

Taking a Comprehensive View of Flood Risk

Go beyond the traditional propertylevel risk characteristics and add further refinement to risk selection with comprehensive flood hazard scoring

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Flood Risk is Ubiquitous

Most counties in the United States experience severe flooding, and when they do, these areas face significant risk to homes, businesses, and infrastructure. Recent flood disasters—such as the 2016 and 2018 flooding of Ellicott City, MD; the 2016 Louisiana floods; the 2017 flooding in Houston resulting from Hurricane Harvey; or the 2018 flood in the Carolinas from Hurricane Florence—remind us that significant flood risk is not limited to government-designated high flood risk areas. Countless properties outside of these areas remain highly vulnerable to damage due to flooding. And traditionally designated Federal Emergency Management Agency (FEMA) flood zones are often based on incomplete and potentially outdated information about prevailing flood risks.

Flooding Isn't Limited to High-Hazard Flood Zones

Flood zone maps, provided by FEMA under the National Flood Insurance Program (NFIP), are commonly used for assessing flood risk in the United States. These FEMA flood maps, while generally perceived to provide complete and accurate flood risk information, are often outdated, incomplete, and at times inaccurate. They have also created the false impression that flood risk exists only within the so called "Special Flood Hazard Areas" (SFHA), or the 100-year flood zone.

Communities have suffered tremendous losses within 500-year flood zones and even in the "minimal flood hazard" areas outside indicated 500-year zones. FEMA's flood maps also have not fully captured other damaging scenarios such as localized or flash flooding that results from extreme precipitation, limited surface slope, and/or poor drainage.

Furthermore, FEMA maps are outdated in many areas and not accurate in others. They take a largely binary view—a location is either at risk or not—and they fail to account for the variations in risk that naturally occur within large geographic areas. These flood maps are typically limited to demarcating flood extents, and they lack any information on

inundation depths to support differentiation of flood risks within a neighborhood or even an entire flood zone. This, in turn, can yield unrefined pricing for consumers and a time-consuming process for underwriters to accurately evaluate risk.

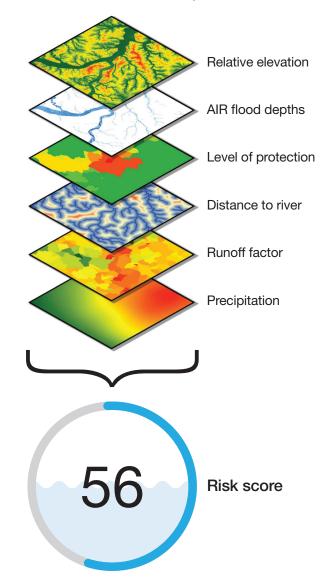
A Better Way to Assess Flood Risk

New technologies provide ways to estimate flood risk that don't rely solely on the historical information provided by FEMA. For example, WaterLine[™], Verisk's flood hazard score, provides a comprehensive flood risk assessment tool that can assist insurers with accurate assessment of location-level flood hazard. This can help streamline underwriting workflows and facilitate better decision making.

Flood Risk Assessment Grounded in Science

Rigorous hydrologic and hydraulic engineering principles provide a scientific, yet simple and intuitive way to assess a location's flood hazard. WaterLine employs these principles to provide a single score, expressed on a scale from 0-100, that captures the aggregated view of all possible types of flood hazards—risks due to riverine (onfloodplain), pluvial (off-floodplain), and storm surge flooding. Unlike FEMA flood zones, a WaterLine score is consistent and available for every location within the contiguous United States.

Each WaterLine score is also complemented by a qualitative risk assessment of each of the three component sub-perils of flooding: riverine, pluvial, and storm surge. To further explain the overall risk score and its components, WaterLine reports also provide information on the driving factors and reference data in quantitative terms. These elements of the WaterLine reports add context to scores, providing added guidance to both underwriters and insureds. WaterLine components:



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Elevating the Accuracy

Most large-scale floods are caused by the continental circulation of moisture in combination with regional storm systems. However, location-level flooding is highly variable and heavily dependent on local topography and drainage conditions. As a result, accurately accounting for ground elevation is critical when developing a robust flood hazard score.

WaterLine provides flood hazard information nationally at a 10-meter resolution, using the latest national and regional Digital Terrain Models (DTMs), with resolution in some urban areas going down to 1 meter. In addition to the high-resolution DTM, all other data metrics and modeling are based on high-resolution datasets to ensure accurate results at the location level. The score captures both how weather systems distribute precipitation and the flooding they cause, while accounting for a broad range of climates, local soil conditions, land use, surface roughness, and topography that affect the flow and drainage of potential flood waters.

Capturing the Nuances of Localized Flood Behavior

Devastating floods are often a combination of several factors, including riverine flooding; water backing up in tributaries due to high flood stages in main rivers (known as "back-water"); significant localized flooding caused by intense rainfall; flat terrain; limited drain-age capacity; and/or the failure of storm drainage systems. Similarly, flooding in coastal areas results from several climatic and topographic factors, including locational frequency and severity of tropical weather systems, nearshore bathymetry, topographic land use, and land cover features in coastal areas.

The WaterLine scoring methodology leverages the flood hazard estimates from AIR's fully-probabilistic inland flood and hurricane models for the United States and combines the output from these models to obtain an overall flood hazard score.

The comprehensive hydrology, hydraulic engineering, and hydro-dynamic storm surge modeling employed to obtain these hazard estimates ensures that the WaterLine score is derived from detailed physical simulations and is based on the most rigorous available science.



The supplementary metrics for this score include flood depths reflecting a broad spectrum of probability of flooding, relative elevation, distance from rivers and coast, level of flood protection, catchment and river slopes, precipitation magnitude, and runoff factors, among others.



WaterLine provides flood hazard information nationally at a **10-meter resolution**, using the latest national and regional Digital Terrain Models (DTMs), with resolution in some urban areas going down to **1 meter**.

The full WaterLine report makes many of these quantitative factors available to help explain the overall WaterLine score, which helps ensure that WaterLine scores are transparent to both the underwriter and the home or business owner. For any 10-meter geospatial grid point, the WaterLine score reflects the expected flood hazard, encompassing a wide range of flood severities and their corresponding exceedance probabilities.

This means WaterLine scores can be compared across state boundaries or hydrological regions, because an identical score in two different states or regions means that the same level of flood hazard would result in a similar level of flood damage.

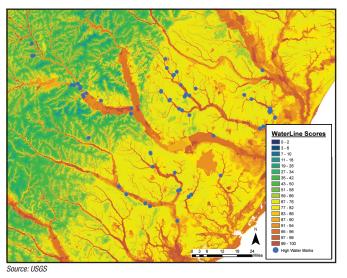
Closing the gap

When devastating floods occur, they can highlight sizable protection gaps between the losses suffered as a result of these floods and the coverage provided by insurance. WaterLine helps decrease these gaps by assisting insurers with accurate assessment of location-level flood hazard. The result can be streamlined underwriting workflows and better decision making.

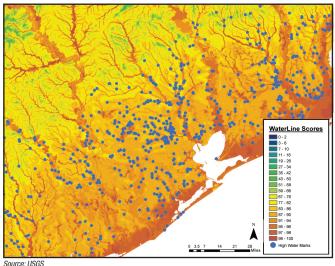
WaterLine at USGS High Water Mark Locations

The heatmaps and histograms below outline WaterLine score distributions at USGS High Water Mark (HWM) locations (denoted by blue dots) with flood depths greater than 1 foot for two significant flood events, the 2015 South Carolina and 2017 Hurricane Harvey floods. WaterLine's delineation of flood hazard risk clearly tracks well with actual flooding shown by the high water mark areas.

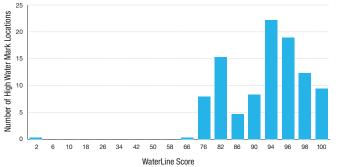
2015 South Carolina



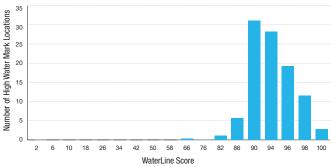
2017 Houston, Texas



South Carolina: High Water Mark Score Distribution



Houston, Texas: High Water Mark Score Distribution



For more information:

Email us at **floodinsurance@verisk.com** or visit us online at **verisk.com/floodinsurance**



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