



***U.S. Geological Survey Streamflow data in Michigan
Using the USGS NWIS database
MDOT Bridge Scour Conference October 5, 2017***

**Tom Weaver
Eastern Hydrologic Data Chief
Upper Midwest Water Science Center**



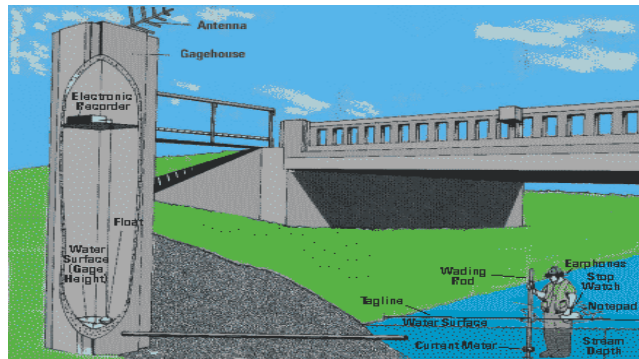
In Michigan, USGS operates gage sites to monitor hydrologic conditions including streamflow, surface water and groundwater levels, and water quality.

In October 2017, the network includes:

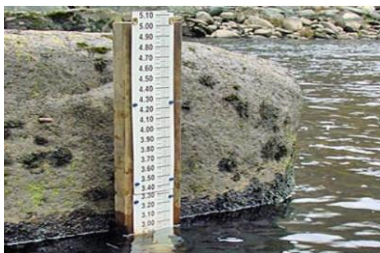
- 166 real time continuous-record streamgages
 - 10 crest-stage gages (CSG), including 5 real time
 - 10 continuous-record lake-level gages
 - 11 miscellaneous streamflow sites
 - 32 continuous-record water-quality sites
 - 24 groundwater wells, including 6 USGS real time
- Climate Response Network sites

How do we monitor surface water?

Surface-water monitoring at a stream site

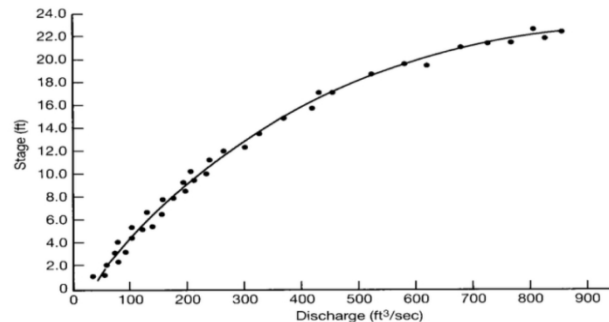


Outside staff gage indicating water level



Gage height (stage) and streamflow are measured at gaging stations through a range of conditions

At most sites a stage-discharge relation is constructed



In 2017, most gaging stations are being constructed with non-submersible pressure transducers and GOES satellite transmitters.



This is station number 04032000
Presque Isle River near Tula:

https://waterdata.usgs.gov/mi/nwis/uv/?site_no=04032000&PARAMeter_cd=00065,00060



Accessing the National Water Information System (NWIS) is easy

<https://mi.water.usgs.gov/>



[USGS Home](#)
[Contact USGS](#)
[Search USGS](#)

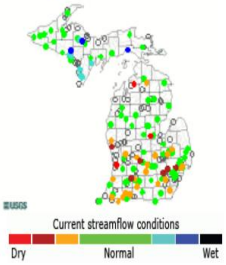
Michigan Water Science Center

[Home](#) • [Data/Information](#) • [Projects](#) • [Publications](#) • [Droughtwatch](#) • [Contact USGS](#) • [Internal](#)

☐ All USGS ☒ This site only

CURRENT CONDITIONS


September 25, 2017 11:30 ET





Current streamflow conditions
Dry Normal Wet


DATA CENTER


[Real-time data](#)
[Streamflow](#)
[Groundwater](#)


[Groundwater](#)

[Microbiology](#)


[Surface Water](#)

[Water Quality](#)

[NAWQA](#)


[GLRI](#)

Newsworthy




Prepared in cooperation with the Silver Lake Improvement Board

Water Quality and Hydrology of Silver Lake, Oceana County, Michigan, with Emphasis on Lake Response to Nutrient Loading, 2012–14




In this [report](#), the USGS Michigan-Ohio Water Science Center and [Annis Water Resources](#)



Prepared in cooperation with the Michigan Department of Natural Resources

Flood-inundation maps for Grand River, Red Cedar River, and Sycamore Creek near Lansing, Michigan



[Flood-inundation maps for Grand River, Red Cedar River, and Sycamore Creek near Lansing, Michigan](#)

It's easy to expand the interactive map by clicking on it twice. At that point you can easily hover the cursor over the gage of interest.

USGS Current Water Data for Michigan

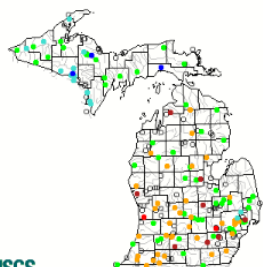
Click to hide state-specific text

Predefined displays
Introduction go

Daily Streamflow Conditions

Select a site to retrieve data and station information.

Thursday, September 28, 2017 00:30ET



Explanation

- High
- > 90th percentile
- 76th - 90th percentile
- 25th - 75th percentile
- 10th - 24th percentile
- < 10th percentile
- Low
- Not ranked

The colored dots on this map depict streamflow conditions as a [percentile](#), which is computed from the period of record for the current day of the year. Only stations with at least 30 years of record are used.

The **gray circles** indicate other stations that were not ranked in percentiles either because they have fewer than 30 years of record or because they report parameters other than streamflow. Some stations, for example, measure stage only.

[Statewide Streamflow Current Conditions Table](#)

[Statewide Lake and Reservoir Current Conditions Table](#)

[Statewide Groundwater Current Conditions Table](#)

[Statewide Water-Quality Current Conditions Table](#)

[Statewide Precipitation Current Conditions Table](#)

[Statewide Meteorological Current Conditions Table](#)

Real-time data typically are recorded at 15-60 minute intervals, stored onsite, and then transmitted to USGS offices every 1 to 4 hours, depending on the data relay technique used. Recording and transmission times may be more frequent during critical events. Data from real-time sites are relayed to USGS offices via satellite, telephone, and/or radio and are available for viewing within minutes of arrival.

All current conditions data are [provisional and subject to revision](#).



Optionally, you can actually just go over to the Statewide Streamflow Current Conditions Table, or the other tables and click them instead. We will visit that option after a few slides.



[Statewide Streamflow Current Conditions Table](#)

[Statewide Lake and Reservoir Current Conditions Table](#)

[Statewide Groundwater Current Conditions Table](#)

[Statewide Water-Quality Current Conditions Table](#)

[Statewide Precipitation Current Conditions Table](#)

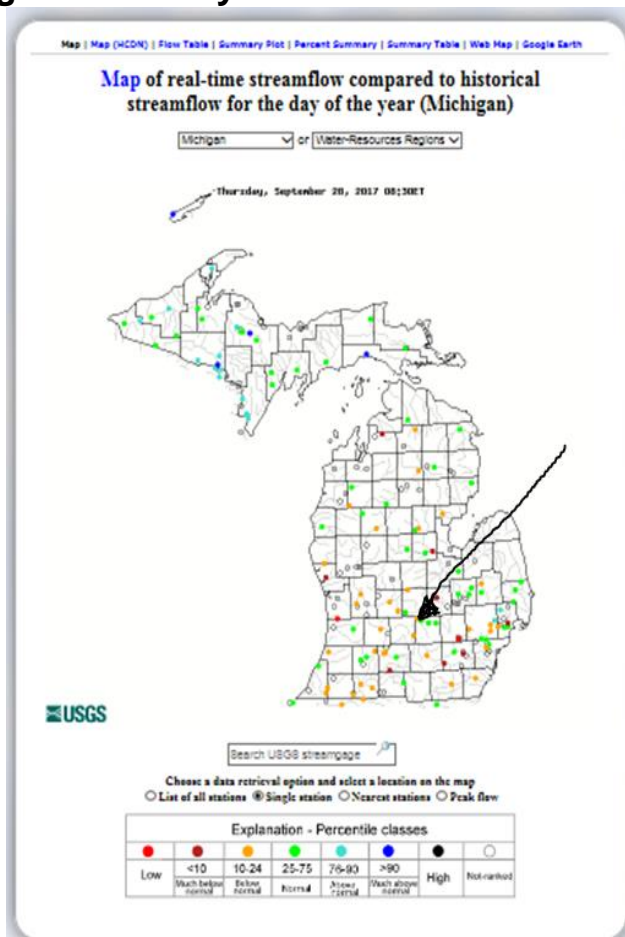
[Statewide Meteorological Current Conditions Table](#)

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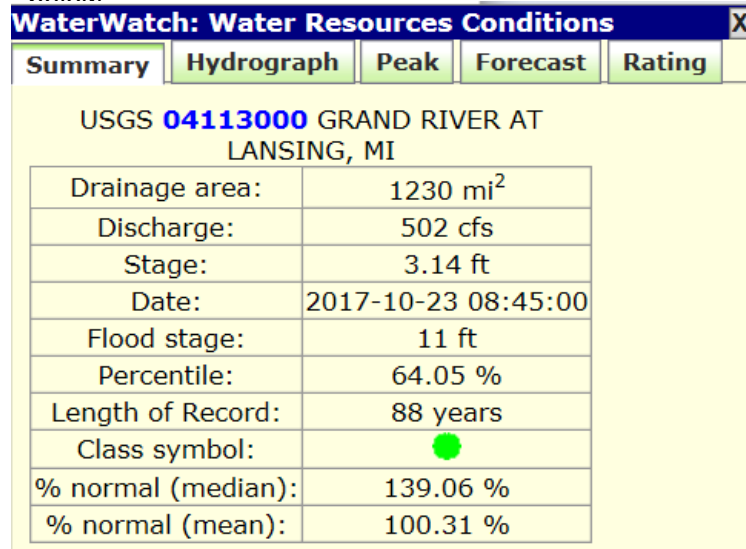
All current conditions data are [provisional and subject to revision](#).

<u>Build Current Conditions Table</u>	Show a custom current conditions summary table for one or more stations.
<u>Build Time Series</u>	Show custom graphs or tables for a series of recent data for one or more stations.

Clicking on the Daily Streamflow Conditions Map again brings you an interactive view:



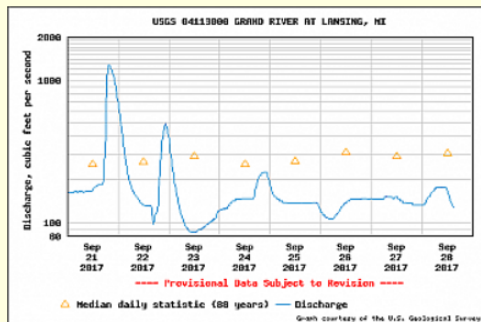
Each colored dot on the map indicates the location of, and streamflow conditions at, a streamgage. Hovering over a dot identifies the streamgage and summary flow conditions, clicking on the dot initiates a pop-up with five tabs brings you to data and the following 5 tabs. Summary tab contents are displayed below.



The tabs link to information specific to the site that may be specific to the day you are accessing the data.

WaterWatch: Water Resources Conditions

Summary Hydrograph Peak Forecast Rating

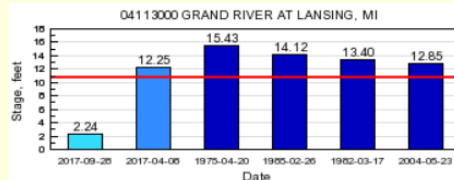


Additional Information:

- [WaterAlert email and text message alerts](#)
- [Subscribe WaterAlert for this site](#)

WaterWatch: Water Resources Conditions

Summary Hydrograph Peak Forecast Rating



- Current Stage 2.24 feet on 2017-09-25 13:45:00 (provisional)
- Recent Maximum Stage (previous 365 days) 12.25 feet on 2017-04-08 (provisional)
- Highest Recorded Peak Stages at Current Datum
- National Weather Service Flood Stage 11 feet

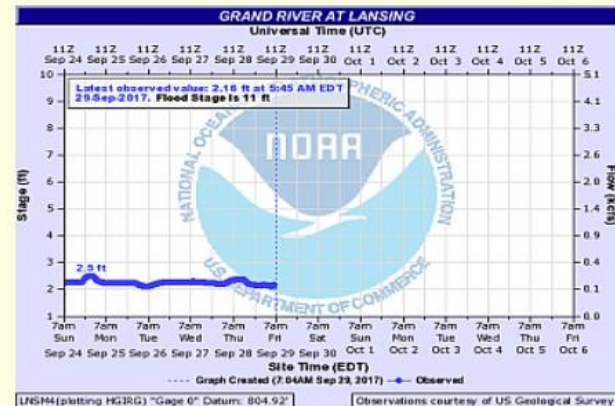
USGS WaterWatch

Additional Information:

- [Discharge-based version of this graph](#)
- [USGS Peak Streamflow](#)
- [Subscribe WaterAlert for this site](#)

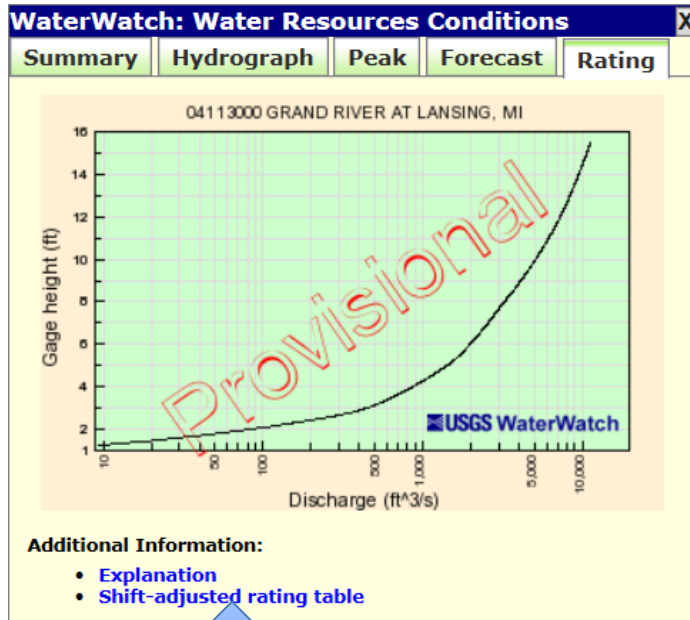
WaterWatch: Water Resources Conditions

Summary Hydrograph Peak Forecast Rating



Forecast data is from the National Oceanic and Atmospheric Administration (NOAA) North Central River Forecast Center (NCRFC)


The Rating tab produces logarithmic diagram of the stage-discharge rating that is currently active at the site. Two clickable links are also included.



Stage-discharge relations (ratings) are usually developed from a graphical analysis of current-meter discharge measurements (sometimes called calibrations) made over a range of stages and discharges. Measurements are made on various schedules and for different purposes. Each measurement is carefully made, and undergoes quality assurance review. Frequently, measurements indicate a change in the rating, often due to a change in the streambed or riparian vegetation. Such changes are called shifts; they may indicate a short- or long-term change in the rating for the gage. In normal usage, the measured shifts (or corrections) are applied mathematically to a defined rating. Ratings may be temporarily invalidated and unavailable due to backwater conditions caused by ice, tides, or other variable physical obstructions. The tables being provided are shift corrected, incorporating the mathematical adjustments for ease of use by the recreational user. The shift adjustments are applied to the individual ratings as measured data becomes available, resulting in an adjusted rating. Some ratings may change as often as weekly, others may not change for months.

The Shift-adjusted rating table is the most recently applied shifting in a numerical rating table with increments of 0.01 feet. Use caution as this is updated with each visit at some sites.

Let's return to the second option mentioned on slide 6. This link provides the same options you will get when you access data from <https://waterdata.usgs.gov/nwis/rt>



[Statewide Streamflow Current Conditions Table](#)
[Statewide Lake and Reservoir Current Conditions Table](#)
[Statewide Groundwater Current Conditions Table](#)
[Statewide Water-Quality Current Conditions Table](#)
[Statewide Precipitation Current Conditions Table](#)
[Statewide Meteorological Current Conditions Table](#)

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<u>Build Time Series</u>	Show custom graphs or tables for a series of recent data for one or more stations.

When we select Statewide Streamflow Current Conditions Table, we get all 192 of the publically viewable surface water sites, including streams, lakes, and real time Crest-Stage Gages:

Current Conditions for Michigan: Streamflow -- 195 site(s) found

PROVISIONAL DATA SUBJECT TO REVISION

--- Predefined displays --- Group table by Select sites by number or name

Michigan Streamflow Table Major River Basin go show sites on a map

[Customize table to display other current-condition parameters](#)

From a list of Grand River Basin streams, site 04113000, Grand River at Lansing is selected

● Grand River Basin

04109000	GRAND RIVER AT JACKSON, MI	10/23 10:30 EST	9.45	84.8	65.0
04111000	GRAND RIVER NEAR EATON RAPIDS, MI	10/23 11:00 EST	2.51	397	225
04111379	RED CEDAR RIVER NEAR WILLIAMSTON, MI	10/23 10:15 EST	3.67	58.0	34.0
04112000	SLOAN CREEK NEAR WILLIAMSTON, MI	10/23 10:45 EST	1.68	0.92	.60
04112500	RED CEDAR RIVER AT EAST LANSING, MI	10/23 10:30 EST	3.54	118	65.0
04113000	GRAND RIVER AT LANSING, MI	10/23 10:45 EST	3.38	595	361
04114000	GRAND RIVER AT PORTLAND, MI	10/23 11:00 EST	6.08	729	442
04114498	LOOKING GLASS RIVER NEAR EAGLE, MI	10/23 10:45 EST	3.46	159	53.0
04115000	MAPLE RIVER AT MAPLE RAPIDS, MI	10/23 11:15 EST	3.19	69.7	56.0
04115265	FISH CREEK NEAR CRYSTAL, MI	10/23 11:00 EST	2.55	31.7	27.0
04116000	GRAND RIVER AT IONIA, MI	10/23 10:45 EST	9.08	1,280	791
04116500	FLAT RIVER AT SMYRNA, MI	10/23 11:00 EST	3.82	--	---
04117004	QUAKER BROOK AT STATE HWY M-66 NEAR NASHVILLE, MI	10/23 10:45 EST	2.45	5.73	5.10
04117500	THORNAPPLE RIVER NEAR HASTINGS, MI	10/23 11:15 EST	3.72	322	158
04118000	THORNAPPLE RIVER NEAR CALEDONIA, MI	10/23 10:30 EST	4.23	--	---
04118105	GRAND RIVER AT ADA, MI	10/23 11:00 EST	8.22	--	---
04118500	ROGUE RIVER NEAR ROCKFORD, MI	10/23 11:00 EST	4.38	215	175
04119000	GRAND RIVER AT GRAND RAPIDS, MI	10/23 11:00 EST	3.80	3,320	1,940
04119055	PLASTER CREEK AT 28TH STREET AT GRAND RAPIDS, MI	10/23 11:00 EST	3.87	72.9	20.0
04119400	GRAND RIVER NEAR EASTMANVILLE, MI	10/23 10:48 EST	12.12	3,910	2,859

There are a number of things to see here. We will explore some of the options in the next few slides:

USGS 04113000 GRAND RIVER AT LANSING, MI

PROVISIONAL DATA SUBJECT TO REVISION

Available data for this site Time-series: Current/Historical Observations GO

Click to hide station-specific text

The Water-Year Summary provides additional information for *most* sites, and can be accessed via the "Available data for this site" drop-down list.

Station operated in cooperation with the [Michigan Department of Transportation](#).

This station managed by the LANSING FIELD OFFICE.

Available Parameters	Available Period	Output format	Days (7)	GO
<input type="checkbox"/> All 3 Available Parameters for this site		<input checked="" type="radio"/> Graph	<input type="text"/>	
<input checked="" type="checkbox"/> 00060 Discharge	1989-10-01 2017-10-02	<input type="radio"/> Graph w/ stats	-- or --	
<input checked="" type="checkbox"/> 00065 Gage height	2017-06-04 2017-10-02	<input type="radio"/> Graph w/o stats	Begin date	
<input type="checkbox"/> 70969 DCP battery voltage	2017-06-04 2017-10-02	<input type="radio"/> Graph w/ (up to 3) parms	<input type="text" value="2017-09-25"/>	
		<input type="radio"/> Table	End date	
		<input type="radio"/> Tab-separated	<input type="text" value="2017-10-02"/>	

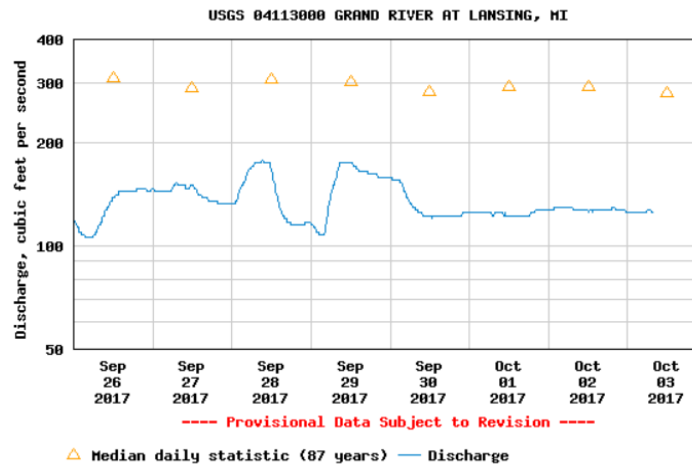
[Summary of all available data for this site](#)
[Instantaneous-data availability statement](#)

Discharge parameter for the most recent seven-day period at 04113000 Grand River at Lansing

Discharge, cubic feet per second

Most recent instantaneous value: 125 10-03-2017 07:45 EST

Note: the period of record displayed can be user specified from one day through an entire period of record



Create [presentation-quality](#) / [stand-alone](#) graph. Subscribe to [WaterAlert](#) P001

[+ Share this graph](#) | [f](#) [t](#) [g+](#) [e](#)

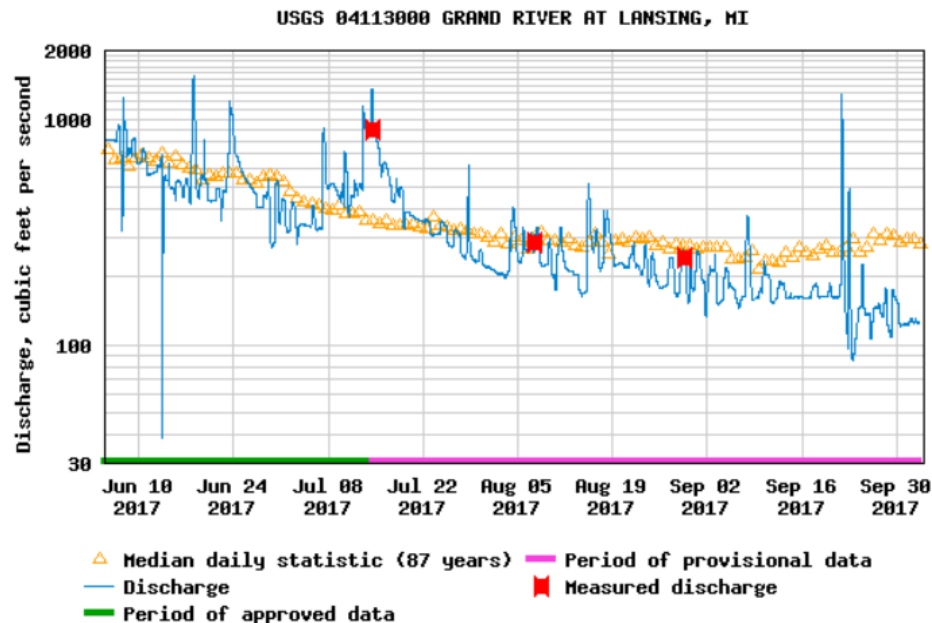
Daily discharge, cubic feet per second -- statistics for Oct 3 based on 88 years of record [more](#)

Min (1964)	Most Recent Instantaneous Value Oct 3	25th percen- tile	Median	75th percen- tile	Mean	Max (1982)
71.0	125	189	280	462	476	3920

The 120-day discharge hydrograph shows additional information about status of records and also shows measured discharge.

Discharge, cubic feet per second

Most recent instantaneous value: 125 10-03-2017 07:45 EST

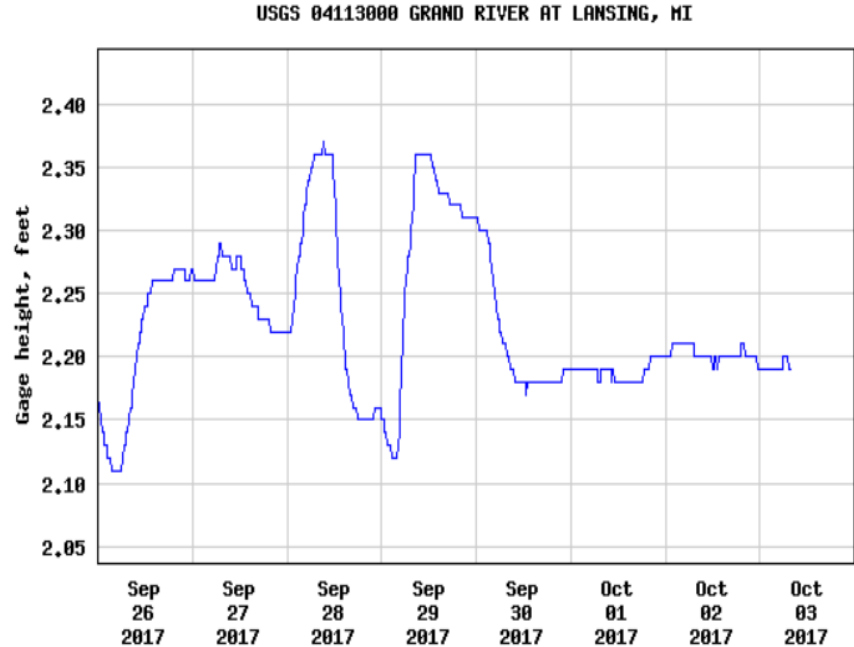


Gage height (stage), is the second hydrograph available for all sites.

The gage height graph is altered during times of high water to show NWS flood stage and USGS operational limits.

Gage height, feet

Most recent instantaneous value: 2.19 10-03-2017 07:45 EST



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

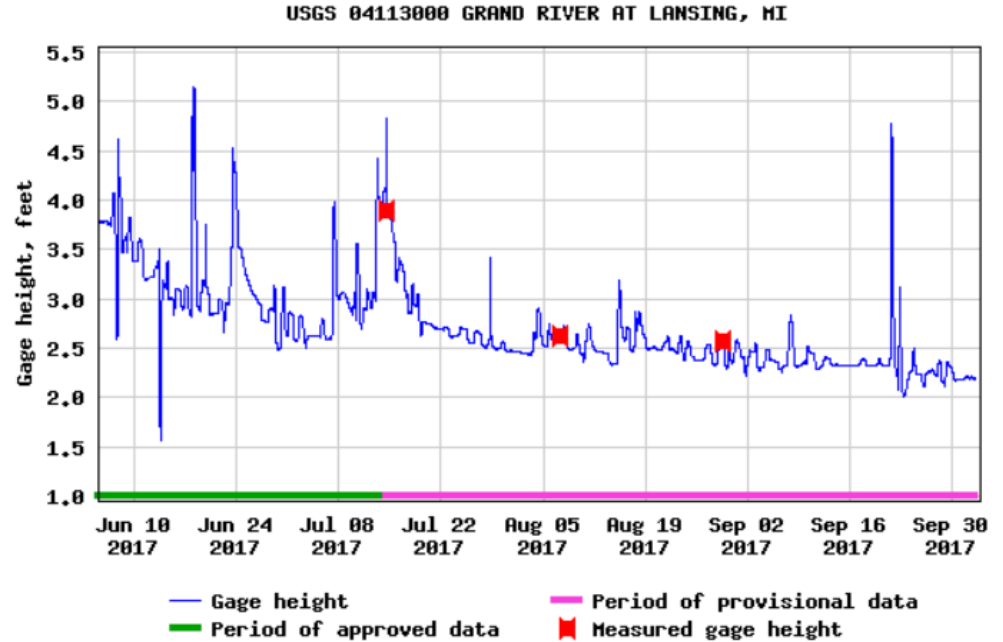
The 120-day gage-height hydrograph also shows additional information.

Only the most recent 120 days of gage height data are available currently.

One option here is to subscribe to Water Alert.

Gage height, feet

Most recent instantaneous value: 2.19 10-03-2017 07:45 EST



Create [presentation-quality](#) / [stand-alone](#) graph. Subscribe to [WaterAlert](#)

P000

Subscription Form

The U.S. Geological Survey WaterAlert service sends e-mail or text (SMS) messages when [certain parameters](#), as measured by a USGS real-time data-collection station, exceed user-definable thresholds. The development and maintenance of the WaterAlert system is supported by the USGS and its partners, including numerous federal, state, and local agencies.

Real-time data from USGS gages are transmitted via satellite or other telemetry to USGS offices at various intervals; in most cases, 1 to 4 times per hour. Emergency transmissions, such as during floods, may be more frequent. *Notifications will be based on the data received at these site-dependent intervals.*

Site Info:

Number: 04113000
Name: GRAND RIVER AT LANSING, MI
Agency: USGS
Transaction ID: TDhZB

Send Notification To:

[about this...](#)

- ☐ My mobile phone
☐ My email address

Notification Frequency:

[about this...](#)

- Hourly
Daily



Streamflow Parameter(s):

[about this...](#)

Recent value:

Gage height, in ft



2.20 [[peak chart](#) | [Flood Inundation Map](#)]

Alert Threshold Condition:

[about this...](#)

- ☒ Greater than (>)
☐ Less than (<)
☐ Outside a range (< or >)
☐ Inside a range (> and <)

Real-time value is greater than: ft

☐ I have read and acknowledge the [Provisional Data Statement](#) and [Disclaimer](#).



Submit

Reset

Cancel

Clicking the Summary of all available data for this site tab below is interesting:

Available Parameters	Available Period	Output format	Days (7)	GO
<input type="checkbox"/> All 3 Available Parameters for this site		<input checked="" type="radio"/> Graph	<input type="text"/>	
<input checked="" type="checkbox"/> 00060 Discharge	1989-10-01 2017-10-03	<input type="radio"/> Graph w/ stats	-- or --	
<input checked="" type="checkbox"/> 00065 Gage height	2017-06-05 2017-10-03	<input type="radio"/> Graph w/o stats	Begin date	
<input type="checkbox"/> 70969 DCP battery voltage	2017-06-05 2017-10-03	<input type="radio"/> Graph w/ (up to 3) parms	<input type="text" value="2017-09-26"/>	
		<input type="radio"/> Table	End date	
		<input type="radio"/> Tab-separated	<input type="text" value="2017-10-03"/>	

[Summary of all available data for this site](#)

[Instantaneous-data availability statement](#)

Datum of gage: 804.92 feet above NAVD88.

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Current / Historical Observations (availability statement)	1989-10-01	2017-10-02	
Daily Data			
Discharge, cubic feet per second	1901-03-01	2017-10-01	32356
Daily Statistics			
Discharge, cubic feet per second	1901-03-01	2017-07-13	32276
Monthly Statistics			
Discharge, cubic feet per second	1901-03	2017-07	
Annual Statistics			
Discharge, cubic feet per second	1901	2017	
Peak streamflow	1901-03-20	2016-04-12	116
Field measurements	1949-06-29	2017-08-29	658
Field/Lab water-quality samples	1963-09-26	2005-09-12	25
Water-Year Summary	2006	2016	11

OPERATION:

Record for this site is maintained by the USGS Michigan Water Science Center


Email questions about this site to [Michigan Water Science Center Water-Data Inquiries](#)




This is the results of three tabs, but all tabs provide interesting datasets, particularly at a gage that's been running off and on since 1901!

These are three parts of the **Annual Statistics** table, look at 1902-06; the drought period in 1935-36 and 1963-64; and lastly, 2014-16


Water Year	00060, Discharge, cubic feet per second	
1902	991.0	
1903	1,296	
1904	1,359	
1905	891.3	
1906	880.6	
1935	430.6	
1936	441.3	
1937	825.3	
1938	744.5	
1939	573.4	
1940	433.3	
1941	589.1	
1942	779.8	
1943	1,410	
1944	783.8	
1962	588.6	
1963	385.8	
1964	232.3	
2014	987.5	
2015	928.8	
2016	901.6	




Much above mean streamflow, particularly 1904



Drought-Low streamflow



Severe drought-very low streamflow, particularly 1964

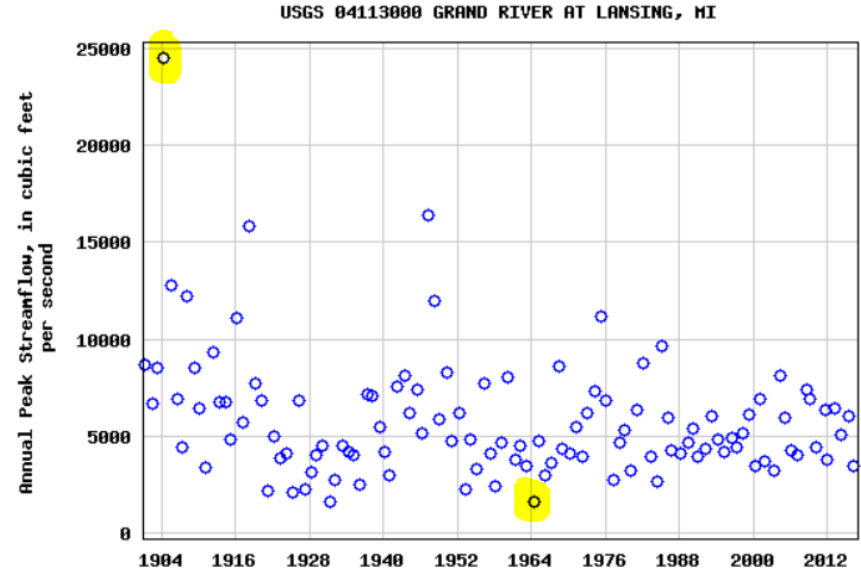


Above mean streamflow

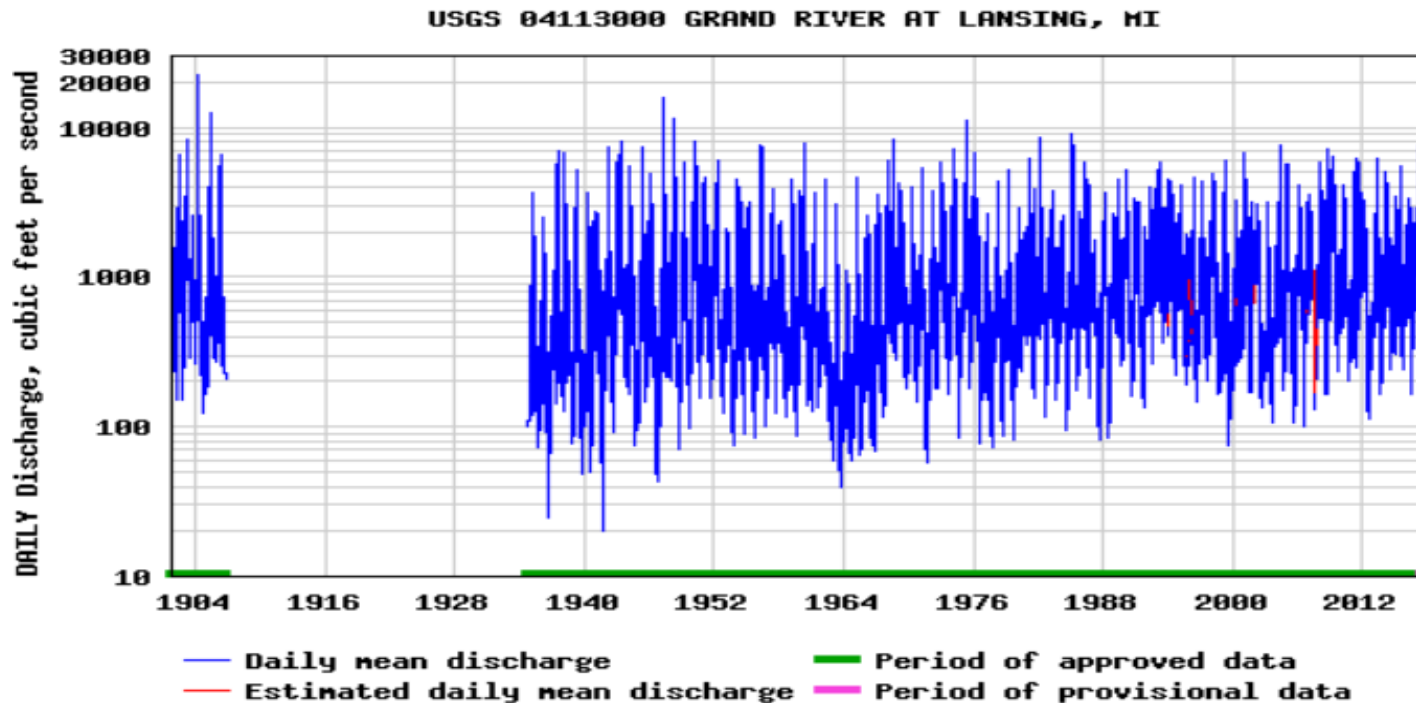
Let's look at Peak Streamflow. When can view peaks several ways using this tab

Output formats	
Table	
Graph	
Tab-separated file	
peakfq (watstore) format	
Reselect output format	

The 1904 flood lasted from March 20-April 8, peak streamflow in Grand Rapids was nearly 40,000 ft³/s. Flood was caused by snowmelt, high temperatures, and moderate rainfall. USGS sent a hydrographer from New York by train to measure the high flows in 1904-05!

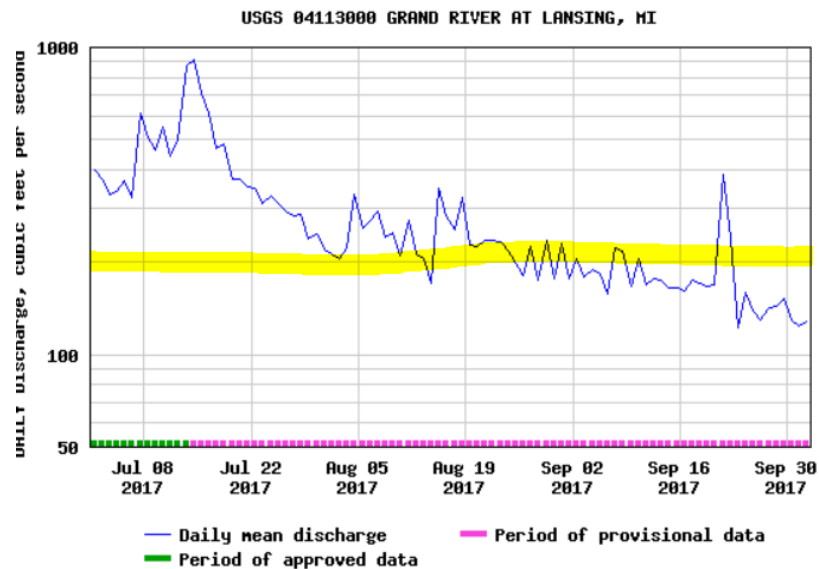
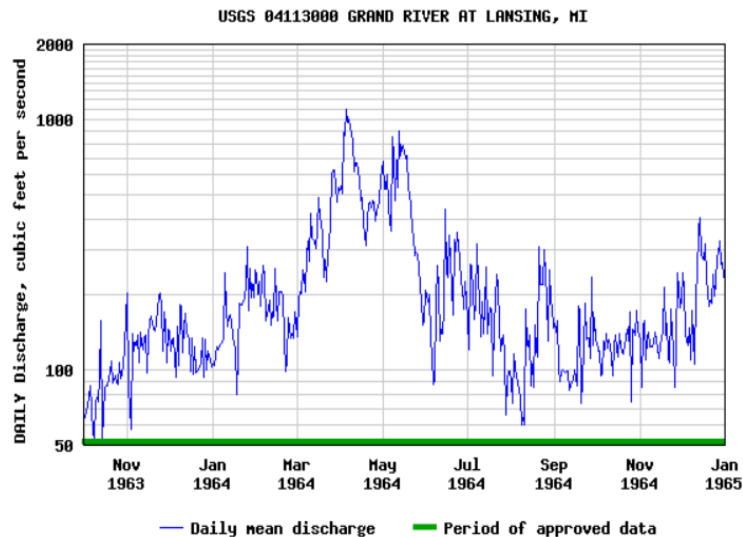


Let's also look at Daily Streamflow. This graph is very busy, but you can limit the period with this tab.



Note: The large gap in USGS record from 1907-34 is notable. National Weather Service was operating at the site during that period. Some data are available in NWS records from that period.

For interest I have also illustrated the 1964 drought year; notice the highest daily flow is only about 1,100 ft³/s and much of time daily flows are around 200 ft³/s. That's about where we were in mid-August this year and it's been trending downward!

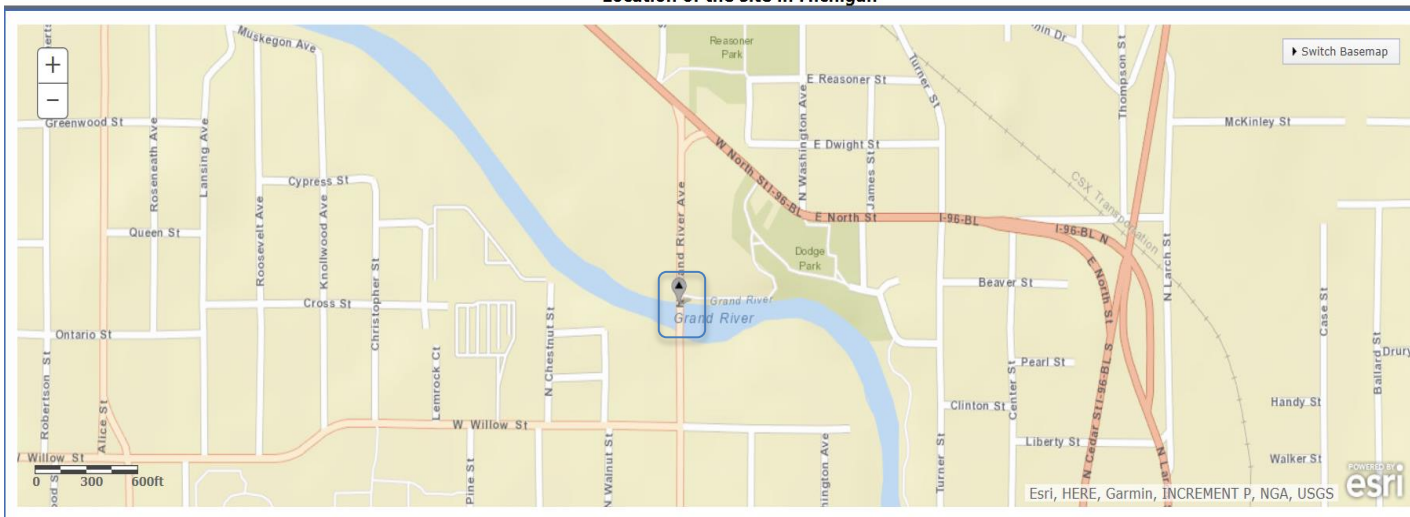


There are two additional data sets available if you go to the tool bar rather than clicking the Summary of all Available Data link. The first is a location map.


USGS 04113000 GRAND RIVER AT LANSING, MI

Available data for this site Location map

Location of the site in Michigan



The second is a link to the EPA's Surf your Watershed site.



Surf Your Watershed
Home

Adopt Your Watershed

Help

U.S. ENVIRONMENTAL PROTECTION AGENCY

[Share](#)

Surf Your Watershed

[Contact Us](#) Search: ☐ All EPA ☒ This Area [Go](#)

You are here: [EPA Home](#) » [Water](#) » [Wetlands, Oceans, & Watersheds](#) » [Watersheds](#) » [Adopt Your Watershed](#) » [Surf Your Watershed](#) » Upper Grand Watershed -- 04050004

Upper Grand Watershed -- 04050004

Upper Grand Watershed Profile

Watershed Name: Upper Grand
USGS Cataloging Unit: 04050004
MI 3rd Congressional District
MI 7th Congressional District
MI 8th Congressional District

[Citizen-based Groups at work in this watershed](#) (Provided by [Adopt your Watershed](#))

[Water quality monitoring data from this watershed](#) (Provided by STORET)



[Environmental Websites Involving this Watershed](#)

Assessments of Watershed Health

- [Impaired Water for this watershed](#)
- [Assessed Waters by Watershed](#)
 - [Michigan](#)

Information provided by the United States Geological Survey (USGS) [EXIT Disclaimer](#)

- [Stream Flow](#) (Source: USGS)
- [Science in Your Watershed](#)
- [Water use data \(1985-2000\)](#): Information about the amount of water used and how it is used.
- [Selected USGS Abstracts](#)



In conclusion, there are several ways to access USGS data. The story the data tells can be very valuable for your next engineering project.

Consider using the Water Alert tool if a gage is near your area of interest.

Please feel free to contact me at 517-887-8923 or tlweaver@usgs.gov.

