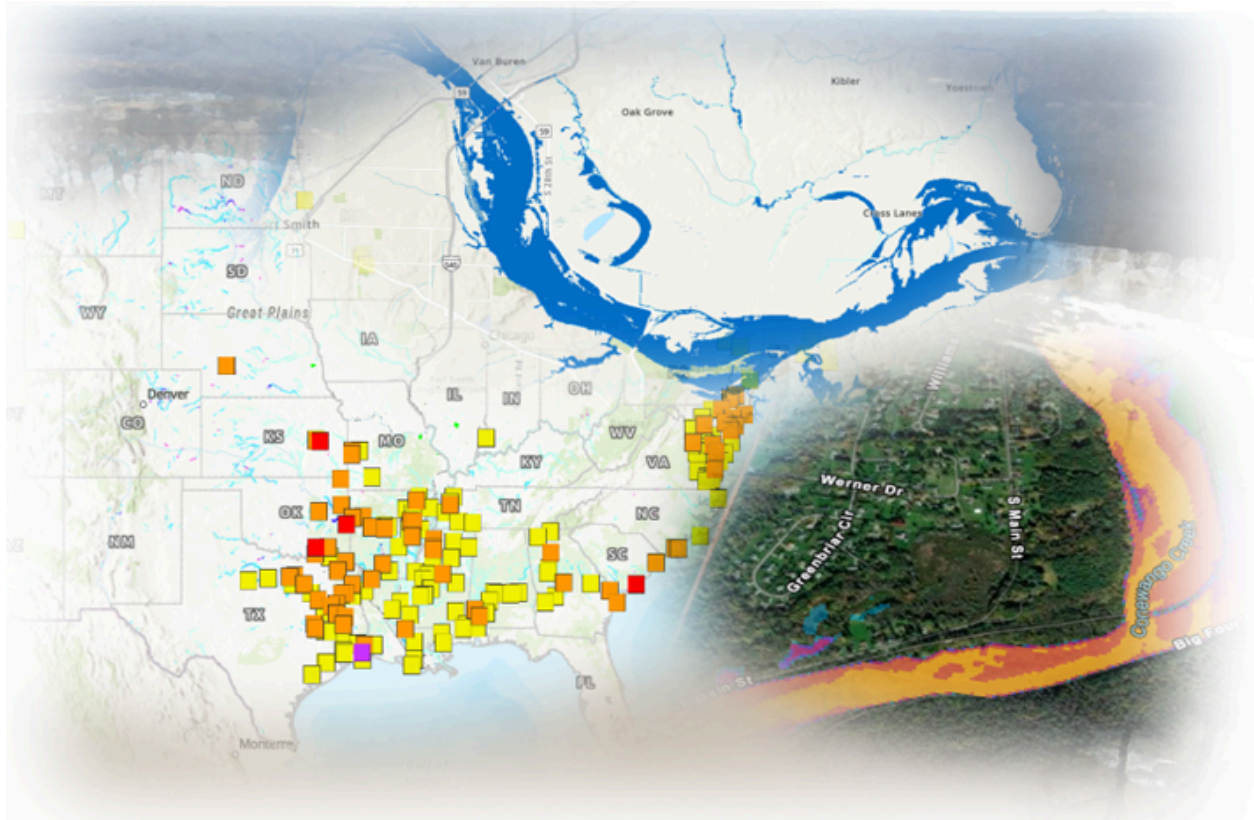


Public Handbook

Visualization Services National Water Center



Version 2.3.1

Last updated: June 24, 2025

*Preliminary - Subject to Change



OWP | OFFICE OF
WATER
PREDICTION

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Introduction

This handbook describes the suite of publicly available visualization services via the National Weather Service National GIS Viewer or through the National Water Prediction Service. Most of these services are developed by the NOAA National Weather Service (NWS) Office of Water Prediction (OWP) in support of the NWS and National Water Center (NWC) operations. Most of these static and dynamic services depict value added information derived from [River Forecast Center \(RFC\)](#) official forecasts and forecast guidance from the operational version of the [National Water Model \(NWM\)](#). A brief description of each service, and a summary of the methodology used to derive each service, is included in this handbook.

Services leverage geography information system (GIS) technology and are made available through the NWC's cloud-based Hydrologic Visualization and Inundation Services (HydroVIS) system, which includes an Enterprise GIS for disseminating geospatial services.



Reference Services

Service	Brief Description
NWM Flowlines	Depicts the NWM streams and rivers
NWM Waterbodies	Depicts the NWM lakes and reservoirs
Coastal FIM Domain	Depicts areas along the coast where coastal flooding processes are not being considered in the visualization FIM output.
Public FIM Domain	Depicts the domain where the NWC FIM has been made public.



NWM Flowlines



Description

Depicts the NWM flowlines of the National Water Model. These represent the network of streams and rivers that provide the spatial geometry and attributes needed for the National Water Model's analysis and forecasting capabilities.

Data Services

[CONUS](#)

[Hawaii](#)

[Puerto Rico and the U.S. Virgin Islands](#)

Alaska (available September 2025)

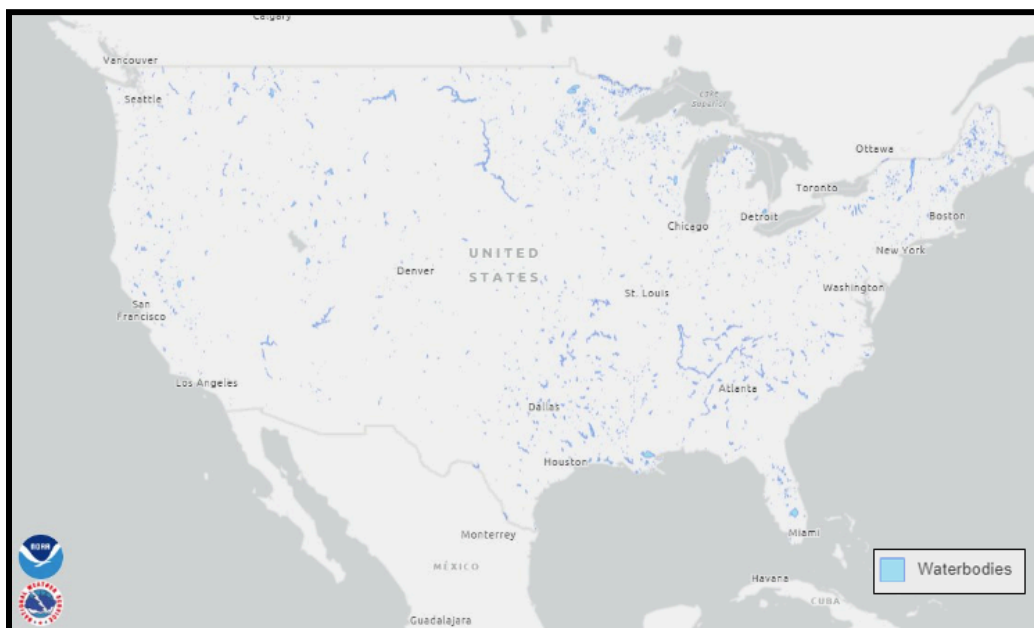
Update Frequency

Static

Methodology

The primary source of this data can be found at <https://water.noaa.gov>. Several attributes are derived from the [NHDPlus-Medium Resolution v2.1 \(NHDPlus v2.1\)](#) dataset by crosswalking the NWM feature_id with the NHDPlus v2.1 ComID. Streamflow thresholds are derived from the National Water Model reanalysis simulation. See the High Flow Magnitude pages for more details.

NWM Waterbodies



Description

Depicts the National Water Model waterbodies which represent both the lakes and reservoirs within the National Water Model hydrologic modeling framework.

Data Services

[CONUS](#)

[Hawaii](#)

[Puerto Rico and the U.S. Virgin Islands](#)

Update Frequency

Static

Methodology

The primary source of this data can be found at <https://water.noaa.gov>. Several attributes are derived from the [NHDPlus-Medium Resolution v2.1 \(NHDPlus v2.1\)](#) dataset by crosswalking the NWM feature_id with the NHDPlus v2.1 ComID. The NHDPlus waterbody data is sourced from the [Watershed Boundary Dataset \(WBD\)](#), a seamless national hydrologic unit geospatial dataset. The WBD is mapped and managed by the U.S. Geological Survey and is an OMB-A16 National Geospatial Data Asset.

Coastal FIM Domain



Description

Depicts the domain where the NWC FIM will be made public. Shown are the WFO domains within the public FIM domain.

Data Services

[CONUS](#)

Update Frequency

Static

Methodology

Depicts the boundary set by the coastal water model (SCHISM) whereby inland Flood Inundation Mapping (FIM) could be questionable due to tides and surge.

Public FIM Domain



Description

Depicts the domain where the National Water Center (NWC) Flood Inundation Mapping (FIM) has been made publicly available.

Data Services

[CONUS/Hawaii/PuertoRicoandVI/Alaska](#)

Update Frequency

Static

Methodology

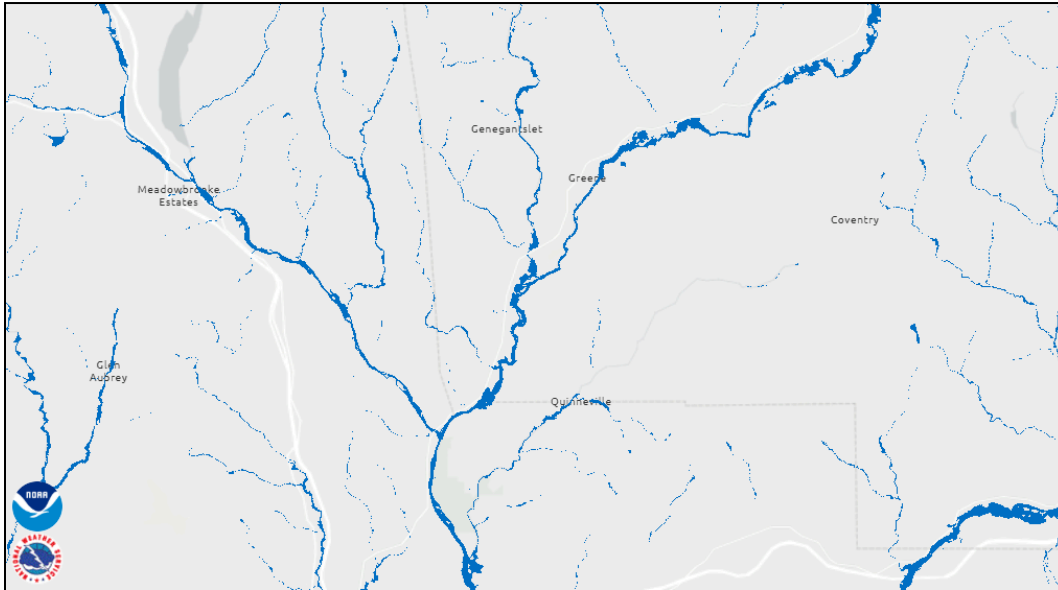
Depicts the areas that users can see NWC FIM maps at the 30% stage. In September 2025, 60% of the United States population will have Flood Inundation Mapping services available to them. In September 2026, 100% of the United States will have FIM services.



Flood Inundation Mapping Service

Service	Brief Description
RFC 5-Day Max Inundation Extent	The map depicts the maximum inundation extent over the next 5 days derived from the official River Forecast Center (RFC) forecast routed downstream through the National Water Model (NWM) stream network.
NWM Latest Analysis Inundation Extent	The map depicts the inundation extent of the National Water Model (NWM) streamflow current conditions where the NWM is signaling high water and is derived from the analysis and assimilation configuration of the NWM.
NWM 5-Day Max Inundation Extent	The map depicts the inundation extent of the peak National Water Model (NWM) streamflow forecast over the next 5 days where the NWM is signaling high water.
NWM 48-Hour Max Inundation Extent	The map depicts the inundation extent of the National Water Model (NWM) streamflow forecast over the next 48 hours for Puerto Rico and the U.S. Virgin Islands where the NWM is signaling high water.
Categorical Flood Inundation Extent	Depicts at the selected site the inundation extent for each impact flood category using Stage-based Categorical Flood Inundation Mapping: Static map extents available for action, minor, moderate, major and record levels.

RFC 5-Day Max Inundation Extent



Description

The service depicts the maximum inundation extent over the next 5 days derived from the official River Forecast Center (RFC) forecast routed downstream through the National Water Model (NWM) stream network.

Data Services

[CONUS/Alaska](#)

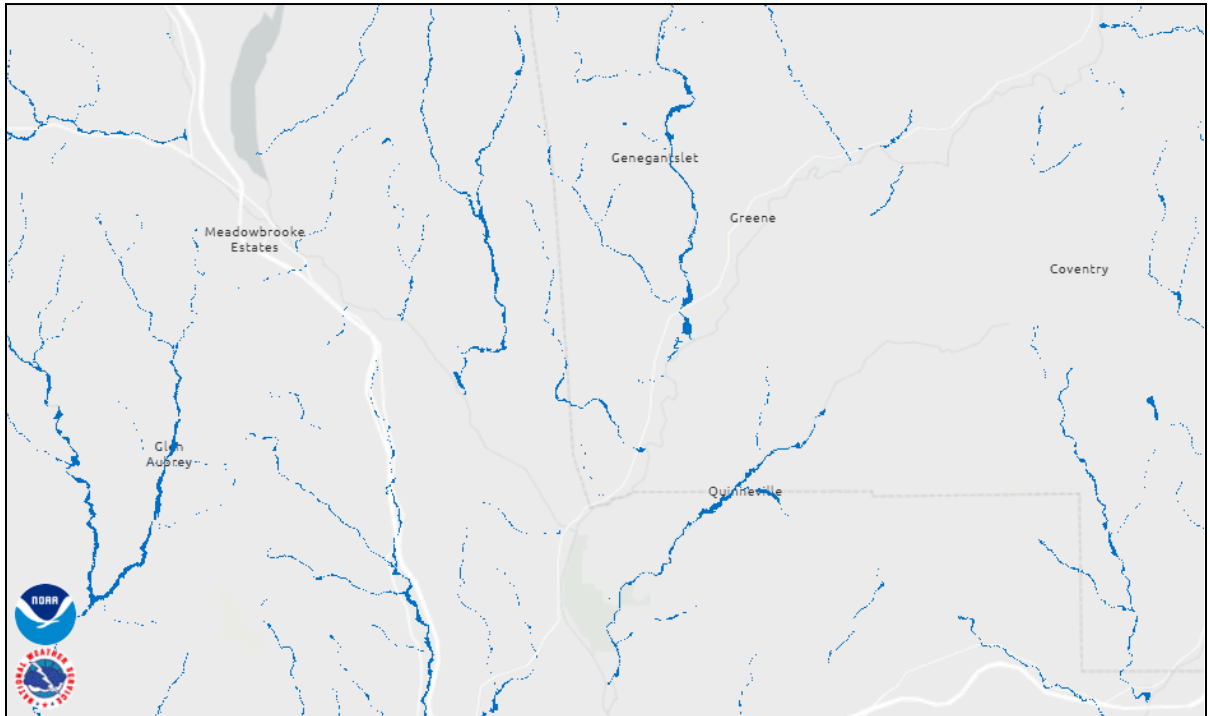
Update Frequency

Within an hour of an RFC Forecast Issuance

Methodology

Utilizes the RFC official forecasts and thus the FIM is only available at the forecast gage location and several miles downstream. Only available at RFC forecast locations when the RFC forecast is at or above the action stage level.

NWM Latest Analysis Inundation Extent



Description

The service depicts the inundation extent of the National Water Model (NWM) streamflow forecast where the NWM is signaling high water and is derived from the analysis and assimilation configuration of the NWM.

Data Services

[CONUS](#)

Alaska (available September 2025)

Hawaii (available in September 2025)

[Puerto Rico and the U.S. Virgin Islands](#)

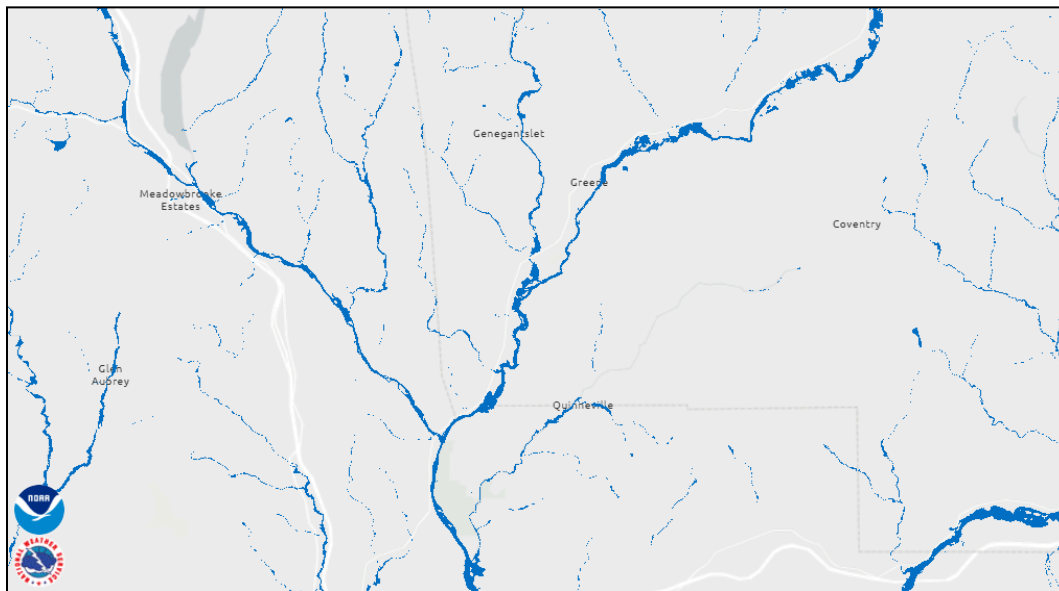
Update Frequency

Hourly

Methodology

Assimilates both USGS observational data and MRMS and RFC rainfall estimates to produce the analysis. This service is not a forecast but a simulation of the extent of the river at the analysis reference time.

NWM 5-Day Max Inundation Extent - CONUS/AK



Description

The service depicts the inundation extent of the peak National Water Model (NWM) streamflow forecast over the next 5 days where the NWM is signaling high water. This service is derived from the medium-range NBM configuration of the NWM.

Data Services

[CONUS](#)

Alaska (available September 2025)

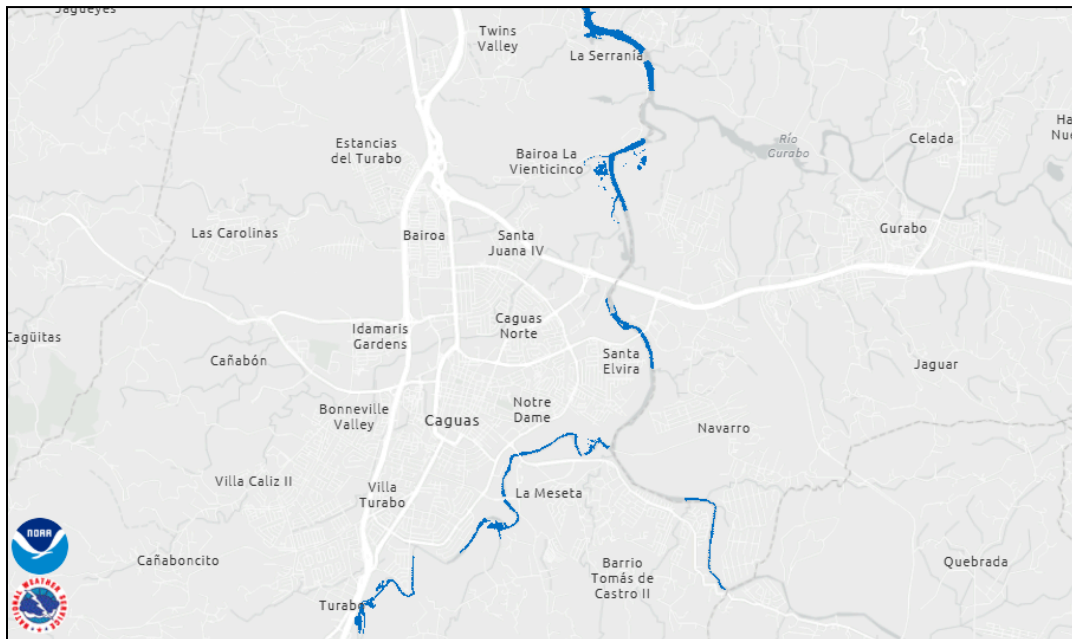
Update Frequency

Every 6 hours

Methodology

Utilizes the NWM streamflow forecast simulations that use the NBM for the meteorological forcing data.

NWM 48-Hour Max Inundation Extent - Puerto Rico and US Virgin Islands / Hawaii



Description

The service depicts the inundation extent of the peak National Water Model (NWM) streamflow forecast over the next 48 hours where the NWM is signaling high water. This service is derived from the short-range HRRR configuration of the NWM.

Data Services

Hawaii (available September 2025)

[Puerto Rico and the U.S. Virgin Islands](#)

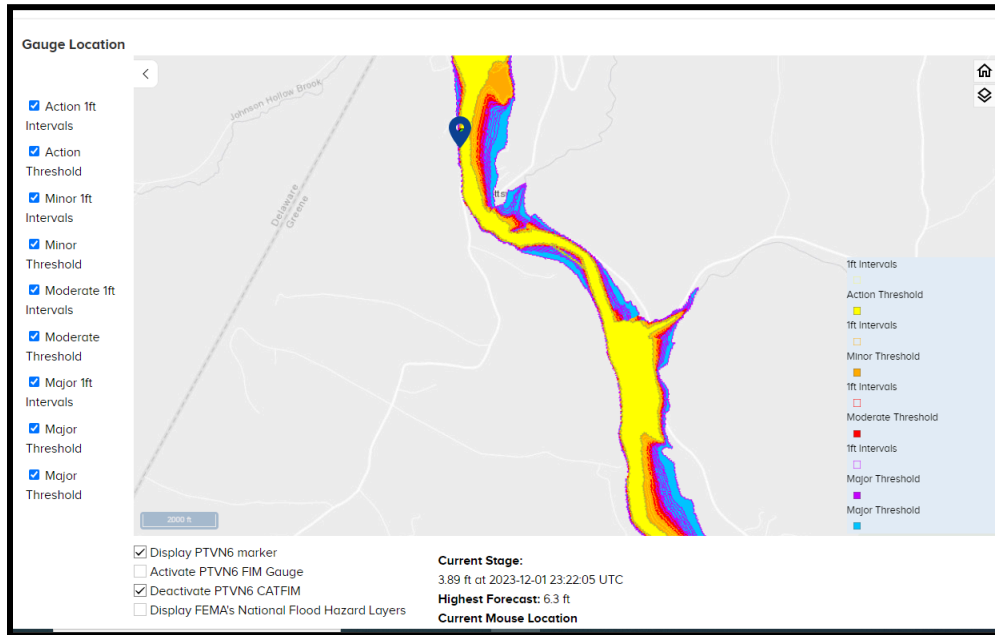
Update Frequency

Every 12 hours

Methodology

Utilizes the NWM streamflow forecast simulations that use the HRRR for the meteorological forcing data.

Stage-based Categorical Flood Inundation Extent



Description

Depicts at the selected site the inundation extent for each impact flood category using Stage-based Categorical Flood Inundation Mapping: Static map extents available for action, minor, moderate, major and record levels.

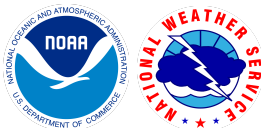
Data Services

[CONUS/Hawaii/PuertoRicoandVI/Alaska](#)

Also available at [select sites on the National Water Prediction Service \(NWPS\)](#).

Update Frequency

This is a static library of maps based on different river flood levels.



River Forecast Center Services

Service	Brief Description
Observed River Stages	Depicts the current river stages by flood status
Forecast River Stages	Depicts the maximum forecast stage flood status over the forecast period issued from the RFC or WFO.
Max Stage - Forecast Trend	Depicts National Water Prediction Service (NWPS) River Forecast Center (RFC) forecast points with forecasts at or above action stage with icons also indicating trend (up/down) in the forecast.
Max Downstream Streamflow Forecast	Depicts maximum forecast streamflow over the next 5 days derived from the official River Forecast Center (RFC) forecast routed downstream through the National Water Model (NWM) stream network. Maximum streamflows are available downstream of RFC forecast points whose forecast reaches action status or greater.

Observed River Stages



Description

Depicts current flood status of rivers and lakes at specific gauge locations.

Data Services

[CONUS/Hawaii/Puerto Rico and VI/Alaska](#)

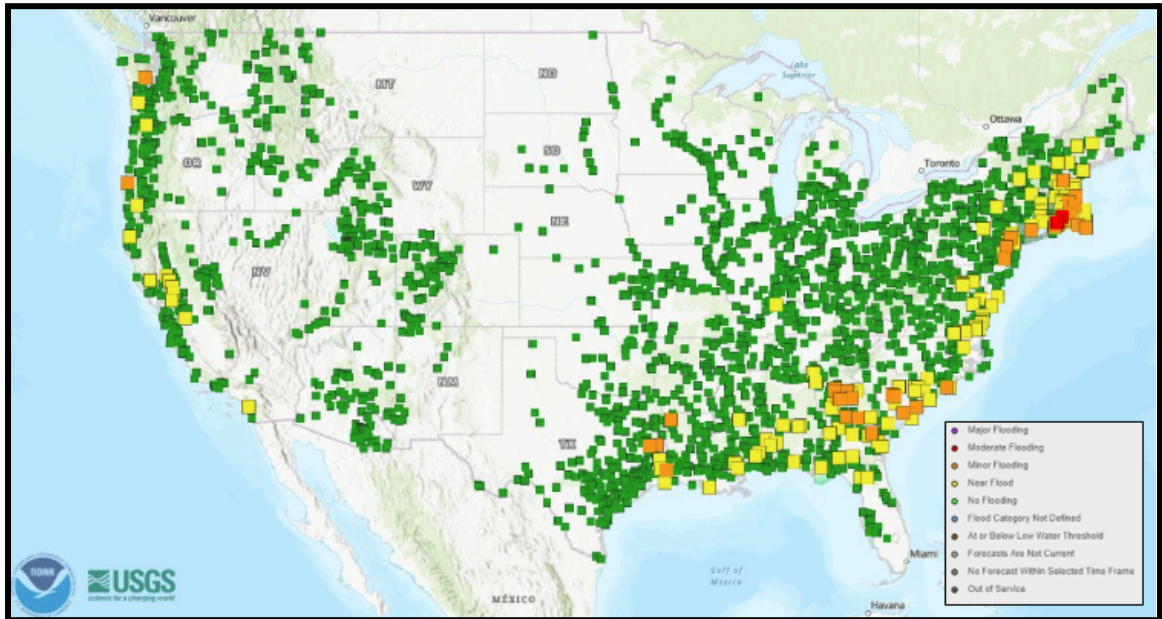
Update Frequency

Every 15 minutes

Methodology

Forecast time series from the RFCs are analyzed to detect changes in flood stage. Change is analyzed between the initial forecast value, and the forecast value with the greatest absolute difference from the initial forecast value. Gauges forecast to change flood category will always be classified with an increasing or decreasing trend, even if the greatest absolute change is less than 5%.

Forecast River Stages



Description

Depicts maximum forecast height stages based on RFC or WFO river or lake forecasts. Point locations are colored by potential flood impact.

Data Services

[CONUS/Hawaii/PuertoRicoand/Alaska](#)

- [Additional layers available for discrete time periods](#)

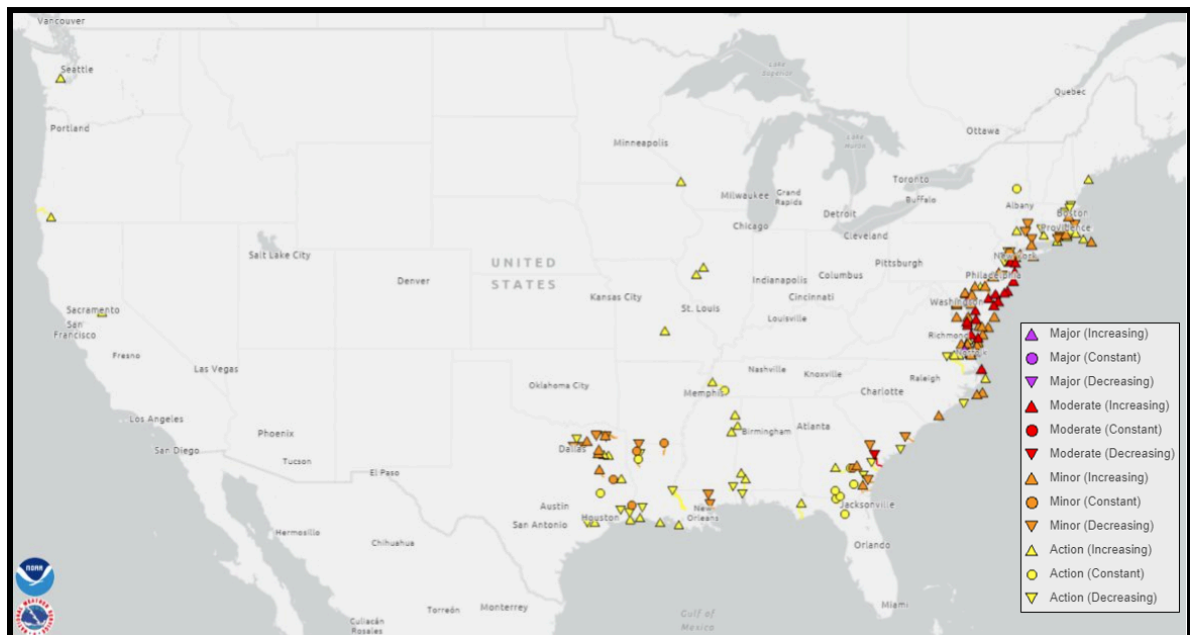
Update Frequency

Every 15 minutes

Methodology

Forecast time series from the RFCs are analyzed to produce point information colored by potential flood impact.

Max Stage - Forecast Trend



Description

Depicts National Water Prediction Service (NWPS) River Forecast Center (RFC) forecast points with forecasts at or above action stage with icons also indicating trend (up/down) in the forecast.

Data Services

[CONUS/Hawaii/PuertoRicoandVI/Alaska](#)

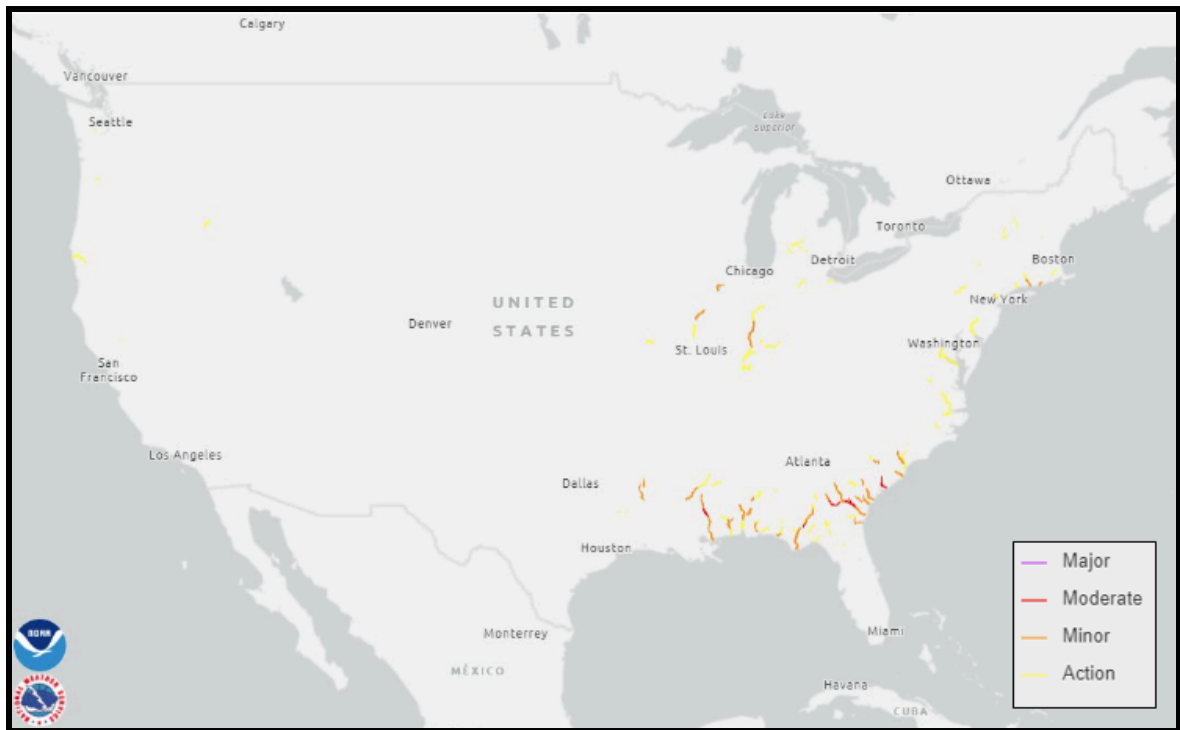
Update Frequency

Every 5 minutes

Methodology

Circles represent forecast points where stages are changing by less than $\pm 5\%$ over the entire forecast period. Upward-pointing triangles represent forecast points where a greater than 5% increase in stage is expected sometime during the forecast. If stage increases greater than 5% are not expected, downward-pointing triangles represent forecast points where a greater than 5% decrease in stage is expected sometime during the forecast. Forecast points are colored by their maximum forecast flood category.

Max Downstream Streamflow Forecast



Description

Depicts maximum forecast streamflow over the next 5 days derived from the official River Forecast Center (RFC) forecast routed downstream through the National Water Model (NWM) stream network. Maximum streamflows are available downstream of RFC forecast points whose forecast reaches action status or greater.

Data Services

[CONUS/Hawaii/PuertoRicoandVI/Alaska](#)

Update Frequency

Every 15 minutes

Methodology

Forecast time series from the RFCs are assimilated into the NWM channel routing module and then routed downstream through the NWM river network. River segments are colored according to the flood status of the RFC forecast point immediately upstream. If there are several RFC forecast points immediately upstream, the maximum flood status is used to derive the color of the river segment. The NWM Analysis and Assimilation configuration provides the initial streamflow conditions for the routing.

National Water Model Services

This section outlines the suite of visualization services driven by the operational version of the National Water Model (NWM). The NWM provides estimates of current and forecast hydrologic conditions (including streamflow) across the U.S. via several model configurations: Analysis and Assimilation (current conditions), Short-Range Forecast (0 to 18-hours), Medium-Range Forecast (0 to 10-days) and Long-Range Forecast (0 to 30-days); see **Figure 1** below. For more information about the NWM, visit <https://water.noaa.gov>.

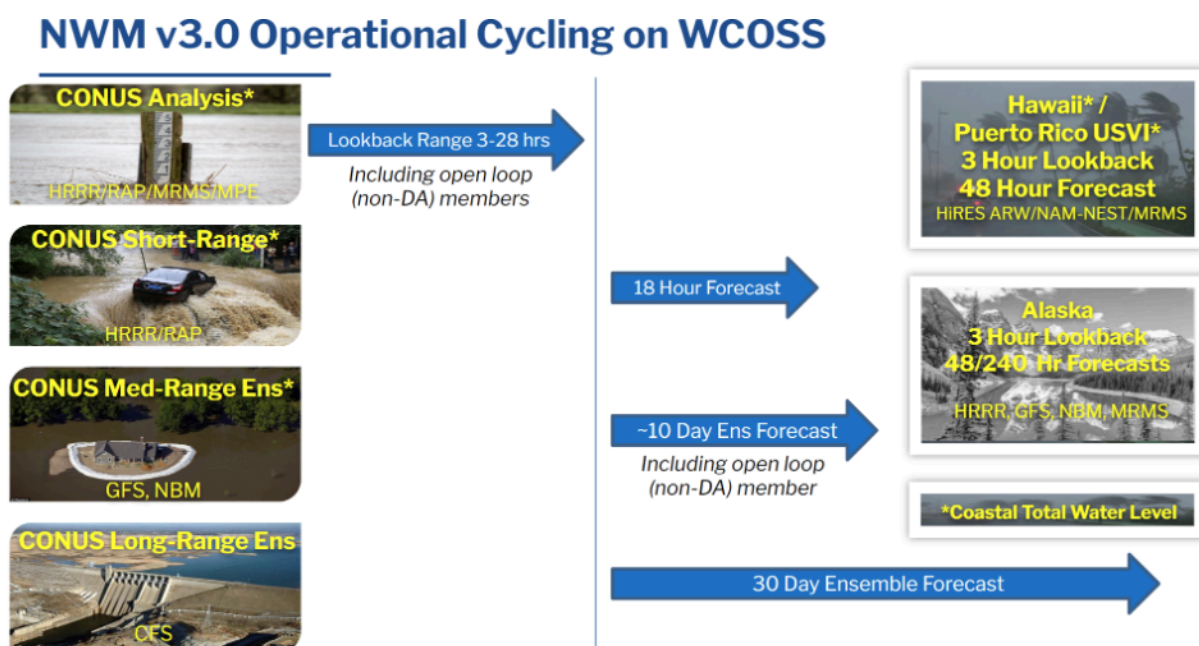


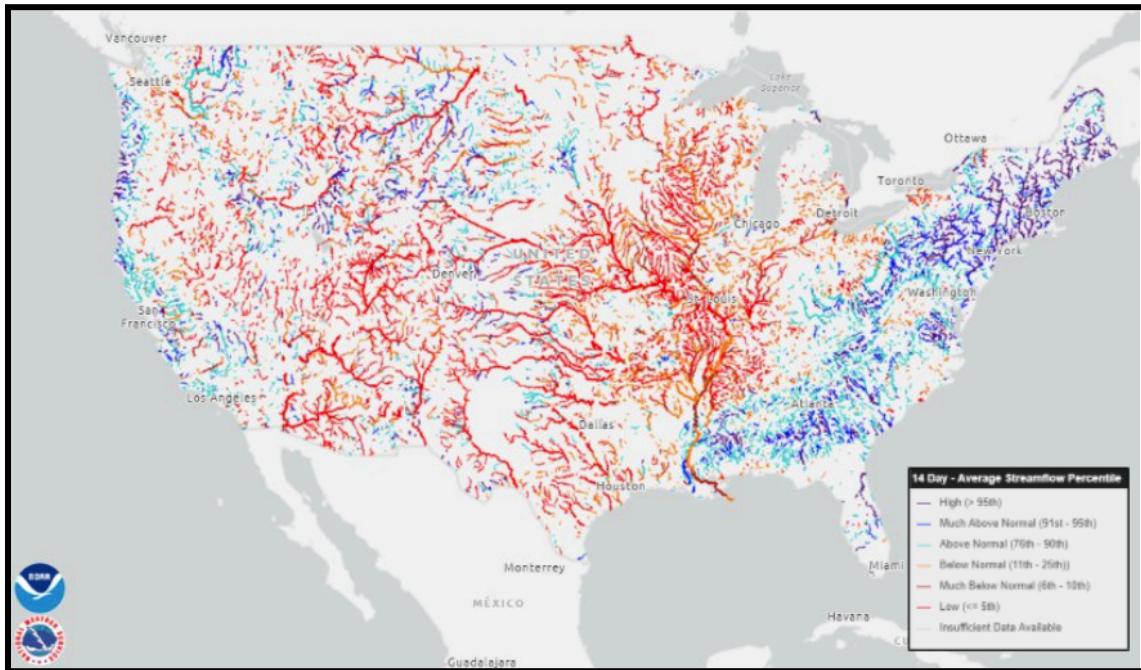
Figure 1 NWM Configurations

Analysis (Current Conditions)

Service	Brief Description
Streamflow Anomaly Analysis	Depicts current seasonal streamflow anomalies derived from the analysis and assimilation configuration of the NWM over the contiguous U.S.
High Flow Magnitude Analysis	Depicts the magnitude of the NWM streamflow forecast where the NWM is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM.



Streamflow Anomaly Analysis



Description

This service has two sublayers: Streamflow Anomaly Analysis 7-Day and Streamflow Anomaly Analysis 14-Day

Depicts seasonal streamflow anomalies derived from the analysis and assimilation configuration of the National Water Model (NWM) over the contiguous U.S. Anomalies are based on 7-day and 14-day moving average streamflow percentiles for each reach and the current calendar day.

Data Services

[CONUS](#)

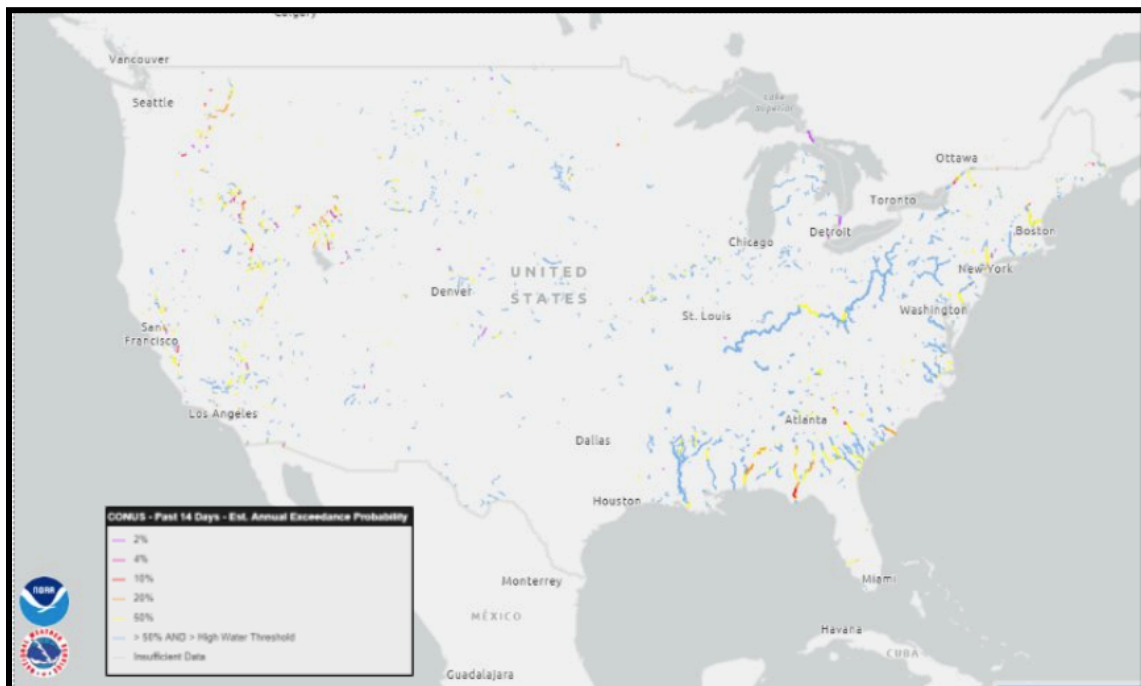
Update Frequency

Daily

Methodology

Streamflow percentiles were derived from 7-day and 14-day moving average streamflows for each reach and each calendar day using the 44-year NWM v3.0 reanalysis simulation. Methods align with the [USGS WaterWatch](#) product.

High Flow Magnitude Analysis



Description

Depicts the magnitude of the National Water Model (NWM) streamflow forecast where the NWM is signaling high water. This service is derived from the analysis and assimilation configuration of the NWM over the contiguous U.S. Shown are reaches with flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their current flow. High water thresholds (regionally varied) and AEPs were derived using the 44-year NWM v3.0 reanalysis simulation.

Data Services

[CONUS](#)

Alaska (available September 2025)

[Hawaii](#)

[Puerto Rico and the U.S. Virgin Islands](#)

Update Frequency

Hourly



Methodology

CONUS

AEPs were derived from the 44-year NWM v3.0 reanalysis simulation, utilizing a multi-decade flood frequency analysis and guidance from the Bulletin 17C guidelines developed by the Subcommittee on Hydrology of the Advisory Committee on Water Information (ACWI). NWM streamflow values are compared to these AEPs and classified accordingly. "High water" conditions are approximated regionally with an AEP that aligns with the "Action" flood threshold of the RFC forecast points within each region. Regions are defined by [McCabe and Wolock, 2016](#) based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units.

Hawaii /

High Water Threshold for Hawaii is derived using USGS regression-based methods rather than direct streamflow observations. These methods estimate flow values for specified recurrence intervals using watershed characteristics such as drainage area, mean annual precipitation, and elevation.

A fixed 2.0-year recurrence interval is applied statewide. This value aligns with [USGS Bulletin 17C](#) guidance for regions with limited continuous data and non-diverse gage networks. The recurrence flow estimates are based on the [USGS publication Flood-Frequency Estimates for Hawai'i](#), which provides region-specific regression equations for different islands and hydrologic zones.

Puerto Rico and the US Virgin Islands

High Water Threshold for Puerto Rico and the U.S. Virgin Islands is set at a fixed 2.0-year recurrence interval. This value follows [USGS Bulletin 17C guidance](#), which recommends a 2.0-year threshold in regions with limited continuous streamflow records and sparse gage networks.

A potential revision to the recurrence interval is under consideration in collaboration with the University of Puerto Rico, with further updates expected in 2026.

Alaska

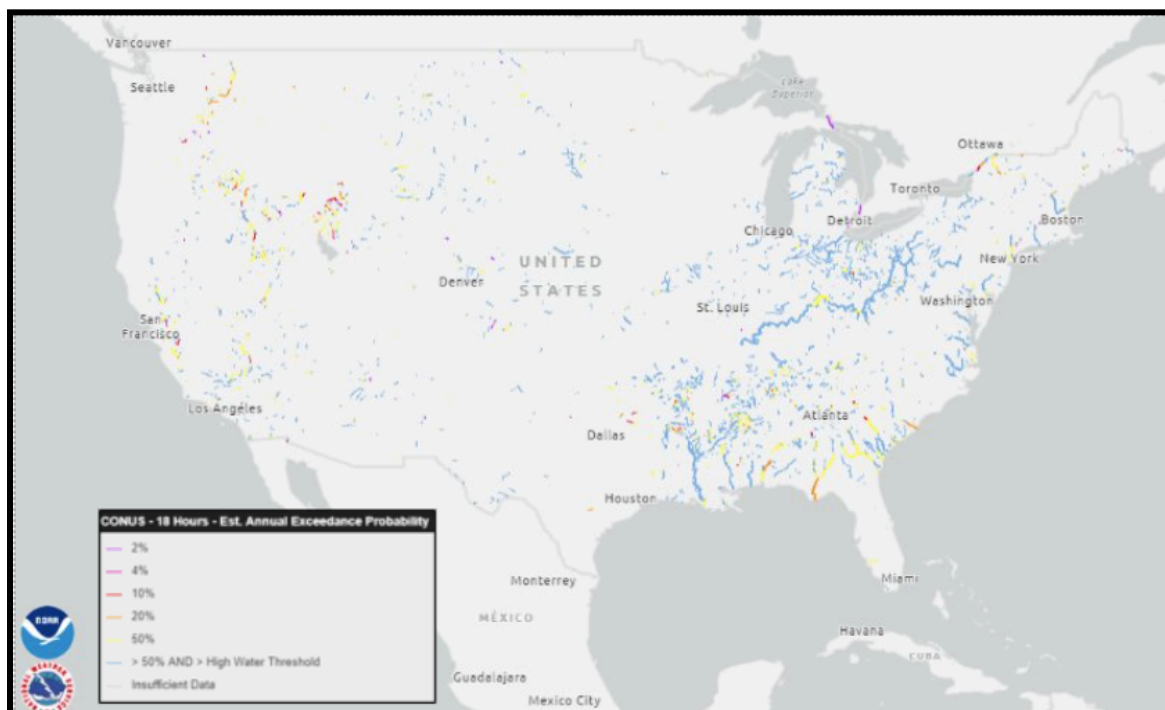
High Water Threshold for Alaska is calculated using flood frequency methods consistent with [USGS Bulletin 17C](#). This approach involves fitting streamflow values to a Log-Pearson Type III distribution to determine recurrence intervals.

A fixed 2.0-year recurrence interval is applied statewide. This threshold selection reflects the limited availability of long-term streamflow data and a relatively sparse gage network across the region. The 2.0-year value follows Bulletin 17C guidance for situations with less than 20 years of continuous data or insufficient spatial coverage to justify a more localized threshold.

Short-Range Forecast

Service	Brief Description
Maximum High Flow Magnitude Forecast	Depicts the magnitude of the peak NWM streamflow forecast over the next 18 hours where the NWM is signaling high water. This service is derived from the short-range configuration of the NWM.
High Water Arrival Time Forecast	Depicts the forecast arrival and end time of high water over the next 18 hours. This service is derived from the short-range configuration of the NWM.
High Water Probability Forecast	Depicts the probability of forecast high water over the next 12 hours using a time-lagged ensemble from the short-range forecast of the NWM.
Rapid Onset Flooding Forecast	Depicts forecast rapid onset flooding using the short-range configuration of the NWM.
Rapid Onset Flooding Probability Forecast	Depicts the probability of forecast rapid onset flooding over the next 12 hours using a time-lagged ensemble from the short-range configuration of the NWM.

Maximum High Flow Magnitude Forecast



Description

Depicts the magnitude of the peak National Water Model (NWM) streamflow forecast over the forecast period where the NWM is signaling high water. This service is derived from the short-range configuration of the NWM. Shown are reaches with peak flow at or above high water thresholds.

Geographic Area	Short Range Forecast Hours	Update Frequency	NWM Run Time
CONUS	18	Hourly	Hourly
Hawaii	48	Every 12 hours	00Z and 12Z
Puerto Rico and US VI	48	Every 12 hours	06Z and 18Z

Data Services

[CONUS](#)

[Hawaii](#)

[Puerto Rico and the U.S. Virgin Islands](#)

Update Frequency

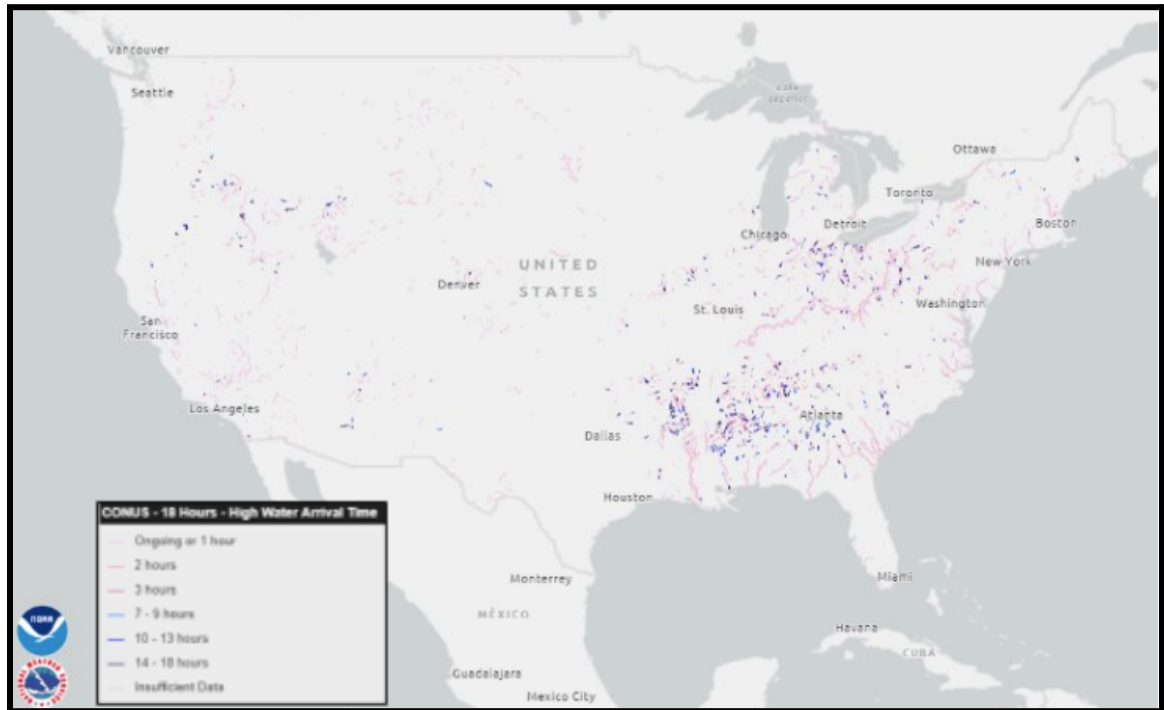
Hourly

Methodology

AEPs were derived from the 44-year NWM v3.0 reanalysis simulation, utilizing a multi-decade flood frequency analysis and guidance from the Bulletin 17C guidelines developed by the Subcommittee on Hydrology of the Advisory Committee on Water Information (ACWI). NWM streamflow values are compared to these AEPs and classified accordingly. See the high water thresholds reference section for more information on the high water thresholds for each area.



High Water Arrival Time Forecast



Description

This service contains two layers: High water arrival time and high water end time.

High water arrival time: Depicts the forecast arrival time of high water over the forecast period. Reaches are colored by the time at which they are forecast to reach high water.

High water end time: Depicts the forecast end time of high water over the forecast period. Reaches are colored by the time at which they are forecast to drop below high water.

Both services are derived from the short-range configuration of the National Water Model (NWM). See the high water thresholds reference section for more information on the high water thresholds for each area.

Geographic Area	Short Range Forecast Hours	Update Frequency	NWM Run Time
CONUS	18	Hourly	Hourly
Hawaii	48	Every 12 hours	00Z and 12Z
Puerto Rico and US VI	48	Every 12 hours	06Z and 18Z

Data Services

[CONUS](#)

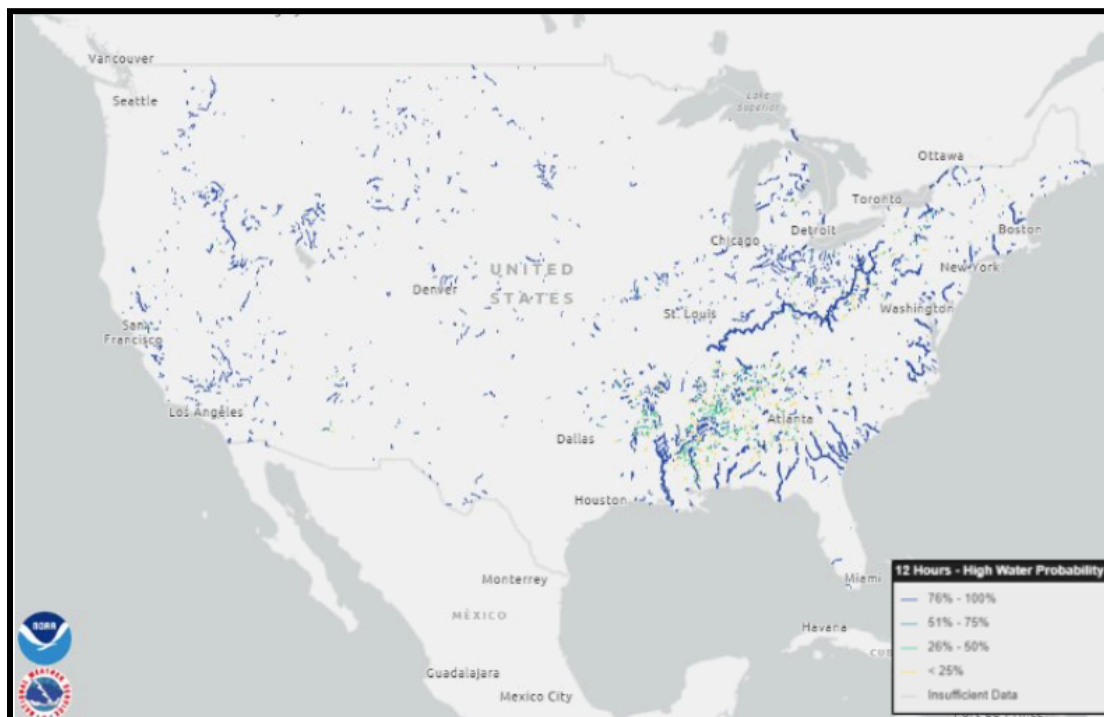
Hawaii (available September 2025)

[Puerto Rico and the U.S. Virgin Islands](#)

Methodology

The arrival and end times are calculated by comparing the forecast streamflow to the estimated "high water" condition. The time at which forecast streamflow first exceeds the "high water" condition is considered the arrival time and the time at which the forecast streamflow first falls below the "high water" condition is considered the end time. See the high water thresholds reference section for more information on the high water thresholds for each area.

High Water Probability Forecast



Description

This service contains two layers: High water probability and average high water probability hotspots.

High water probability: Depicts the probability of forecast high water over the next 12 hours using a time-lagged ensemble from the short-range forecast of the National Water Model (NWM) over the contiguous U.S. Shown are reaches that are forecast to have flow at or above high water within the next 12 hours of at least one of the last 7 forecasts. Reaches are colored by the probability that they will meet or exceed the high water threshold across the last 7 forecasts. Probabilities are derived by counting the number of forecasts that meet the high water condition within the next 12 hours, equally weighted. High water thresholds (regionally varied) were derived using the 44-year NWM v3.0 reanalysis simulation.

Average high water probability hotspots:

USGS HUC10 polygons for basins with greater than 50% of NWM features with flow expected to be at or above high water over the next 12 hours, symbolized by the average probability.

Geographic Area	Short Range Forecast Hours	Update Frequency	NWM Run Time
CONUS	12	Hourly	Hourly

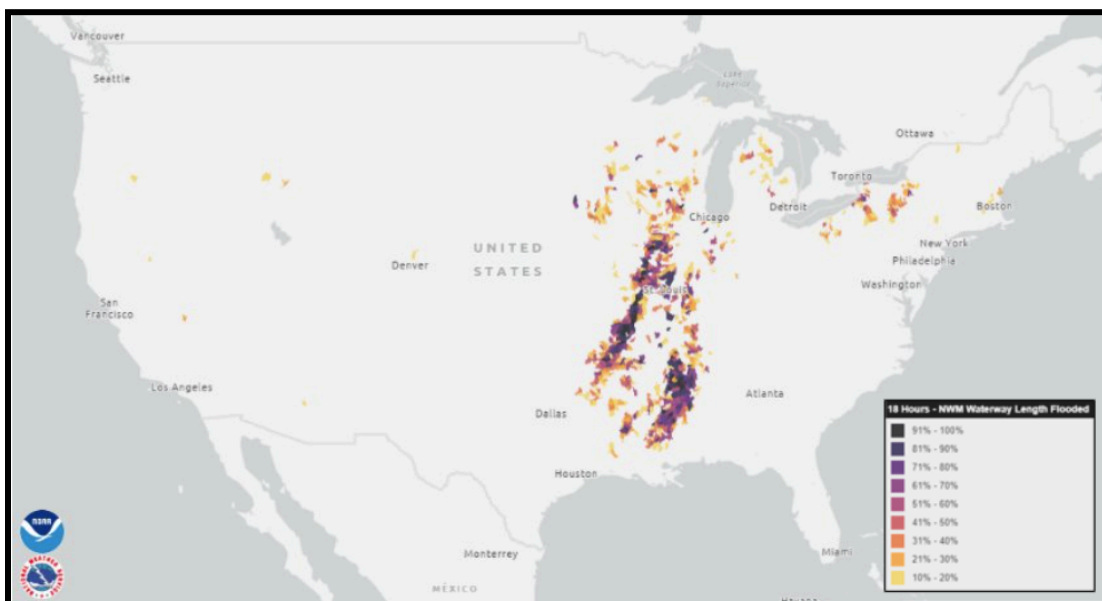
Data Services

[CONUS](#)

Methodology

Shown are reaches or hotspots (USGS HUC10 basins) that are expected to have forecast streamflow at or above “high water” conditions within the next 12 hours. Probabilities are computed as the % agreement across 7 “ensemble members”, in this case represented by the last 7 short-range forecasts. See the high water thresholds reference section for more information on the high water thresholds for each area.

Rapid Onset Flooding Forecast



Description

This service contains 3 sublayers: Rapid Onset Flooding Arrival Time, Rapid Onset Flooding Duration and NWM Waterway Length Flooded

Rapid Onset Flooding Arrival Time: This sublayer colors reaches by the time at which they are expected to reach "high water" conditions and fall within the rapid onset criteria.

Rapid Onset Flood Duration: This sublayer colors reaches by the length of time between when the streamflow increases above the high water threshold and the streamflow decreases below the high water threshold. If the streamflow never decreases below the high water threshold within the forecast period, the length will be "ongoing".

NWM Waterway Length Flooded: This sublayer colors the HUC10 basin polygons by the percentage of the NWM waterway length (within each HUC10) that is expected to meet the rapid onset flood criteria

Forecast rapid onset flooding uses the short-range configuration of the National Water Model (NWM) over the contiguous U.S. **Rapid Onset Criteria** are as follows: when a river reach (stream order 4 and below) has a forecast flow increase of 100% or greater within an hour, and which are expected to be at or above the high water threshold within 6 hours of that increase.

Geographic Area	Short Range Forecast Hours	Update Frequency	NWM Run Time
CONUS	18	Hourly	Hourly

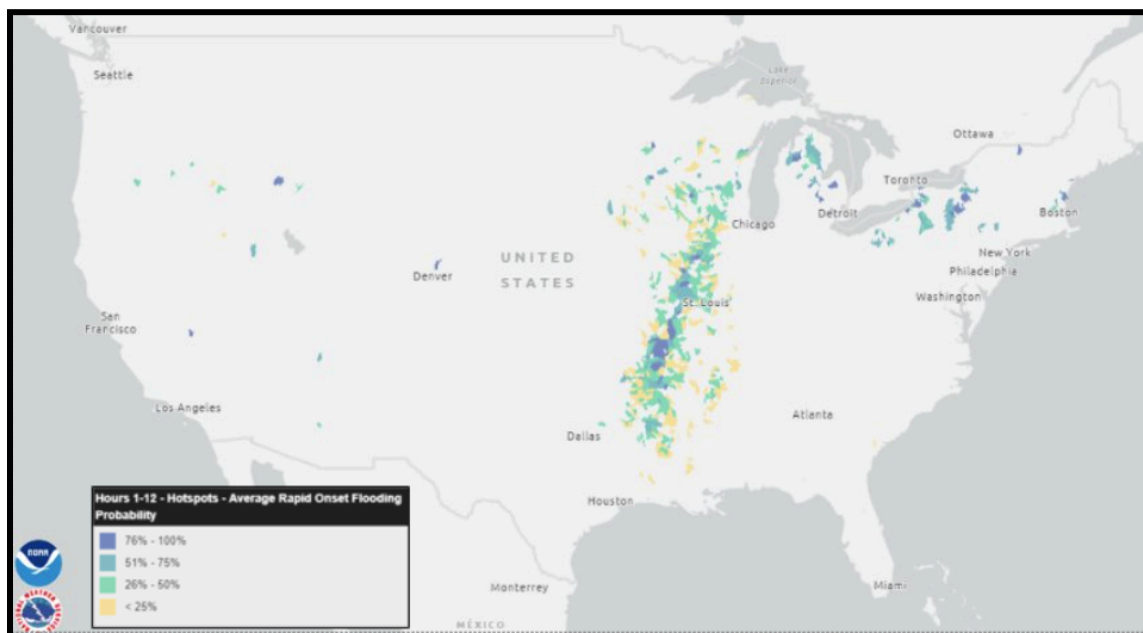
Data Services

[CONUS](#)

Methodology

Forecast rapid onset flooding uses the short-range configuration of the National Water Model (NWM). **Rapid Onset Criteria** are as follows: when a river reach (stream order 4 and below) has a forecast flow increase of 100% or greater within an hour, and which are expected to be at or above the high water threshold within 6 hours of that increase. See the high water thresholds reference section for more information on the high water thresholds for each area.

Rapid Onset Flooding Probability



Description

This service contains 4 sublayers based on time: Rapid Onset Flooding Probability for hours 1-6, Rapid Onset Flooding Probability for hours 7-12, Rapid Onset Flooding Probability for hours 1-12, and Average Rapid Onset Flooding Probability Hotspots.

Depicts the probability of forecast rapid onset flooding over the next 12 hours using a time-lagged ensemble from the short-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches (stream order 4 and below) that are expected to meet rapid onset flooding criteria (flow increase of 100% or greater within one hour and high water threshold conditions within 6 hours) using the most recent 7 forecasts. Reaches are colored by the probability that they will meet or exceed rapid onset conditions within hours 1-6, 7-12, and 1-12. Probabilities are computed as the % agreement across the 7 ensemble members that a given reach will meet rapid onset criteria at some point during the time period of interest. Hotspots show the average 1-12 hour rapid onset flooding probability, weighted by reach length, for USGS HUC10 basins with greater than 10% of NWM feature length meeting rapid onset criteria in the next 12 hours. High water thresholds (regionally varied) were derived using the 44-year NWM v3.0 reanalysis simulation.

Geographic Area	Short Range Forecast Hours	Update Frequency	NWM Run Time
CONUS	18	Hourly	Hourly

Data Services

[CONUS](#)

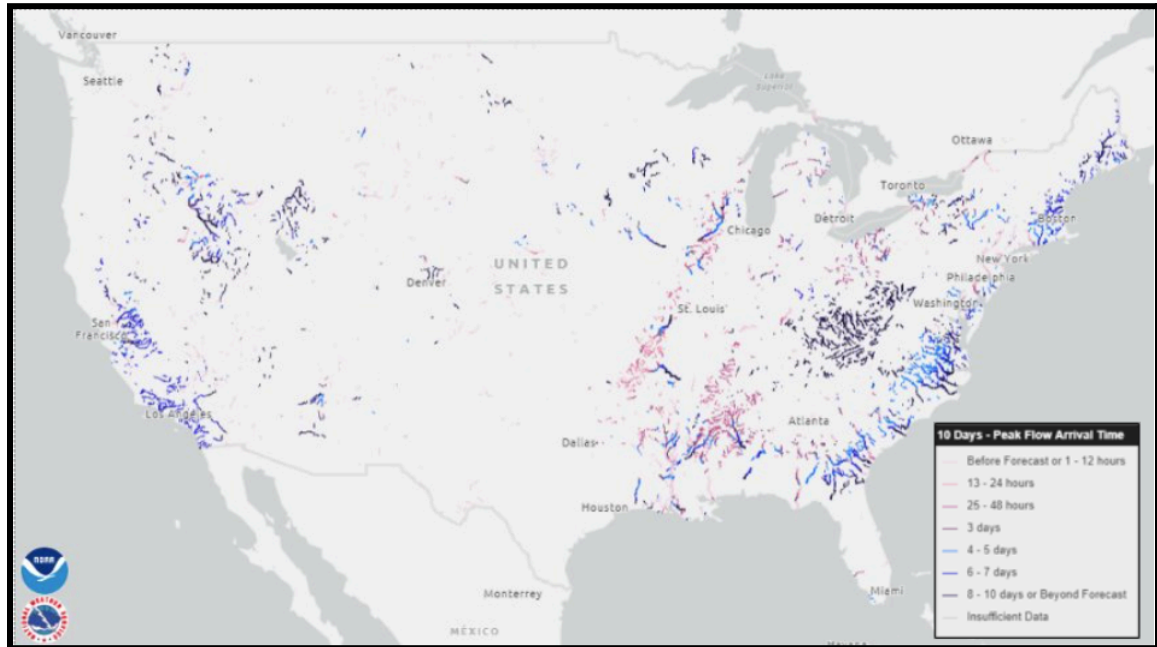
Methodology

Probabilities are computed as the % agreement across 7 “ensemble members”, in this case represented by the last 7 short-range forecasts. Reaches (stream order 4 and below) that are expected to have a forecast flow increase of 100% or greater within an hour, and which are expected to be at above the high water threshold within 6 hours of that increase, are considered agreeable for the probability calculation. See the high water thresholds reference section for more information on the high water thresholds for each area.

Medium-Range Forecast

Service	Description
Peak Flow Arrival Time Forecast	Depicts expected peak flow arrival times over the next 10 days. This service is derived from the medium-range configuration of the NWM over the contiguous U.S.
Maximum High Flow Magnitude Forecast	Depicts the magnitude of the peak NWM streamflow forecast over the next 3, 5 and 10 days where the NWM is signaling high water. This service is derived from the medium-range configuration of the NWM over the contiguous U.S.
High Water Arrival Time Forecast	Depicts the forecast arrival time of high water over the next 10 days. This service is derived from the medium-range configuration of the NWM over the contiguous U.S.
Maximum High Water Probability Forecast	Depicts the probability of forecast high water over the next 5 days using ensembles from the medium-range configuration of the NWM over the contiguous U.S.
Rapid Onset Flooding Forecast	Depicts forecast rapid onset flooding using the medium-range configuration of the NWM over the contiguous U.S.
Rapid Onset Flooding Probability	Depicts the probability of forecast rapid onset flooding over the next 5 days using ensembles from the medium-range configuration of the NWM over the contiguous U.S.

Peak Flow Arrival Time Forecast



Description

This service has 2 sublayers: Peak Flow Arrival Time Forecast for 3 days and 10 days.

Depicts expected peak flow arrival times in hours derived from the operational NWM medium-range forecast. Shown are reaches that are expected to have flow at or above high water over the next 3 to 10 days.

Data Services

[CONUS](#) (GFS)

Alaska (NBM) (available in September 2025)

Alaska (GFS) (available in September 2025)

Update Frequency

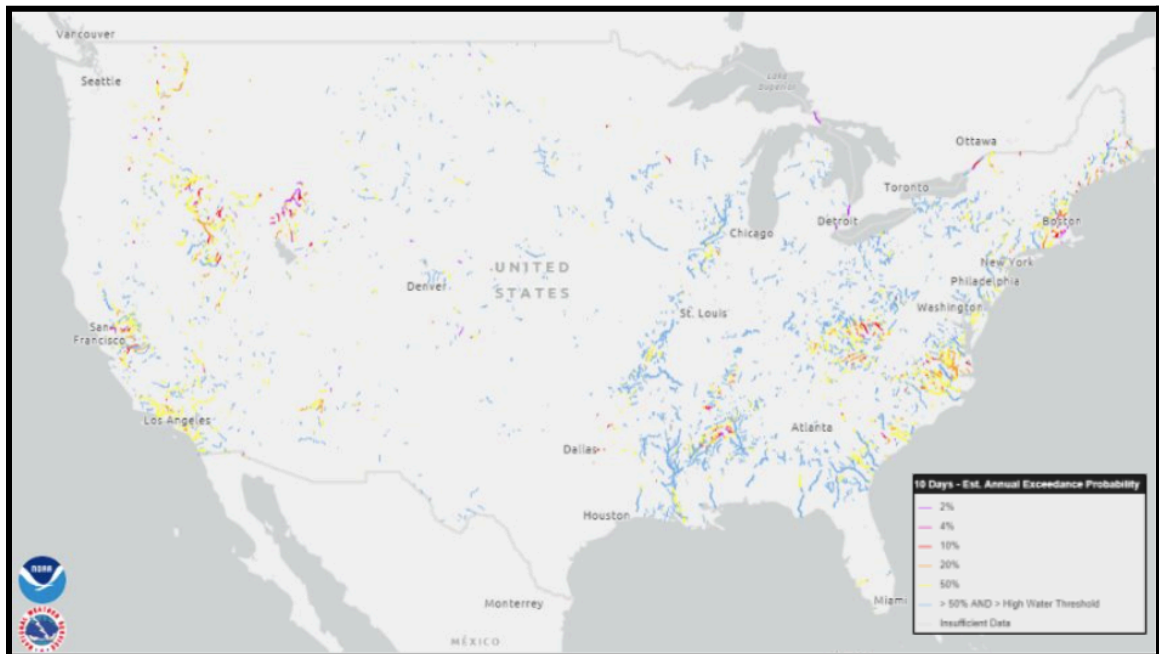
Every 6 hours

Methodology

Reaches are colored by the time at which they are expected to be at their maximum flow within the forecast period (from model initial time to peak flow). See the high

water thresholds reference section for more information on the high water thresholds for each area.

Maximum High Flow Magnitude Forecast



Description

This service has 3 sublayers: Maximum High Flow Magnitude Forecast for 3, 5 and 10 days.

Depicts the magnitude of the peak National Water Model (NWM) streamflow forecast over the next 3, 5 and 10 days where the NWM is signaling high water. This service is derived from the medium-range configuration of the NWM over the contiguous U.S. Shown are reaches with peak flow at or above high water thresholds. Reaches are colored by the annual exceedance probability (AEP) of their forecast peak flow.

Data Services

[CONUS](#) (NBM)

[CONUS](#) (GFS)

Alaska (NBM) (available in September 2025)

Alaska (GFS) (available in September 2025)

Update Frequency

Every 6 hours

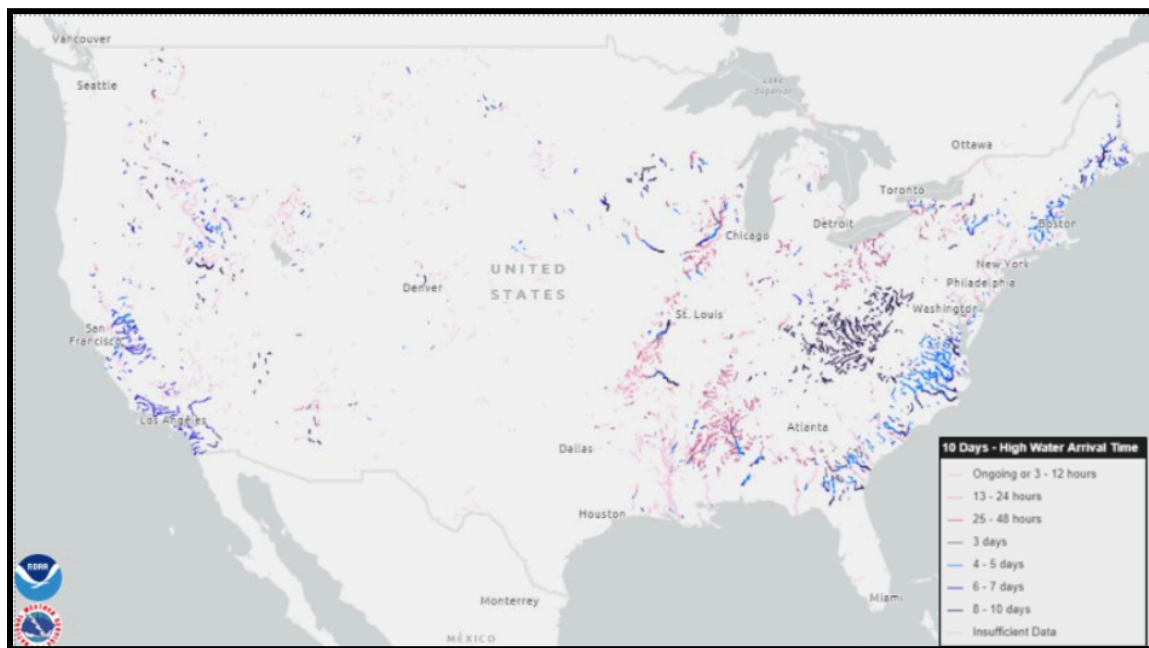


Methodology

AEPs were derived from the 44-year NWM v3.0 reanalysis simulation, utilizing a multi-decade flood frequency analysis and guidance from the Bulletin 17C guidelines developed by the Subcommittee on Hydrology of the Advisory Committee on Water Information (ACWI). NWM streamflow values are compared to these AEPs and classified accordingly. "High water" conditions are approximated regionally with an AEP that aligns with the "Action" flood threshold of the RFC forecast points within each region. Regions are defined by [McCabe and Wolock, 2016](#) based on a spatial analysis of variability in water-year runoff efficiency across HUC8 units. This service uses the NWM model run that uses the NBM for forcings in precipitation and temperature.



High Water Arrival Time Forecast



Description

This service contains 3 sublayers: High Water Arrival Time for 3 days, High Water Arrival Time for 10 days and High Water End Time for 10 days.

High Water Arrival Time for 3 days: Depicts the forecast arrival time of high water over the next 3 days. Reaches are colored by the time at which they are forecast to reach high water.

High Water Arrival Time for 10 days: Depicts the forecast arrival time of high water over the next 10 days. Reaches are colored by the time at which they are forecast to reach high water.

High Water End Time for 10 days: Depicts the forecast end time of high water over the next 10 days. Reaches are colored by the time at which they are forecast to drop below high water.

This service is derived from the medium-range GFS configuration and the medium-range NBM configuration of the National Water Model (NWM). Reaches are colored by the time at which they are forecast to reach high water (calculated in 3 hour increments).

Data Services

[CONUS](#) (NBM)

[CONUS](#) (GFS)

Alaska (NBM) (available in September 2025)

Alaska (GFS) (available in September 2025)

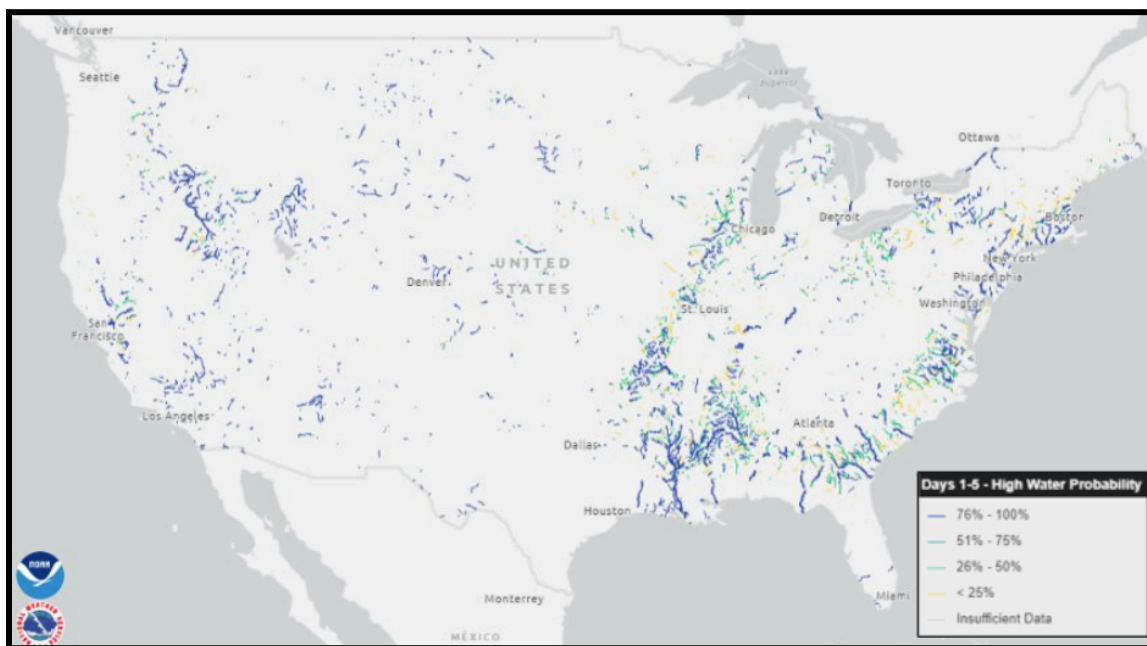
Update Frequency

Every 6 hours

Methodology

The arrival and end times are calculated by comparing the forecast streamflow to the estimated “high water” condition. The time at which forecast streamflow first exceeds the “high water” condition is considered the arrival time and the time at which the forecast streamflow first falls below the “high water” condition is considered the end time. AEPs were derived from the NWM (v2.1) retrospective, utilizing a multi-decade flood frequency analysis with guidance from the USGS Bulletin 17C. See the high water thresholds reference section for more information on the high water thresholds for each area.

Maximum High Water Probability Forecast



Description

This service has 6 sublayers: High Water Probability Day 1, High Water Probability Day 2, High Water Probability Day 3, High Water Probability Day 4-5, High Water Probability Day 1-5, and Average High Water Probability Hotspots.

Depicts the probability of forecast high water over the next 5 days using ensembles from the medium-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches that are expected to have flow at or above high water on Day 1, Day 2, Day 3, and Days 4-5, using the 7 ensemble members of the medium-range forecast. Reaches are colored by the probability that they will meet or exceed the high water threshold on Day 1, Day 2, Day 3, and Days 4-5. Probabilities are computed as the % agreement across the 7 ensemble members, equally weighted.

Data Services

[CONUS](#) (GFS)

Update Frequency

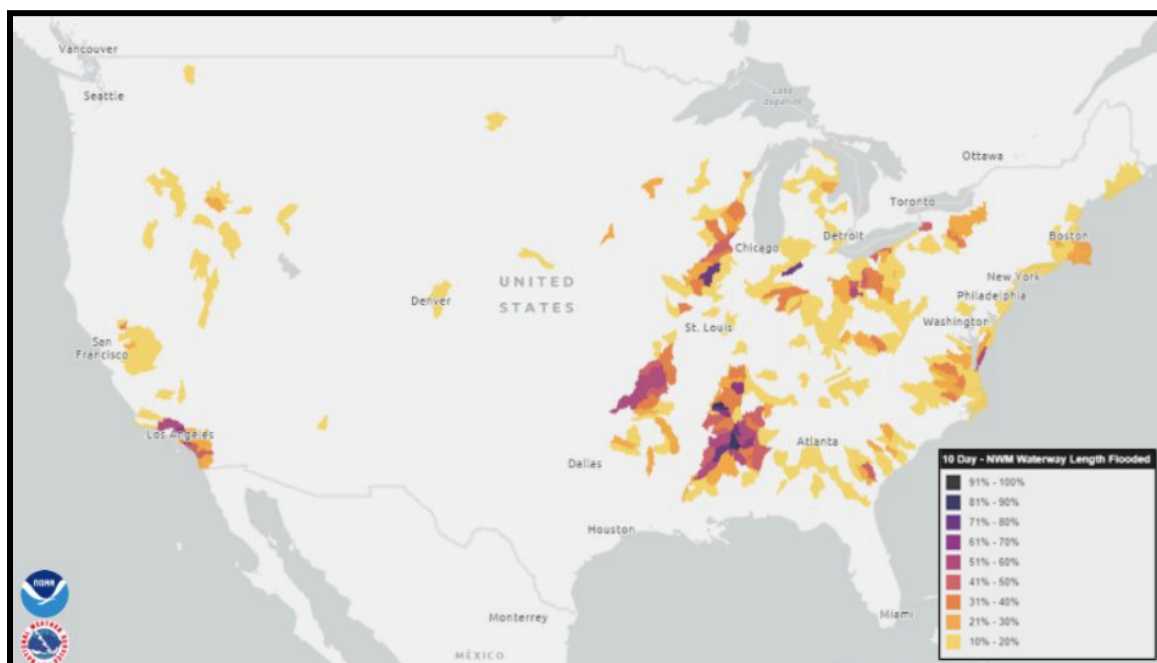
Every 6 hours

Methodology

Shown are reaches that are expected to have forecast streamflow at or above “high water” conditions on Day 1, Day 2, Day 3, and Days 4-5. Probabilities are computed for Day 1, Day 2, Day 3, and Days 4-5 valid time ranges. For a particular reach, all forecast streamflow values from the 7 ensemble members for the valid time ranges of interest are obtained and considered of equal weight. From these values, the number of times a reach was forecast to be at or above “high water” during each of the valid time ranges is used to compute high water threshold probabilities. Also shown are the High Water Probability Hotspots which are USGS HUC8 polygons for basins with greater than 50% of NWM features with flow expected to be at or above high water over the next 5 days, symbolized by the average probability. See the high water thresholds reference section for more information on the high water thresholds for each area.



Rapid Onset Flooding Forecast



Description

This service contains 3 sublayers: Rapid Onset Flooding Arrival Time, Rapid Onset Flooding Duration and NWM Waterway Length Flooded

Rapid Onset Flooding Arrival Time: This sublayer colors reaches by the time at which they are expected to reach "high water" conditions and fall within the rapid onset criteria.

Rapid Onset Flood Duration: This sublayer colors reaches by the length of time between when the streamflow increases above the high water threshold and the streamflow decreases below the high water threshold. If the streamflow never decreases below the high water threshold within the forecast period, the length will be "ongoing".

NWM Waterway Length Flooded: This sublayer colors the HUC08 basin polygons by the percentage of the NWM waterway length (within each HUC08) that is expected to meet the rapid onset flood criteria

Forecast rapid onset flooding uses the medium-range configuration of the National Water Model (NWM) over the contiguous U.S. **Rapid Onset Criteria** are as follows: when a river reach (stream order 4 and below) has a forecast flow increase of 100% or greater within 3 hours, and which are expected to be at or above the high water

threshold within 6 hours of that increase. High water thresholds (regionally varied) were derived using the 44-year NWM v3.0 reanalysis simulation.

Data Services

[CONUS](#) (NBM)

[CONUS](#) (GFS)

Alaska (NBM) (available in September 2025)

Alaska (GFS) (available in September 2025)

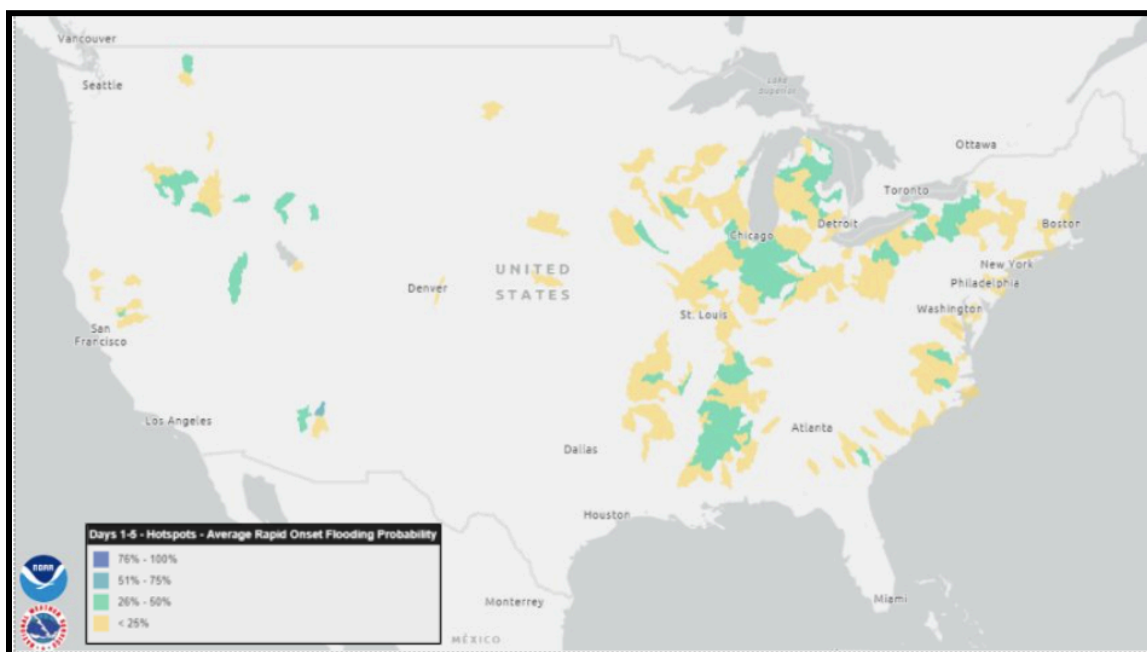
Update Frequency

Every 6 hours

Methodology

Shown are reaches that are expected to have a forecast flow increase of 100% or greater within 3 hours, and which are expected to be at above the high water threshold within 6 hours of that increase. Reaches are colored in two ways. One sublayer colors reaches by the time at which they are expected to reach “high water” conditions. Another sublayer colors reaches by the length of time between when the streamflow increases above the high water threshold and the streamflow decreases below high water. If the streamflow never decreases below “high water” within the forecast period, the length will be “ongoing”. HUC8s are also shown and colored based on the percentage of NWM waterway length within that HUC that meets the rapid onset flooding criteria. See the high water thresholds reference section for more information on the high water thresholds for each area.

Rapid Onset Flooding Probability



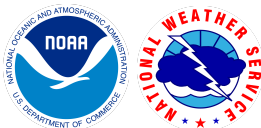
Description

This service contains 6 sublayers: Rapid Onset Flood Probability for Day 1, Day 2, Day 3, Days 4-5, Days 1-5 as well as Average Rapid Onset Flooding Probability Hotspots.

Depicts the probability of forecast rapid onset flooding over the next 5 days using ensembles from the medium-range configuration of the National Water Model (NWM) over the contiguous U.S. Shown are reaches that are expected to have flow at or above high water thresholds on Day 1, Day 2, Day 3, Days 4-5, and Days 1-5 using the 7 ensemble members of the medium-range forecast. Reaches are colored by the probability that they will meet or exceed high water thresholds on Day 1, Day 2, Day 3, Days 4-5, and Days 1-5. Probabilities are computed as the % agreement across the 7 ensemble members, equally weighted. Hotspots show USGS HUC08 basins with greater than 50% of NWM features with flow expected to be at or above high water thresholds over the next 5 days. High water thresholds (regionally varied) were derived using the 44-year NWM v3.0 reanalysis simulation.

Data Services

[CONUS](#) (GFS)



Update Frequency

Every 6 hours

Methodology

Probabilities are computed as the % agreement across all medium-range forecast ensemble members. Reaches (stream order 4 and below) that are expected to have a forecast flow increase of 100% or greater within 3 hours, and which are expected to be at above the high water threshold within 6 hours of that increase, are considered agreeable for the probability calculation. See the high water thresholds reference section for more information on the high water thresholds for each area.



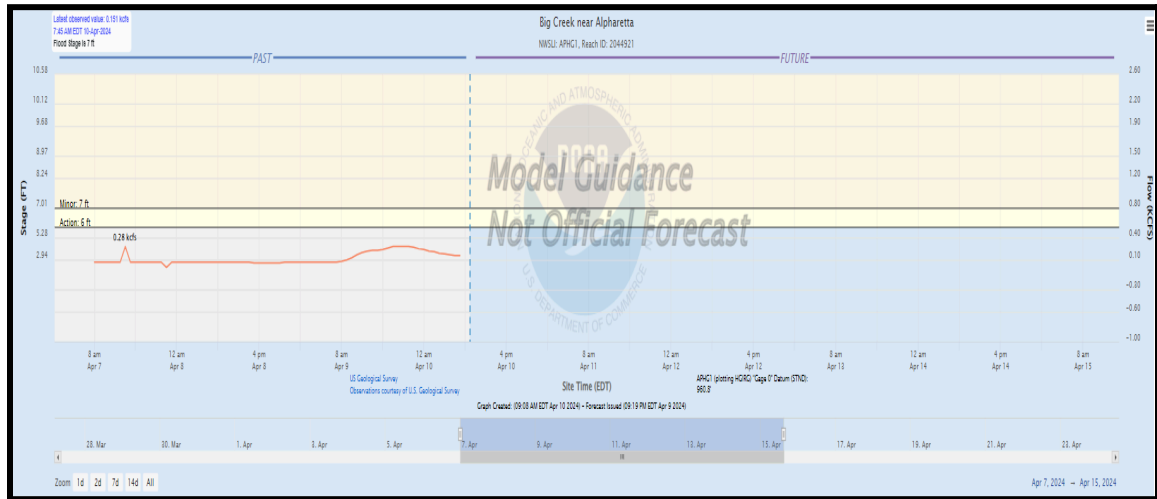
Point-Based National Water Model Services

National Water Prediction Service

Service	Description
Streamflow Analysis	Depicts at the selected site the National Water Model analysis assimilation output.
Short-Range Streamflow Forecast	Depicts at the selected site the National Water Model 18-hour Short-Range streamflow forecast. The Short-Range Forecast uses the HRRR and RAP weather models.
Medium-Range Blend Streamflow Forecast	Depicts at the selected site the 10-Day National Water Model streamflow forecast at the selected site. The Medium Range Blend uses the NBM weather model.
Medium-Range Ensemble Forecasts	Depicts at the selected site the National Water Model Medium-Range Forecasts which present a streamflow forecast using the GFS model including the most recent 10-day medium-range, the 8.5 day 6-member ensemble mean, and the 6 individual medium-range ensemble members each extending out to 8.5 days.
Long-Range Ensemble Forecasts	Depicts at the selected site the suite of streamflow forecasts which include the 30-day long-range ensemble mean and the 4 individual long-range ensemble members each extending out to 30 days.
Categorical Flood Inundation Extent	Depicts at the selected site the inundation extent for each impact flood category using Stage-based Categorical Flood Inundation Mapping: Static map extents available for action, minor, moderate, major and record levels.

For all Point-Based National Water Model Services, please refer to the [National Water Prediction Service Product Guide](#).

Streamflow Analysis (at selected site)



Selected site data available at the [National Water Prediction Service \(NWPS\)](#).

For more information on the NWPS Products, go to the [National Water Prediction Service Product Guide](#).

Description

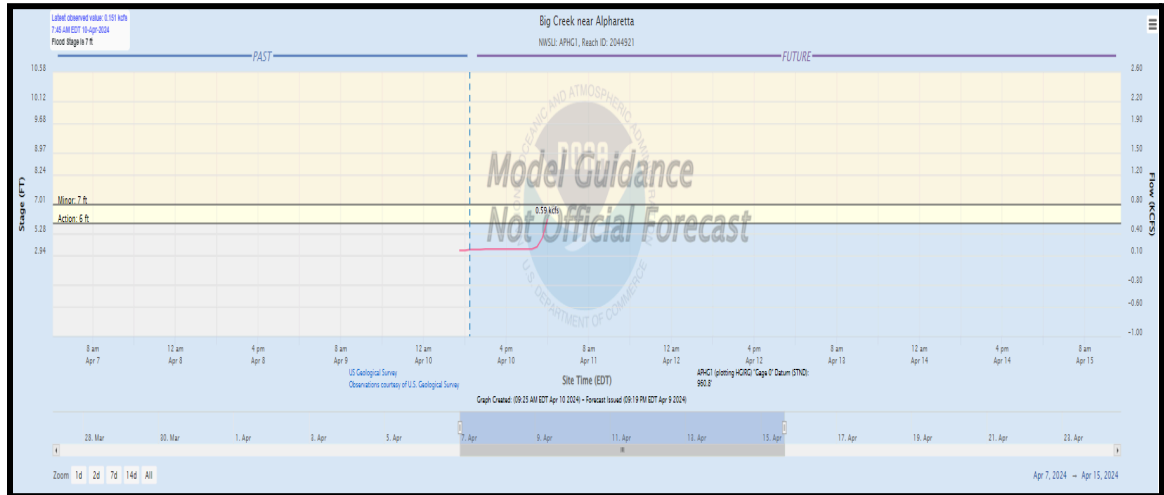
Depicts the streamflow output from the operational National Water Model (NWM) analysis and assimilation for the continental United States.

Update Frequency

Hourly



Short-Range Streamflow Forecast (at selected site)



National Water Model

- Analysis (ANA)
- Short Range (SR)

Selected site data available at the [National Water Prediction Service \(NWPS\)](#).

For more information on the NWPS Products, go to the [National Water Prediction Service Product Guide](#).

Description

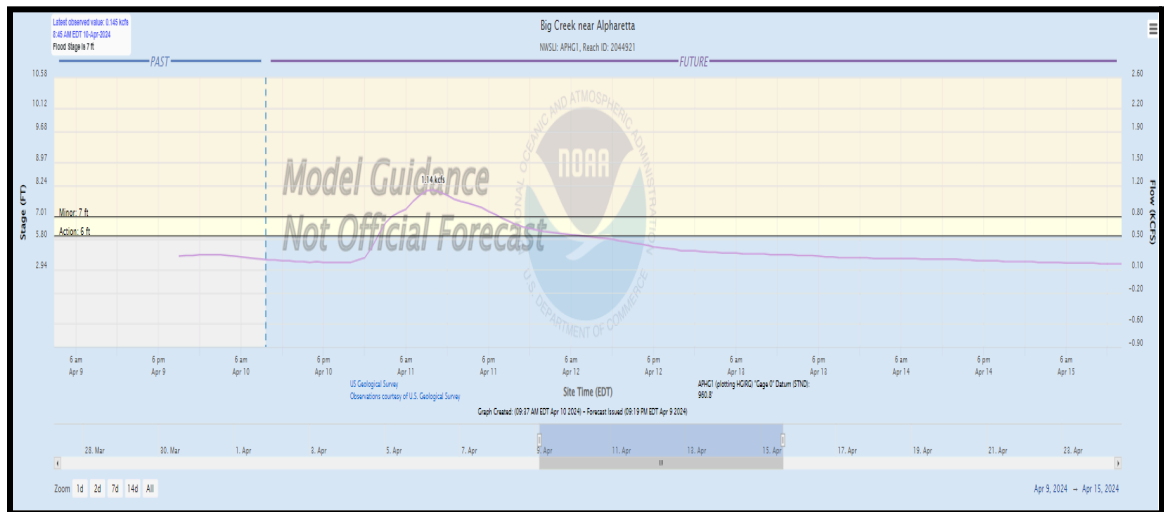
Depicts at the selected site the National Water Model 18-hour Short-Range streamflow forecast. The Short-Range Forecast uses the HRRR and RAP weather models.

Update Frequency

Hourly



Medium-Range Blend Streamflow Forecast (at selected site)



National Water Model

- Analysis (ANA)
- Medium Range Blend (MRB)

Selected site data available at the [National Water Prediction Service \(NWPS\)](#).

For more information on the NWPS Products, go to the [National Water Prediction Service Product Guide](#).

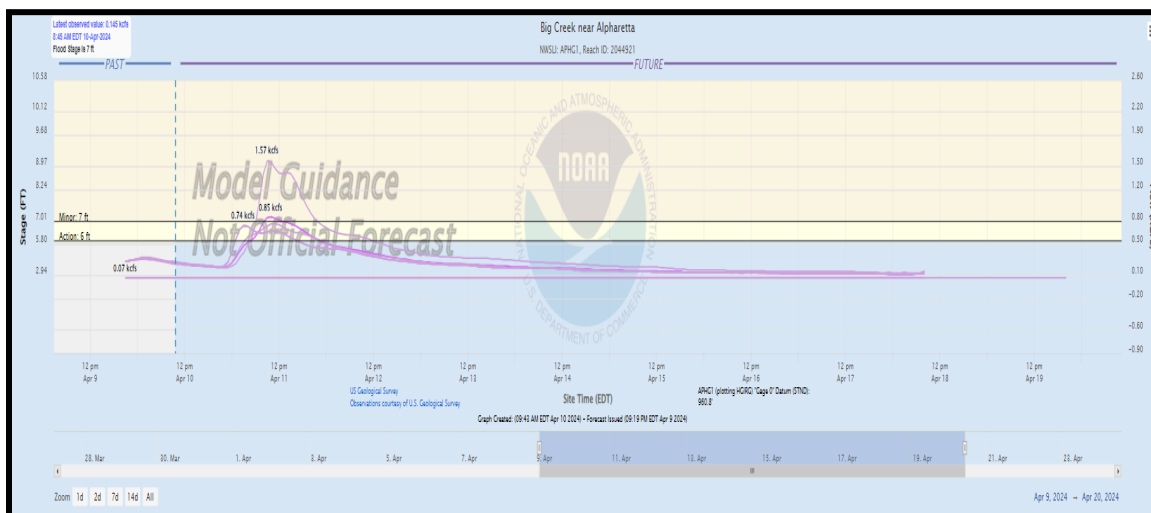
Description

Depicts at the selected site the 10-Day National Water Model streamflow forecast at the selected site. The Medium Range Blend uses the NBM weather model.

Update Frequency

Every 6 Hours

Medium-Range Ensemble Forecasts (at selected site)



▼ Medium Range Ensembles

- Medium Range Ensemble Mean (MRM)
- Medium Range Member 1 (MR 1)
- Medium Range Member 2 (MR 2)
- Medium Range Member 3 (MR 3)
- Medium Range Member 4 (MR 4)
- Medium Range Member 5 (MR 5)
- Medium Range Member 6 (MR 6)

Selected site data available at the [National Water Prediction Service \(NWPS\)](#).

For more information on the NWPS Products, go to the [National Water Prediction Service Product Guide](#).

Description

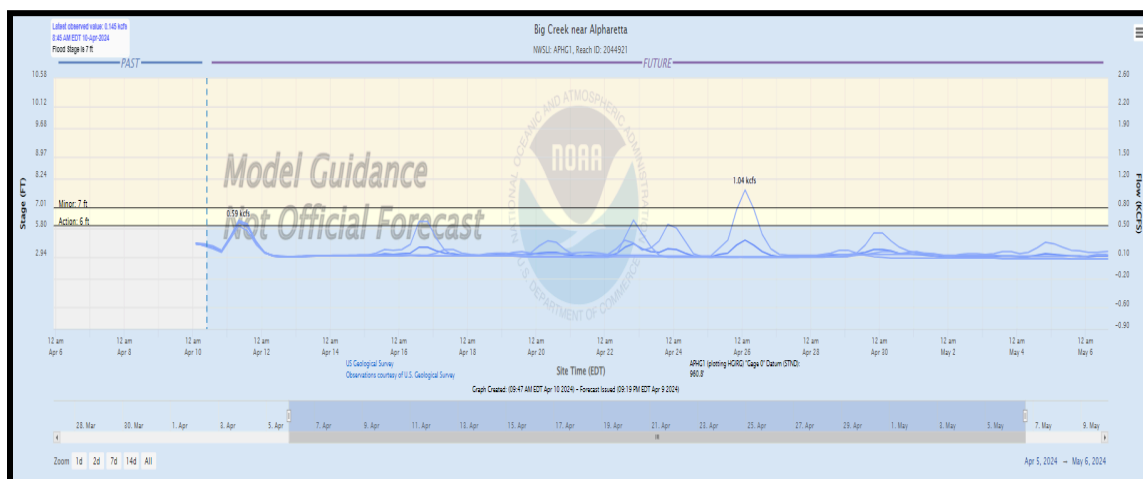
Depicts at the selected site the National Water Model Medium-Range Forecasts which present a streamflow forecast using the GFS model including the most recent 10-day medium-range, the 8.5 day 6-member ensemble mean, and the 6 individual medium-range ensemble members each extending out to 8.5 days.

Update Frequency

Every 6 Hours



Long-Range Ensemble Forecasts (at selected site)



✓ Long Range Ensembles

- Long Range Ensemble Mean (LRM)
- Long Range Member 1 (LR 1)
- Long Range Member 2 (LR 2)
- Long Range Member 3 (LR 3)
- Long Range Member 4 (LR 4)

Selected site data available at the [National Water Prediction Service \(NWPS\)](#).

For more information on the NWPS Products, go to the [National Water Prediction Service Product Guide](#).

Description

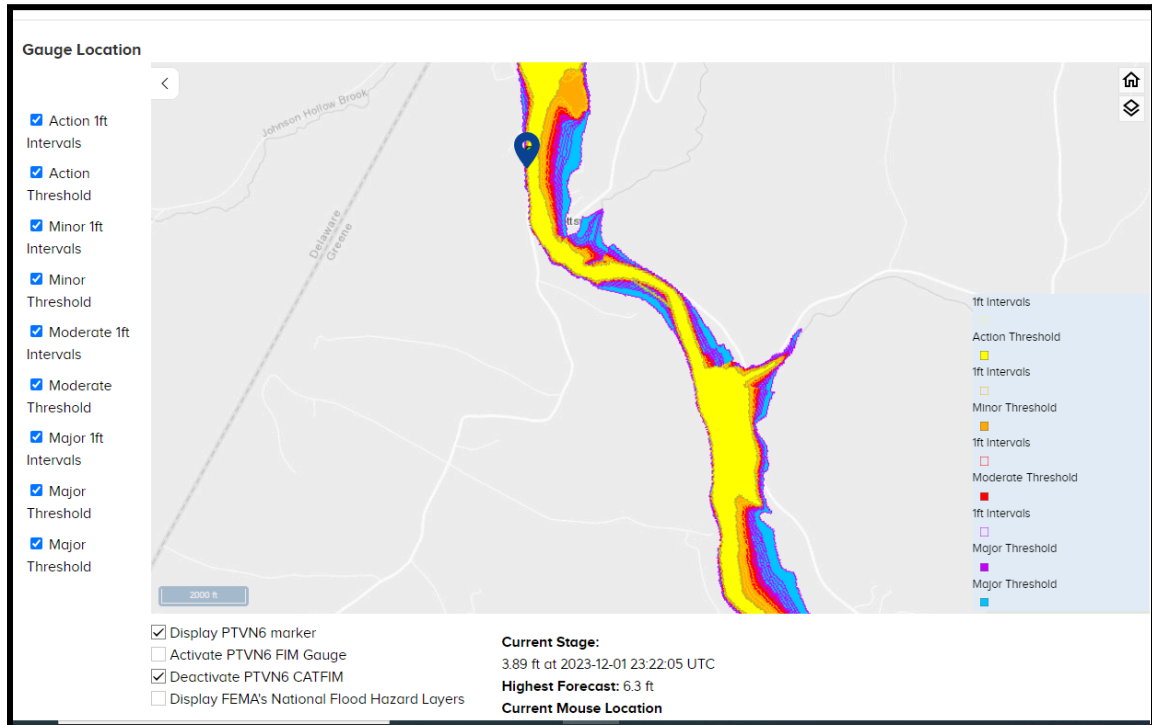
Depicts at the selected site the suite of streamflow forecasts which include the 30-day long-range ensemble mean and the 4 individual long-range ensemble members each extending out to 30 days.

Update Frequency

Every 6 Hours



Categorical Flood Inundation Extent (at selected site)



Description

Depicts at the selected site the inundation extent for each impact flood category using both Stage-based and Flow-based Categorical Flood Inundation Mapping: Static map extents available for action, minor, moderate, major and record levels.

Data Services

[Individual Stage-based Categorical Flood Inundation Mapping \(CatFIM\) Locations](#)

Update Frequency

Static

Definitions

Term	Description
National Water Model	A hydrologic modeling framework run by the US National Oceanic and Atmospheric Administration (NOAA) National Water Center (NWC). that simulates observed and forecast streamflow over the entire continental United States (CONUS), southern Alaska (Cook Inlet, Copper River Basin, and Prince William Sound regions), Hawaii, Puerto Rico and the US Virgin Islands
High Water Threshold	A predefined water level that indicates elevated streamflow for a given reach and serves as the basis for generating National Water Model (NWM) Flood Inundation Mapping (FIM).
GFS Weather Model	A global weather forecast model run by the US National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Prediction (NCEP). It's a numerical weather prediction system that provides forecasts for the entire globe, including atmospheric, ocean, land/soil, and sea ice conditions.
NBM Weather Model	A suite of weather forecast guidance developed by the National Weather Service (NWS) and the National Oceanic and Atmospheric Administration (NOAA). It combines data from various numerical weather prediction (NWP) models, both within the NWS and from other sources, to produce a single, more accurate, consistent, and skillful forecast.

High Water Threshold

High Water Threshold is a predefined water level that indicates elevated streamflow for a given reach and serves as the basis for generating National Water Model (NWM) Flood Inundation Mapping (FIM). NWM FIM is only produced when streamflow meets or exceeds this threshold. The High Water Threshold also supports other NWM services, including:

- Maximum high flows
- Peak and high flow arrival times
- Rapid onset flooding
- Flood inundation mapping (FIM)

Calculations for High Water Threshold depend on the geographic domain and follow specific methods tailored to one of four regions:

- Continental United States (CONUS)
- Alaska
- Hawaii
- Puerto Rico/Virgin Islands (PRVI)

CONUS

High Water Threshold is established for eleven clusters across CONUS, each defined by similar water-year runoff efficiency variability





Alaska

High Water Threshold for Alaska is calculated using flood frequency methods consistent with USGS Bulletin 17C. This approach involves fitting streamflow values to a Log-Pearson Type III distribution to determine recurrence intervals.

A fixed 2.0-year recurrence interval is applied statewide. This threshold selection reflects the limited availability of long-term streamflow data and a relatively sparse gage network across the region. The 2.0-year value follows USGS Bulletin 17C guidance for situations with less than 20 years of continuous data or insufficient spatial coverage to justify a more localized threshold.

Hawaii

High Water Threshold for Hawaii is derived using USGS regression-based methods. These methods estimate flow values for specified recurrence intervals using watershed characteristics such as drainage area, mean annual precipitation, and elevation.

A fixed 2.0-year recurrence interval is applied statewide. This value aligns with USGS Bulletin 17C guidance for regions with limited continuous data and non-diverse gage networks. The recurrence flow estimates are based on the USGS publication Flood-Frequency Estimates for Hawai'i, which provides region-specific regression equations for different islands and hydrologic zones.

Puerto Rico, U.S. Virgin Islands

High Water Threshold for Puerto Rico and the U.S. Virgin Islands is set at a fixed 2.0-year recurrence interval. This value follows USGS Bulletin 17C guidance, which recommends a 2.0-year threshold in regions with limited continuous streamflow records and sparse gage networks.

A potential revision to the recurrence interval is under consideration in collaboration with the University of Puerto Rico, with further updates expected in 2026.

