

# MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

## SAGINAW BAY

### POST 2009 FIELD SEASON

## OBSERVATIONS, COMMENTS, AND PERSPECTIVES

BRUCE R. WALKER, MDEQ, WATER BUREAU

# DATA INFLUENCES: TASTE THE FUDGE FACTOR

- KNOW THE SITUATION YOU ARE SAMPLING

# DATA INFLUENCES: TASTE THE FUDGE FACTOR

- KNOW THE SITUATION YOU ARE SAMPLING
- BAY WATER CONDITIONS
  - USE ALL INFO FOR PROPER CONTEXT

APRIL 10, 2009



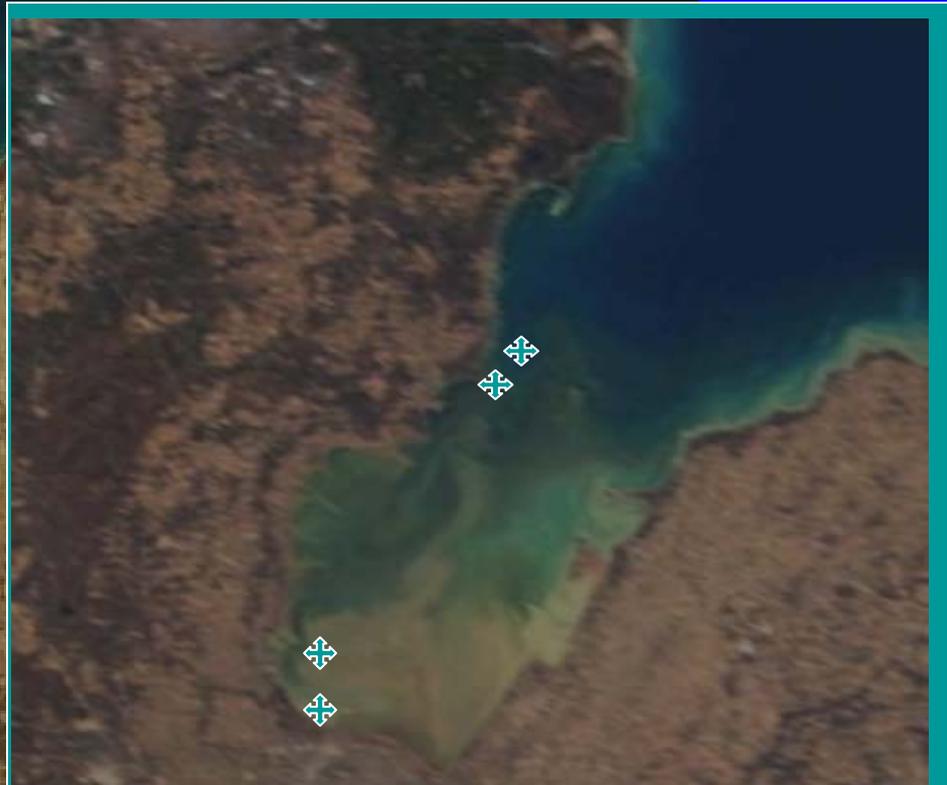
APRIL 13, 2009



General location of primary and emergency public water intakes for Midland/Saginaw and Bay City, MI



April/14/2008



April 2009

May 11, 2009

MODIS Imagery: t1.09131.1604.LakeHuron.143.250m.jpg - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://coastwatch.glerl.noaa.gov/modis/modis.cgi/modis?region=h&page=2&template=sub&image=t1.09131.1604.LakeHuron.143.250m.jpg

Wind Direction Map Lake Huron MODIS Imagery MODIS Imagery: t1.09131.1604.L...



Done

Start Microsoft PowerPoint - [...] MODIS Imagery: t1.0... copernic 5:43 PM

The image is a screenshot of a Mozilla Firefox browser window displaying MODIS satellite imagery of Lake Huron. The browser's address bar shows the URL: http://coastwatch.glerl.noaa.gov/modis/modis.cgi/modis?region=h&page=2&template=sub&image=t1.09131.1604.LakeHuron.143.250m.jpg. The main content area shows a satellite image of the lake, with a large, dark green area in the center, likely representing a large body of water or a specific vegetation type. The surrounding land areas are shown in lighter green and brownish tones. The browser's taskbar at the bottom shows the Start button, several open applications including Microsoft PowerPoint and MODIS Imagery, and the system tray with the time 5:43 PM and the Copernicus logo.

May 14, 2009

MODIS Imagery: a1.09134.1821.LakeHuron.143.250m.jpg - Mozilla Firefox

File Edit View History Bookmarks Tools Help

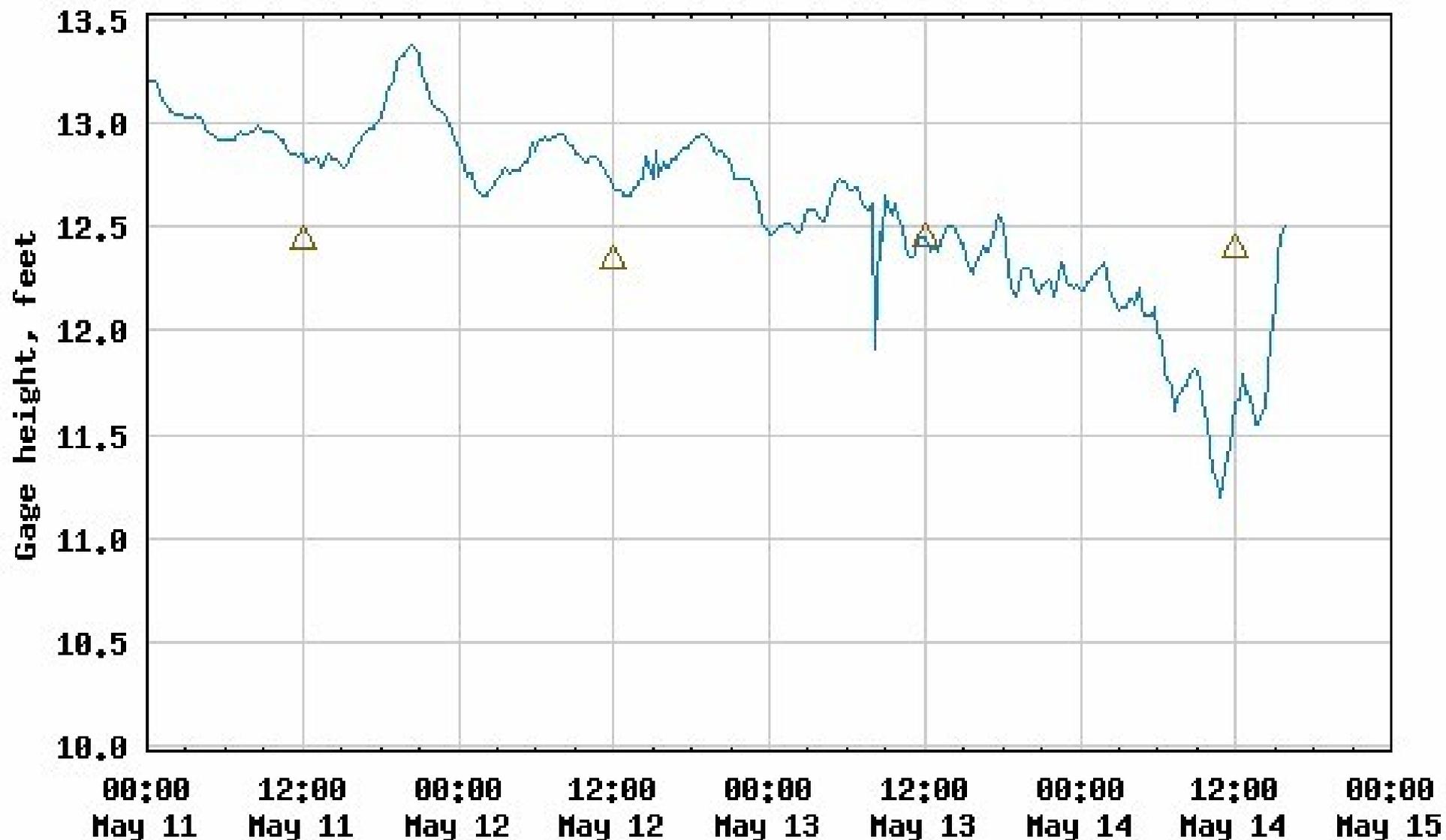
http://coastwatch.glerl.noaa.gov/modis/modis.cgi/modis?region=h&page=1&template=sub&image=a1.09134.1821.LakeHuron.143.250m.jpg

Wind Direction Map Lake Huron MODIS Imagery Michigan Sea Grant Coastwatch USGS Real-Time Water Data for USGS ... MODIS Imagery: a1.09134.1821...



Done

USGS 04157065 SAGINAW RIVER AT MEADOCK ROAD AT ESSEXVILLE, MI

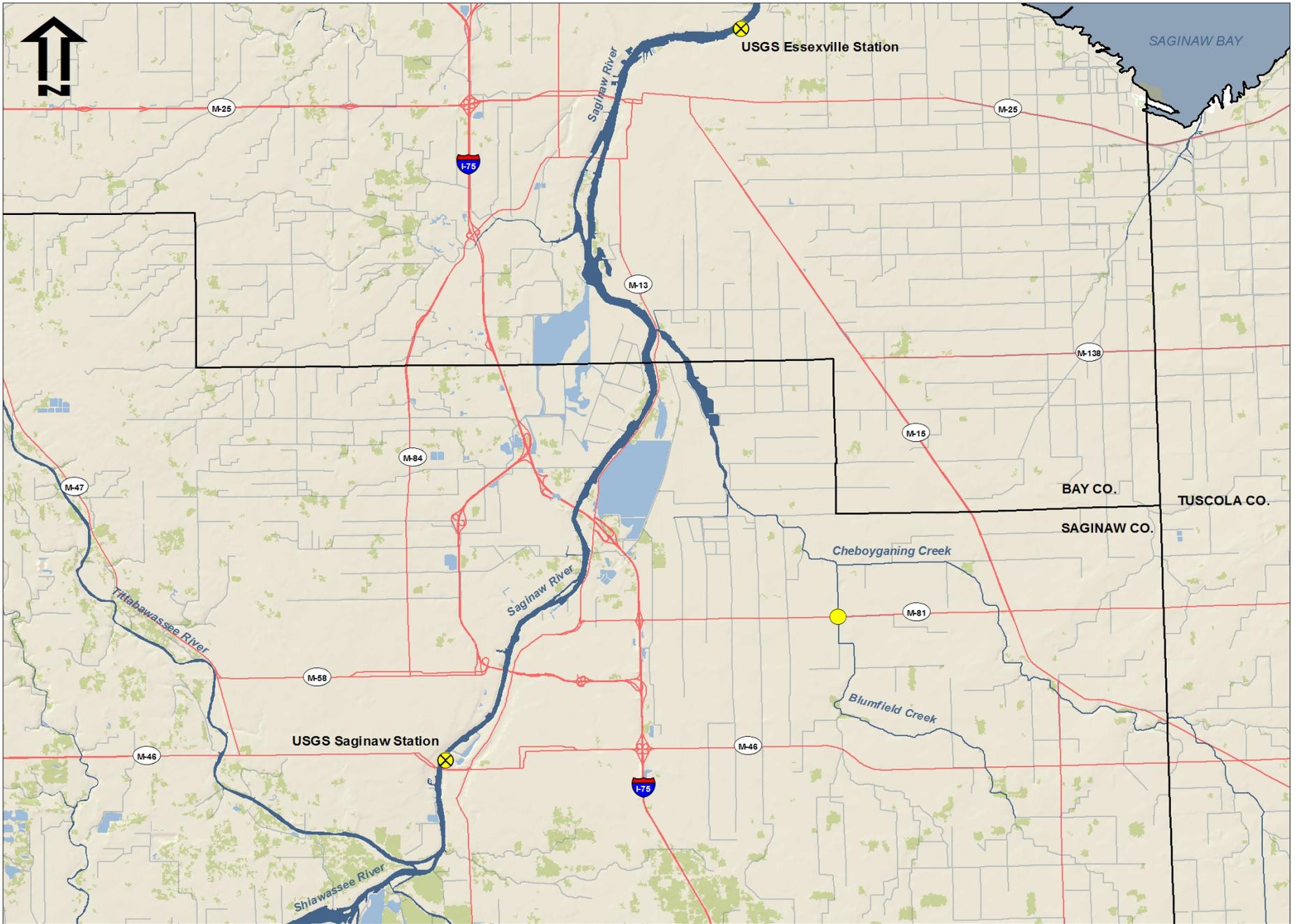


---- Provisional Data Subject to Revision ----

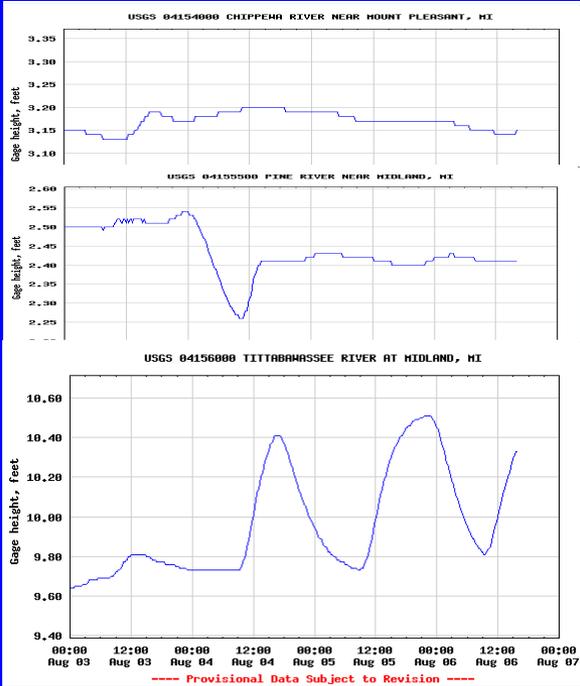
△ Median daily statistic (8 years) — Gage height

# DATA INFLUENCES: TASTE THE FUDGE FACTOR

- KNOW THE SITUATION YOU ARE SAMPLING
- BAY CONDITIONS – USE ALL INFO
- RIVERINE CONDITIONS & FLOW STATUS
  - WHAT WATER ARE YOU GETTING?



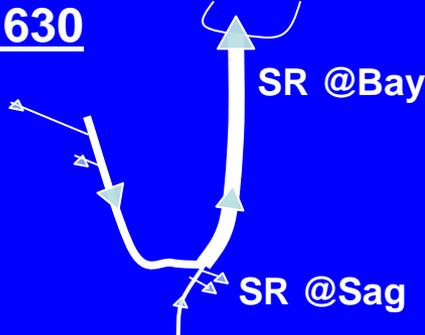
# 3 Day USGS Gauge (ft) Aug 6 2009 1630



Chip @Mt PI  
175 cfs

Pine ^Chip  
82

TR @Dow Dam  
833



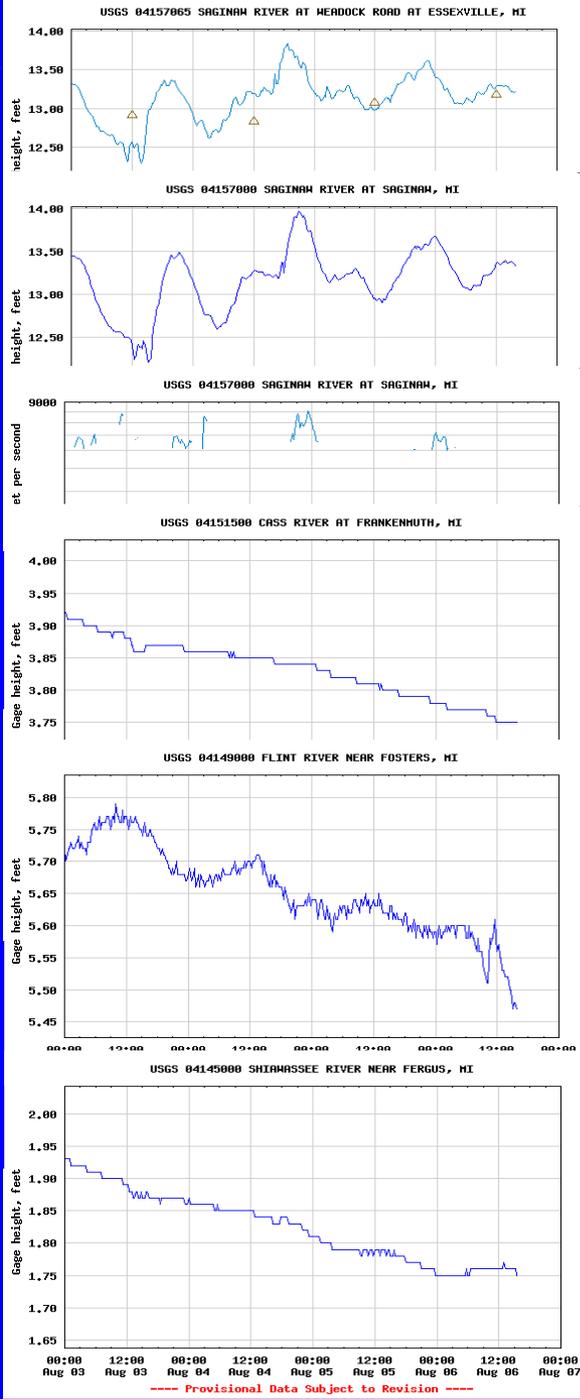
SR @Sag  
no flow cfs

Cass @Frkmth  
62

Flint @M-13  
255

Shia @Fergus  
143

SR@SAG 13.34 +0.12  
SR@Bay 13.22



833 cfs (64.4% TR) + 460 cfs (35.5% Shia+Flint+Cass) = 1293 cfs (xx % of SR@Sag)

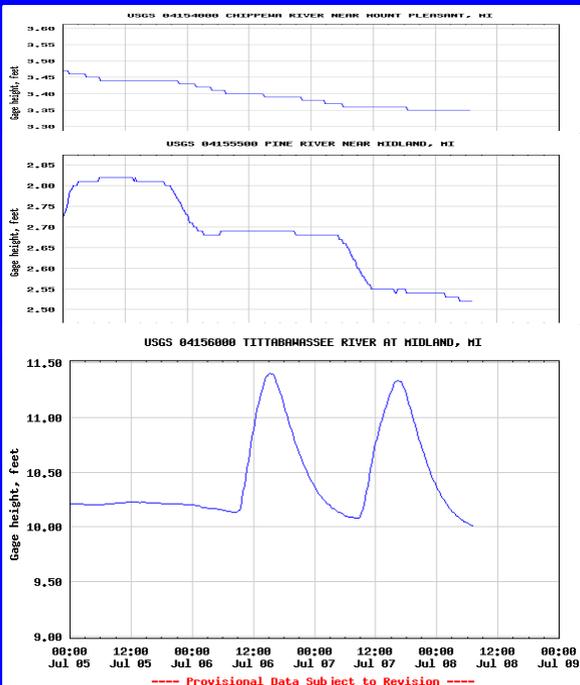
USGS Real-Time Data for Michigan - Streamflow - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://waterdata.usgs.gov/mi/nwis/current/?type=flow

Gauge ID	Station Name	Date	Time	Flow (cfs)	Stage (ft)	Velocity (ft/s)
04144500	SHIAWASSEE RIVER AT OWOSSO, MI	08/06	15:15	2.31	68	95.0
04145000	SHIAWASSEE RIVER NEAR FERGUS, MI	08/06	15:30	1.75	143	104
04146063	SOUTH BRANCH FLINT RIVER NEAR COLUMBIAVILLE, MI	08/06	15:30	1.41	58	44.0
04147500	FLINT RIVER NEAR OTISVILLE, MI	08/06	15:30	2.91	131	114
04148140	KEARSLEY CREEK NEAR DAVISON, MI	08/06	11:30	3.54	10	14.0
04148300	SWARTZ CREEK AT FLINT, MI	08/06	15:15	1.99	--	---
04148440	THREAD CREEK NEAR FLINT, MI	08/06	15:30	Eqp	--	---
04148500	FLINT RIVER NEAR FLINT, MI	08/06	15:30	3.00	120	179
04149000	FLINT RIVER NEAR FOSTERS, MI	08/06	15:45	5.47	255	214
04150500	CASS RIVER AT CASS CITY, MI	08/06	15:30	4.78	20	17.0
04151500	CASS RIVER AT FRANKENMUTH, MI	08/06	15:45	3.75	62	82.0
04152238	SOUTH BRANCH TOBACCO RIVER NEAR BEAVERTON, MI	08/06	15:30	3.86	62	69.0
04154000	CHIPPEAWA RIVER NEAR MOUNT PLEASANT, MI	08/06	15:45	3.15	175	144
04155000	PINE RIVER AT ALMA, MI	08/06	15:30	1.65	122	81.0
04155500	PINE RIVER NEAR MIDLAND, MI	08/06	16:00	2.41	82	112
04156000	TITTABAWASSEE RIVER AT MIDLAND, MI	08/06	15:45	10.33	833	494
04157000	SAGINAW RIVER AT SAGINAW, MI	08/06	15:45	13.34	--	1,770
04157065	SAGINAW RIVER AT WEADOCK ROAD AT ESSEXVILLE, MI	08/06	15:45	13.22	--	---

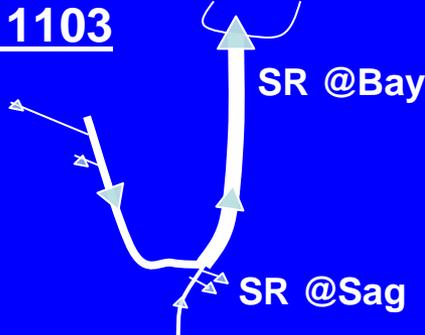
# 3 Day USGS Gauge (ft) July 08 2009 1103



Chip @Mt PI  
250 cfs

Pine ^Chip  
118

TR @Dow Dam  
736

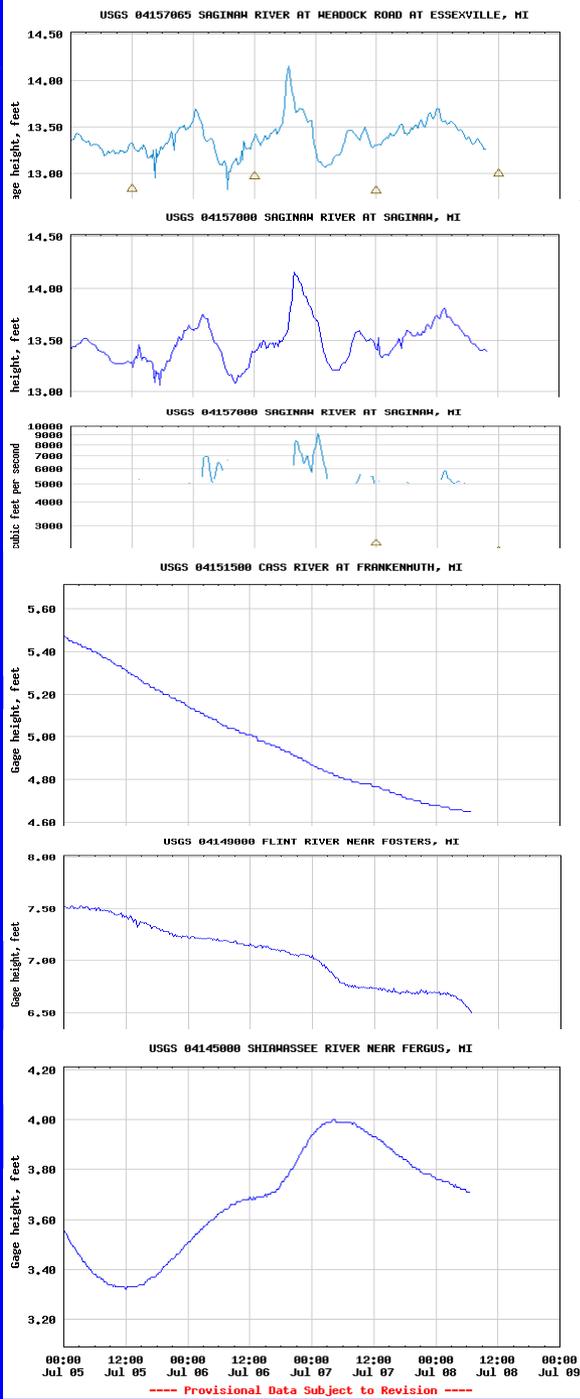


SR @Sag  
NO FLOW cfs

Cass @Frkmth  
186

Flint @M-13  
526

Shia @Fergus  
424

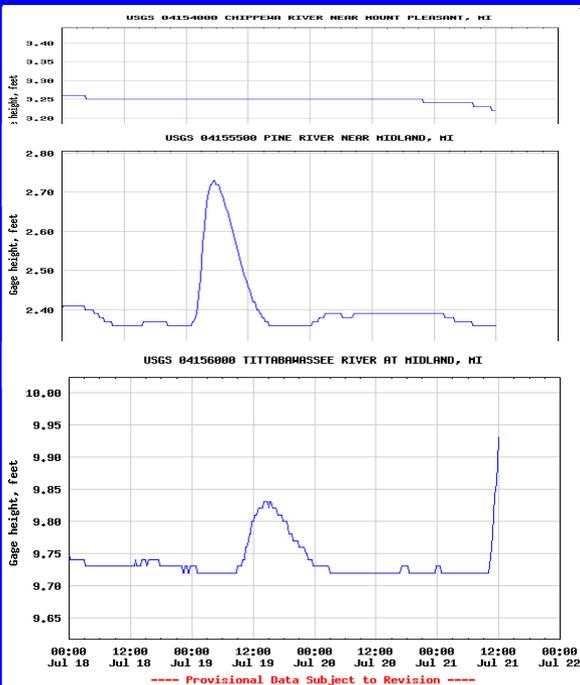


736 cfs (39.3% TR) + 1136 cfs (60.6% Shia+Flint+Cass) = 1872 cfs (xx % of SR@Sag)

Gauge ID	Location	Date/Time	Gage Height (ft)	Discharge (cfs)	Flow Status
04144500	SHIABASSEE RIVER AT OWOSSO, MI	07/08 06:15	2.80	225	136
04145000	SHIABASSEE RIVER NEAR FERGUS, MI	07/08 06:30	3.71	424	154
04146063	SOUTH BRANCH FLINT RIVER NEAR COLUMBIAVILLE, MI	07/08 06:30	1.98	135	60.0
04147500	FLINT RIVER NEAR OTISVILLE, MI	07/08 06:30	3.85	282	125
04148140	KEARSLEY CREEK NEAR DAVISON, MI	07/08 06:30	4.12	31	20.0
04148300	SWARTZ CREEK AT FLINT, MI	07/08 06:30	2.34	--	---
04148440	THREAD CREEK NEAR FLINT, MI	07/08 07:45	Eop	--	---
04148500	FLINT RIVER NEAR FLINT, MI	07/08 06:45	3.91	368	207
04149000	FLINT RIVER NEAR FOSTERS, MI	07/08 06:45	6.50	526	250
04150500	CASS RIVER AT CASS CITY, MI	07/08 06:45	5.13	70	27.0
04151500	CASS RIVER AT FRANKENMUTH, MI	07/08 06:45	4.65	186	112
04152238	SOUTH BRANCH TOBACCO RIVER NEAR BEAVERTON, MI	07/08 06:30	3.92	66	67.0
04154000	CHIPPEWA RIVER NEAR MOUNT PLEASANT, MI	07/08 06:45	3.35	250	177
04155000	PINE RIVER AT ALMA, MI	07/08 06:45	1.77	137	95.0
04155500	PINE RIVER NEAR MIDLAND, MI	07/08 07:00	2.52	118	112
04156000	TITTABAWASSEE RIVER AT MIDLAND, MI	07/08 07:00	10.01	736	616
04157000	SAGINAW RIVER AT SAGINAW, MI	07/08 09:45	13.39	--	2,220
		07/08 09:30	--	--	2,220
04157065	SAGINAW RIVER AT WEADOCK ROAD AT ESSEXVILLE, MI	07/08 09:30	13.26	--	---

SR@SAG 13.39 +0.13  
SR@Bay 13.26

# 3 Day USGS Gauge (ft) July 21 2009 1600

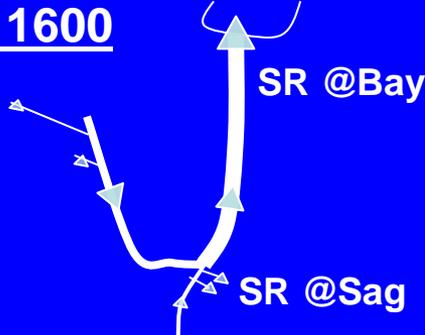


Chip @Mt PI  
211 cfs

Pine ^Chip  
79

TR @Dow Dam  
689

Note, The SR@mouh is 2.16 inches higher than up in the City of Saginaw. – flow upstream



SR @Sag  
no flow cfs

Cass @Frkmth  
94

Flint @M-13  
492

Shia @Fergus  
183

689 cfs (47.2% TR) + 769 cfs (52.7% Shia+Flint+Cass) = 1458 cfs (xx % of SR@Sag)

USGS Real-Time Data for Michigan - Streamflow - Mozilla Firefox

File Edit View History Bookmarks Tools Help

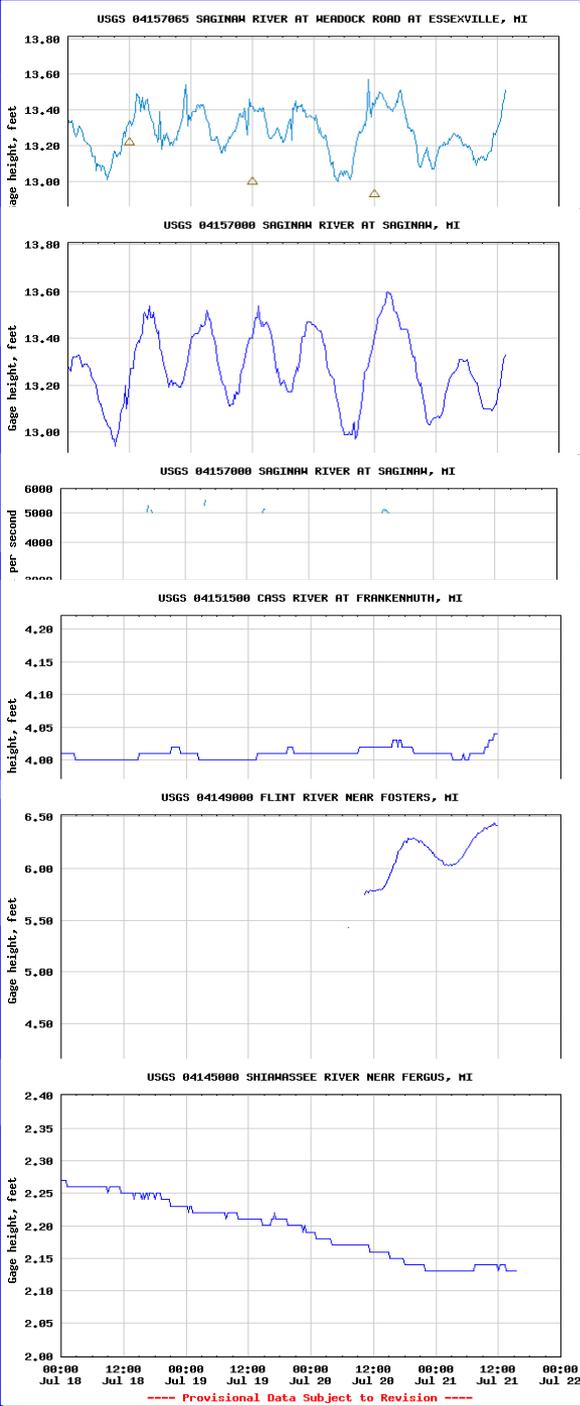
http://waterdata.usgs.gov/mi/nwis/current/?type=flow

USGS Real-Ti... USGS Real-Time Wa... USGS Real-Time Wa...

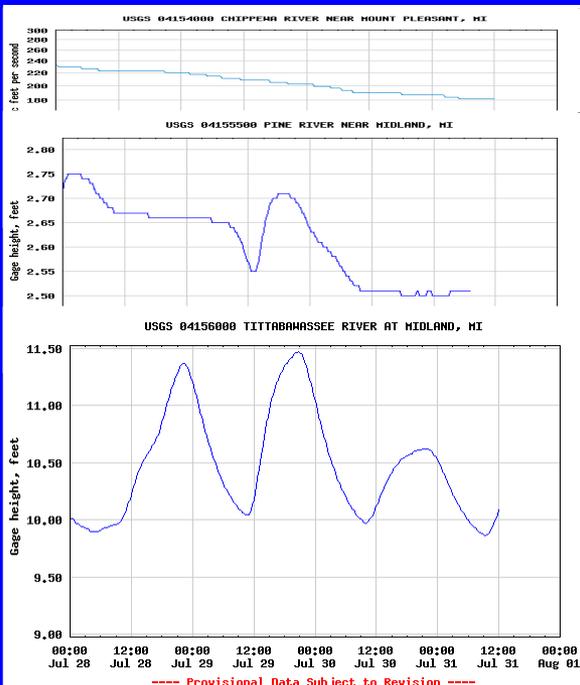
● Saginaw River Basin

Gage ID	Location	Date/Time	Flow (cfs)	Stage (ft)
04144500	SHIAWASSEE RIVER AT OWOSSO, MI	07/21 15:15	2.42	96
04145000	SHIAWASSEE RIVER NEAR FERGUS, MI	07/21 15:30	2.13	183
04146063	SOUTH BRANCH FLINT RIVER NEAR COLUMBIAVILLE, MI	07/21 15:30	1.67	91
04147500	FLINT RIVER NEAR OTISVILLE, MI	07/21 15:30	3.17	169
04148140	KEARSLEY CREEK NEAR DAVISON, MI	07/21 15:30	3.82	18
04148300	SWARTZ CREEK AT FLINT, MI	07/21 15:30	2.13	--
04148440	THREAD CREEK NEAR FLINT, MI	07/21 15:30	Eqp	--
04148500	FLINT RIVER NEAR FLINT, MI	07/21 15:45	3.99	395
04149000	FLINT RIVER NEAR FOSTERS, MI	07/21 15:45	6.39	492
04150500	CASS RIVER AT CASS CITY, MI	07/21 15:45	4.84	27
04151500	CASS RIVER AT FRANKENMUTH, MI	07/21 11:45	4.04	94
04152238	SOUTH BRANCH TOBACCO RIVER NEAR BEAVERTON, MI	07/21 11:45	3.82	59
04154000	CHIPPEWA RIVER NEAR MOUNT PLEASANT, MI	07/21 11:45	3.22	211
04155000	PINE RIVER AT ALMA, MI	07/21 11:45	1.81	140
04155500	PINE RIVER NEAR MIDLAND, MI	07/21 12:00	2.36	79
04156000	TITTABAWASSEE RIVER AT MIDLAND, MI	07/21 12:00	9.93	689
04157000	SAGINAW RIVER AT SAGINAW, MI	07/21 13:30	13.33	--
04157065	SAGINAW RIVER AT WEADOCK ROAD AT ESSEXVILLE, MI	07/21 13:30	13.51	--

SR@SAG 13.33 -0.18  
SR@Bay 13.51



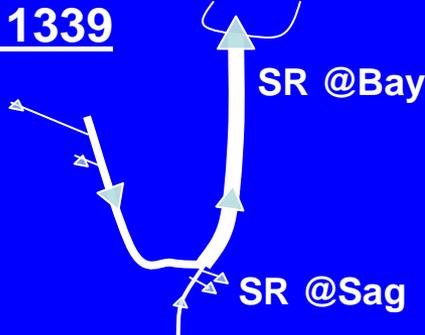
# 3 Day USGS Gauge (ft) July 31 2009 1339



Chip @Mt PI  
181 cfs

Pine ^Chip  
105

TR @Dow Dam  
683



SR @Sag  
No flow cfs

Cass @Frkmth  
117

Flint @M-13  
350

Shia @Fergus  
171

683 cfs (51.7% TR) + 638 cfs (48.3% Shia+Flint+Cass) = 1321 cfs (xx % of SR@Sag)

USGS Real-Time Data for Michigan - Streamflow - Mozilla Firefox

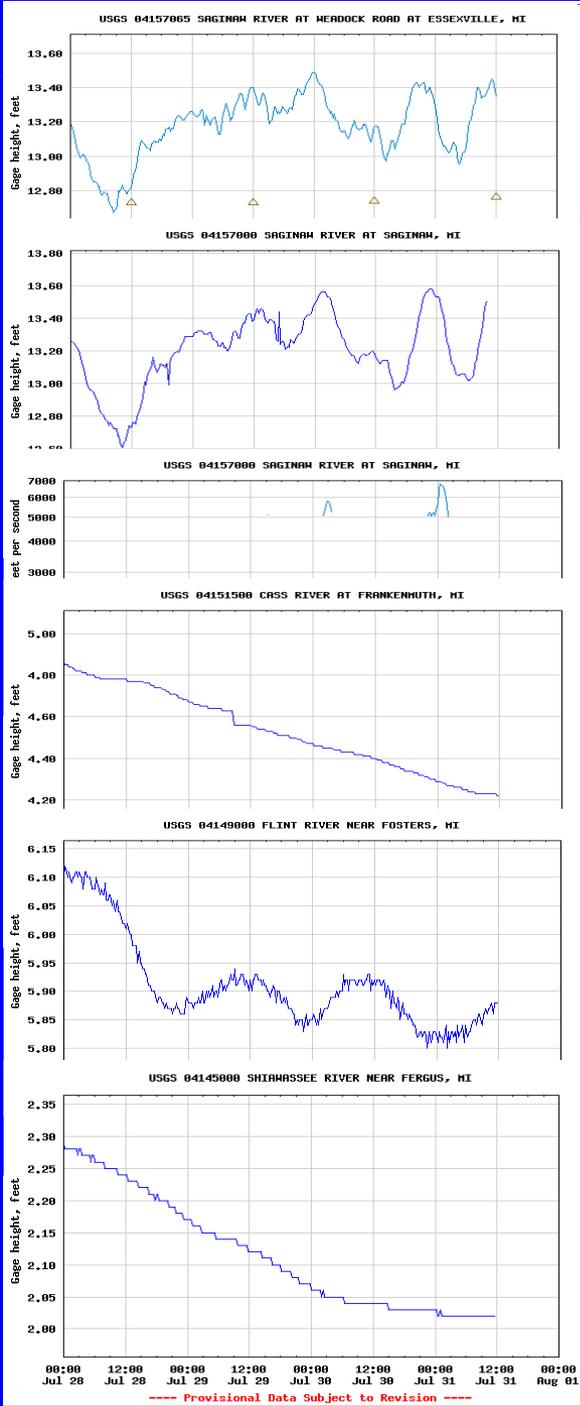
http://waterdata.usgs.gov/mi/nwis/current/?type=flow

USGS Real-Time Wa... USGS Real-Time Wa...

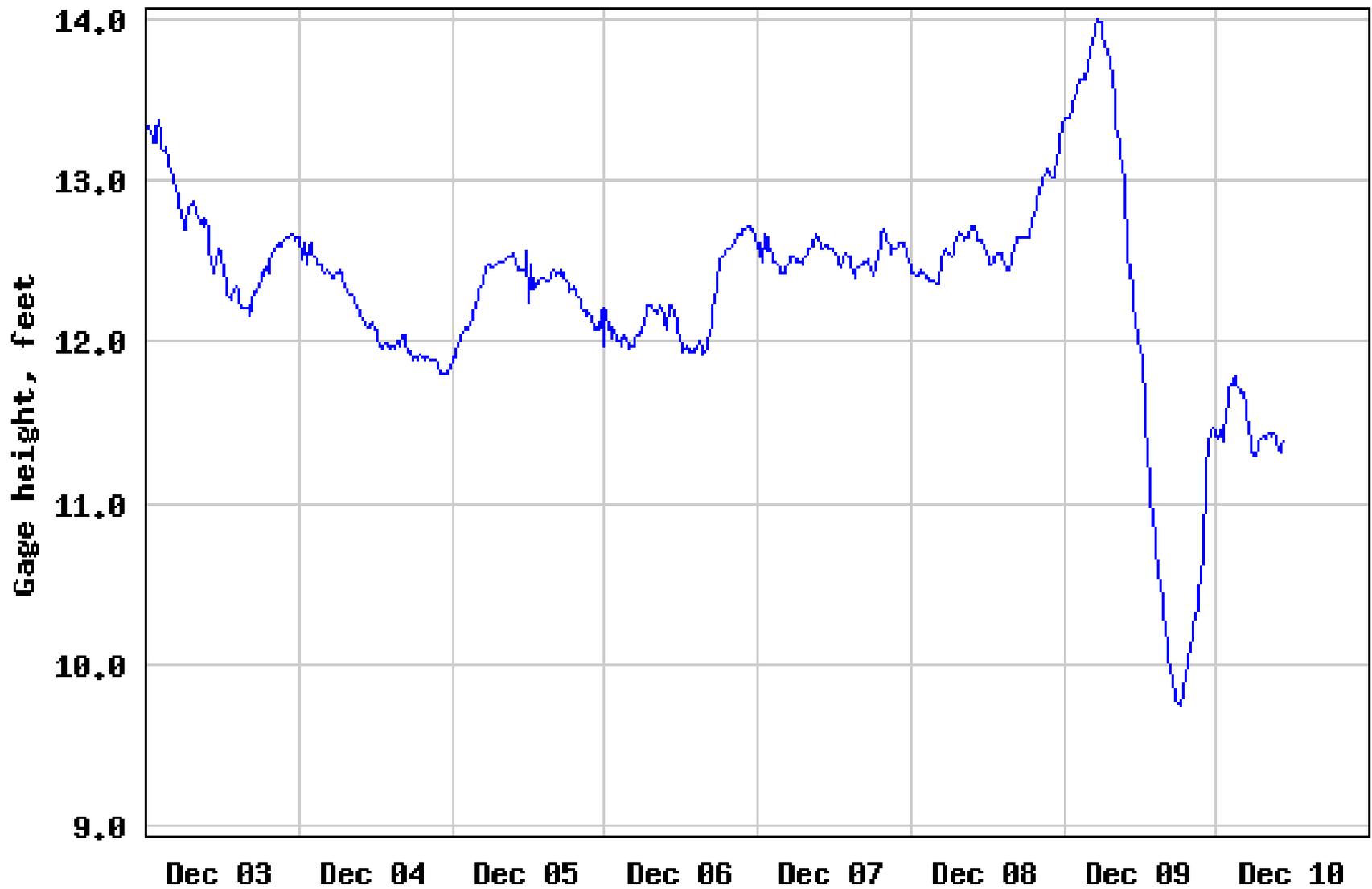
**Saginaw River Basin**

04144500	SHIAWASSEE RIVER AT OWOSSO, MI	07/31 11:15	2.42	82	96.0
04145000	SHIAWASSEE RIVER NEAR FERGUS, MI	07/31 11:30	2.02	171	114
04146063	SOUTH BRANCH FLINT RIVER NEAR COLUMBIAVILLE, MI	07/31 11:30	1.56	77	63.0
04147500	FLINT RIVER NEAR OTISVILLE, MI	07/31 11:30	3.15	166	112
04148140	KEARSLEY CREEK NEAR DAVISON, MI	07/31 11:30	3.73	15	15.0
04148300	SWARTZ CREEK AT FLINT, MI	07/31 11:30	2.04	--	--
04148440	THREAD CREEK NEAR FLINT, MI	07/31 11:30	Eqp	--	--
04148500	FLINT RIVER NEAR FLINT, MI	07/31 11:45	3.73	310	182
04149000	FLINT RIVER NEAR FOSTERS, MI	07/31 11:45	5.88	350	228
04150500	CASS RIVER AT CASS CITY, MI	07/31 11:45	4.99	46	17.0
04151500	CASS RIVER AT FRANKENMUTH, MI	07/31 11:45	4.22	117	86.0
04152238	SOUTH BRANCH TOBACCO RIVER NEAR BEAVERTON, MI	07/31 11:45	3.88	63	62.0
04154000	CHIPPEWA RIVER NEAR MOUNT PLEASANT, MI	07/31 12:00	3.17	181	157
04155000	PINE RIVER AT ALMA, MI	07/31 11:45	1.41	93	88.0
04155500	PINE RIVER NEAR MIDLAND, MI	07/31 07:00	2.51	105	111
04156000	TITTABAWASSEE RIVER AT MIDLAND, MI	07/31 12:00	10.09	683	521
04157000	SAGINAW RIVER AT SAGINAW, MI	07/31 09:45	13.50	--	1,760
04157065	SAGINAW RIVER AT WEADOCK ROAD AT ESSEXVILLE, MI	07/31 12:00	13.35	--	--

SR@SAG 13.50 +0.15  
SR@Bay 13.35



USGS 04157065 SAGINAW RIVER AT HEADOCK ROAD AT ESSEXVILLE, MI



---- Provisional Data Subject to Revision ----

# What does it mean?

- Bay samples
  - Spatial/Temporal variation is significant.

# What does it mean?

- Bay samples
  - Spatial/Temporal variation is significant.
  - Is the current sample size & frequency adequate for seeing trends or effects from controls?
  - For open water, near-shore?

# What does it mean?

- Bay samples
  - Spatial/Temporal variation abound.
  - Is the current sample size & frequency adequate for seeing trends or effects from controls? Open water, near-shore.
  - Use of satellite shots may help understand site conditions and some of the "random" data variability.

# What does it mean?

- River samples - what water are you getting?
  - Essexville – Bay or River flow?

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  - At Saginaw – Flow or Stagnant?

# What does it mean?

- River samples - what water are you getting?
  - Essexville – Bay or River flow?
  - At Saginaw – Flow or Stagnant?
  - Lots of “no flow” periods seen.
    - Stagnant – Bay intrusion or backed up trib waters from hydraulic dam effect? Sort out with P-chem data?

# What does it affect?

- Modeling

- What do river sample data represent?

# What does it affect?

- Modeling

- What do river sample data represent?
- Contrary to prior assumptions?

# What does it affect?

## ➤ Modeling

- What do river sample data represent?
- Contrary to prior assumptions?
- What are effects in modeling loads if data do not represent flow/export?

# What does it affect?

## ➤ Modeling

- What do river sample data represent?
- Contrary to prior assumptions?
- What are effects in modeling loads if data do not represent flow/export?
- Affects how we assess “improvements”?

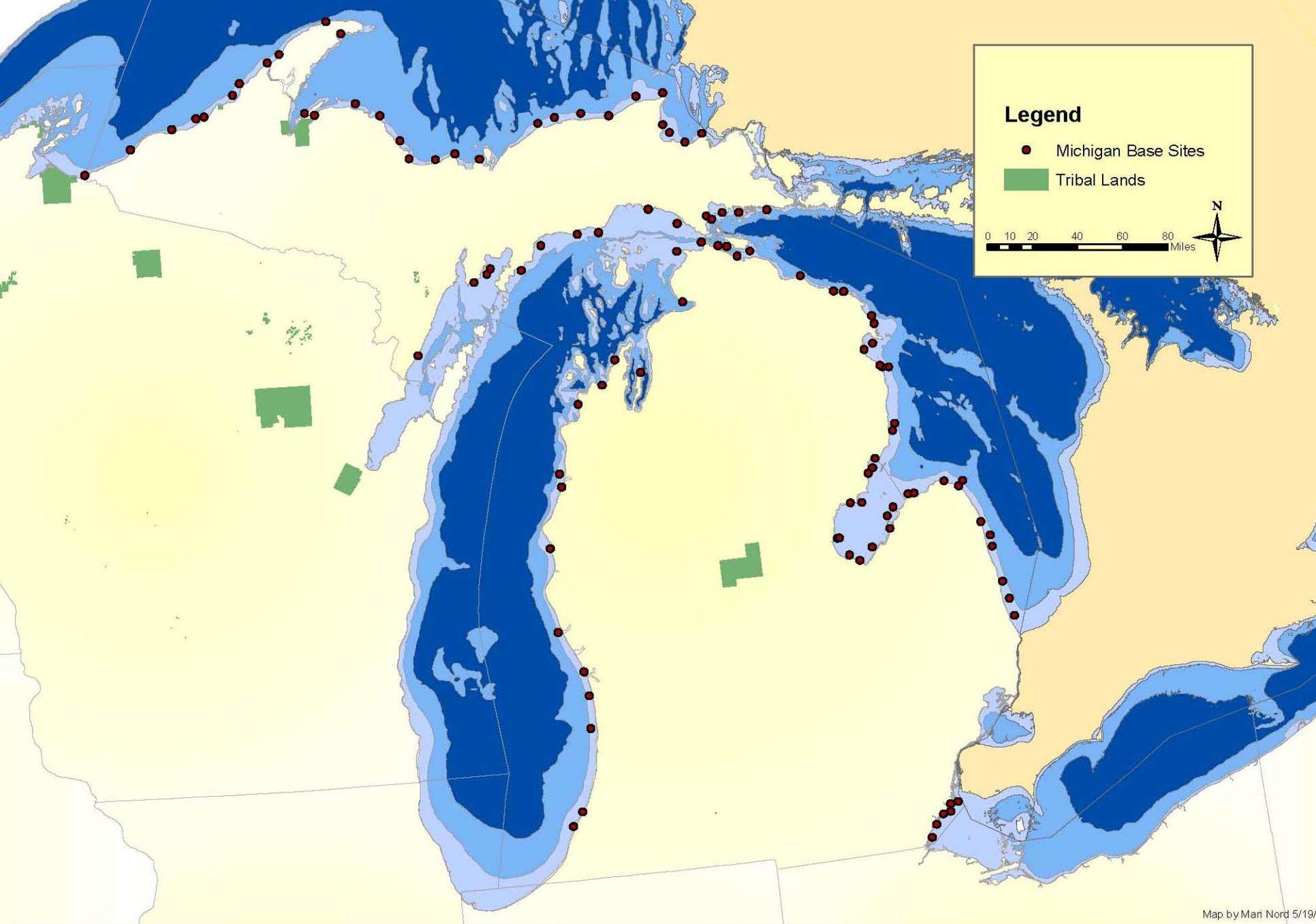
# What does it affect?

## ➤ Modeling

- What do river sample data represent?
- Contrary to prior assumptions?
- What are effects in modeling loads if data do not represent flow/export?
- Affects how we assess “improvement”?
- Does this indicate a need to better understand real time sampling conditions?

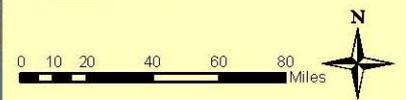
# COORDINATION

- EPA 2010 COASTAL SAMPLING
  - Inner & Outer bay, 14 Stations Total
  - Water, Seds, Tox, Fish



**Legend**

- Michigan Base Sites
- Tribal Lands



Map by Mari Nord 5/19/



# Draft Great Lakes Coastal Water Survey Sites - Nearshore Waters

# COORDINATION

- EPA 2010 COASTAL SAMPLING
  - Inner & Outer bay, 14 Stations Total
  - Water, Seds, Tox, Fish
- USGS – Saginaw flow measure study

# COORDINATION

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  - Inner & Outer bay, 14 Stations
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- MDEQ WCMP: 7 inner bay stations; SR and trib mouth stations; random stations

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  - Inner & Outer bay, 14 Stations
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  - Inner & Outer bay, 14 Stations
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- USGS – Saginaw flow measure
- MDEQ WCMP: 7 inner bay stations; SR and trib mouth stations; random stations
- MTU – Dr. Auer, *Cladophora*/TP
- Canada's EC Lake Huron/Bay Sampling

# COORDINATION

## EPA 2010 COASTAL SAMPLING

- Inner & Outer bay, 14 Stations
- Water, Seds, Tox, Fish
- USGS – Saginaw flow measure
- MDEQ – WCMP, 7 inner bay stations
- MTU – Dr. Auer, *Cladophora*/TP
- Canada's EC Lake Huron/Bay Sampling
- NOAA – Big kid on block right now

# COORDINATION

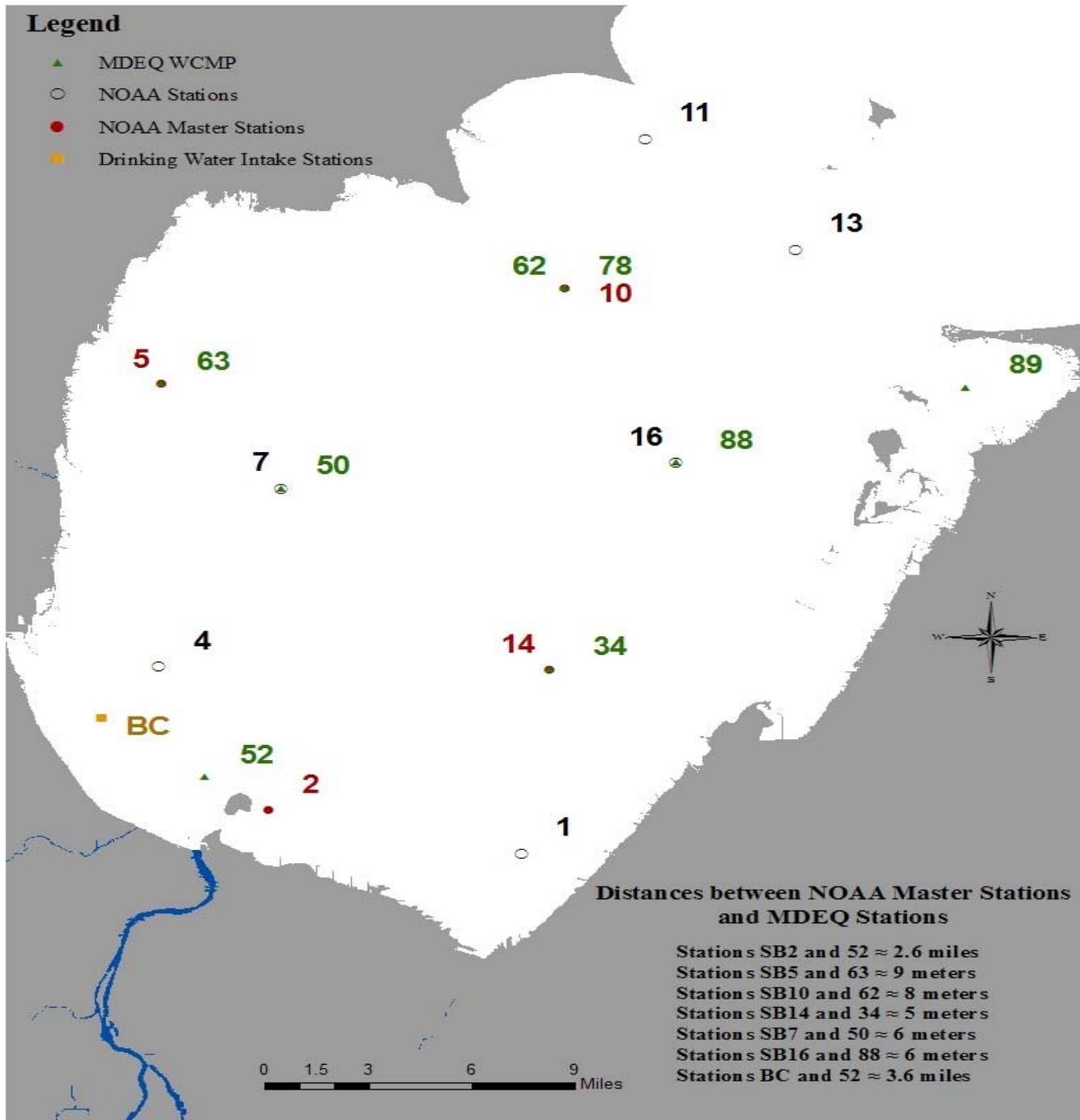
- EPA 2010 COASTAL SAMPLING
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- MDEQ – WCMP, 7 inner bay stations
- MTU – Dr. Auer, *Cladophora*/TP
- Canada's Lake Huron/Bay Sampling
- NOAA – Big kid on block right now
- Potential GLRI projects: ID Gaps to hit?

# MDEQ VIEWS

- HABs still a major focus for project.
  - Reduced sampling on this endpoint a concern

## Legend

- ▲ MDEQ WCMP
- NOAA Stations
- NOAA Master Stations
- Drinking Water Intake Stations



# MDEQ VIEWS

- HABs still a major focus for project.
  - Reduced sampling on this endpoint a concern
- Near-shore algae info a primary need.
  - Processes, Drivers, etc.
  - Can external changes have effects?

# MDEQ VIEWS

- HABs still a major focus for project.
  - Reduced sampling on this endpoint a concern
- Near-shore algae info a big need.
  - Processes, Drivers, etc
  - Can external changes have effects on near-shore zone?
- Model output to ID sig sources/areas.
  - Control options, priorities.
  - Will controls affect one/both issues?



Bring back the Saginaw!