Dredging Activity on Intermediate River

Decided by Tuesday's Vote

AEN - 4/18/1974



RECONSTRUCTION is well underway at the Intermediate River Dam in Bellaire. Work includes construction of a new Spillway as well as repair of the existing spillway structure. The old power house, seen in the background, will be removed as part of the overall improvement plans. John Apfel of Bellaire contracted to do the work.

Manselon voters will vote to vote \$4,700,000 which has members of a major or in light of rollment.

The amo construction school bull remodeling goes in the The press would be cafeteria ad tary buildin remodeled, added, and room added Remodelin Elementary included in

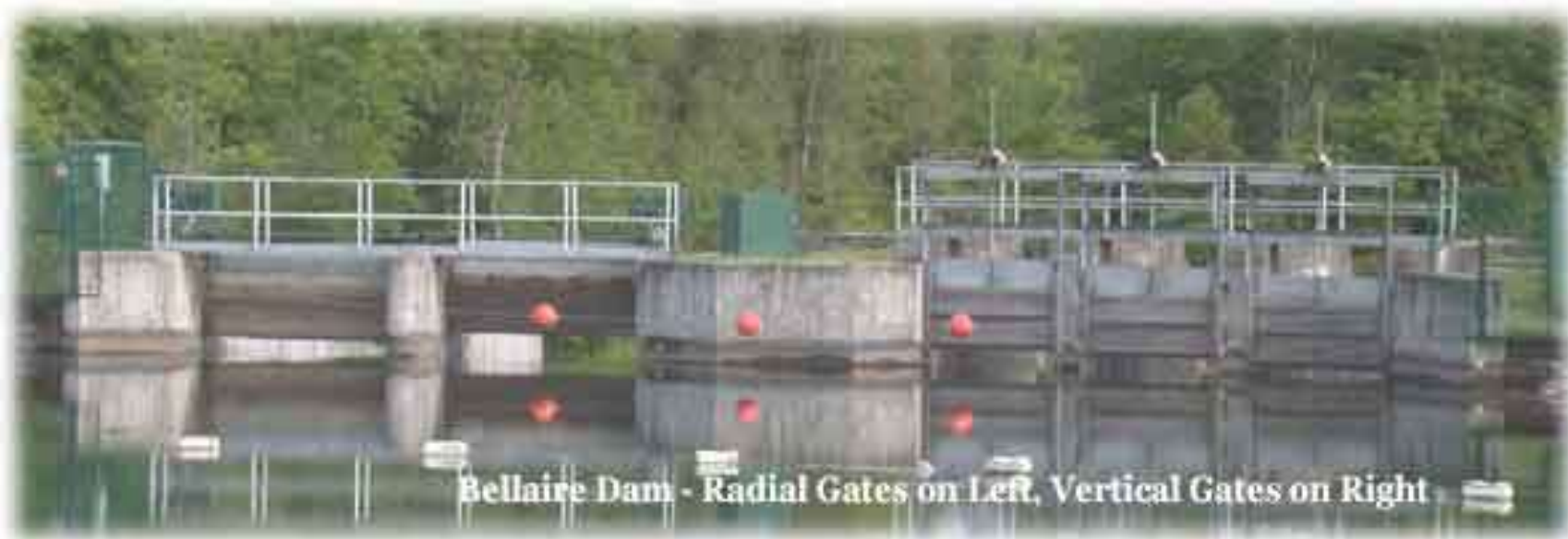
At the a tion last ap ed down a proposal w provided for ing and add isting buildin 305 to 210.

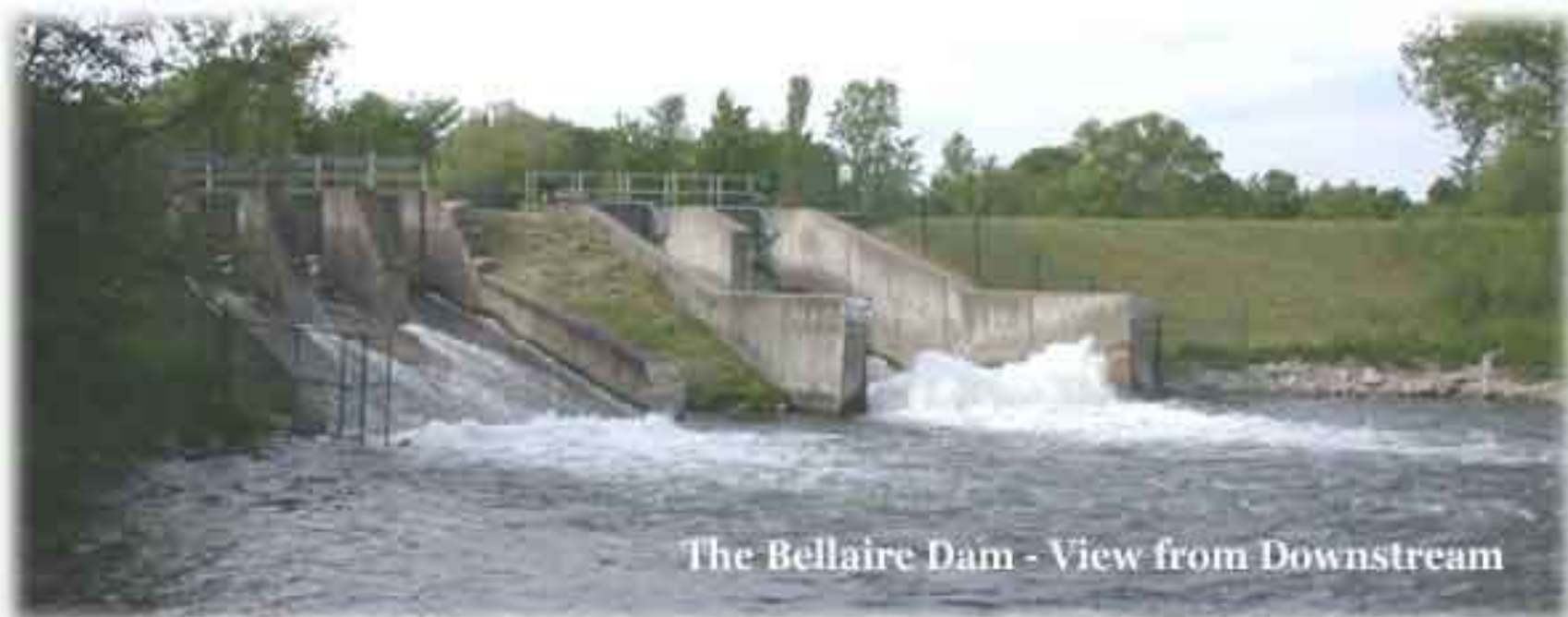
When that approved pe ditional relo which broo number of units now school. Ina has brought ing conditio feels can b through a n gram.

When on this year t bringing the triet to a making Mans school distri the board studies and sion to seek \$4,700,000 b

Dam Rebuilt 1974

Westward View Of Bellaire Dam from East End Of Earthen Dam Embankment





The Bellaire Dam - View from Downstream

Intermediate Lake Court-Ordered Lake Level (1990)

- Summer Lake Level at 607.15
(May 15–November 1)
- Winter Lake Level at 606.54
(November 1–May 15)



**Lake Level Sight Gauge
Intermediate Lake**

History of County Dam Policy

- **1974–2012**, Drain Commissioner Delegated the Operation of Bellaire Dam, Maintenance of ER
- **1982–2007**, Traverse City Light & Power Operates & Manages the Elk Rapids Hydro Dam
- **1974–1999**, County Administrator/Public Works Handles Oversight of Dams & FERC License
- **1999–2012**, Drain Commissioner Assumes FERC Duties and ER Dam Administration
- **2007–Present**, Elk Rapids Hydroelectric Power, LLC Operates Elk Rapids Dam
- **2012–Present**, Consolidation under Operator of Dams

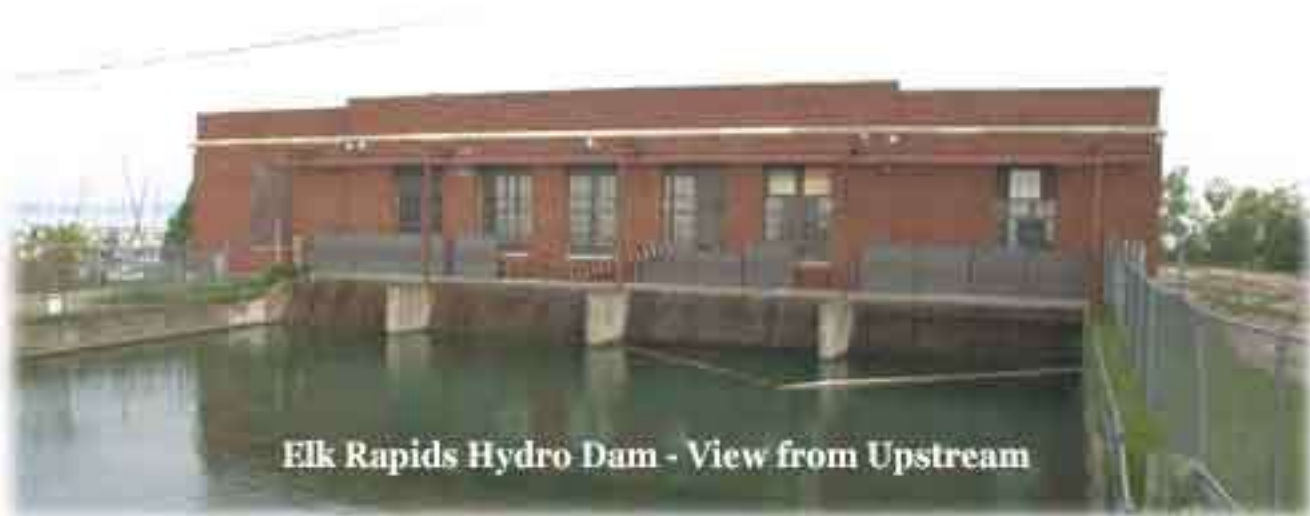
Operator of Dams—Job Description

- Administrator of the Dams Department
- Operator of the Bellaire Dam
- Supervisor of Operations at the ER Dam
- County Administrator of the FERC License
- Contact Person for Lake Level Inquiries

Antrim Chain Of Lakes

Part 2 Lake Level Tour





Elk Rapids Hydro Dam - View from Upstream



**Elk Rapids
Hydroelectric Dam
View from Downstream**



Aerial View of the Elk River and Elk Rapids Dam Location



Aerial Showing the Configuration of Channels and Flow at Elk Rapids

Elk Lake Lake Skegemog

Regulated,
Stable



Torch Lake
 Clam Lake
 Lake Bellaire

Unregulated,
 Mostly Stable

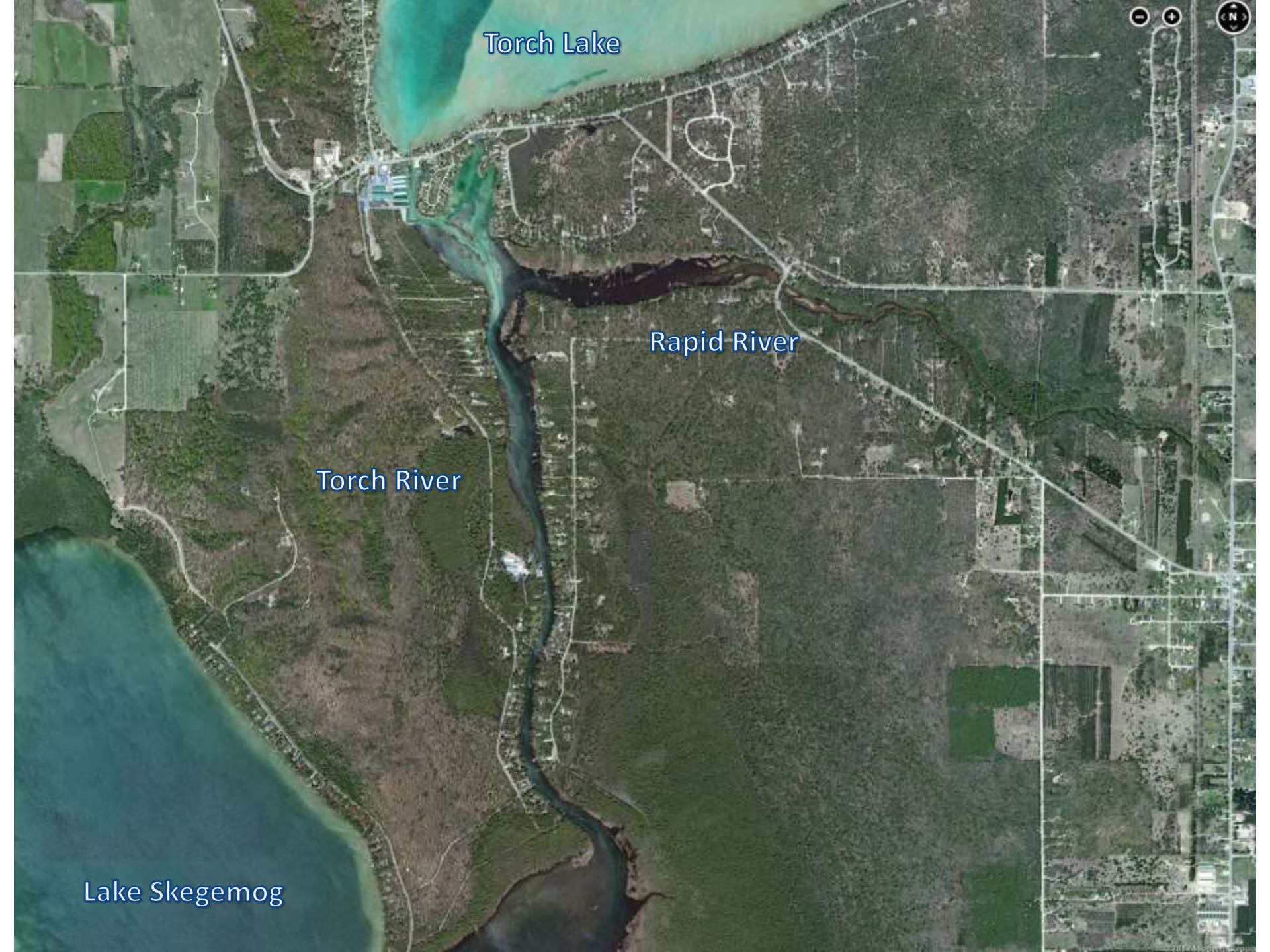


Torch Lake

Rapid River

Torch River

Lake Skegemog

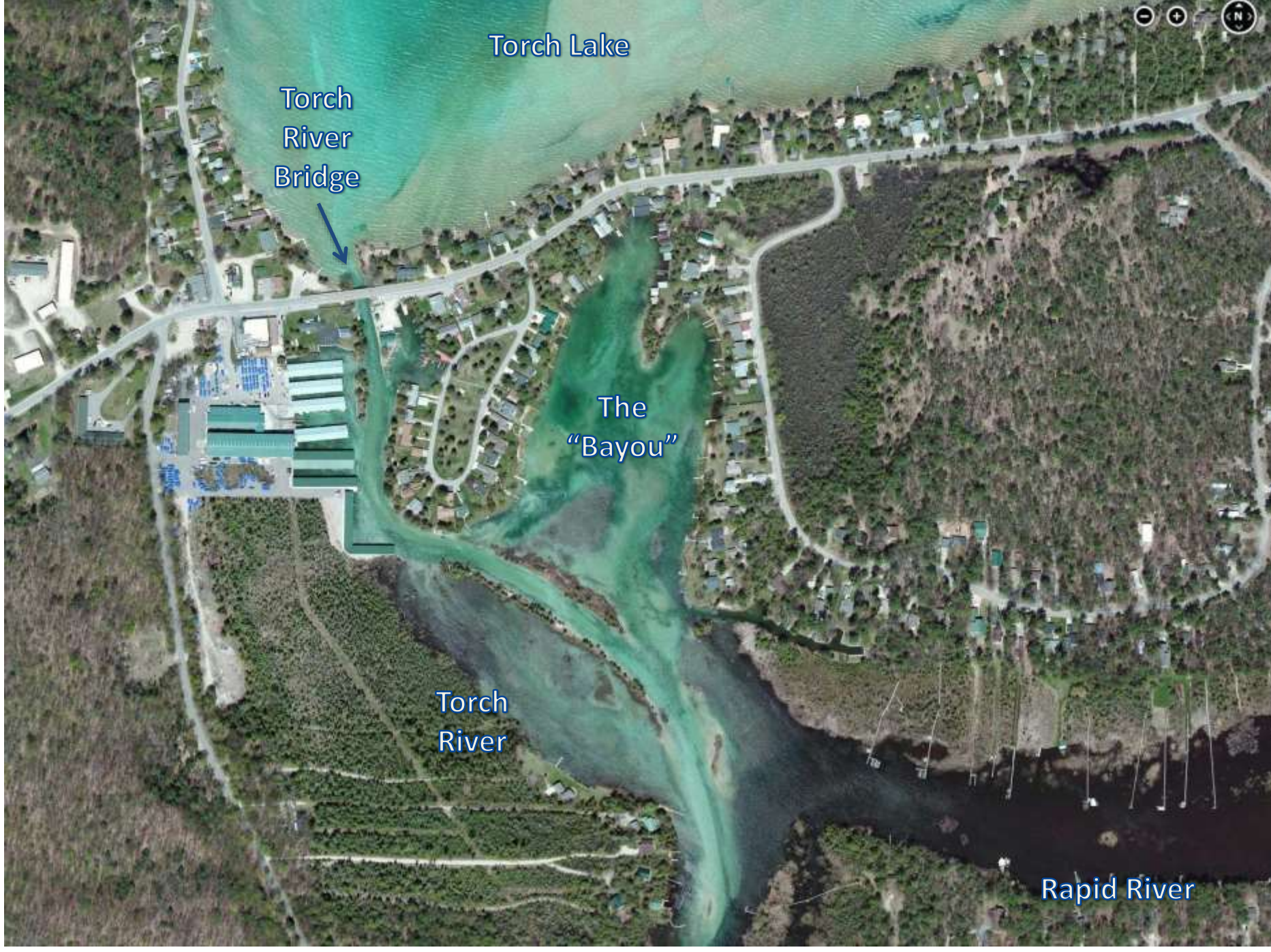




Lake Bellaire

Grass
River

Clam Lake



Torch Lake

Torch
River
Bridge

The
"Bayou"

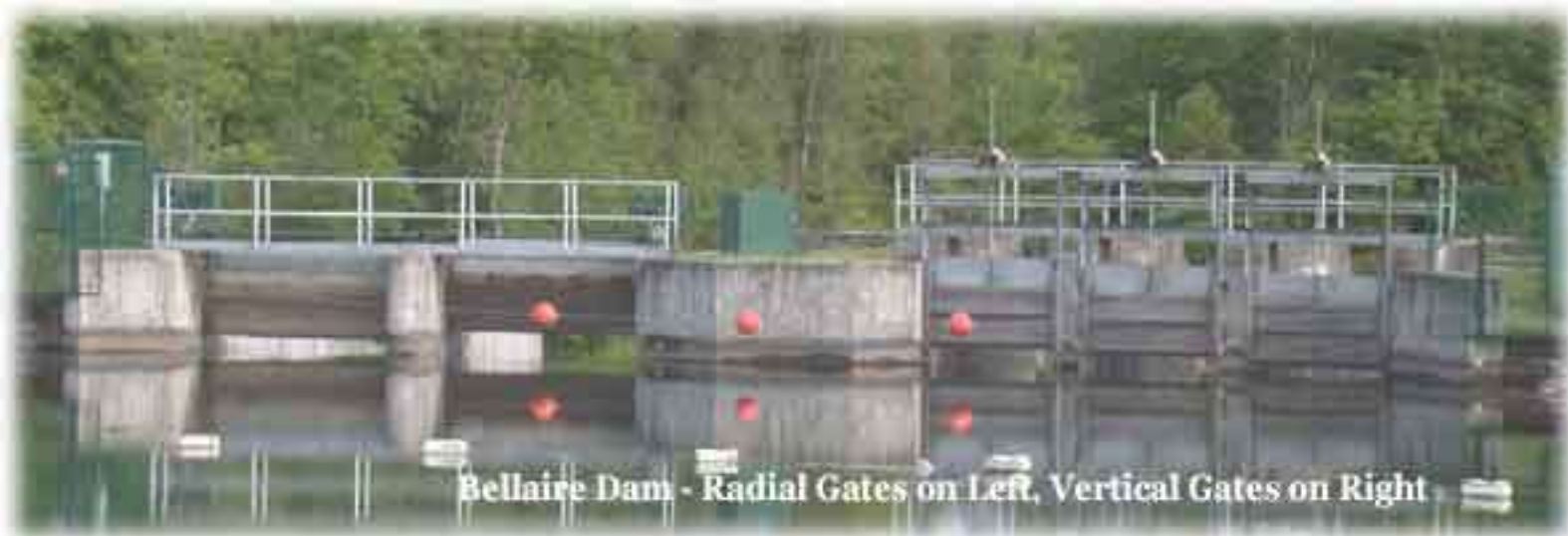
Torch
River

Rapid River

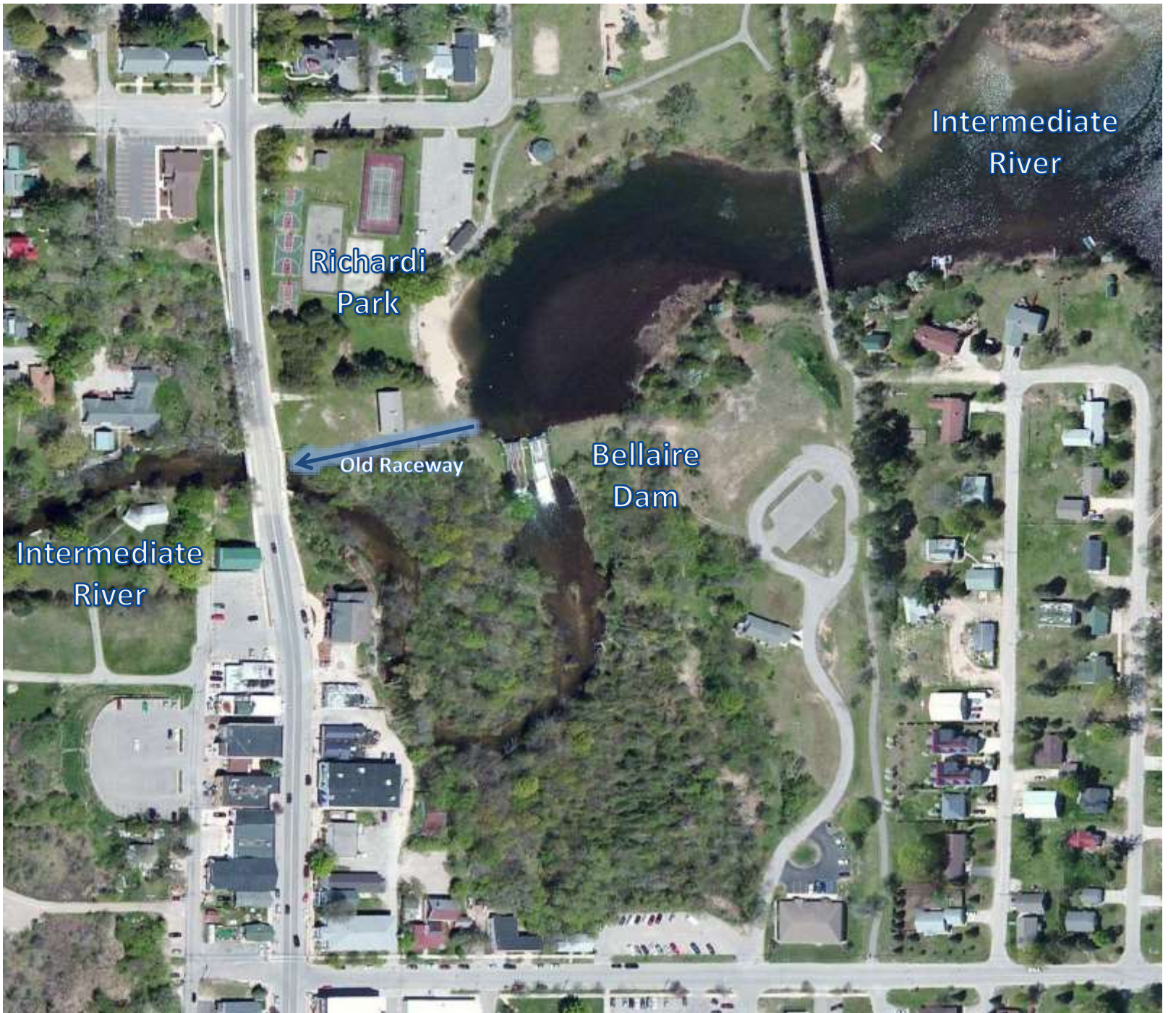
Intermediate Lake

Regulated,
Unstable





Bellaire Dam - Radial Gates on Left, Vertical Gates on Right



Intermediate
River

Richardi
Park

Bellaire
Dam

Old Raceway

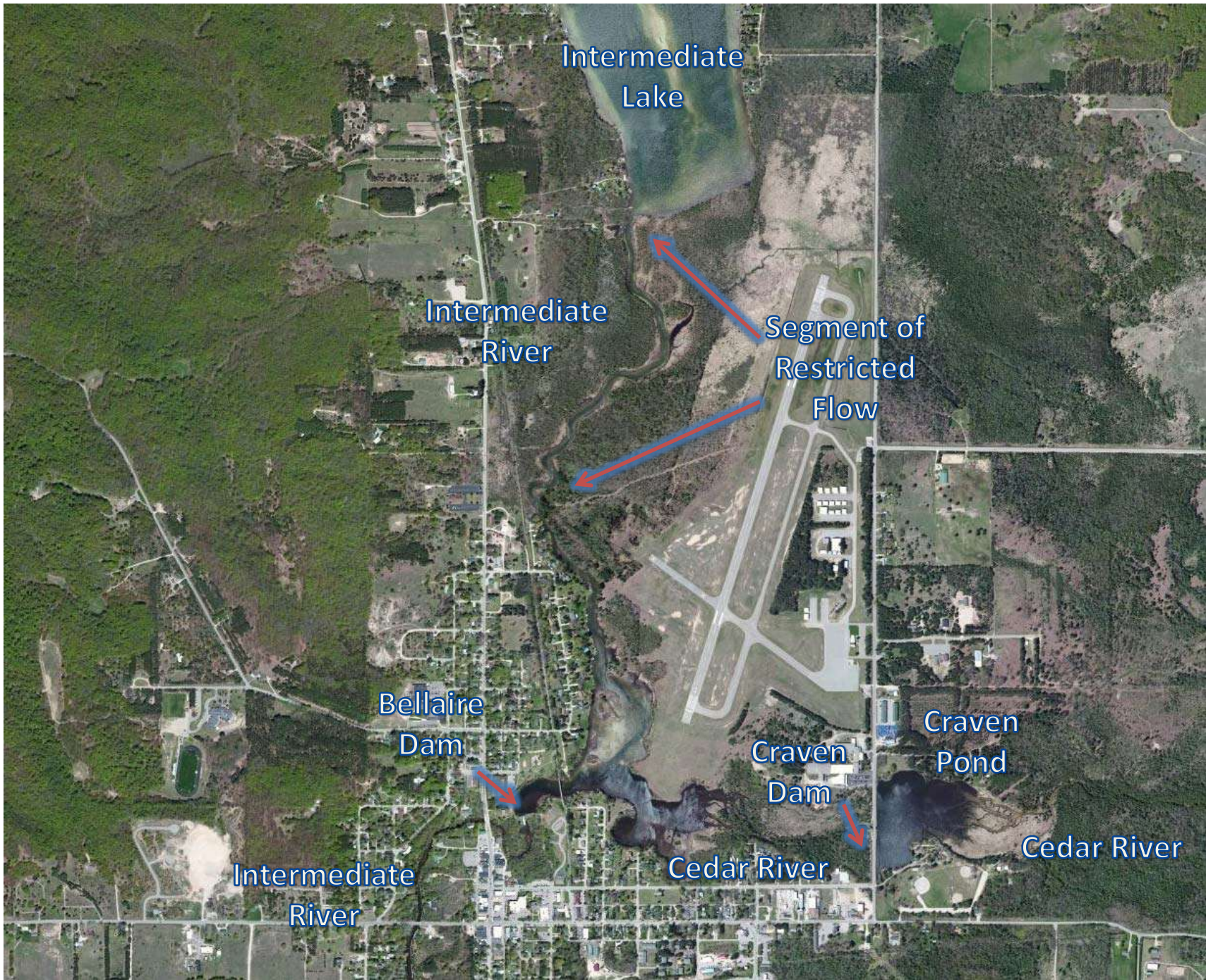
Intermediate
River

Complications at the Bellaire Dam

1) Separated from Intermediate Lake By a Long, Shallow River

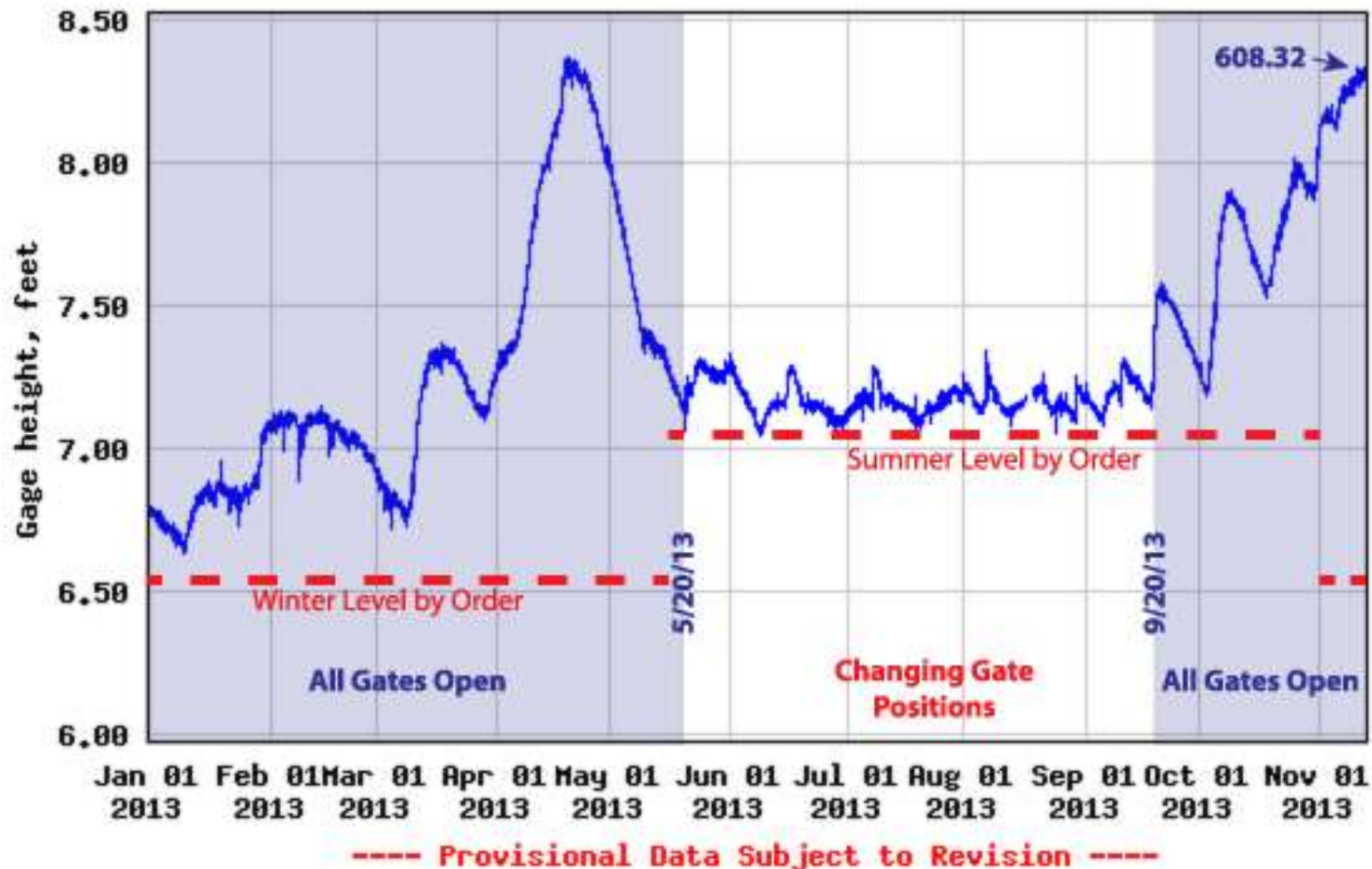
2) Located Below The Confluence of Intermediate and Cedar Rivers







USGS 450415085153501 INTERMEDIATE LAKE AT CENTRAL LAKE, MI

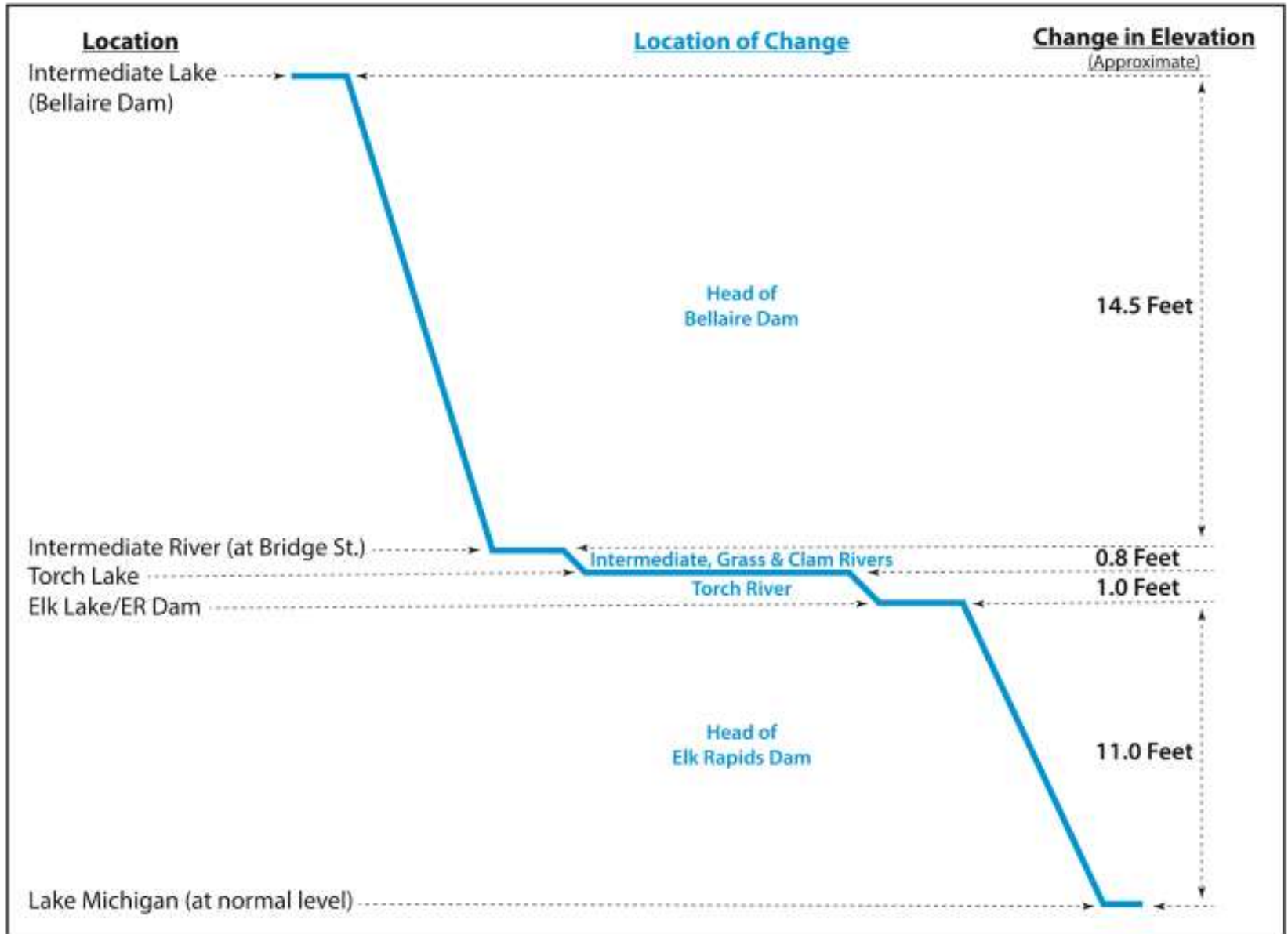


**2013 Water Levels on Intermediate Lake
Showing Periods when All Gates Are Open**

Intermediate Lake Level USGS Recorded Extremes

- Records Span: November, 1945 – February, 1975
January, 2001 – Present
- Maximum Gauge Height: 609.55 (April 6, 1963)
- Minimum Gauge Height: 606.05 (September 12, 1973)

GRADE CHANGES IN THE LOWER ANTRIM CHAIN OF LAKES





Upper Chain of Lakes

Unregulated, Unstable

Antrim Chain Of Lakes

Part 3

Dams Dept. Management Objectives



Ongoing Public Outreach

A Constant Education Process in All Media
with one Underlying Principle:

- *Lake levels remind us that the Antrim Chain of Lakes is a complex dynamic environment and we need to act accordingly—with sound judgement and flexibility.*

FERC License
Issued
December, 2014(?)



**ELK RAPIDS HYDROELECTIC PROJECT
FERC PROJECT NUMBER 3030**

**BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION
APPLICATION FOR LICENSE FOR A
MINOR (1.5 MEGAWATTS OR LESS) WATER POWER PROJECT**

**VOLUME I of II
PUBLIC MATERIAL**

**ANTRIM COUNTY
BELLAIRE, MICHIGAN**

December 21, 2012

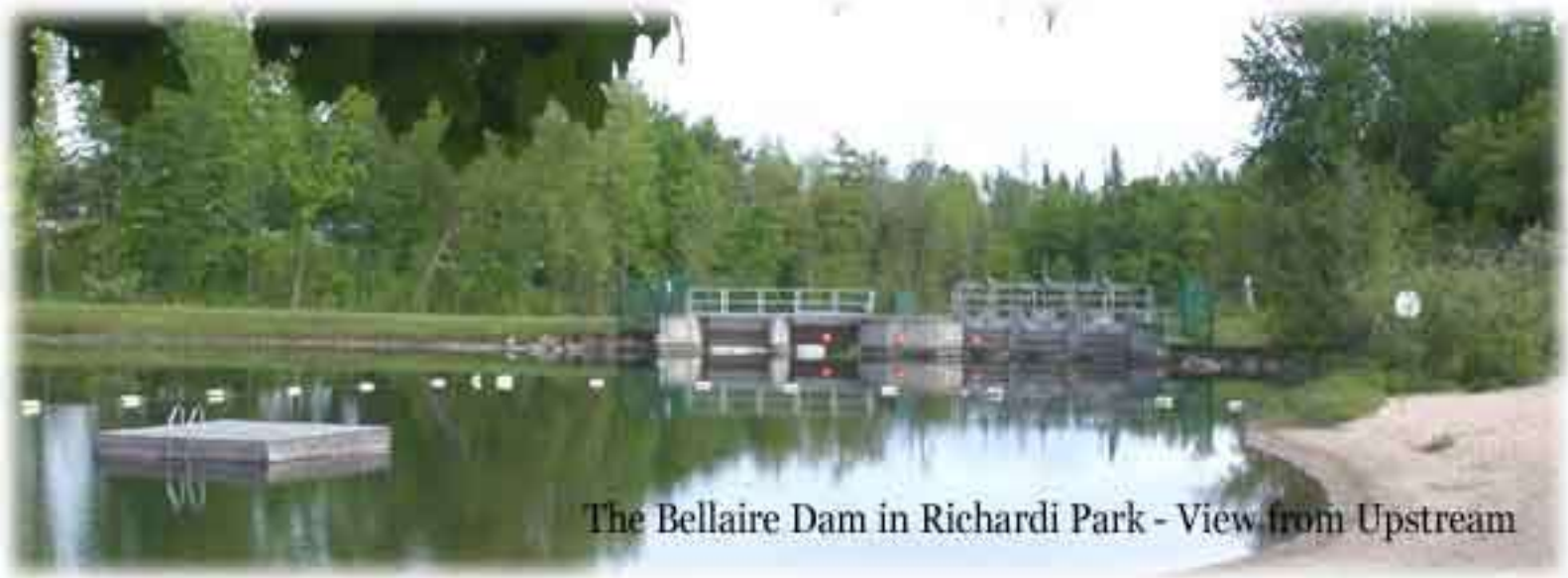


Continued Improvements on the Elk Rapids Dam



New Pedestrian Suspension Bridge behind the Elk Rapids Dam
(Dedication Ceremony April 1, 2014)

Bellaire Dam Improvements and Maintenance



The Bellaire Dam in Richardi Park - View from Upstream

Dams are prone to deterioration. Owning a dam assumes a long-term commitment to an upkeep that will never be cheap, but could be enormously expensive if not cared for properly.

Proposal:
To Install
Hydroelectric
Power at the
Bellaire Dam

The Bottom Line

	<u>At Dam</u>	<u>At Bridge St</u>
Engineering	\$30,000	\$35,000
Equipment	\$700,000	\$750,000
Civil Works	\$40,000	\$80,000
Interconnection	\$60,000	\$60,000
License/Exemption	\$100,000	\$100,000
Total	\$930,000	\$1,025,000

Main
Obstacle:
Requires a
FERC
License

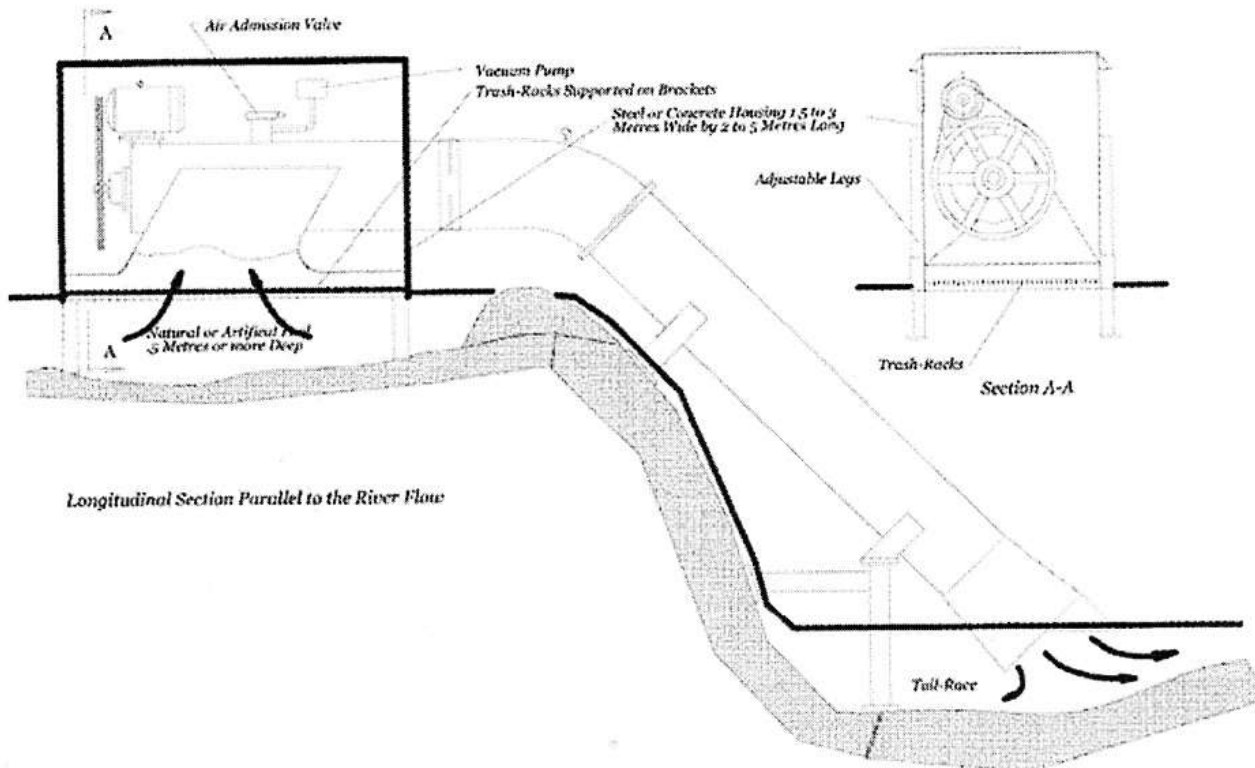
Net Savings	\$79,203
Less O&M	<u>-\$13,000</u>
Annual Savings	\$66,203

Payback in years

15.5

Products & Services

ECO-SIPHON PACKAGED HYDRO STATION
"Good things come in small packages."



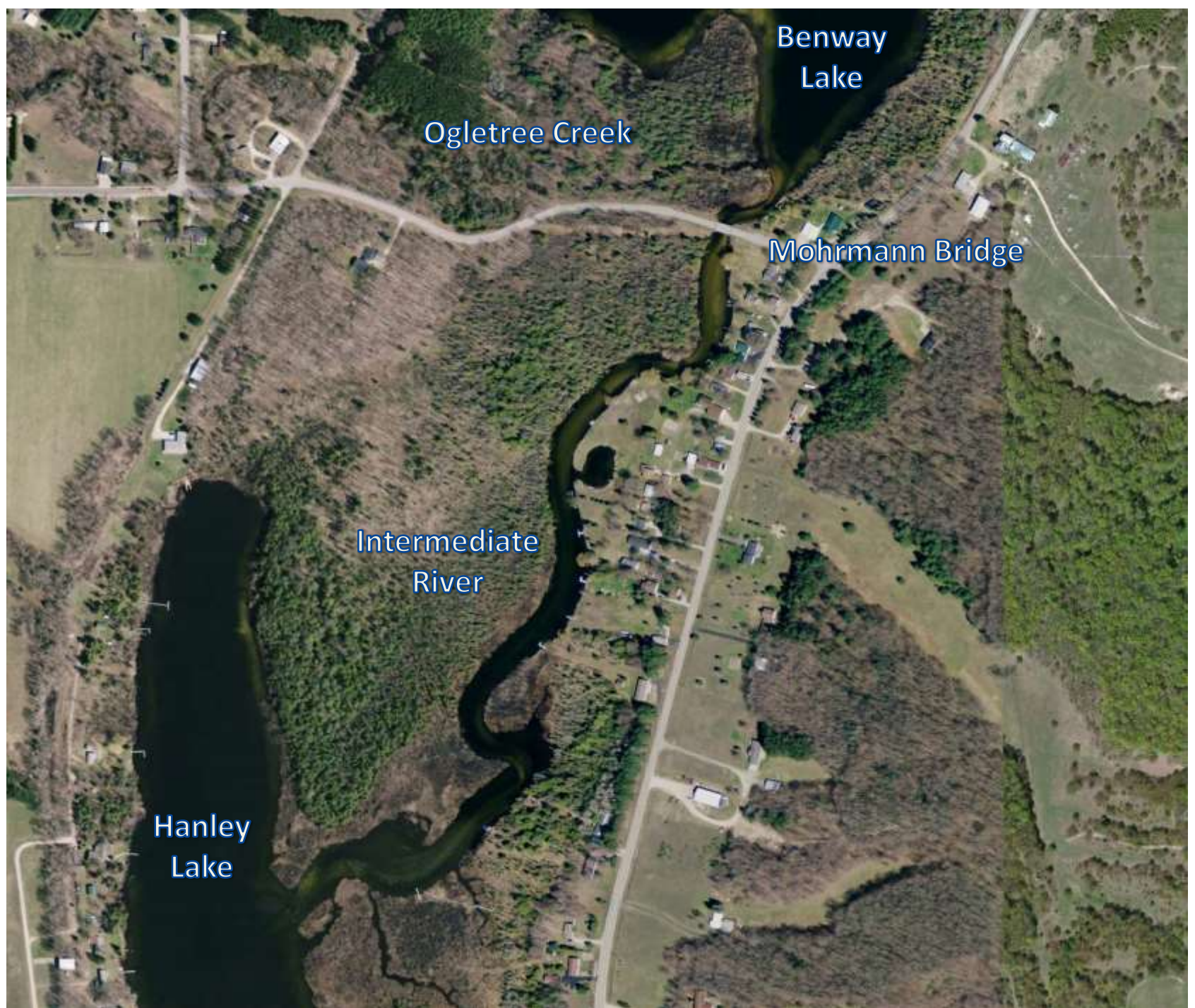
Siphon Type Turbine

Budgetary
Estimate:
\$595,000

Antrim Chain Of Lakes

Addressing Navigation And Flowage Improvements





Benway
Lake

Ogletree Creek

Mohrmann Bridge

Intermediate
River

Hanley
Lake

**Grass River
Large Woody Debris
Demonstration
Overview**

**Proposed Work
on Two Sites:**

**Site 1–
6 Structures**

**Site 2–
2 Structures**



**Grass River
Large Woody Debris
Demonstration**

Site 1

**6 LWD
Structures**

Scale
100 Ft.



Grass River
Large Woody Debris
Demonstration

Site 2



Scale
100 Ft.

2 LWD
Structures

An aerial photograph taken from the perspective of someone in a small aircraft, looking down at a river that winds through a dense forest. The river is a mix of green and blue, with several small, light-colored structures (LWD structures) visible along its banks. The forest is a mix of green and some autumn-colored trees. The wing of the aircraft is visible in the bottom right corner, and a person's hand wearing a yellow glove is seen holding a camera. The text "LWD Structures Photographed The day After Installation" is overlaid in the center of the image.

LWD Structures Photographed
The day After Installation

Photo by Art Hoadley



LWD Structures At Dawn



Volunteers Worked for Two Days Cutting and Shuttling Trees to Building Sites



LWD Supporters

Managed by

- Antrim County Dams
- Antrim Conservation Dist.
- Grass River Natural Area
- Three Lakes Association

Funding Provided by

- Antrim County
- Butch's Tackle & Marine
- Dewitt Marina
- Dockside Restaurant
- Moon Electric
- Northaire Resort
- Three Lakes Association
- Friends of Clam Lake



Why We Do The Work