

Frequent Questions

Lake Level Viewer

United States Great Lakes

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Using the Tool

Slider

Use the slider controls to raise or lower water levels and see how these changes might impact shoreline position and water depth in the Great Lakes:

- Drag the slider control up or down the scale to adjust the water level.
- Use the (+) or (-) buttons to adjust the water level by 0.5 foot increments.
- Input a value at the top of the slider for a more granular adjustment.
- Jump to particular water levels by clicking one of the marked levels: High, Average, Low, and Current.

Note, while the viewer allows users to visualize water levels down to a hundredth of a foot or meter, comparing water levels within the root mean square error of the underlying data isn't meaningful due to the elevation data's vertical accuracy. See the accuracy question under the "Data" section of this document for more information.

Photo Visualizations

Click on a photo visualization marker in the map to launch that location's water level simulation. Adjust the slider to visualize what potential water levels may look like. Click the Expand button in the visualization pop-up to view a full-screen version of the simulation.

Water Level Charts

Click on a water level icon in the map to view historical water levels for that location. Use the chart controls to change the year, date range, units of measure, and vertical datum. Click on the chart's data to display a specific water level on the map.

Lake Switcher

Use the Great Lake drop-down to select the lake of interest. Because each lake has a specific Low Water Datum to International Great Lakes Datum of 1985 relationship, the viewer needs to know which lake should be used for setting the slider values. The viewer automatically selects the appropriate lake when the Search functionality is used to zoom to a location. In addition, if panning from one lake to another, the viewer will either suggest switching lakes in a pop-up at the bottom of the map or will automatically switch lakes. Automatic switching can be enabled or disabled under Settings.

Depth Query

To query the depth of water at any location, turn on the Depth Query tool (query icon) and click anywhere along the shoreline where elevation data are available. A pop-up will appear showing the depth of water based on the water level selected in the slider. The depth will adjust as water levels are adjusted in the slider.

Data Layer

Select between Water Level, Land Cover, or Social Vulnerability Index in the Data Layer drop-down. Selecting a layer will display those data on the map. Water Level will be displayed on top of Land Cover and Social Vulnerability Index to provide greater insight into where land cover types or vulnerable populations might be impacted. For more information on the data, see the “Data” section of this document.

Settings

Click on the Settings icon or tab at the top of the window on the left. There are a variety of settings that adjust the slider, map, map functionality, and data.

How Do I Get My Regional or Local GIS Data to Overlay with the Layers in this Viewer?

Because the main focus of this viewer is to provide a region-wide preliminary look at impacts of changing lake levels, ingesting regional or local GIS data into the viewer is impractical. Because of scale, data quality, and consistency issues, we currently do not incorporate these data. For regional and local implementation, regional and local users must either obtain the viewer’s data layers or ingest them as web map services. This strategy enables regional and local users to visualize the data layers on their own desktop or web mapping GIS applications for visualization and analysis. See the question on data access in the “Data” section of this document.

How Far Can I Zoom In?

The layers or data included in the viewer are cached for display down to roughly the 1:4500 scale (zoom level 17 in the Google/Esri Web Mercator tiling scheme). This dictates how close users can zoom in. If zooming closer is necessary, users can download the data and examine them more closely.

Can I Get the Viewer Source Code?

The viewer was built using HTML 5, SCSS, Preact, Javascript and OpenLayers 8. The code is available upon request.

Data

Water Level Change

The water levels on the map show the extent and relative depth of water from 3 feet below to 10 feet above each lake’s respective Low Water Datum (LWD). In addition, water levels can be viewed in reference to the International Great Lakes Datum of 1985 (IGLD85). The relationship between LWD and IGLD85 can be found at tidesandcurrents.noaa.gov/gldatums.html.

The data in the maps do not consider natural processes such as erosion, subsidence, or future construction. Water extent is as it would appear on a calm day with no wind-driven waves or seiche effect. The mapping may not accurately capture detailed hydrologic/hydraulic features such as canals,

ditches, and stormwater infrastructure, resulting in inundated areas that are not connected to a lake. A more detailed analysis may be required to determine an area's actual susceptibility to flooding. The data, maps, and information provided should be used only as a screening-level tool.

Photo Simulations

Clickable camera icons display water level impacts of -3 to +10 feet from each lake's respective Low Water Datum at various public locations. The water surface was superimposed on existing photographs based on site elevations taken from digital elevation models.

Water Level Stations

Clickable water level station icons launch a water level chart that displays historical water level data for that location in one-year increments. The data shown come from the official NOAA water level stations, which are operated and maintained by the NOAA Center for Operational Oceanographic Products and Services (tidesandcurrents.noaa.gov).

Areas Not Mapped

These hash-marked areas indicate places where adequate elevation data (see question on data accuracy below) were not available for mapping.

Land Cover

The land cover data are provided by the NOAA Digital Coast's Coastal Change Analysis Program (coast.noaa.gov/digitalcoast/data/ccapregional.html). The data are 30-meter resolution and based on remotely sensed imagery. Up to 25 categories of land cover are displayed on the map. By looking at the intersection of potential lake levels and various land cover classes, one can see and start to plan for how communities might be impacted.

Social Vulnerability Index

The Social Vulnerability Index (SVI) data, which show areas of high human vulnerability to hazards at the Census tract level, are provided by the Centers for Disease Control and Prevention. By Looking at the intersection of potential lake levels and Census tracts, one can get an idea of how vulnerable populations might be affected by varying lake levels. More information is available at atsdr.cdc.gov/placeandhealth/svi/index.html.

What is the Accuracy of the Mapping Used in this Viewer?

The maps in the viewer are derived from source elevation data that meet or exceed the Federal Emergency Management Agency (FEMA) mapping specifications for the National Flood Insurance Program.

- 0.6 feet (18.5 centimeters) root mean square error (RMSE) for low relief terrain
- 1.2 feet (37.0 centimeters) RMSE for high relief terrain

The vertical accuracy of the elevation data, specifically the RMSE, helps inform users when comparing the mapped extent of water levels. When comparing two or more water level extents, ensuring that their vertical difference is at least the RMSE ensures a meaningful comparison. If the vertical difference

is less than the RMSE, there is the potential that a water level's extent is within another's vertical error range, which is generally plus or minus 0.5 feet. See the "Slider" section of this document under "Using the Tool" for more information on using the slider controls to compare mapped water level extents.

How Often is the Mapping Updated with New Elevation Data?

New elevation data are being collected at various time intervals by federal, state, and local entities, so it is possible that newer data have been collected since mapping was last completed for the viewer. The overall update strategy is to examine new elevation data sets as they become available to determine if a mapping update is warranted. Gaps in bathymetry data will be assessed and filled, where necessary, when new data are discovered or become available. Metadata describing the elevation data sources used for each digital elevation model can be found on the Data Download page (chs.coast.noaa.gov/htdata/Inundation/GreatLakes/BulkDownload/index.html) under "DEMs."

How Do I Access the Data Layers in the Viewer?

All data displayed in the viewer, including the underlying digital elevation models, can be downloaded from the Data Download page (chs.coast.noaa.gov/htdata/Inundation/GreatLakes/BulkDownload/index.html).

Can I Get the Digital Elevation Models that Were Used to create the Layers in the viewer, and How Are They Different from Most Other Digital Elevation Models?

Building the digital elevation models (DEMs) for the viewer is by far the most time-consuming process step. DEMs are created by first gathering the best available lidar-based topographic and bathymetric elevation data (see data accuracy question above). The elevation sources are then combined to create a mostly seamless data set. There are data gaps throughout the coverage area, primarily on the bathymetric side. DEMs and accompanying metadata are available for download on the Data Download page (chs.coast.noaa.gov/htdata/Inundation/GreatLakes/BulkDownload/index.html).

Modeling Approach

How is this Viewer and Its Associated Data Different from Other Lake Level Change Mapping Efforts?

The purpose of this data viewer is to provide a preliminary look at changing lake levels and their impacts across the Great Lakes. The viewer is a screening-level tool that uses the highest accuracy elevation data sets available at the time maps were produced. The project team is not aware of any other Great Lakes-wide lake level change mapping efforts at this time.

Why Does the Viewer Use Low Water Datum as a Starting Point?

Low Water Datum (LWD) is used as the viewer's starting point, or zero, because it is a stable datum that doesn't change over time based on fluctuating water levels. This is in contrast to using a lake's Long Term Average, which can change over time due to fluctuating water levels and was previously used in the viewer. The LWD identifies a surface so low that the water level will seldom fall below it, which

makes this datum valuable for marine charting and navigation. LWD, sometimes referred to as “chart datum,” is widely known throughout the Great Lakes and is a common reference for water levels and elevations. Different lakes and rivers use different LWD surfaces. Those differences can be found at tidesandcurrents.noaa.gov/gldatums.html.

Are the Data Based on a “Bathtub” Modeling Approach?

Yes, the process used to map lake level change in this viewer can be described as a bathtub approach or linear superposition method. This approach does not take into account hydraulic connectivity and may result in inundated areas that are not connected to a lake.

Does this Viewer Show Timing of Lake Level Change (e.g., 3 feet lower by 2100)?

This viewer does not show specific timing of lake level change. This is by design. Data are mapped above and below Low Water Datum from minus 3 feet to positive 10 feet. This range covers all the historical lake level variation and allows users to consider future scenarios of their choosing.

Do the Maps Shown in this Viewer Take into Account Levees or Hydraulic Features (culverts, pipes, dikes, bridges)?

The digital elevation models used to map changing lake levels in this viewer do not incorporate a detailed pipe network analysis or engineering-grade hydraulic analysis. For example, culverts and ditches may not be incorporated into the digital elevation models, resulting in incorrectly mapped areas.

Do the Maps Take into Account Future Changes in geomorphology, Shoreline Change, etc.?

The mapped lake levels in this viewer do not incorporate future changes in coastal geomorphology and assume present conditions will persist. Geomorphologic changes associated with natural processes and human actions will, of course, be vital in determining water extents. Failing to consider these processes is a significant limitation of the mapping process. As the scientific community continues to increase its understanding of and skill in predicting these critical processes, the functionality and underlying data of the viewer can be updated. Until then, the above-mentioned effects are still sufficiently unknown that they may compound or offset each other in unpredictable ways, such that including only some processes may cause greater error than ignoring them.

Geographic Coverage

Why doesn't my area have elevation data in the viewer?

Areas with existing topographic and bathymetric lidar data were able to be mapped. Areas with no data are denoted with a hash marking. Please note that some data gaps have topography but no bathymetry data, and a smaller number of areas have bathymetry but no topography.

User Feedback

How Do I Provide Feedback on this Tool?

If you have questions or comments about the Lake Level Viewer, or want to request data or information, you may send an email to coastal.info@noaa.gov.