

# *Base Level Engineering - Data For a Resilient Future*



**FEMA**

**FEMA Region 6**

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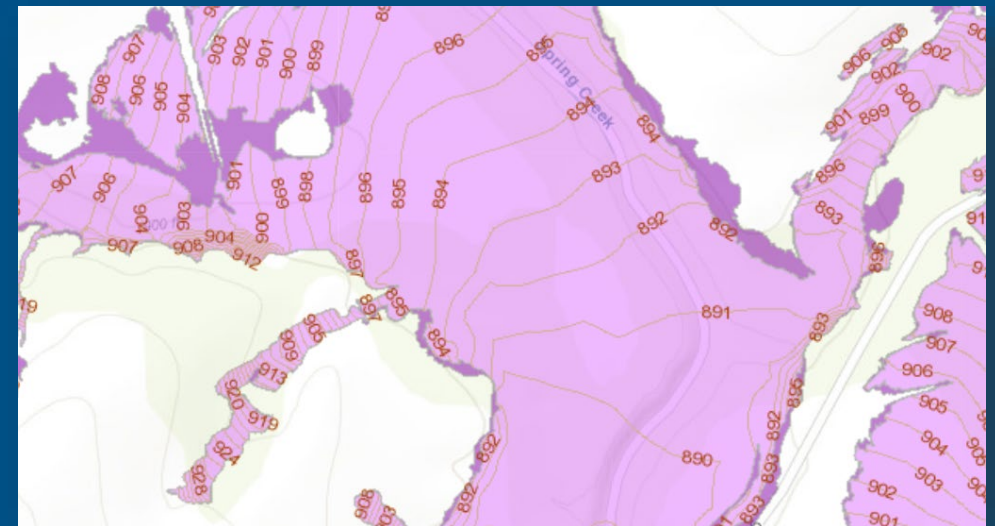
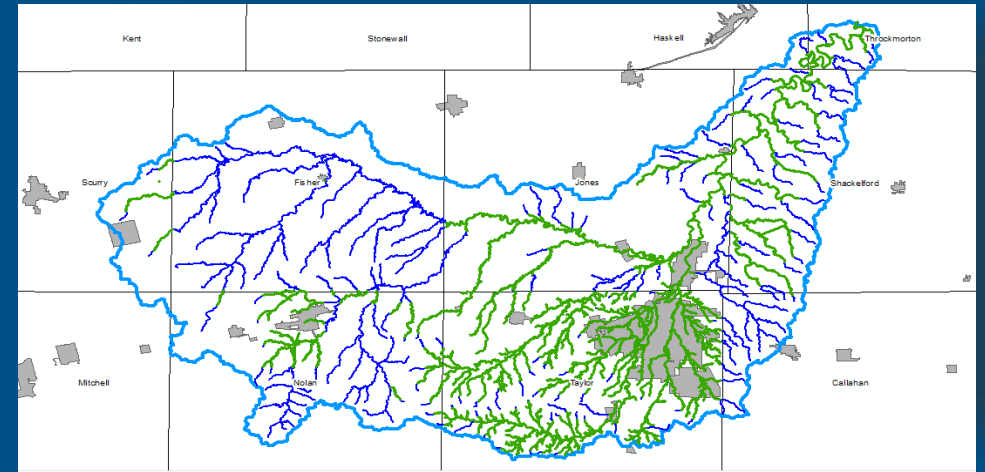
# Base Level Engineering - BLE

## What is it?

- Automated flood modeling and mapping technique
- Watershed-scale depiction of flood risk
- Interactive and downloadable datasets
- Starting point – can be refined

## What are the benefits of 2D BLE?

- Improved efficiency/cost effectiveness
- Simplifies the development and updating models through automation and incorporation of geospatial data
- Can be produced much faster – 1 week vs 3-4 weeks for hydraulic model development
- Provides WSELs for Zone As
- Allow R6 to provide model-backed data to large areas – many had only paper maps or no maps
- More accurate output by modeling basin-wide through improved continuity/tie-ins



# Base Level Engineering – What Mapping Products are Developed?

## Approach

- 1D and 2D modeling using HEC-RAS – **all 2D since 2021 in R6**
- High Resolution elevation data required
- Manual XS and grid adjustments
- XS added near stream crossings
- Regression Equations – 1D
- Rain-on-Grid – 2D
- No structure data, but can be refined when needed

## Products

- Hydraulic Engineering Models  
**10%, 4%, 2%, 1%, 1%+, 1%-, 0.2%**
- Estimated Flood Extents 10%, **1% and 0.2%**
- Estimated Water Surface Grids **1% and 0.2%**
- Estimated Flood Depth Grids **1% and 0.2%**
- Optional Layers **HAZUS, Point file (Choke Points, Update Areas), Freeboard Grids**



# Guidance for Flood Risk Analysis and Mapping

Base Level Engineering (BLE)  
Analysis and Mapping

November 2021



FEMA

## Base Level Engineering is a Watershed Approach

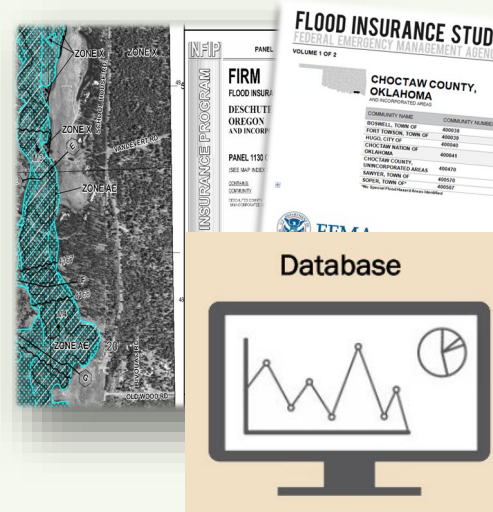
- BLE was created as a watershed approach in 2014.
  - Allows use of updated flood risk information for unmapped areas or those that have paper maps.
  - Delivers updated flood risk information in advance of new flood maps.
  - Can be adopted any time for floodplain management.
  - Provides basic engineering models which can be further refined.
- BLE can be used for creating digital flood maps where only paper ones or no maps existed before.

# FEMA's Mapping Program

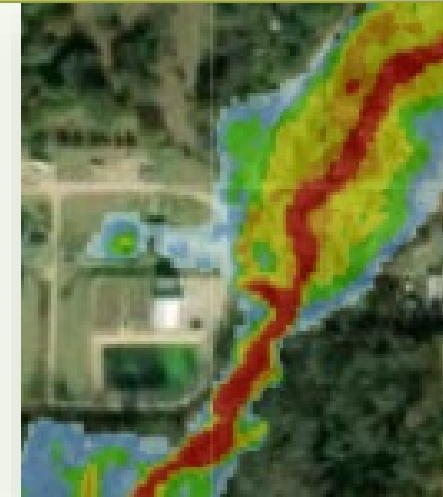
- Forms the basis of the NFIP regulations and flood insurance requirements.
- Communities agree to adopt regulatory flood maps and the data used to produce them.



At a minimum, your community should manage development wherever known flood risk exists.



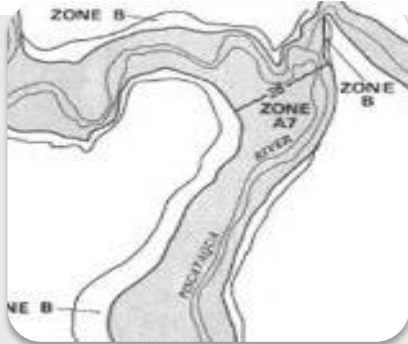
FEMA provides communities with maps and data showing their areas of increased flood risk.



FEMA may also provide other datasets that help communities manage development.



# Flood Mapping Program Evolution



1985

Community Based  
Multiple Maps  
Converted Maps  
Mismatched  
Inventory



2000

Orthos  
Two Color  
County/ Parish-  
wide Maps  
Digital Map

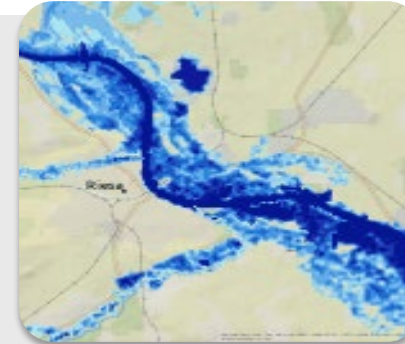
Map Modernization



2010

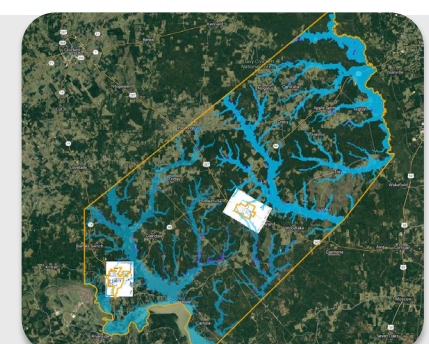
Multi-color  
Flood Risk  
Datasets (select  
streams)  
County/ Parish  
Digital Map

Risk MAP



2016

Base Level  
Engineering  
Flood Risk  
Datasets for  
Watersheds  
Viewer with  
Download



2023

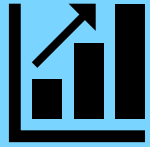
Mapping the  
Unmapped using  
BLE  
Developing 2D BLE  
everywhere



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Federal Emergency Management Agency

# Aligning Regional Objectives with HQ Priorities



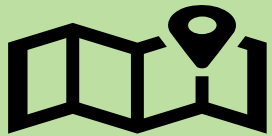
## Meet National Metrics through prioritized Regional Investments

- Priority #2: Advancing On-going Risk MAP Projects
- Priority #3: Advance Remaining Statute Requirements



## Empower communities with risk information

- Create an informed public that is “risk aware”
- Support local capability and capacity building
- Align and engage partnerships to create efficiencies and build a network of practitioners



## Provide data and support to improve local floodplain management

- Support Communities through training on local use and adoption of these data
- Offer technical assistance through an integrated team
- Support Mitigation Actions to reduce long term risk



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Federal Emergency Management Agency

## Regional Investments in 2023

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- Finishing those projects already in the “pipeline”
- Producing 2D Base Level Engineering
- Reducing our paper map inventory (PIRs)

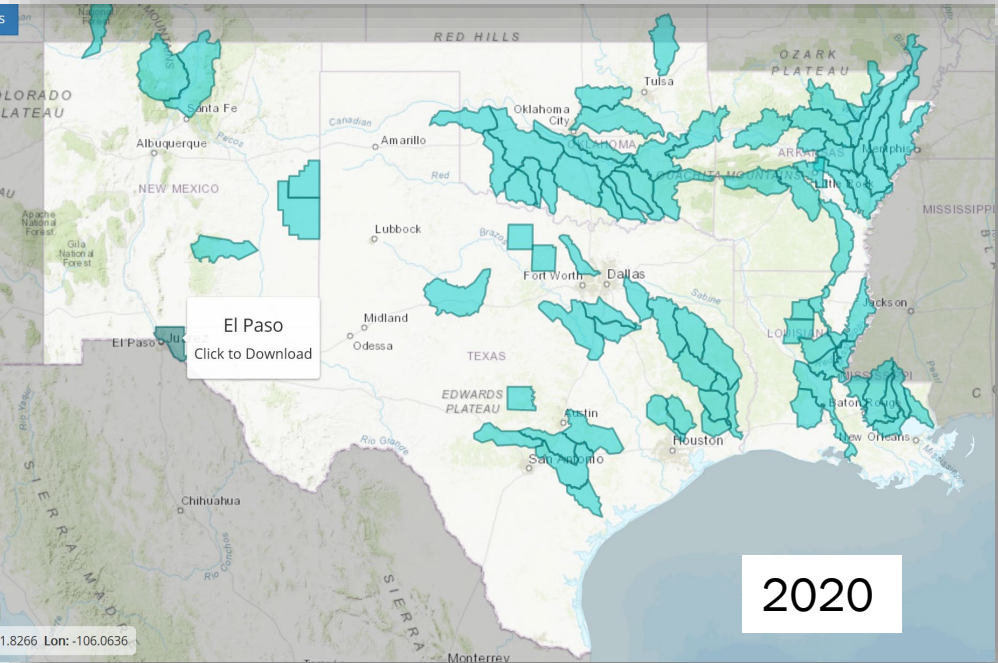
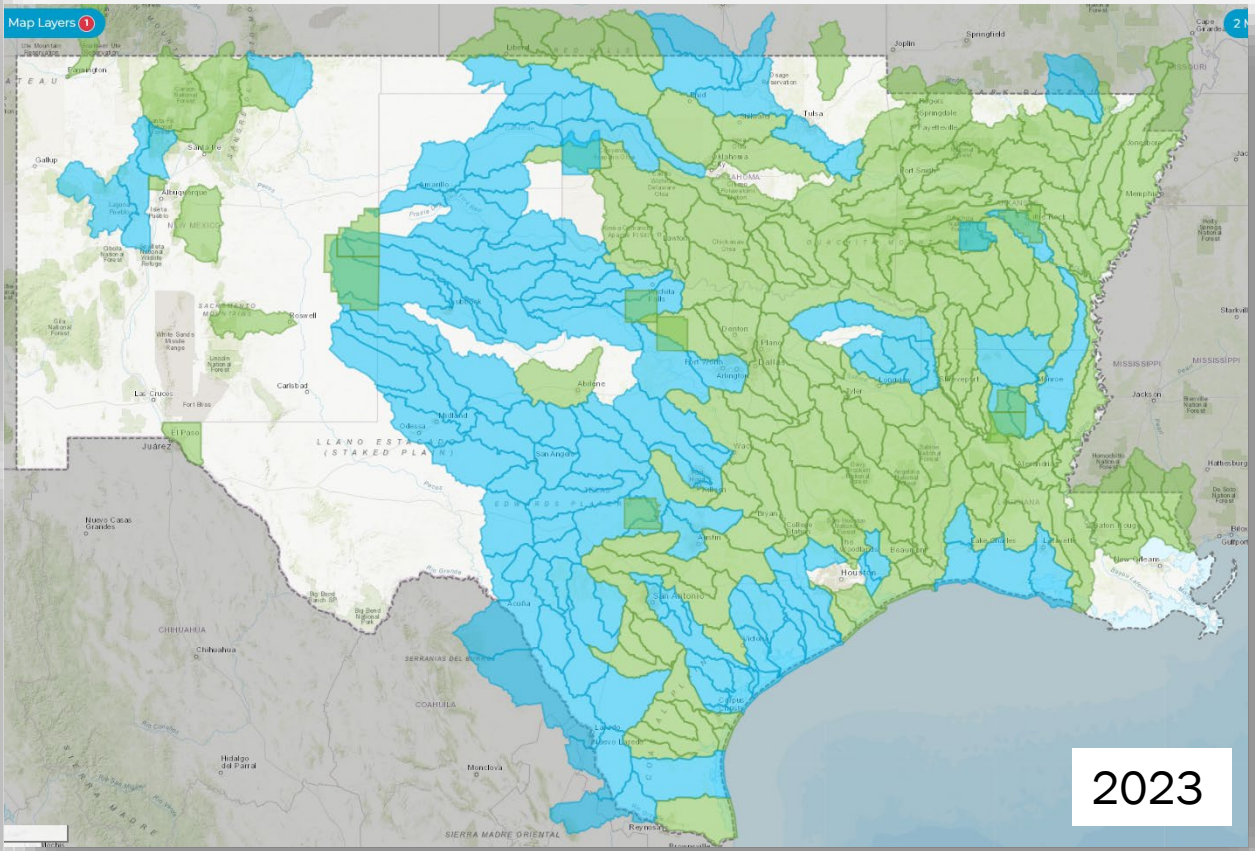


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# BLE Availability in Region 6





# Estimated Base Flood Elevation (estBFE) Viewer

Welcome to the  
**Estimated Base Flood Elevation Viewer**

Base Level Engineering assessments are produced using high resolution ground data to create technically credible flood hazard information that may be used to expand and modernize FEMA's current flood hazard inventory.

**High Flood Risk**

This location is in a 1% (100 year) flood zone.

[View Report](#)

**Property Look Up**

Where data are available, produce a property-specific report with estimated base flood information.

[What's My Flood Risk?](#)

**View Base Level Engineering Data**

Access all available Base Level Engineering data without GIS software.

[I Want to Explore](#)

**Download Datasets & Models**

Download the Base Level Engineering data presented in the viewer.

File Name	Size	Download
12030106_Models.zip	383.9 MB	<a href="#">Download</a>
12030106_Depth01.zip	82.8 MB	<a href="#">Download</a>
12030106_Depth02.zip	91.3 MB	<a href="#">Download</a>
12030106_Elev01.zip	19.5 MB	<a href="#">Download</a>
12030106_Elev02.zip	20.1 MB	<a href="#">Download</a>
12030106_VectorData.zip	263.7 MB	<a href="#">Download</a>

[I Want to Download](#)

3 1 2

<https://webapps.usgs.gov/infrm/EstBFE/>

 Available

 In Progress



# View the Base Level Engineering Data

FEMA

Estimated Base Flood Elevation (estBFE) Viewer

Report Legend 9 Map Layers 5

data are available there.

OR

My Location

Click this button to zoom the map to your actual location. A popup will appear and you can create a report when BLE data are available there.

OR

Map Click

Zoom in to your area of interest. Click this button and then the map. A popup will appear and you can create a report when BLE data are available there.

Click on the center of the roof of your home or the most upstream point of your structure.

Glossary Quick Start

Notifications Hover tips About

5 km 5 mi Scale 202,227

Map Layers 5 1 Map View

<https://webapps.usgs.gov/infrm/EstBFE/>



# Download the Data

**Study Area Information**

**Denton**

HUC8 / County Name	Denton
HUC8 / County FIPS Identifier	12030104
BLE Status	Data Available
Planned for Funding (Fiscal Year)	N/A
Project Initiated (Fiscal Year)	N/A
BLE Data Available Date	N/A

ⓘ Dates shown indicate the target date for data availability through the Estimated BFE Viewer. These dates will be monitored as projects are progressing and updated as needed. If the watershed of interest is not shown as available or in progress, please contact your State POC to determine the current prioritization of the area you are interested in. State POCs can be found at <https://infrm.us>

[Download Datasets & Models](#)

Zoom Close

## Products

- Hydraulic Engineering Models: 10%, 4%, 2%, 1%, 1%+, 1%-, 0.2%
- Estimated Flood Extents: 10%, 1% and 0.2%
- Estimated Water Surface Grids: 1% and 0.2%
- Estimated Flood Depth Grids: 1% and 0.2%
- Additional Purchased (R6)
  - HAZUS – Level 2 Analysis
  - Point file (Choke Points, Survey Support and Update Areas)
  - Freeboard Grids

<https://webapps.usgs.gov/infrm/EstBFE/>

# Run a Site-Specific Report

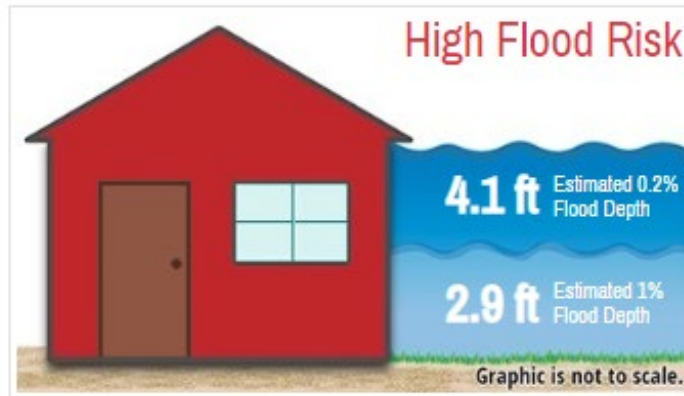
The screenshot displays the FEMA Estimated Base Flood Elevation (estBFE) Viewer interface. The top navigation bar includes the FEMA logo and the text 'Estimated Base Flood Elevation (estBFE) Viewer'. On the left side, there are three options for generating a report: 'Report', 'My Location', and 'Map Click'. The 'Map Click' option is highlighted with a yellow border. Below these options, there are instructions for using the 'Map Click' feature: 'Zoom in to your area of interest. Click this button and then the map. A popup will appear and you can create a report when BLE data are available there.' and 'Click on the center of the roof of your home or the most upstream point of your structure.' The main map area shows a topographic map of Hemphill, Georgia, with flood zones overlaid in purple and pink. A popup window titled 'Map Click Location' is displayed over the map, indicating 'High Flood Risk' and stating 'This location is in a 1% (100 year) flood zone.' The popup also includes a 'View Report' button and 'Zoom' and 'Close' options. The right side of the interface shows a satellite view of the same area, with flood zones overlaid in a color-coded manner. The bottom of the interface includes a scale bar (3 km, 2 mi), a scale of 86,669, and navigation controls like 'Glossary', 'Quick Start', 'Notifications', 'Hover tips', and 'About'.

<https://webapps.usgs.gov/infrm/estBFE/>

# Report Features

Flood Event	Estimated Flood Depth*	Estimated Base Flood Elevation*
1 Percent (100 Year)	2.9 feet above land surface	496.1 feet NAVD 1988
0.2 Percent (500 Year)	4.1 feet above land surface	497.2 feet NAVD 1988

\* The information included in this report is based on the location marker shown in the map. Results are not considered an official determination.

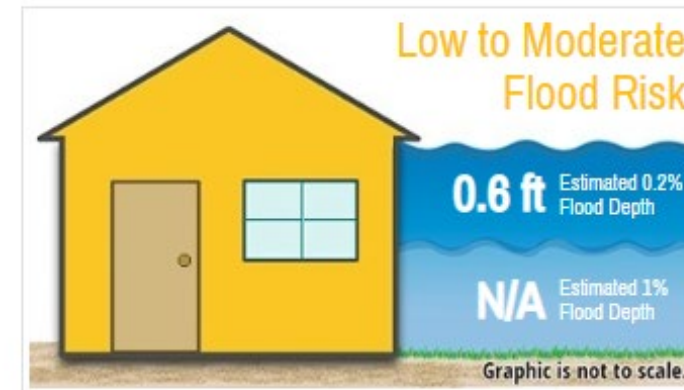


1% and 0.2%  
Estimated Flood  
Depths values

1% and 0.2%  
Estimated Flood  
Depths & Estimated  
BFE values

Flood Event	Estimated Flood Depth*	Estimated Base Flood Elevation*
1 Percent (100 Year)	No Data	No Data
0.2 Percent (500 Year)	0.6 feet above land surface	498.7 feet NAVD 1988

\* The information included in this report is based on the location marker shown in the map. Results are not considered an official determination.





# Resources and Training

## Base Level Engineering Resource Library

[www.fema.gov/about/organization/region-6/base-level-engineering-ble-tools-and-resources](http://www.fema.gov/about/organization/region-6/base-level-engineering-ble-tools-and-resources)

<https://www.fema.gov/flood-maps/tools-resources/risk-map/base-level-engineering>

## 3-Part BLE Training Video

[https://www.youtube.com/playlist?list=PLkAxXt8OFI8CJkv7R7xMd99Cu\\_oKmd14A](https://www.youtube.com/playlist?list=PLkAxXt8OFI8CJkv7R7xMd99Cu_oKmd14A)

## Virtual Brown Bag Training

<https://www.eventbrite.com/e/fema-region-6-virtual-brown-bag-vbb-tickets-392536145177>

### HOW2 Use BLE Data for Local Permitting

The BLE Use Matrix

As a participating community in the National Flood Insurance Program, the minimum standards outlined in the Code of Federal regulation require communities to (1) permit all development, (2) review all proposed development, and (3) assure that development activities will be built in a manner that will be reasonably safe from flooding. Developments in excess of 5 lots or 50 acres are required to determine a Base Flood Elevation (BFE) - 44CFR60.3(b)(3). This document will help you determine how to use BLE data to assist your local permitting efforts.



FEMA works closely with State, Regional and Local entities to educate and support local floodplain management activities. Base Level Engineering is information made available for local use. The State of Arkansas Natural Resources Division created the BLE use matrix/tool included in this HOW2 document. The approach is transferable and usable by all NFIP communities; these tools may be used to support and inform local permitting activities.

1. Locate your project area on the current effective FIRMs. Effective, historic, preliminary and pending FIRMs may be accessed on FEMA's Map Service Center website at <https://msc.fema.gov> or the National Flood Hazard Layer Viewer at <https://msc.fema.gov/nflh>.  
→ Create a FIRMette with the on-line tools to keep for your records.
2. Locate your project/structure with the Estimated Base Flood Elevation Viewer. Access the free interactive portal at: <https://webapps.usgs.gov/infrm/estBFE/>. Once you have accessed the site, review the DISCLAIMER, click OK. You will be greeted with a screen, select Property Look-Up from the three available options. On the left of the screen, in the REPORT tab enter the location, street address or latitude/longitude of the project site in the cell available.



Once you are zoomed near the structure of interest, place your cursor on the center of the location of interest and determine if the project area or structure is in an area identified as prone to flooding. Create a report for the site location.

3. Review the reports created and use the matrix on the reverse to identify how the Base Level Engineering data may be used. If you still have additional questions, please contact your State NFIP coordinator or your local permitting or floodplain administrator with your questions. For a list of NFIP State Coordinators, reference the ASFPM resource list at: [www.floods.org/membership-communities/connect/state-floodplain-managers-ecs/](http://www.floods.org/membership-communities/connect/state-floodplain-managers-ecs/).

### BASE LEVEL ENGINEERING

Flood data to expand local risk awareness



### WHAT IS BASE LEVEL ENGINEERING?

Base Level Engineering produces quality data. The Base Level Engineering production approach combines higher ground elevation data, and modeling technology advancements to create engineering models and flood hazard data. Analyses are produced at a large scale, like a watershed, as opposed to targeting individual stream reaches. The hazard information prepared is based off engineering models that determine flood elevations along each stream reach studied. The data prepared provides flood hazard information to community officials and allows them to interact with analysis results and review areas identified as prone to flooding.

Base Level Engineering increases public awareness. Producing and sharing this data provides FEMA an opportunity to broaden and expand risk awareness conversations with local communities, ultimately strengthening disaster resilience, reducing public spending on recovery efforts after a flood event. The Estimated Base Flood Elevation Viewer, an web portal, allows Federal, State, Regional, local entities, industry professionals, and the public at large to interact with Base Level Engineering results. This tool increases FEMA's ability to present comprehensive flood hazard information public, providing additional risk assessment resources where there are currently gaps in the current national flood data inventory.

Base Level Engineering will lead to flood risk reduction. Communities can access and use data prior to updates to their regulatory Flood Insurance Rate Maps (FIRMs). Once a Base Level Engineering assessment is completed, FEMA releases the flood risk information on the Estimated Base Flood Elevation Viewer (<https://go.usa.gov/xsGdn>), providing flood risk information that may be immediately used for community floodplain management activities, local land use discussions, all-hazard mitigation planning, and identification of mitigation strategies, as well as providing a basis for more informed community development. The datasets may be used to inform future land use decisions, support grant submissions, generate flood vulnerability assessments, prioritize flood risk reduction projects, evaluate, design and prioritize capital improvement projects. The approach ultimately will allow FEMA to build a more robust network of flood risk information, an expedited process to update regulatory products and enable future expansion to risk-based analysis and future risk scenario modeling opportunities.



**BASE LEVEL ENGINEERING**  
Flood data to expand local risk awareness

### THE ESTIMATED BASE FLOOD ELEVATION VIEWER

**What is Base Level Engineering?**  
An investment approach allowing creation of flood hazard data. This approach expands the availability of information to communities currently untrapped and unmodernized.

Engineering analysis across land areas, using high-tech modeling software and high resolution ground data to produce credible engineering analysis for thousands of miles of stream at a time.

Data informing FEMA's continuing assessment of the flood information shown on the nation's FIRMs.

Expedient data delivery, providing useable flood information to communities far ahead of regulatory map updates.

Skeleton engineering models that can be further refined by engineering and development industry professionals working with both FEMA and local communities.

The current inventory of Flood Insurance Rate Maps (FIRMs) provides regulatory flood hazard information for approximately 1.3 million of the nation's 4.0+ million miles of stream. More than half of the nation's streams do not have readily available flood hazard information for individuals or communities to accurately assess and understand the potential for flooding in their area.

Base Level Engineering watershed assessments are being performed across the nation in an effort to increase the availability of flood hazard information. Once assessments are completed, thousands of engineering models are compiled into an expanded collection of spatial data allowing this information to be easily shared with the public.

The Estimated Base Flood Elevation Viewer (available at <https://webapps.usgs.gov/infrm/estBFE/>) is an interactive web portal that transforms thousands of models and data results into a few datasets that provide users with a variety of useable and meaningful information. Users can review estimated flood extents by three different event scenarios, and can review possible flood depths in the vicinity of their homes using this tool.

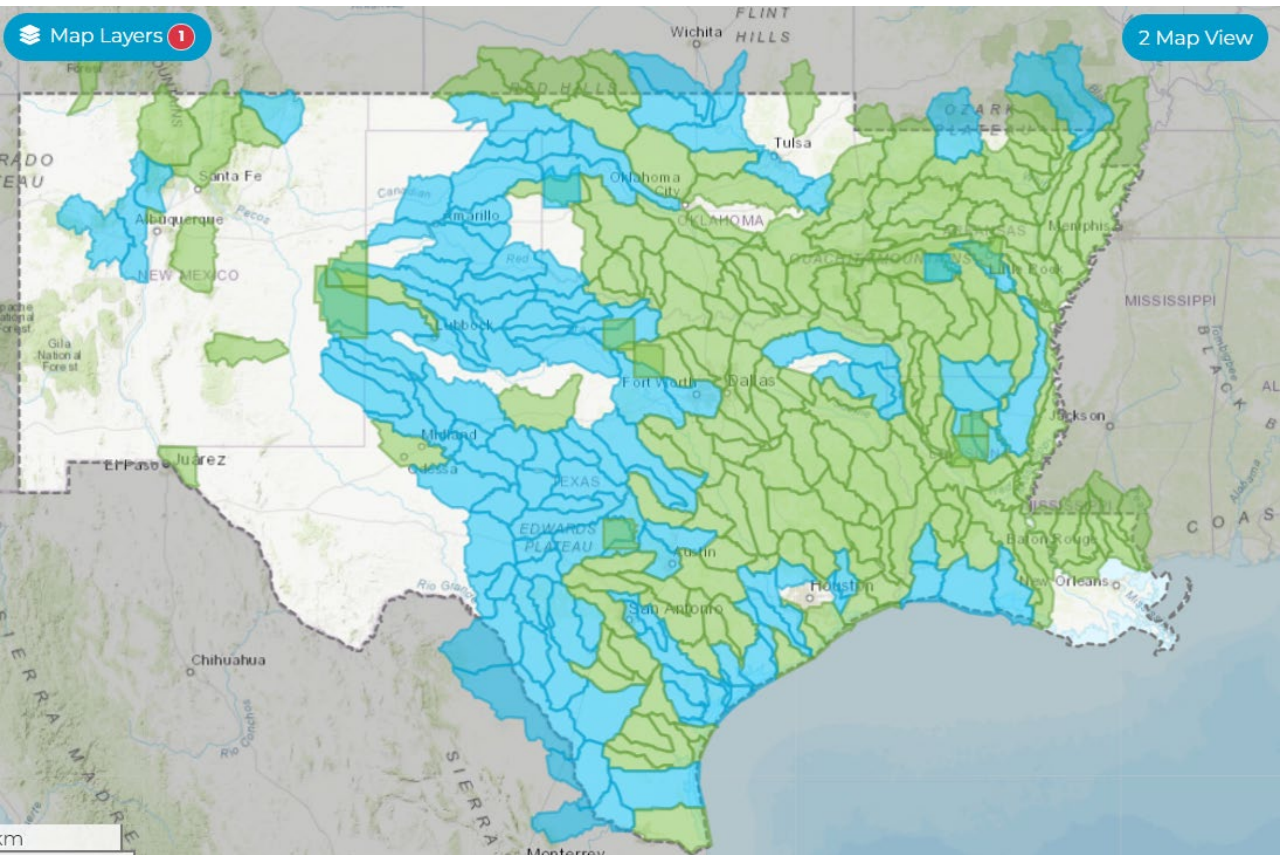
Structures and land areas within the estimated flood 1% annual chance extent are identified to have HIGH flood risk. Site specific reports provide individual results based on the user identified location. The estimated flood elevations and flood depths are provided in easy-to-understand graphics identifying an estimate of the flood depth for the user.

### BLE Data Download Reference Guide

The Base Level Engineering database is broken into a number of pieces for download through the Estimated Base Flood Elevation (EstBFE) Viewer available at: <https://webapps.usgs.gov/infrm/estBFE/>

But what is included in each download and what software do I need to review and interact with the information I download? If you have these questions, this flash card can help you.

Name of Data Set	File Name	Description
HECRAS models	HUC8#_Models.zip	HEC-RAS hydraulic models for all streams studied in Base Level Engineering assessment. Use HOW2 Find the Right HEC-RAS Model for tips to find the model you need. Detailed models from FIRMs are not included.
1% event depths, raster	HUC8#_Depth01.zip	Flood depth elevations in a gridded format for the 1% storm event.
0.2% event depths, raster	HUC8#_Depth002.zip	Flood depth elevations in a gridded format for the 0.2% storm event.
1% event elevations, raster	HUC8#_Elev01.zip	Top of water surface elevations in a gridded format for the 1% storm event.
0.2% event elevations, raster	HUC8#_Elev002.zip	Top of water surface elevations in a gridded format for the 0.2% storm event.



# Questions?



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