International Upper Great Lakes Study

Bay City &Port Huron, Michigan

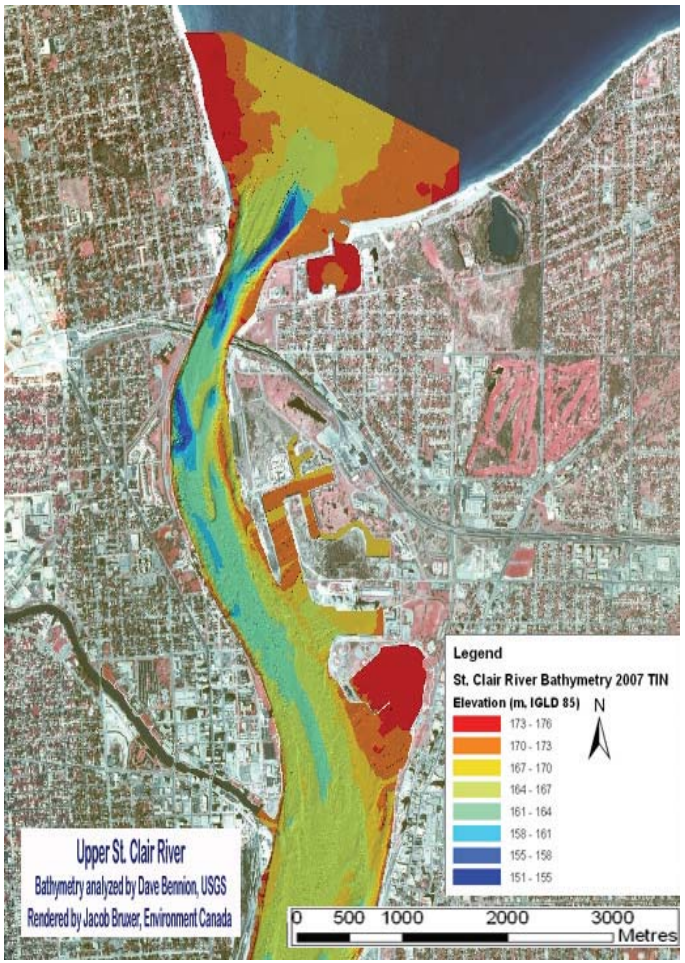
Public Meetings

April 28-29, 2008

INTERNATIONAL Upper Great Lakes STUDY

Presenters

- **Kay Felt**
  - U.S. co-chair, Public Interest Advisory Group
- **Dr. Eugene Stakhiv**
  - U.S. co-chair, IUGL Study Board
- **Dr. Jim Bruce**
  - Canadian co-chair, PIAG
- **John Nevin**
  - IJC Policy Advisor
  - IUGLS Communications Advisor



Today's Presentation

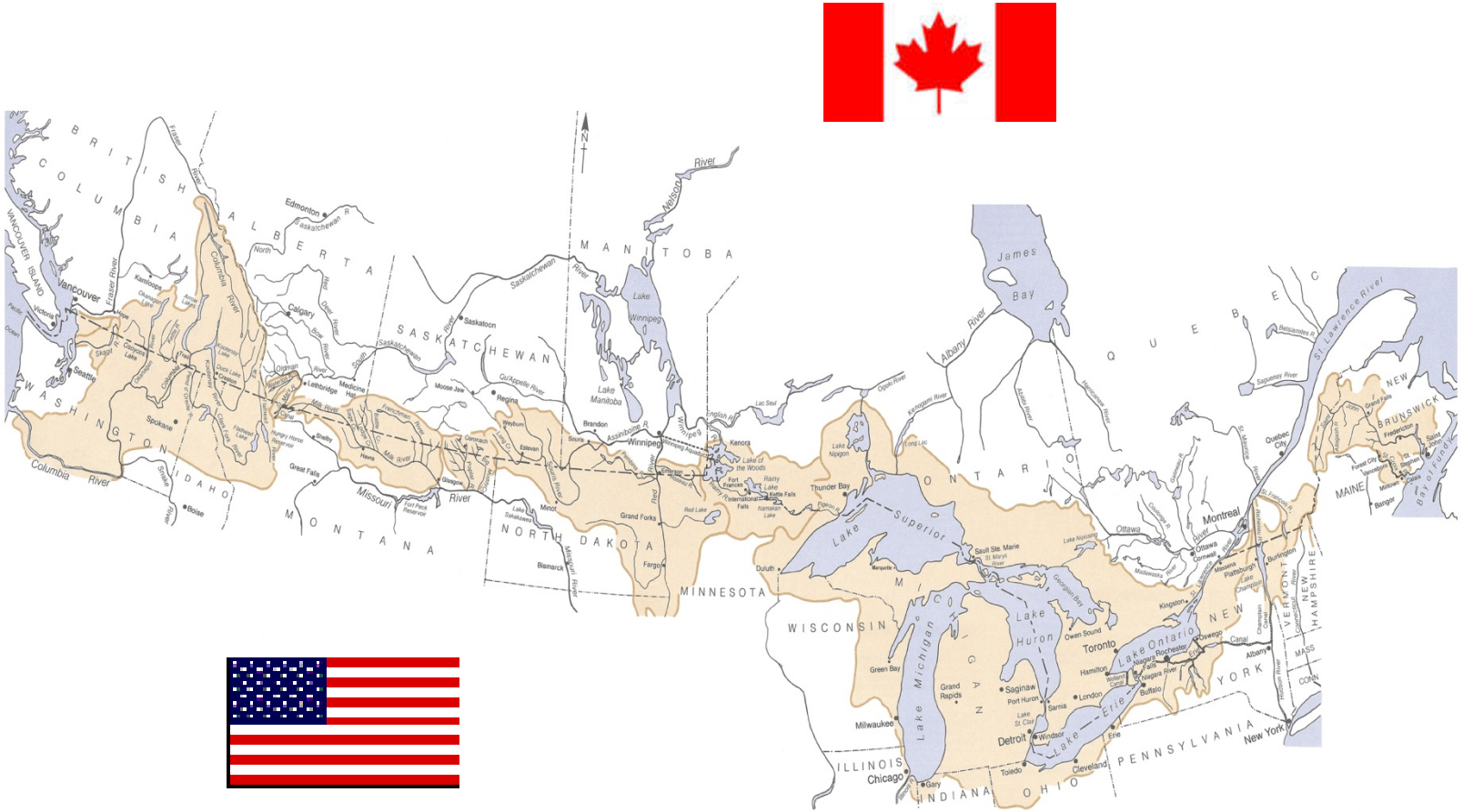
- What is the IJC?

- Purpose and objectives of the Study
- Management and task structure
- Public outreach plans

- Previous work and recommendations of IJC
- The Baird Report
- IJC mandate limitations
- Science questions being addressed
- Work underway and expedited schedule
- Current conditions
- Conclusions

- Questions & comments

What is the IJC?



International Joint Commission

- **Established by Canada and US under the 1909 Boundary Waters Treaty**
  - **Prevents and resolves boundary water disputes**
  - **Authorizes projects affecting levels and flows in boundary waters**

International Lake Superior Board of Control

- **Oversees operation of approved works**
- **Sets outflows and water allocation**
- **Ensures accurate reporting of outflows**
- **Advises IJC on outflow regulation**

IJC Orders of Approval

- Issued in 1914 for hydropower development.
- Led to Lake Superior outflow regulation.
- Protect interests in both countries affected by changes in water levels and flows

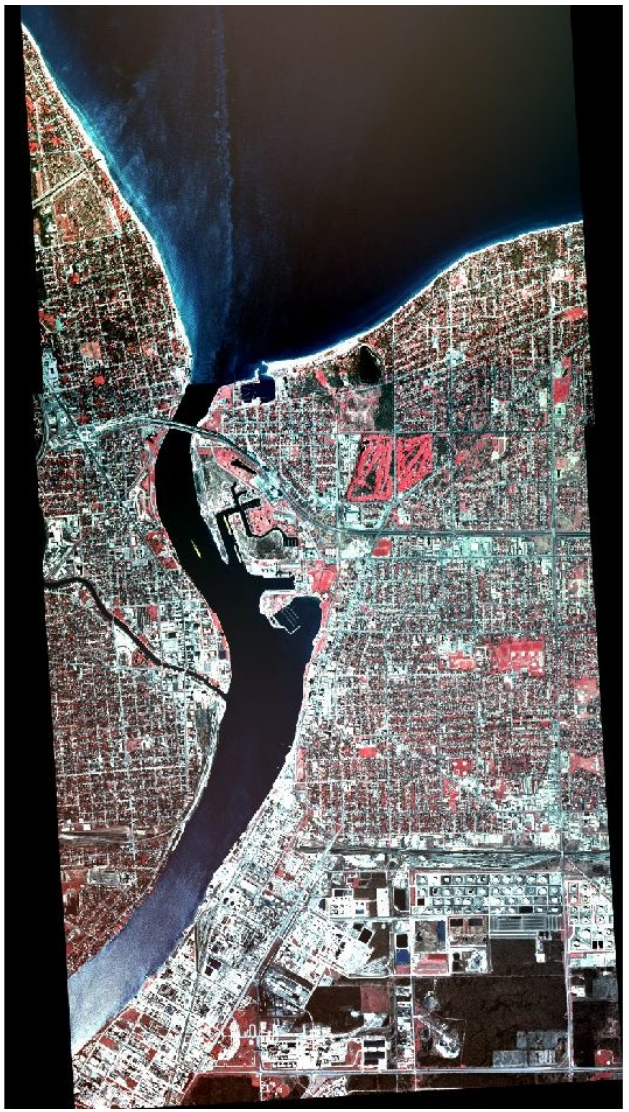
  - Supplementary orders issued in response to changing needs and conditions - latest in 1979
    - Systemic Regulation
    - Range of 1.1 meters
    - Safeguard against high flows below structure
    - Safeguard against low Lake Superior levels

Purpose of the Study

- Determine how water level changes affect resource groups including the environment.
- Develop improved knowledge of hydrologic and hydraulic processes of the Great Lakes system under the present climate regime and considering climate change.
- Involve governments, industry, academia and Native Americans and the public.

Study Objective 1

- To investigate St. Clair River flow characteristics and determine how the natural regime of the river has been changed by human activities. Further on-going changes may change the water level relationship between Lakes Michigan-Huron and Erie.



Study Objective 2

- To investigate whether the current Lake Superior outflow management procedures could be improved considering evolving upper Great Lakes interests and climate change.

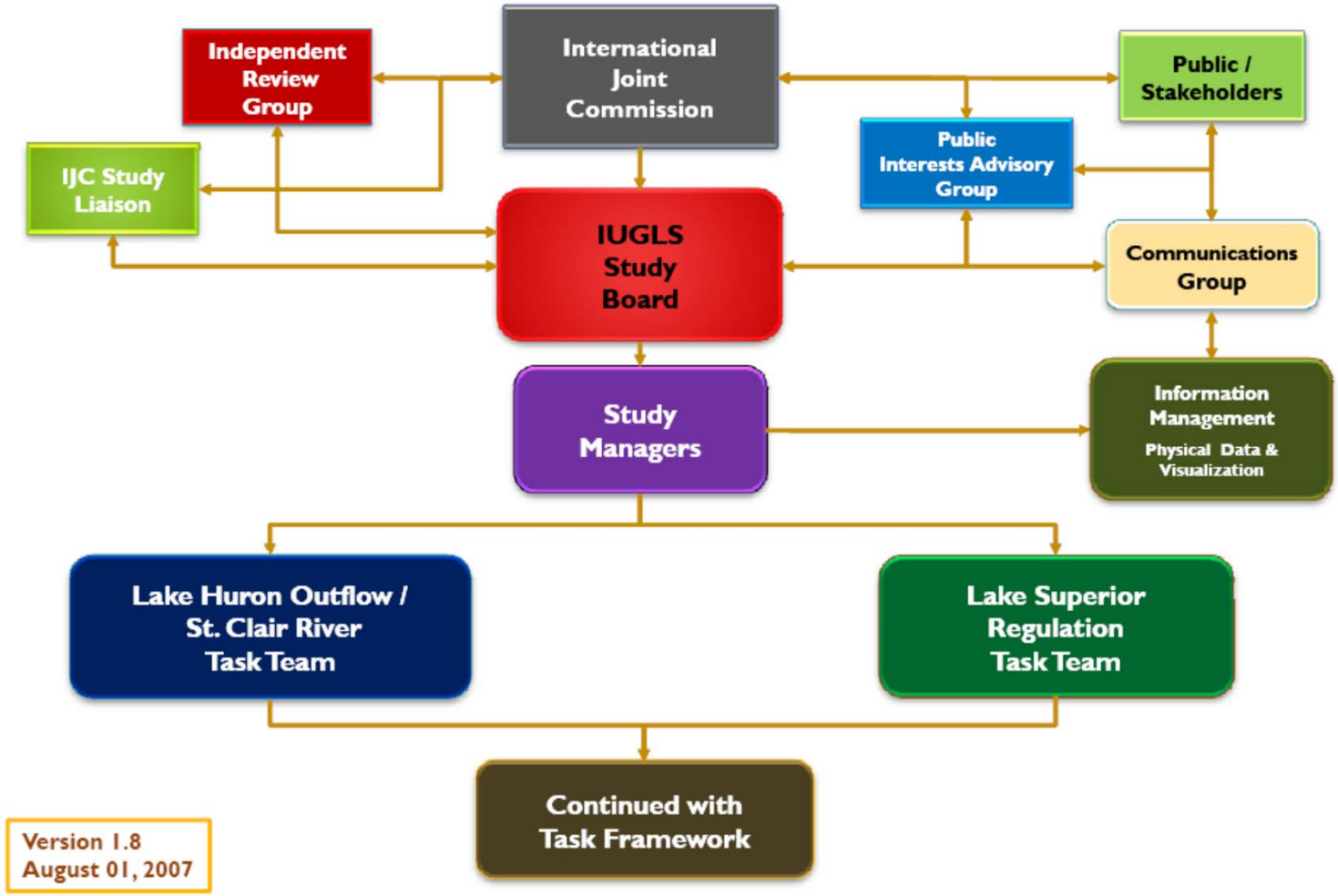
- To make recommendations to the IJC on changes and actions that may be necessary.

IUGLS Study Area

IUGLS Study Organization

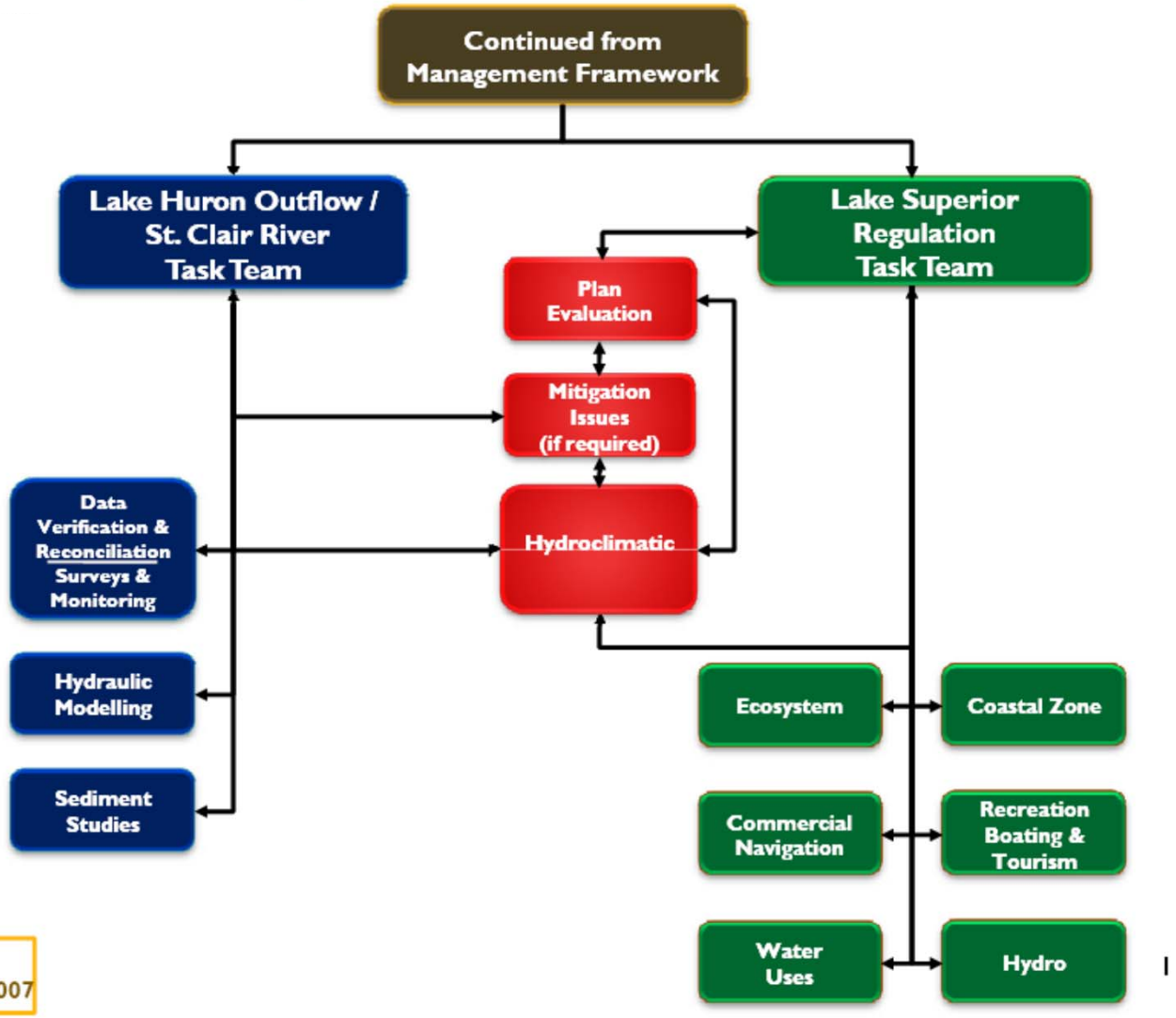
- Binational Study Board
- Public Interest Advisory Group
- Independent Technical Peer Review
- Communications, Information Technology
- Technical Teams on Lake Superior outflow regulation and St. Clair River
- Technical Working Groups (Resource Evaluation Teams)

IUGLS Study Organization - Management Framework



Version 1.8
August 01, 2007

IUGLS Study Organization - Task Framework



Public Interest Advisory Group (PIAG)

- Gives public the opportunity to provide input to the study regarding values associated with different Great Lakes water levels.
- Provides vehicle for study to provide information to the public.
- Advises study on outreach and communications.
- Advises study on broad direction of work.
- Study benefits from experience and expertise of PIAG members

PIAG Reflects Broad Range of Interests

- Ecosystem/environment
- Recreational boating and tourism
- Hydropower
- Commercial navigation
- Municipal, industrial and domestic water uses
- Coastal and shoreline interests

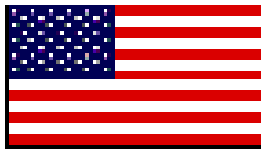
PIAG Membership

Canada

James Bruce **(PIAG Co-Chair)**
James Anderson, **Ducks Unlimited**
Doug Cuddy, **Lake Superior Conservancy and Watershed Council**
Dick Hibma, **Conservation Ontario**
Kenneth Higgs, **Property Owner**
William Hryb, **Lakehead Shipping Co. Ltd.**
John Jackson, **Great Lakes United**
Don Marles, **Lake Superior Advisory Committee**
Mary Muter, **Georgian Bay Association**

United States

Kay Felt, **Co-Chair**
David Powers **– Save our Shoreline**
Roger Smithe **– Int'l Great Lakes Coalition**
Dan Tadgerson **– Sault Ste. Marie Tribe, Chippewa Indians**
Alan Steinman **– Annis WRI**
Samuel Speck **–Ohio DNR**
Jim Weakley **– Lake Carriers' Assn.**
Jeff Vito **– Cities Initiative**
Dan Thomas **–GL Sport Fishing Council**
David Irish **– boat shop owner**



Outreach strategy highlights

- Public Meetings
- Internet/web dialogues
- Targeted interest-based workshops
- Regular progress reports
- PIAG liaison to Technical Work Groups
- Congressional/Parliamentary Briefings
- Meetings with federal/state/provincial officials
- Newsletter
- Interactive web page

Public Interest is High

- Seven Great Lakes senators wrote to IJC urging that the study be expedited and special attention given to public involvement (September, 2007)
- Senator Stabenow wrote to ACOE, asking:
  - whether ACOE had evaluated the validity of the Baird study;
  - whether ACOE intends to take any remedial action prior to the completion of the IJC study
  - why was the 1962 weir never built and what would the impacts be today.

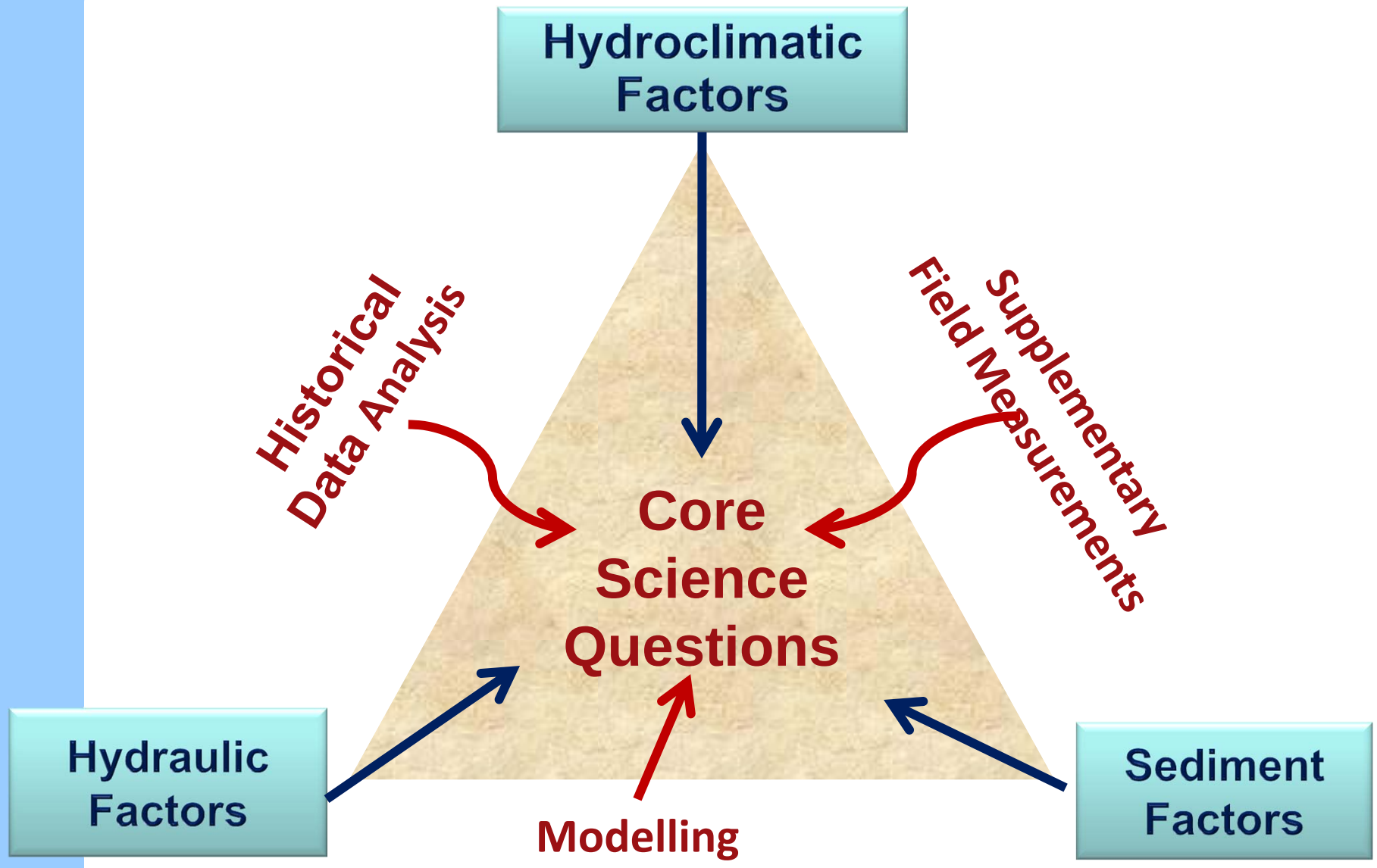
Public Interest is High (cont.)

- Great Lakes Commission passed resolution urging:
  - governments to fully fund investigations of the cause of low water levels;
  - ACOE, EC, and IJC begin investigations of possible remedial measures to address erosion; and,
  - the IJC (IUGLS) to expedite the St. Clair River portion of the study and to provide an interim report by the end of 2008.
- Governor Granholm wrote to ACOE asking them to immediately evaluate the effectiveness of mitigation measures recommended following the 1962 dredging project.

IJC Alerts Governments regarding requests for immediate mitigation

In a recent letter to both governments, the IJC highlights the limitations of its mandate:

> **"The Commission's authority under IUGLS with respect to flow capacity is limited to providing advice to governments on remediation options in the St. Clair River *where it is found that there are ongoing changes in the river bed.* The IUGLS is not set up to consider mitigation of low water levels regardless of cause, nor does the authority from governments to date provide for such. However, governments could provide the Commission with additional authority by issuing a formal reference, if desired."**


Hydroclimatic Factors
Historical Data Analysis
Supplementary Field Measurements
Core Science Questions
Hydraulic Factors
Modelling
Sediment Factors

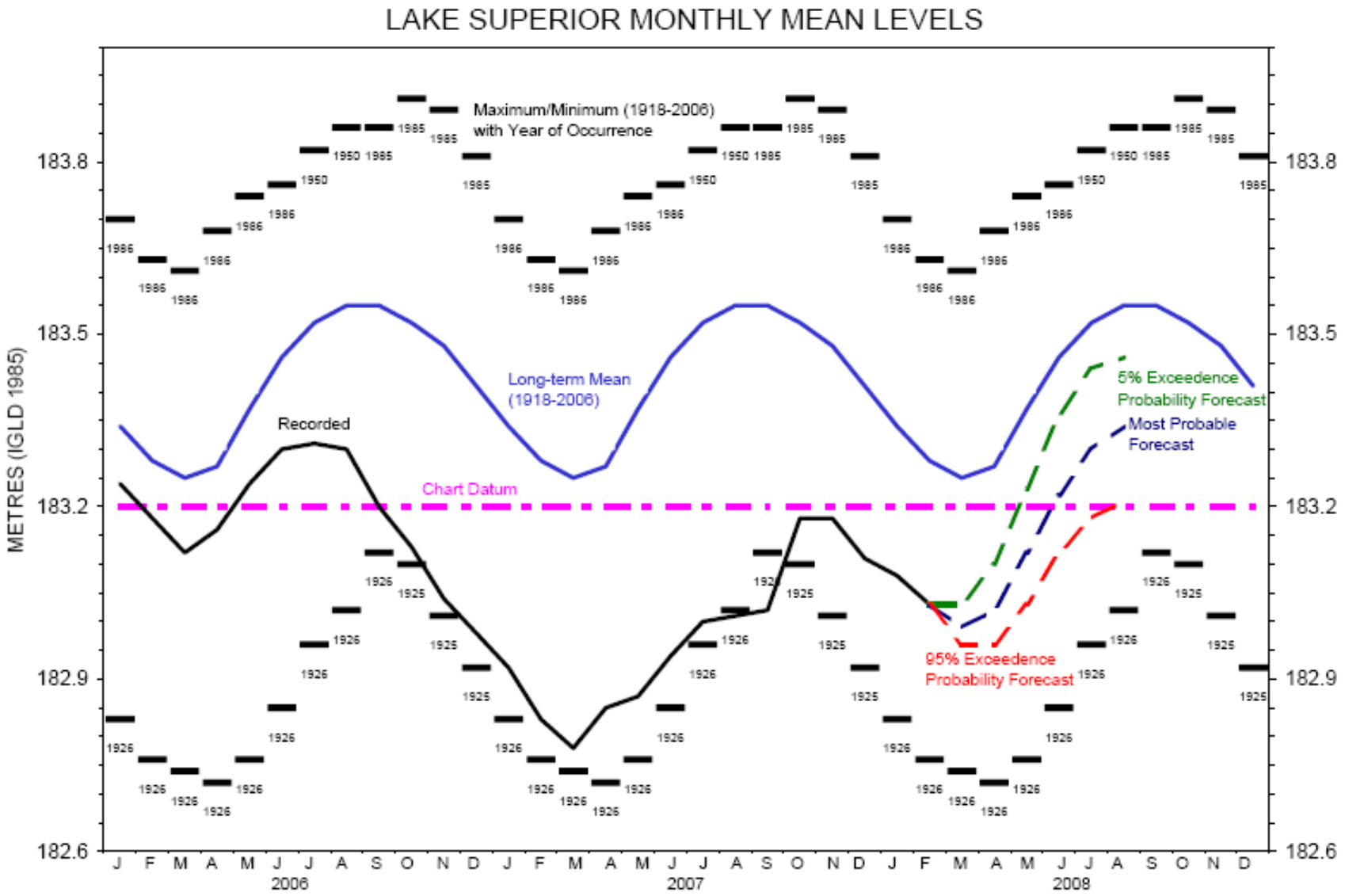
Some Basic Facts

- Diversion of water from L. Michigan at Chicago = 3,200 ft^3/sec (90 m^3/sec)
- Long Lac & Ogoki diversions into L. Superior = 5, 400 ft^3/sec (154 m^3/sec)
- Flow through St. Clair R. = 188,000 ft^3/sec (cfs) (5,310m^3/sec)
- 2 bgd 'loss due to 'drain hole' = 3,040 cfs or 1.6% of daily St. Clair R. flow.
- Avg daily evaporation from L. M-H ~ 87,000 cfs +/- 20%
- IJC reports (2000) that in 1998, about 2.6 mill. gal (~10 mill. Liters) of water were exported from the GL basin, while 37 mill. gal. (141 MegaL) were imported.

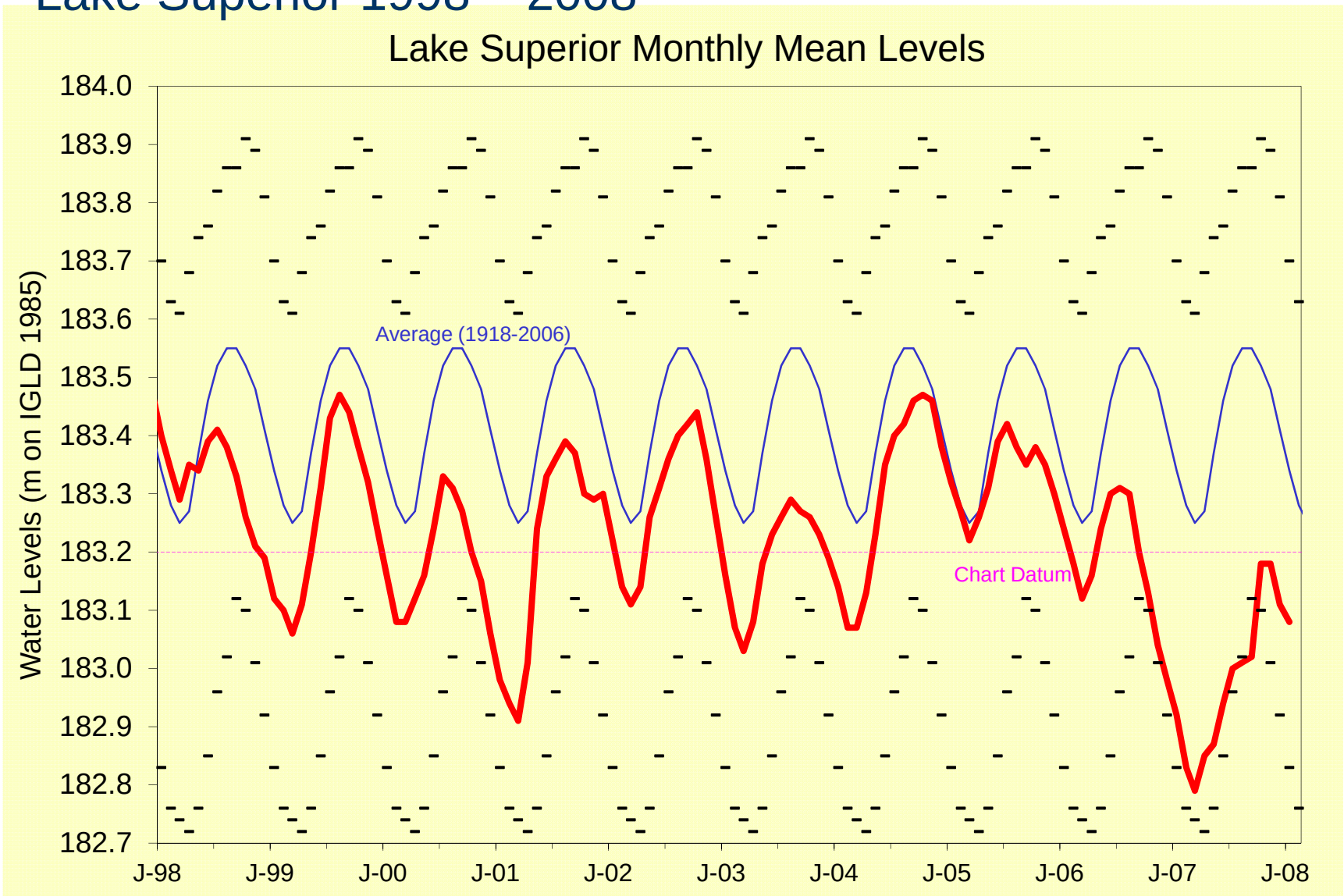
Current levels

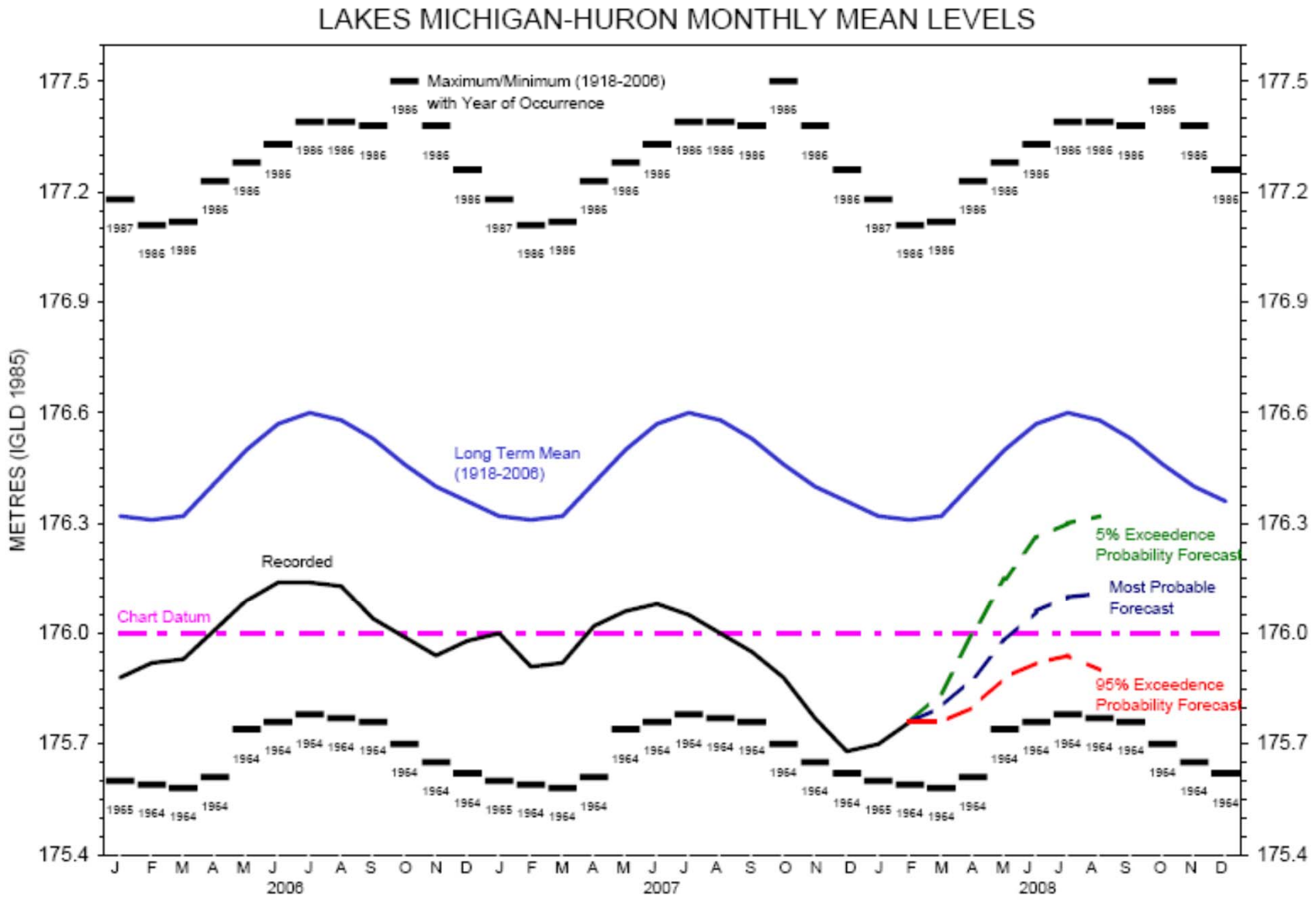
GREAT LAKES WATER LEVELS

Lake	March Monthly Mean Level		Beginning-of-April Level	
	Compared to Monthly Average (1918-2006)	Compared to One Year Ago	Compared to Beginning-of-Month Average (1918-2006)	Compared to One Year Ago
Superior	27 cm below	19 cm above	27 cm below	17 cm above
Michigan-Huron	54 cm below	14 cm below	54 cm below	17 cm below
St. Clair	2 cm below	3 cm below	8 cm below	10 cm below
Erie	20 cm above	Same	22 cm above	3 cm above
Ontario	20 cm above	2 cm above	20 cm above	4 cm below

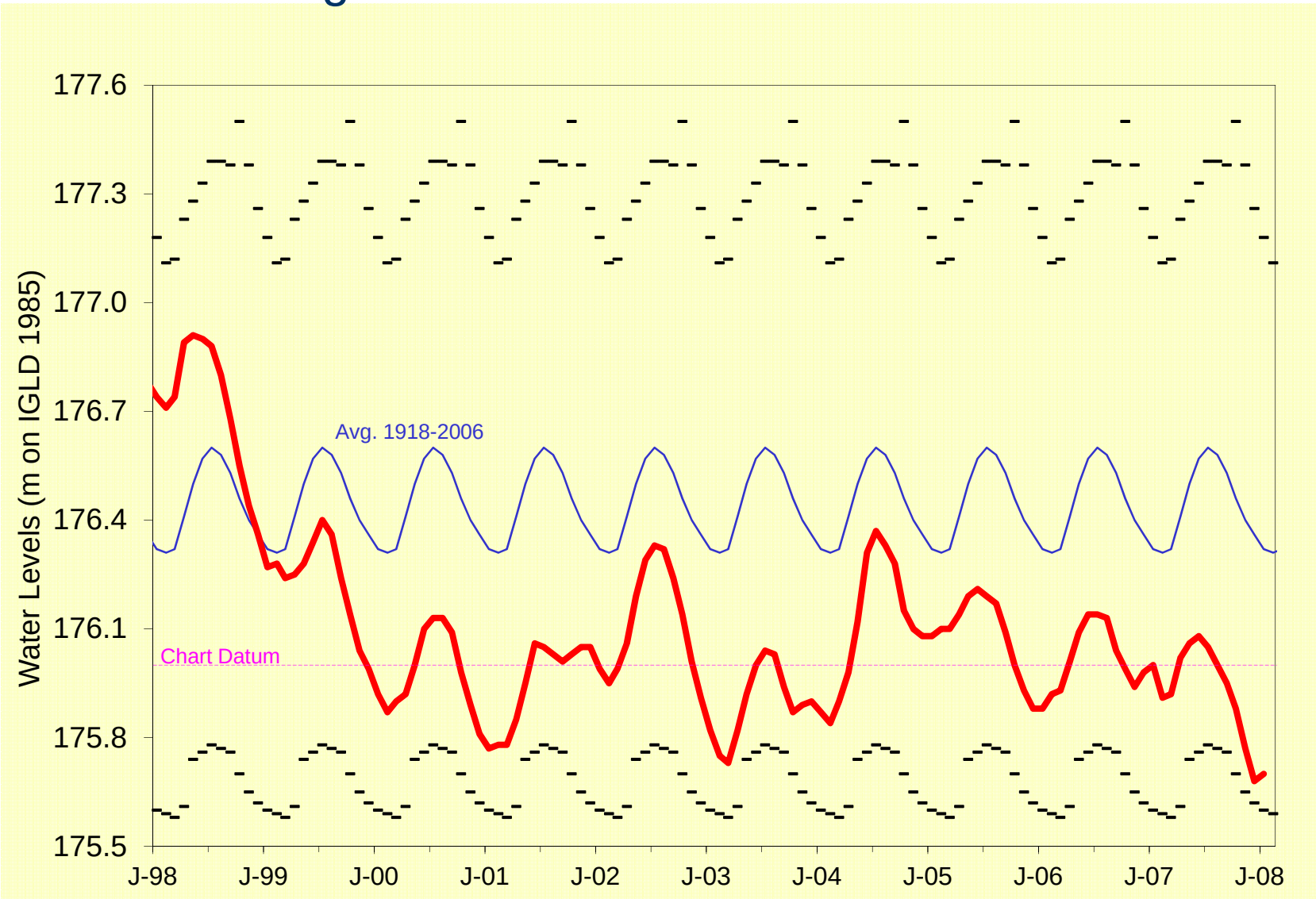

LAKE SUPERIOR MONTHLY MEAN LEVELS
Maximum/Minimum (1918-2006)
with Year of Occurrence
Long-term Mean
(1918-2006)
Recorded
Chart Datum
5% Exceedence
Probability Forecast
Most Probable
Forecast
95% Exceedence
Probability Forecast
METRES (IGLD 1985)
183.8
183.5
183.2
182.9
182.6
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
2006
2007
2008

Lake Superior 1998 – 2008

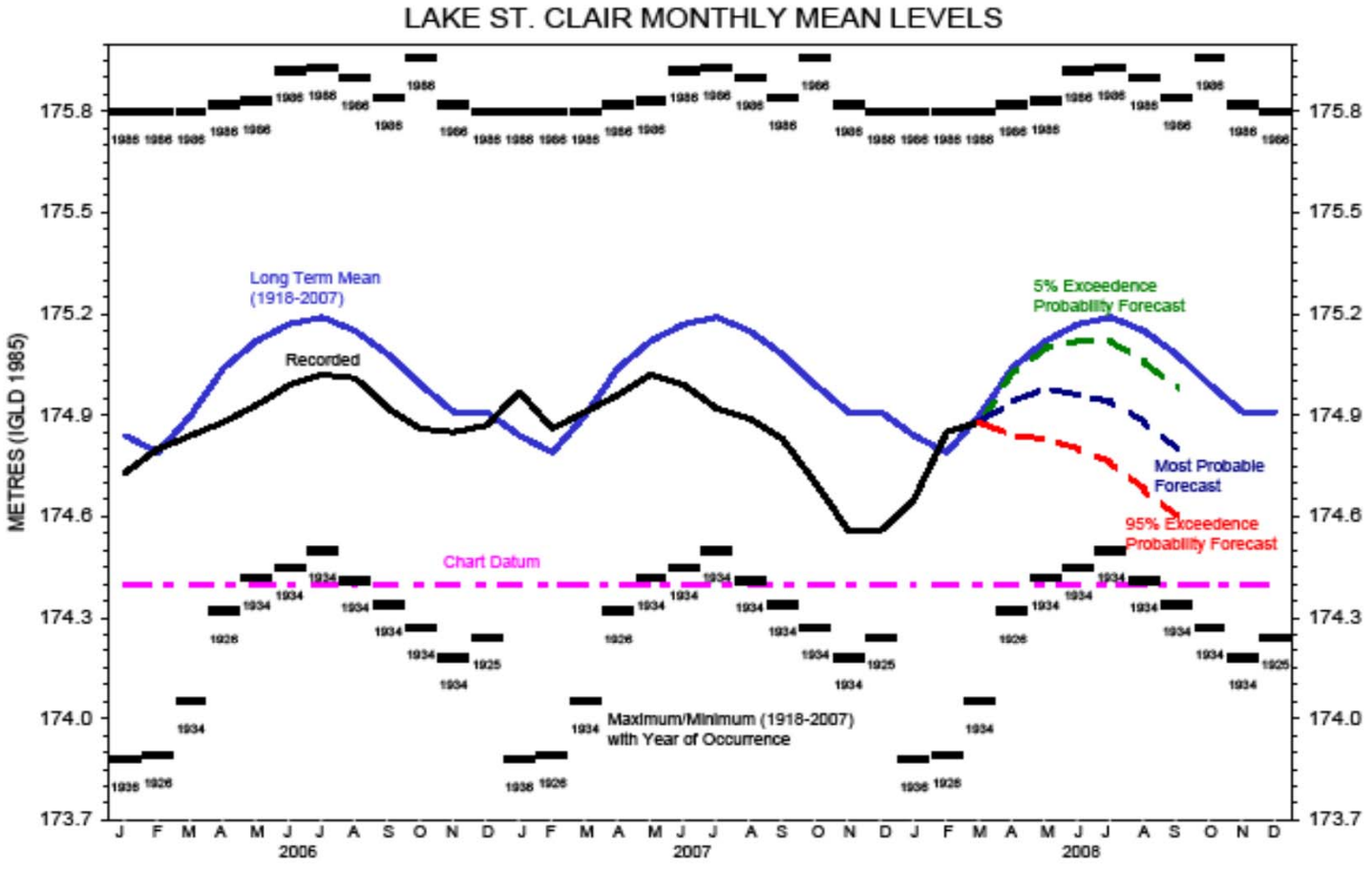



LAKES MICHIGAN-HURON MONTHLY MEAN LEVELS
METRES (IGLD 1985)
177.5
177.2
176.9
176.6
176.3
176.0
175.7
175.4
Maximum/Minimum (1918-2006)
with Year of Occurrence
Long Term Mean
(1918-2006)
Recorded
Chart Datum
5% Exceedence
Probability Forecast
Most Probable
Forecast
95% Exceedence
Probability Forecast
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
2006
2007
2008

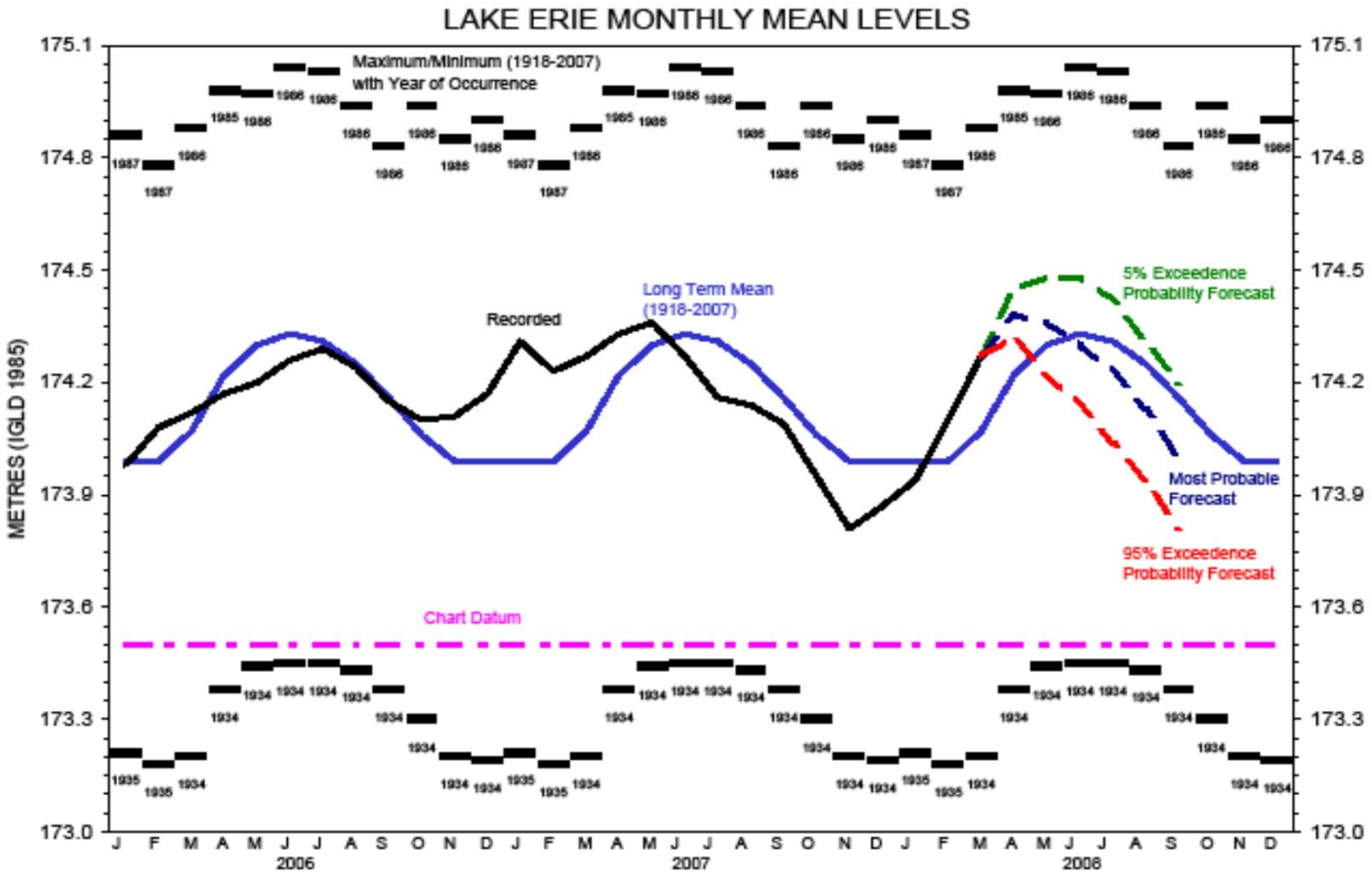
Lakes Michigan and Huron 1998-2008



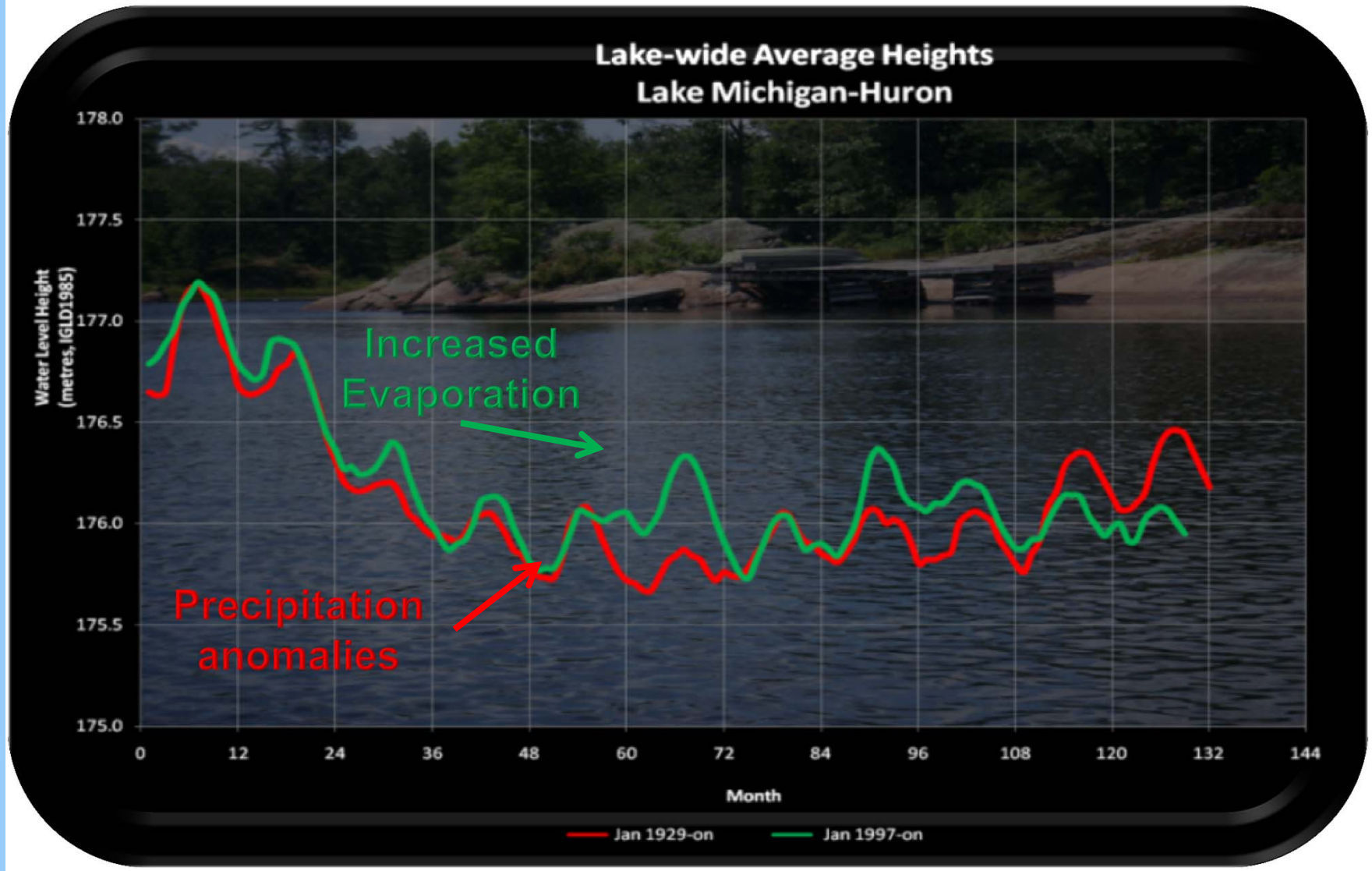
Lake St. Clair water levels - March 2008



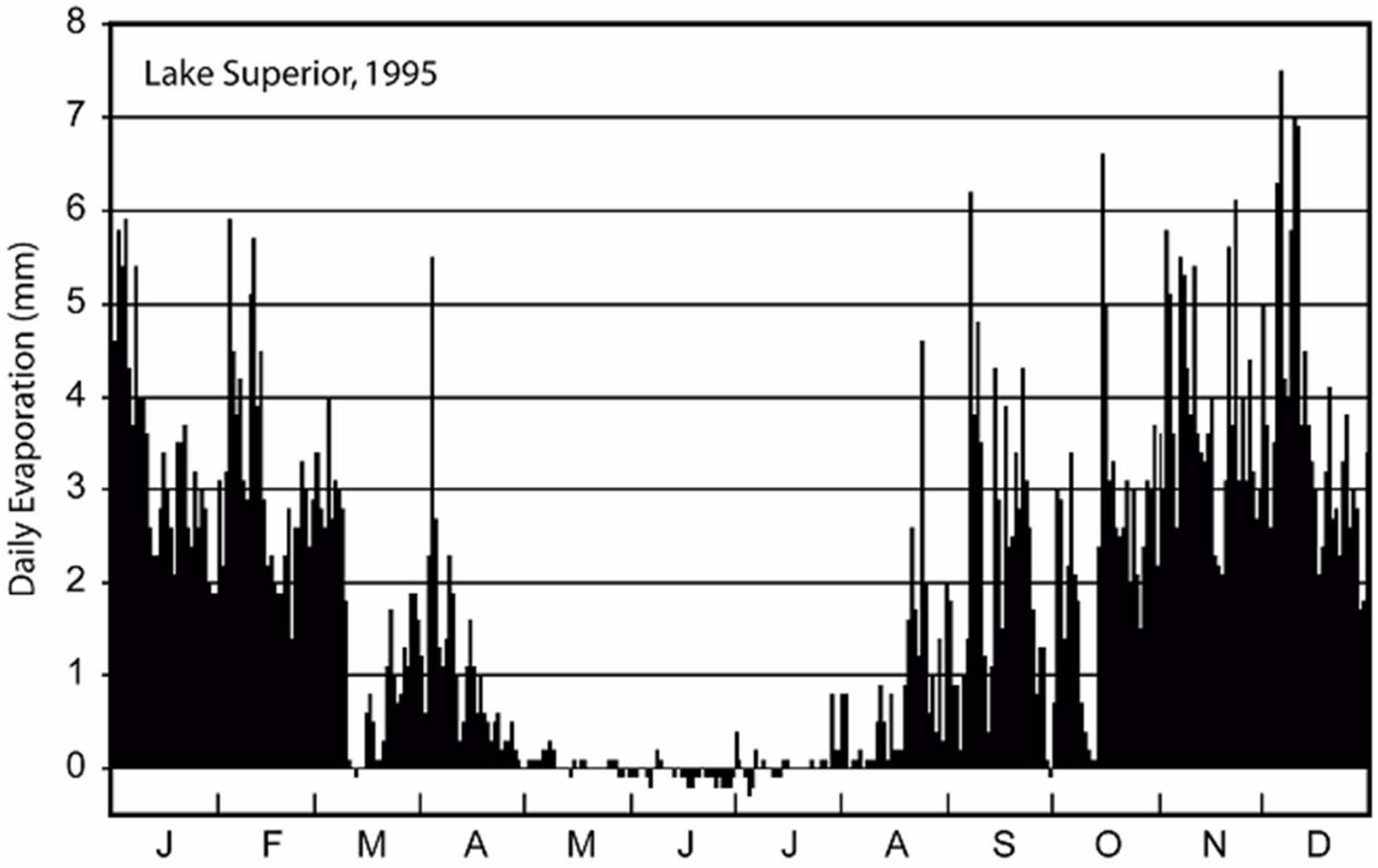
Lake Erie water levels - Mar, 2008



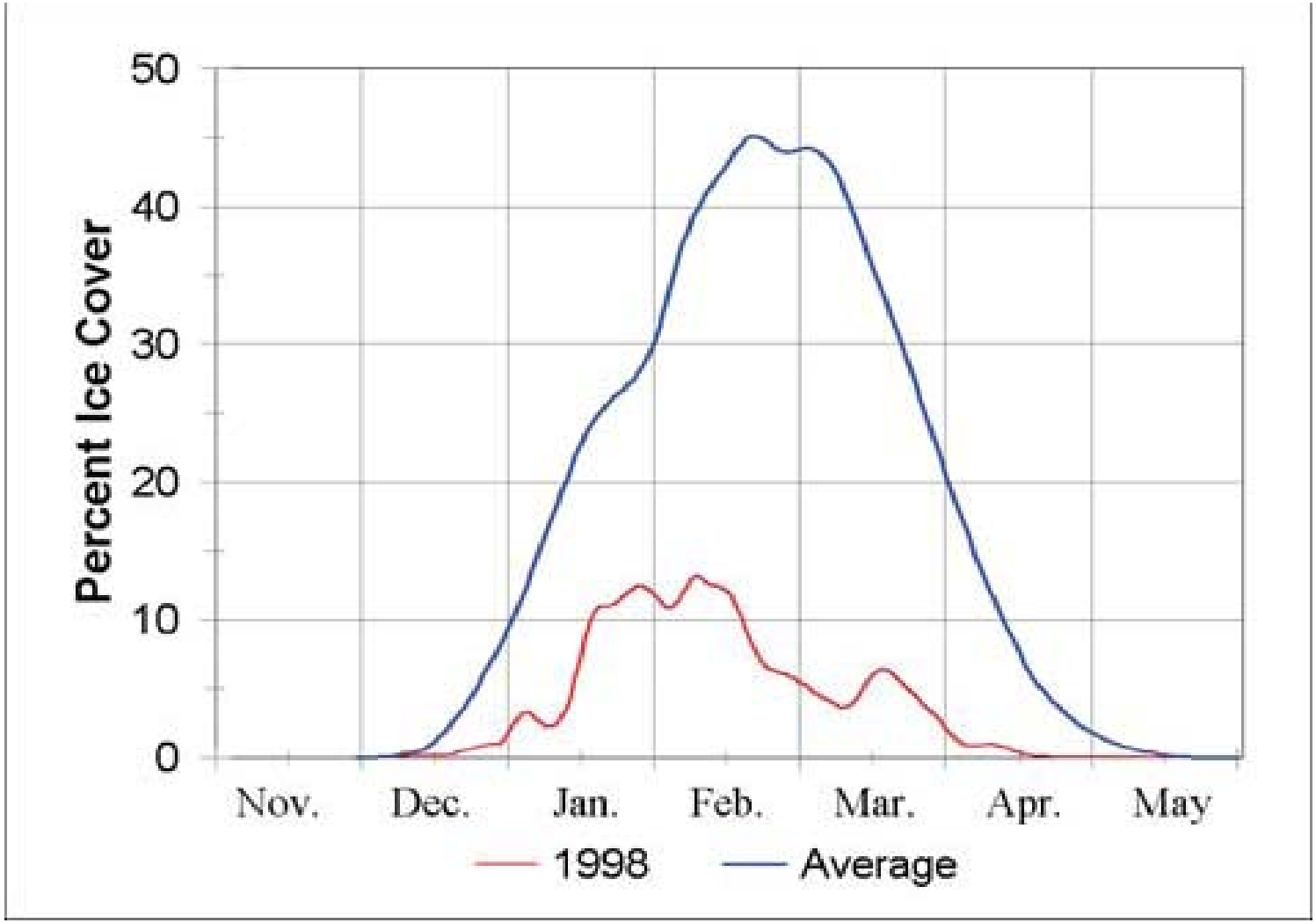
Current era compared to “Dust Bowl”



Daily Evaporation, L. Superior



Ice-covered surface area of Great Lakes

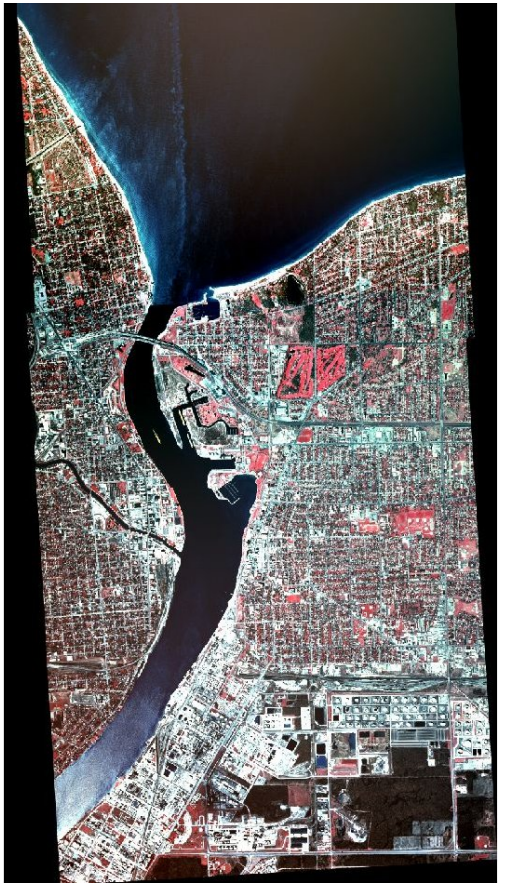


St. Clair River Issues

- Recent low Lakes Michigan-Huron levels may not be entirely due to hydrology, but rather to ongoing physical changes in the St. Clair River

- Decline in water level difference between Lakes Michigan-Huron and Lake Erie since 1970 implies ongoing St. Clair River erosion (causes?).

- If a problem is identified, are there any remedial measures that could be undertaken?

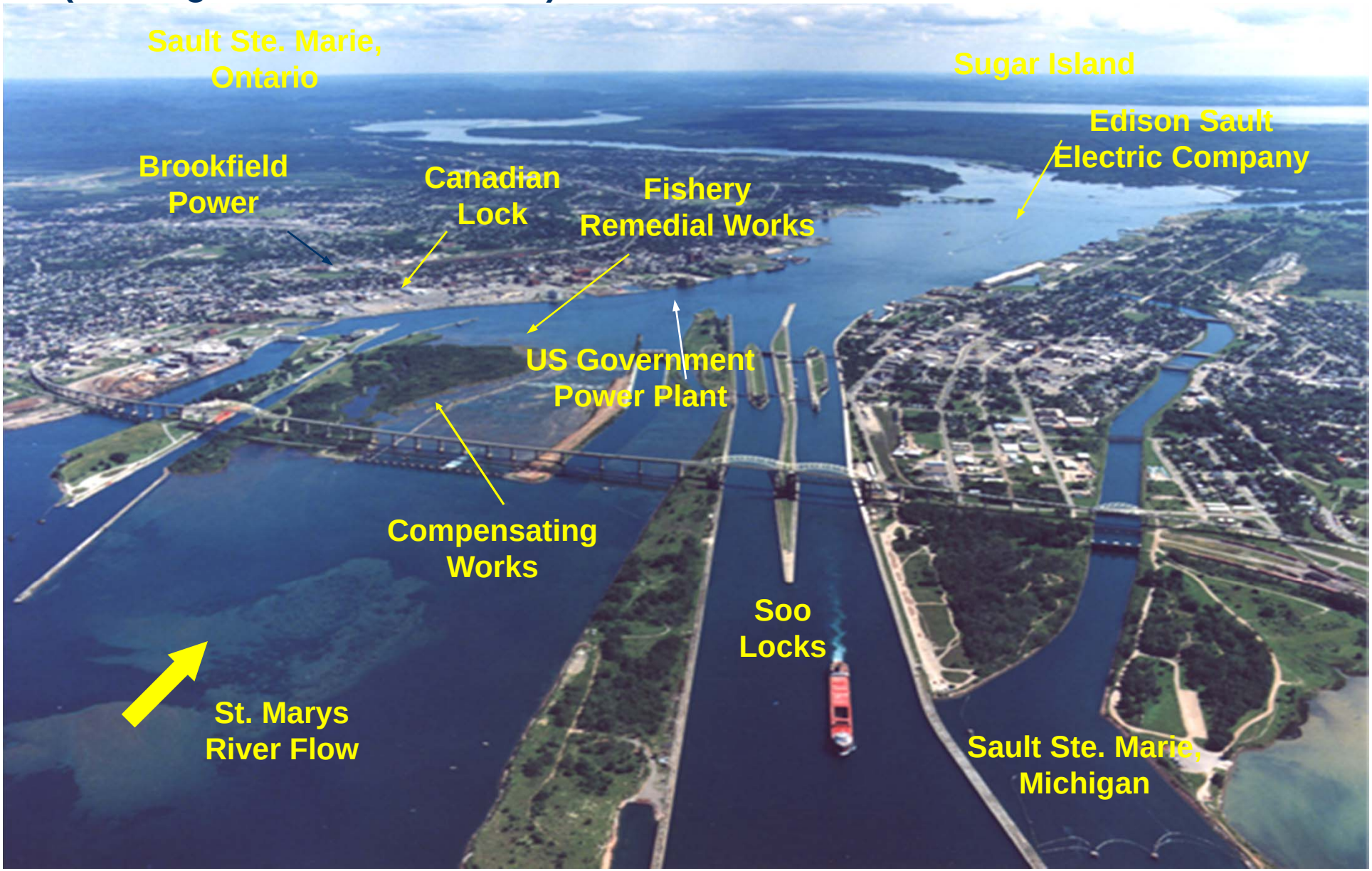


Understanding the St. Clair-Detroit River System:

- Investigate the factors affecting Great Lakes levels and flows, including physical changes in the St. Clair River related to:
  - Basin water supplies,
  - Diversions and consumptives uses,
  - Glacial rebound and subsidence (isostatic adjustments),
  - St. Clair – Detroit River **flow conveyance capacity.**

St. Marys River at Sault Ste. Marie

(Looking East or Downstream)



Improving Lake Superior Outflow Regulation:

- Review how the present management plan, Plan 1977-A, and the operation of the control structures affect water levels and flows.
- Identify potential updates and improvements to Plan 1977-A criteria, requirements, operating rules and outflow limits and incorporating operational experience.
- Review institutional arrangements.
- Test plan performance under climate variability and climate change scenarios.

The Baird Report

Requested by the Georgian Bay Associations to investigate causes of the "significant and ongoing drop in the level of Lake Michigan-Huron relative to levels of Lakes St. Clair and Erie."

Conclusions

- **Glacial rebound is negligible**
- **Net basin supply (NBS) shift unsubstantiated**
- **Primary cause is river bed erosion due to:**
  - **dredging of the 27 foot channel**
  - **loss of sand supply because of shore protection**
  - **Changes in the position of the outer channel**

Historical Background (key reports)

- *"Further Regulation of the Great Lakes"* **(RGL) 1976 IJC Report to the Governments of Canada and the U.S.** **(began with record lows and ended with record highs)**
- *"Levels Reference Study: Great Lakes- St. Lawrence River Basin"* **(LLR) – 1993 Levels Reference Study Board Report submitted to the IJC** **(focused on reducing extreme high levels)**

IJC – RGL Report

- Study Board considered 5-, 4-, 3-, & 2- Lake regulation plans, with hundreds of combinations
- Study used 1933 Lake Huron outlet conditions as baseline, for evaluation purposes, and calculated that returning Lake levels to that condition (+ 7”) would result in higher water levels that would cause an increase in shoreline property damages of ~$12M/yr ($1970)
- 5- and 4-lake plans were not economically feasible
- “Regulation of L. Michigan & Huron requires not only an increase in the capacity of the channels of the St. Clair and Detroit R., but also the ability to restrict the outflows below the capacity of the channel”

IJC – RGL Report

- Additional dredging and control structures would be required for St. Clair and Detroit, but not locks
- Gated structures to control flow and training walls to separate recreational boating from main channel commercial navigation.
- "The Commission believes…that no amount of structural innovation, within the realm of economic feasibility, can bring about a dramatic compression of the range of lake levels (*reducing highs and raising lows*) that people seem to expect and demand."

LLR recommendations

- “The Board recommends that Governments give no further consideration to 3-lake regulation”
- “The Board recommends that the Orders of Approval for the regulation of L. Superior be reviewed to determine if the current criteria are consistent with the current uses and needs of the users and interests of the system”
- “The Board recommends that the Int’l Lake Superior Board of Control be authorized to use its discretion in regulating the outflows…similar to those of the St. Lawrence Control Board”

Overall Conclusions from the RGL and LLR

- GL must be managed as system, maximizing net benefits to all, without unduly harming any single interest
- IJC has authority to revise "Orders" for operating existing control structures, but must refer all other new structural and non-structural measures that could alleviate damages to respective countries, states, provinces for implementation
- Most proposed water control structures that could deal with extreme lake level fluctuations have BCR<<1
- GL are a large, self-regulating system – human intervention cannot significantly modify extremes

Science Questions Framework

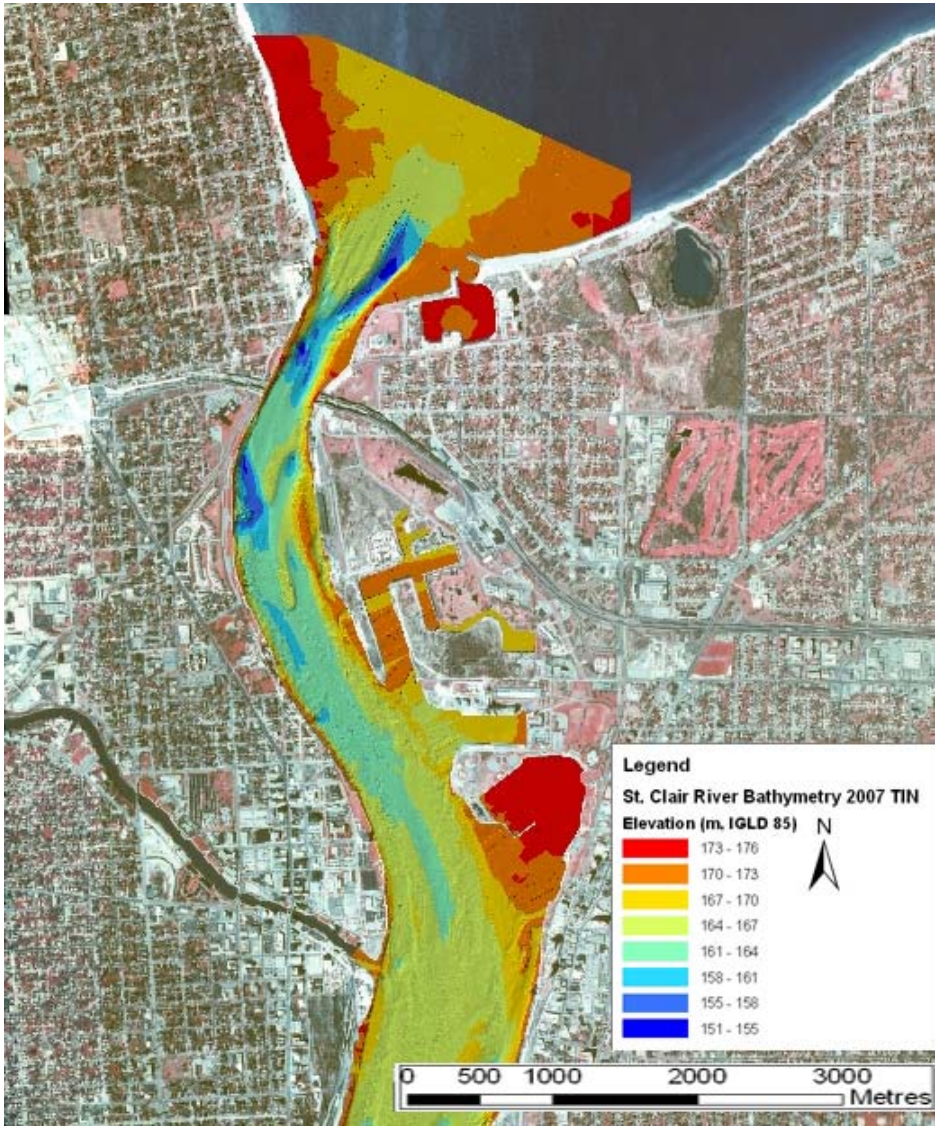
Has the "Conveyance" of the St. Clair River changed since the 1962 dredging?	SQ1	What is causing the declining head difference between Lakes Michigan/Huron - Erie?
	SQ2	Has the St. Clair River flow regime (i.e. water level-discharge relationship) changed with time and if so, why?
	SQ3	Has the velocity patterns in the St Clair River been modified and if so, what are the implications?
Has the "Morphology" of the St. Clair River been altered since the 1962 dredging?	SQ4	Is the St. Clair River bed stable or eroding?
	SQ5	If the bed of the St Clair river is eroding, what initiated it, and when?
	SQ6	Has the sediment budget for the St. Clair River changed and if so, what are the implications?

Secondary "Morphology" Questions

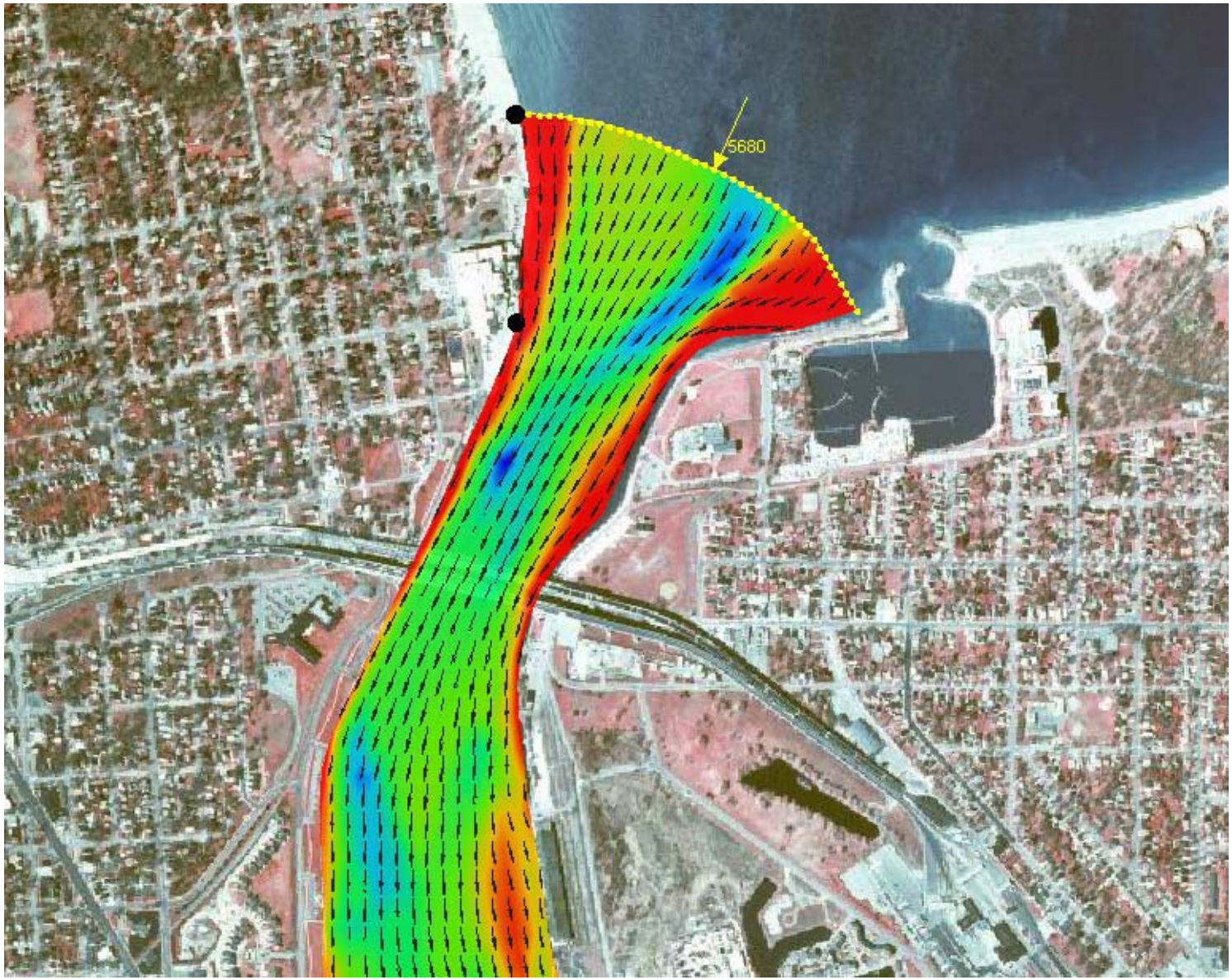
- Is the St. Clair River bed stable or eroding?
- If the bed of the St Clair river is eroding, what initiated it, and when?
- Has the sediment budget for the St. Clair River changed and if so, what are the implications?

Historical Bathymetry – 1870-72

Bathymetry Features – Upper River



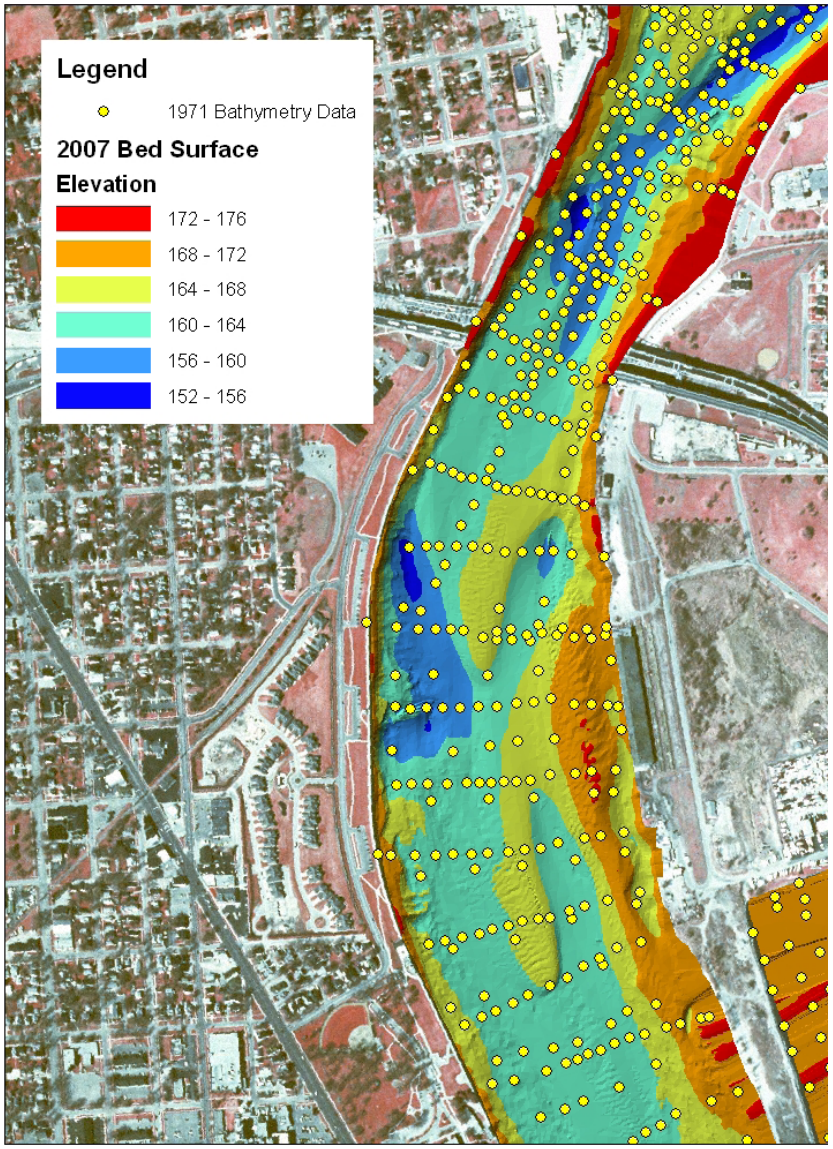
Flow Features – Upper River



Highlights:

- All bathymetry from 1971, 2001, 2002, 2005, 2006 and 2007 was processed and is being used in modelling.
- Preliminary results from 2-D modelling of St. Clair River hydraulics using two different models were completed and a draft report received.
- The results of hydraulic model outputs will be used in 2-D sediment modelling.
- A key project on comparing different computation techniques on the hydrologic components for water supplies into upper Great Lakes was completed and data delivered.

Data Density Features – Upper St. Clair River 1971 profiles



Work underway to address questions:

Scientific and Technical:

- **Collection of suite of bathymetric data**
- **GIS analysis of all the cross-sectional data**
- **Application and calibration of 1-D, 2-D hydraulic and sediment models**
- **Net basin supply component sensitivity analyses**
- **Review and QA/QC of data sets, datums, etc.**
- **Reconnaissance for installation of 3 hydrometric gauges**
- **Bed material sampling and videoing of St. Clair bed**
- **Climate change scenarios and regional climate models**

Table 2 - Result Integration - St. Clair River Tasks

		Science Questions Framework					
		Has the "Conveyance" of the St. Clair River Changed since the 1962 dredging?			Has the "Morphology" of the St. Clair River altered since the 1962 dredging?		
		SQ1	SQ2	SQ3	SQ4	SQ5	SQ6
No.	Project	What is causing the declining head difference between Lakes Michigan/Huron - Erie?	Has the St. Clair River flow regime (i.e. water level-discharge relationship) changed with time and if so, why?	Has the velocity patterns in the St Clair River been modified and if so, what are the implications?	Is the St. Clair River bed stable or eroding?	If the bed of the St Clair river is eroding, what initiated it, and when?	Has the sediment budget for the St. Clair River changed and if so, what are the implications?
P21	Net Basin Supplies Comparison and Water Balance Closure	❑	❖				
P22	Glacial Isostatic Adjustment	❑	❖				
P2	Review of St. Clair & Detroit River Rating Curves and Develop Hydraulic Performance Graphs	❑	❑		❖	❖	
P7	Discharge Computation of the River Using the Standardized HEC-RAS Model	❑	❑		❖	❖	
P3	Development of a Basic 1-D Modelling of St. Clair River Using HEC-RAS	❖	❑	❖	❖		
P4	1-D Conveyance Analysis of the St. Clair River Using the Standardized HEC- RAS Model	❖	❑	❖	❖		
P8	Ice Effects of Flows and Levels Using Standardized Geometry Model of HEC-RAS	❖	❑	❖	❖		
P10	1-D Conveyance Analysis of the St. Clair River using the Mobile Bed MOBED Model	❖	❑	❖	❑	❖	❖
P23	2-D Conveyance / Morphological Analysis of the St. Clair River using SED2D or equivalent	❖	❑	❖	❑	❖	❖
P5	Application of 2-D Modelling Using Existing RMA2 Model of the St. Clair River with Different Bathymetric Data Sets	❖	❑	❑	❑	❑	
P6	Application of 2-D Model of the St. Clair River Using Telemac Modules with Different Bathymetric Data Sets	❖	❑	❑	❑	❑	
P24	Quantification of Uncertainties in 1-D and 2-D Modeling	❖	❑	❑	❑	❑	❖
P1	Bathymetry of St. Clair River 1971 - 2007		❑		❑	❑	❖
P13	Analysis of Bathymetric and Planform Changes in the Past 130 years and Registration into Common GIS		❑		❑	❑	❖
P15	Obtain and Analyze the Bottom Velocity Data from ADCP		❖	❑	❑	❖	
P16	New Coincident ADCP and Multi-beam Data for Hydraulic/sediment Model Verification		❖	❑	❑	❖	
P18	Extract Bed Movement Velocity from Existing or New ADCP Data		❖	❑	❑	❖	
P11	Side-scan Sonar and Video of Substrate in Upper St Clair River		❖		❑	❖	
P12	Sediment Coring and Physical Testing of Substrate in the ST. Clair River		❖		❑	❖	
P9	Video Transects of River Bed, Monthly Sediment Load Measurements, Cross-section Surveys, Grab samples of Bed Material - Sarnia-Pt Lambton		❖		❑	❑	❑
P17	Analysis of Ship Effects, Both Movement and Sinking on Sediment and Erosion Regimes				❖	❑	❖
P19	Reports and Data on Surficial Geology, Littoral Transport, St Clair River and Delta				❖	❖	❑
P20	Conduct Sedimentation Studies of the St Clair River Delta		❖		❖		❑
P14	History of St. Clair River and Detroit River Dredging and Compensation Works				❖	❖	❖

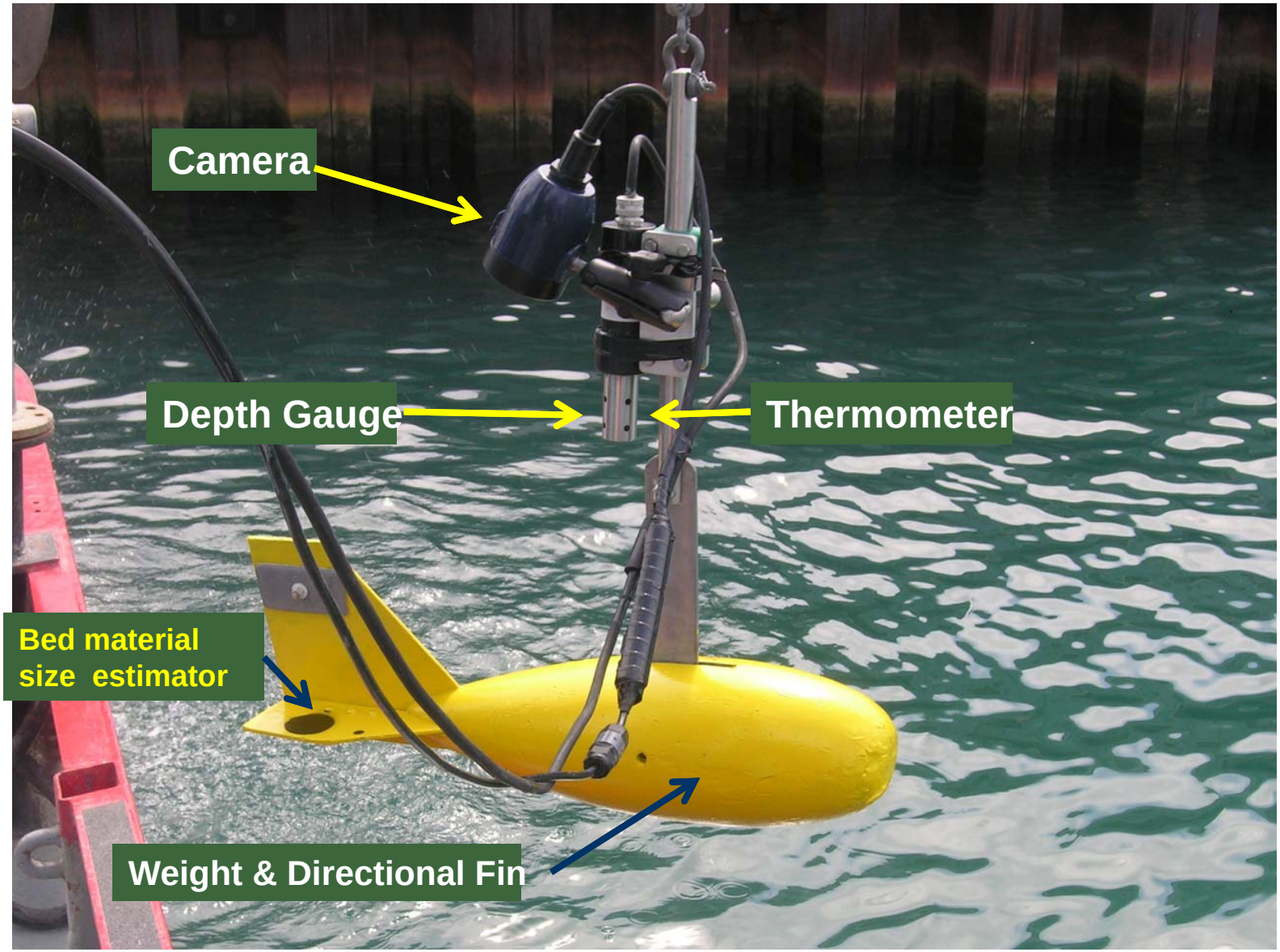
Legend:

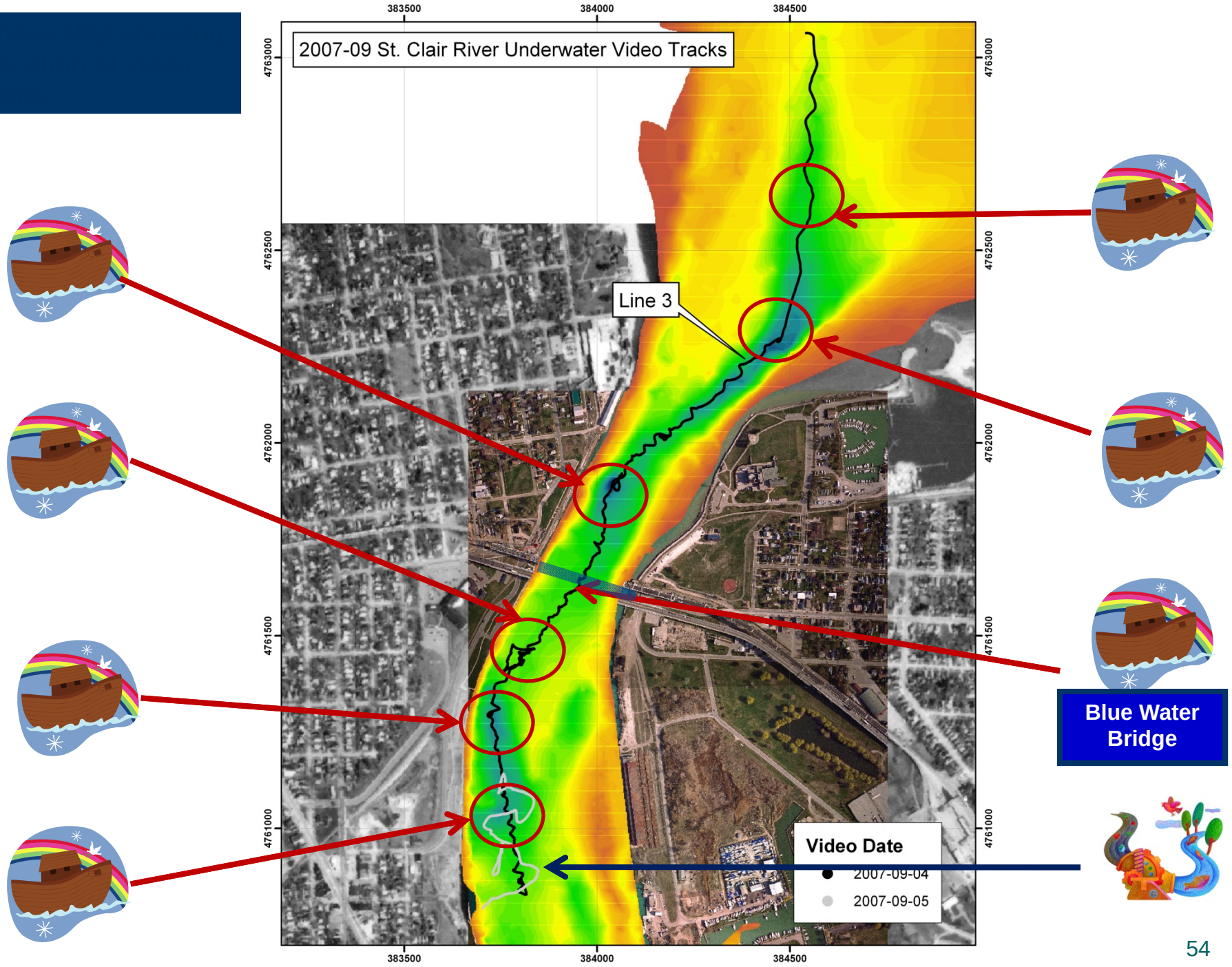
Primary focus	❑
Secondary focus	❖
Projects not initiated - Will start this spring	

Matrix version 1.5 - Study Team - March 18, 2008

INTERNATIONAL Upper Great Lakes STUDY

St. Clair River Animation


Camera
Depth Gauge
Thermometer
Bed material size estimator
Weight & Directional Fin


2007-09 St. Clair River Underwater Video Tracks
383500
384000
384500
4763000
4762500
4762000
4761500
4761000
Line 3
Video Date
2007-09-04
2007-09-05
Blue Water Bridge

Expedited Reporting Schedule

April, 2008	**Interim Progress Report focusing on status of projects examining the conveyance and morphology of the St. Clair River, including hydraulic models and Net Basin Supply analysis.**
October, 2008	**Interim Progress Report providing an initial assessment of science questions.**
February, 2009	**Draft Final Report on St Clair River completed and distributed for comments to all the key groups.**
June, 2009	**Final Report for the St. Clair River portion of IUGLS submitted to the IJC.**

Conclusions

- Study is well under way – previous work is being reviewed, new research pursued, with a focus on getting the facts first.
- The public will be heavily engaged and their input will help drive study activities and outcomes.
- The scientific issues related to climate and physical processes are complex and demand serious, peer-reviewed science.
- Immediate mitigation is premature and not within the current mandate.
- Study results will reflect independent, binational work that is credible and on the level.

Questions?

For more information and to submit written comments, visit:

www.iugls.org