Flood Risk Report

Lower Sabine Watershed

HUC-8: 12010005

FEMA Case Number: 22-06-0013S

August 2025

FEMA

Project Area Community List in Scope

Community Name
Beauregard Parish (Unincorporated Areas)
Calcasieu Parish (Unincorporated Areas)
Cameron Parish (Unincorporated Areas)
Sabine Parish (Unincorporated Areas)
Vernon Parish (Unincorporated Areas)
Village of Anacoco
Village of Fisher
Village of Florien
Town of Hornbeck
City of Leesville
Town of Merryville
Town of New Llano

Flood Risk Report History

Version Number	Version Date	Summary
v1.0	08/06/2025	Discovery and Flood Risk Report

Preface

The Department of Homeland Security, Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states and local communities with flood risk information, datasets, risk assessments, and tools that they can use to increase their resilience to flooding and better protect their residents. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, Risk MAP transforms the traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks.

The Flood Risk Report (FRR) is one of the tools created though the Risk MAP program. An FRR provides non-regulatory information to help local officials, floodplain managers, planners, emergency managers, and others. Local, federal, and state officials can use the information in the FRR to establish a better understanding of their flood risk, take steps to mitigate those risks, and communicate those risks to residents and local businesses.

The FRR serves as a guide when communities update local hazard mitigation plans (HMPs), community comprehensive plans, and emergency operations and response plans. It is meant to communicate risk to officials and inform them of the modification of development standards, as well as assist in identifying necessary or potential mitigation projects. The FRR extends beyond community limits to provide flood risk data for the Lower Sabine watershed.

Flood risk is always changing, and studies, reports, or other sources may be available that provide more comprehensive information. This report is not intended to be the regulatory nor the final authoritative source of all flood risk data in the watershed. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the project area.

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Executive Summary

The Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides communities with flood information to help them understand their current flood risk and make informed decisions about taking action to become stronger and more resilient in the face of future risk. The Risk MAP process provides communities with new or improved information about their flood risk based on watershed models that use information from local, regional, state, and federal sources. Communities can use the resulting tools and data to enhance mitigation plans and better protect their residents.

This report is one such tool for communities impacted by an updated flood hazard analysis of the lower Sabine Hydrologic Unit Code 8 (HUC-8) watershed. The FRR has two goals: (1) **inform communities of their risks** related to certain natural hazards, and (2) **enable communities to act** to reduce their risk. It is intended to assist federal, state, and local officials with the following:

- Updating local Hazard Mitigation Plans and community comprehensive plans
- Updating emergency operations and response plans
- Communicating risk
- Informing the modification of development standards
- Identifying mitigation projects.

Most importantly, during this phase of the process, communities are encouraged to review the flood hazard changes closely and provide feedback to FEMA Region VI based on their local knowledge and any additional data available.

About the FEMA Risk Mapping, Assessment, and Planning (Risk MAP) Program

Flood risk is continually changing over time due to factors such as new building and development and weather patterns. The goal of FEMA's Risk MAP program is to work with federal, state, tribal, and local partners to identify and reduce flood risk across communities. These projects are conducted using watershed boundaries and bring together multiple communities to identify broader mitigation actions and create consistency across the watershed. The program provides resources and support tailored to each community to help mitigate their risk and work towards a reduction in risk and future loss.

Through coordination and data sharing, the communities in the watershed work as partners in the mapping process. In addition to providing data, the communities can also provide insight into flooding issues and flood prevention within their areas. To prepare for a future study and assist in mitigation, FEMA provides several data sources, including information from the community, such as the following:

- Areas of repeated flooding and insurance claims
- Future development plans
- Areas of low water crossings
- High water marks from recent flooding events
- Areas of evacuation during high water
- Master drainage plans, flood risk reduction projects, and large areas of fill placement
- Local flood studies
- Other flood risk information

For more information about ways communities can act or take advantage of available resources, please review the attached appendices.

FEMA provides communities with Base Level Engineering (BLE) data for select watersheds during the Risk MAP process. BLE is a form of automated hydrologic and hydraulic modeling which, when completed, can provide modeled flood hazard data for all flooding sources within the HUC-8 watersheds. Knowing the extent of flooding during the 1-percent-annual-chance flooding event supports both risk reduction efforts and more resilient community planning. Completed BLE data is provided to watershed communities for planning, risk communication, floodplain management, and permitting activities, and to inform future flood study needs. BLE is large scale watershed-based modeling that lacks the detail of Zone AE modeling such as road crossings and the effects of routing storage. **BLE does not replace Zone AE data and should be used for comparison purposes only in these areas.**

For the Lower Sabine watershed BLE datasets and products, see Mapping Information Platform (MIP) case number 22-06-0013S or visit the Interagency Flood Risk Management (InFRM) estimated Base Flood Elevation (BFE) Viewer. For a review of these BLE products, see Appendix III.

About the Lower Sabine Watershed

The Louisiana Department of Transportation and Development (LADOTD) became a FEMA Cooperating Technical Partner (CTP) in the Fiscal Year 2015 (FY15). In 2021, LADOTD contracted with FEMA to provide Risk MAP Discovery for portions of the Lower Sabine HUC-8 watershed located in Louisiana. The project area covers the portions of parishes within the Lower Sabine HUC-8 watershed: Beauregard, Calcasieu, Cameron, Sabine, and Vernon Parishes. Though some hydrologically and hydraulically significant data in the Texas section of the HUC is included to provide a full picture of engineering considerations in the watershed. It is important to note that only the part of the HUCs inside the Louisiana boundary are scoped for this contract. Location maps covering the study area can be found in Appendix I.

The oldest effective FEMA flood hazard mapping for the parishes within the Lower Sabine watershed was released in the 1990s. Most of the parishes received modernized parish-wide Digital Flood Insurance Rate Maps (DFIRMs) as part of FEMA's Map Modernization (MAP MOD) program in the 2010s. However, Sabine Parish still has paper maps with flood hazard data developed during the 1990s.

According to the 2023 National Land Cover Data, approximately 90 percent of the area in the Lower Sabine watershed is undeveloped, including evergreen forest, woody wetlands, and hay/pasture. Roughly eight percent of the area is developed, and the remaining two percent is open water. Over the past decade, the population overall has decreased slightly in the watershed.

The Sabine River runs through a diversity of landscapes and physical conditions, with dams (e.g. the Lower Anacoco Dam in the City of Caney), levees (e.g. the Orange County Levee System), and urbanized towns, villages, and unincorporated areas. Over the past two decades, the study area has experienced an increase in occurrence of flash floods. During the March 2016 storm, Southwest Louisiana experienced record-breaking rainfall as well as a record release from Toledo Bend Reservoir that crested at several locations including: the Sabine River in Shreveport, Louisiana and Toledo Bend Reservoir, Louisiana. The flooding caused millions of dollars in property damage in the study area. Additional background information for the Lower Sabine watershed is depicted in Appendix I.

In 2021, FEMA authorized LADOTD to leverage the previously completed BLE data to perform Discovery in the Lower Sabine watershed. The goal of the Discovery project is to work closely with communities to better understand local flood risks, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Introduction

Flood Risk

Floods are naturally occurring phenomena that can and do happen almost anywhere. In its most basic form, a flood is an accumulation of water over a normally dry area. Floods become hazardous to people and property when they inundate an area where development has occurred, causing losses. Mild flood losses may have little impact on people or property, such as damage to landscaping or the accumulation of unwanted debris. Severe flood losses can destroy buildings and crops and cause severe injuries or death.

Calculating Flood Risk

It is not enough to simply identify where flooding may occur. Even if people know where a flood might occur, they may not know the level of flood risk in that area. The most common method for determining flood risk, also referred to as vulnerability, is to identify both the probability and the consequences of flooding:

> **Flood Risk** (or Vulnerability) **= Probability x Consequences**; where
>
> **Probability** = the likelihood of occurrence
>
> **Consequences** = the **estimated** impacts associated with the occurrence on life, property, and infrastructure

The probability of a flood is the likelihood that it will occur. The probability of flooding can change based on physical, environmental, and/or engineering factors. Factors affecting the probability that a flood will have an impact on an area range from changing weather patterns to the existence of mitigation projects. The ability to assess the probability of a flood, and the level of accuracy for that assessment, are also influenced by modeling methodology advancements, better knowledge, and longer periods of record for the body of water in question.

The consequences of a flood are the estimated impacts associated with its occurrence. Consequences relate to human activities within an area and how a flood affects the natural and built environment.

The FRR has two goals: (1) inform communities of their risks related to certain natural hazards, and (2) enable communities to act to reduce their risk. The information within this Risk Report is intended to assist federal, state, and local officials to:

- **Communicate risk** – Local officials can use the information in this report to communicate with property owners, business owners, and other residents about risks and areas of mitigation interest.
- **Update local hazard mitigation plans and community comprehensive plans** – Planners can use risk information to develop and/or update hazard mitigation plans, comprehensive plans, future land use maps, and zoning regulations. For example, zoning codes can be changed to provide for more appropriate land uses in high-hazard areas.
- **Update emergency operations and response plans** – Emergency managers can identify high-risk areas for potential evacuation and low-risk areas for sheltering. Risk assessment information may show vulnerable areas, facilities, and infrastructure for which continuity of operations plans, continuity of government plans, and emergency operations plans would be essential.

- **Inform the modification of development standards –** Planners and public works officials can use information in this report to support the adjustment of development standards for certain locations.
- **Identify mitigation projects –** Planners and emergency managers can use this risk assessment to determine specific mitigation projects of interest. For example, a floodplain manager may identify critical facilities that need to be elevated or removed from the floodplain.

This FRR focuses on the Risk MAP BLE and the Discovery projects. It showcases risk assessments, which analyze how a flood hazard affects the built environment, population, and local economy to identify mitigation actions and develop mitigation strategies.

The information in this report should be used to identify areas for mitigation projects and to educate residents on the hazards that may affect them. The areas of greatest hazard impact are identified in the Areas of Mitigation Interest section of this report, which can serve as a starting point for identifying and prioritizing actions a community can take to reduce its risks.

Watershed Basics

Background

The Lower Sabine watershed is located on the border of Texas and Louisiana. These watersheds cover portions of Beauregard, Calcasieu, Sabine, and Vernon Parishes as well as parts of Jasper, Newton, and Orange Counties. See Figure 1 for an overview map of the Lower Sabine watershed. The watershed impacts 12 communities which includes an estimated 329,856 people across Louisiana. The total watershed size is approximately 2,643 sq. mi. The watershed size within the Louisiana state limits is approximately 1,231 sq. mi. of which approximately 141 sq. mi. is mapped floodplain. See Appendix I for figures showing effective floodplain locations in the Lower Sabine watersheds.

The BLE study covers the entirety of the HUC-8 watershed. However, LADOTD's Discovery effort focuses on the communities in Louisiana. Information relevant to the flooding sources within the watershed but outside the Louisiana state limits, including dams, levees, flash flood frequencies, and rainfall totals, will not be represented in the report.

The Sabine River flows from Greenville, Texas, through Lake Tawakoni, into Toledo Bend Reservoir that covers the Texas and Louisiana state line, down to Sabine Lake, and out to the Gulf of America. There are approximately 1,777 stream miles in the Lower Sabine watershed that drain all of the 31 HUC-12 watersheds within the study area. Flooding is highly dependent on rainfall and often follows tropical thunderstorms or hurricane events hitting the watershed. There is a increase in rainfall from north to south across the watershed with an average rainfall of 1.31 inches in Florien, LA to 2.16 inches in Leesville, Louisiana per https://www.usclimatedata.com/.

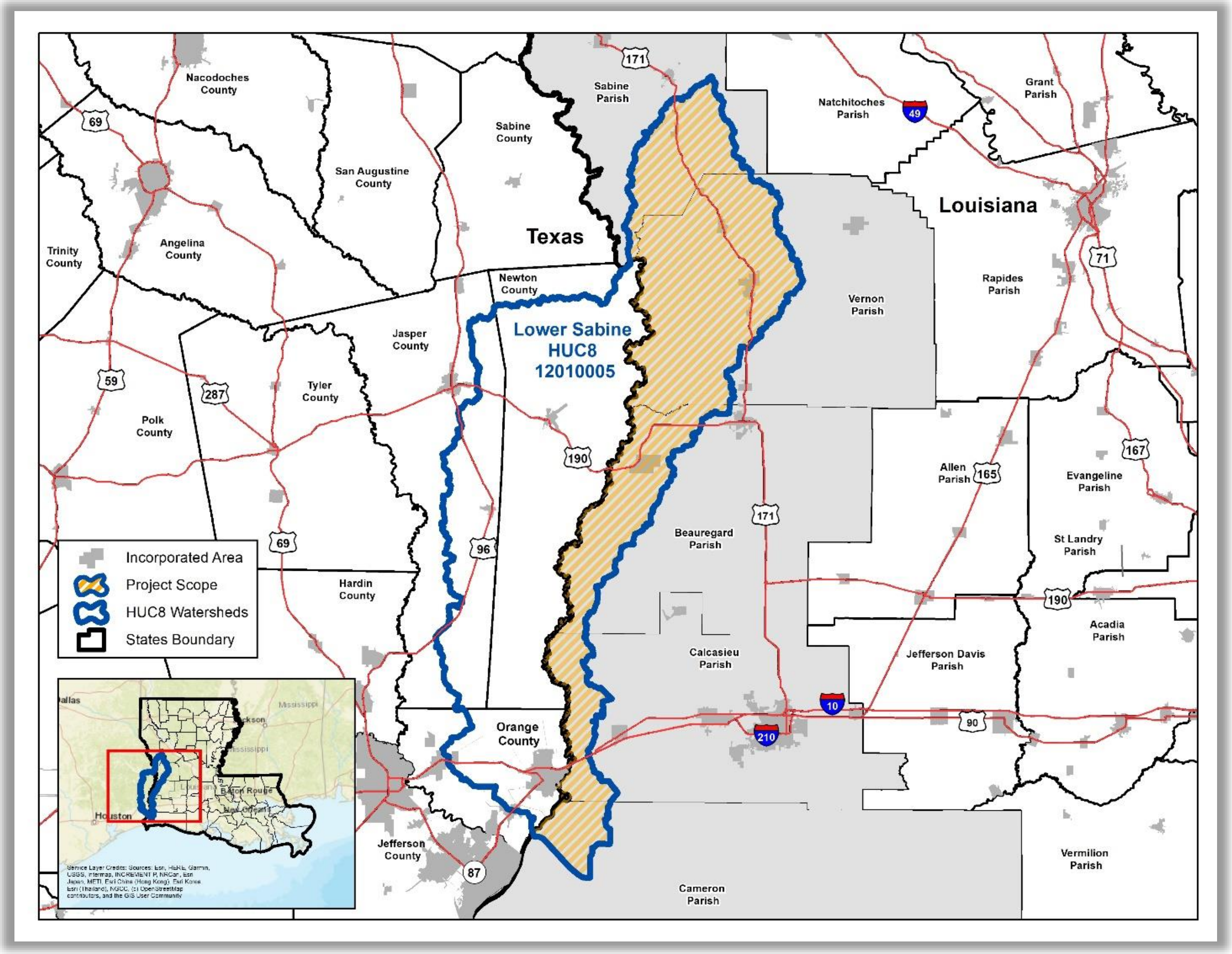


Figure 1: Overview Map of the Lower Sabine watershed

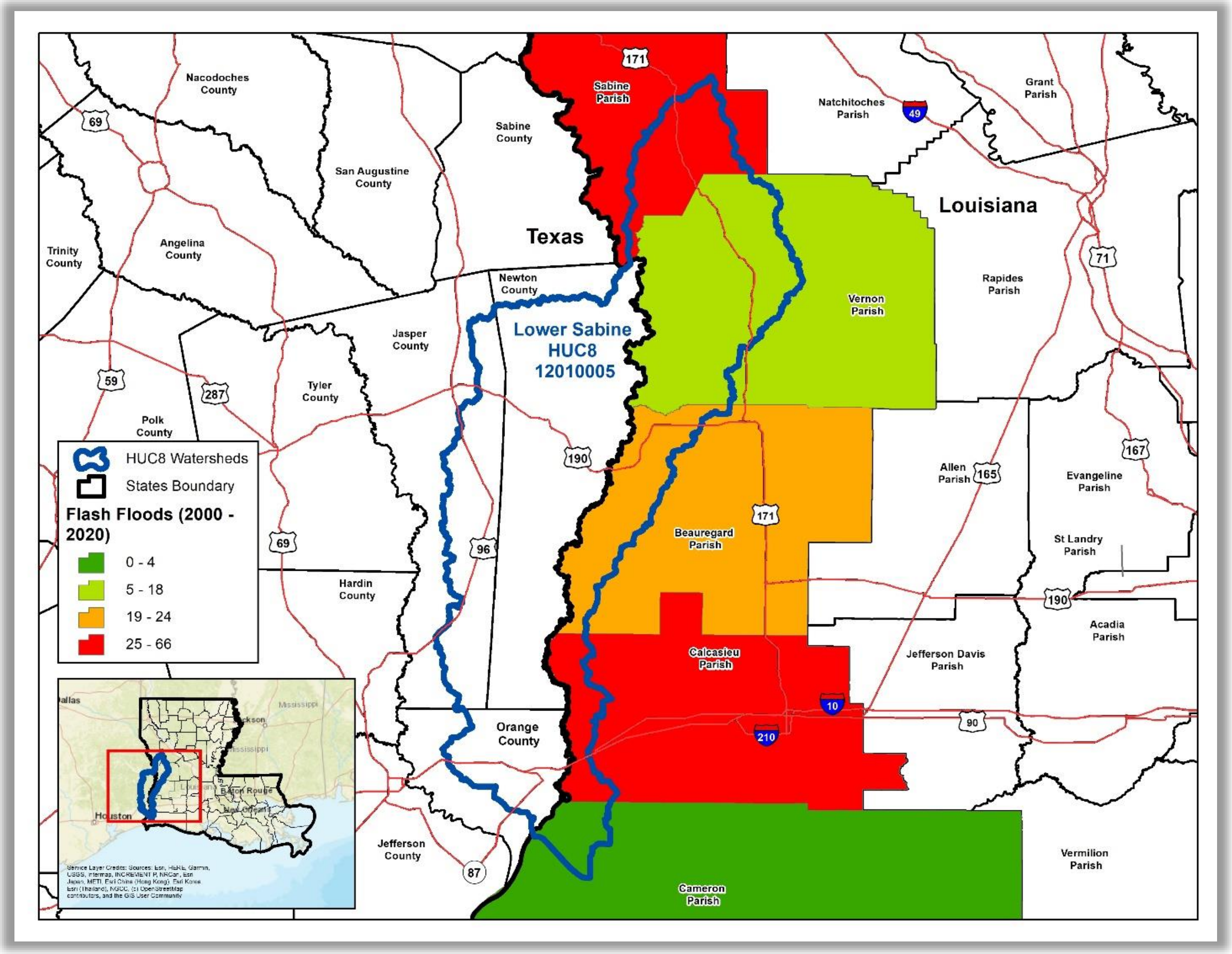


Figure 2: Flash Flood Incidents

The Lower Sabine watershed is mainly in the South Central Plains ecoregion of Southwestern Louisiana that consists of the following subregions: Floodplains and Low Terraces, Southern Tertiary Uplands, Flatwoods, Northern Humid Gulf Coastal Prairies, and Texas-Louisiana Coastal Marshes. The soils of the area consist of moderately drained Ultisols and Alfisols that have sandy, and loamy surface textures, as well as Alfisols, Inceptisols, Vertisols, Mollisols, Histosols, and Entisols that are poorly drained with clayey and loamy textures. Western Gulf Coastal Plains consist of mainly grasses, with live oaks, hackberries, and croplands in the area. Native trees of the area consist of variations of pine trees, oak trees, hickories, and sweet gums, but the South Central Plains ecoregion of Louisiana also holds many rare species of animals and plants for the state and the globe. The ecoregion’s landscape is cut by several small streams and the flow is often intermittent in the summer and early fall, while the marshes provide wintering grounds for globally significant populations. The land use is predominantly timber, but also has livestock grazing, poultry production, crawfish aquaculture, and oil and gas production.

The Sabine River is known for carrying high levels of rainfall and having the largest discharge volume of any river in the state of Texas. Figure 2 shows the number of flash floods per parish in Louisiana. Most of the flooding is in Calcasieu and Sabine Parish due to their proximity to the Toledo Bend Reservoir and the Sabine River. Within the parishes, approximately 153 flash flood events occurred from 2000 to 2020.

Population

A review of land cover changes and population growth patterns in the watershed revealed that minimal development and a steady decrease in population occurred from 2010 to 2020 in most of the Lower Sabine watershed. According to the United States Census Bureau, about half of every town and village decreased in population between 2010 and 2020 while the other half increased. The study area's population within Louisiana increased from 55,099 to 56,085, but a decrease of approximately 18 percent is shown due to a large decrease in Cameron although this parish only represents a small portion of the study area. In comparison, the total population of Louisiana increased by 2.7 percent in the same timeframe.

Since 2010, Beauregard Parish's population increased by approximately three percent and Calcasieu Parish's population increased by about 12 percent. All other communities experienced a decline in population. The largest population drop between 2010 and 2020 occurred in Cameron Parish, whose population dropped approximately 18 percent. Sabine Parish experienced a drop of approximately nine percent. Vernon Parish, experienced a drop of approximately seven percent. Individual communities as well as full parish outlooks can be found in the community snapshots in Appendix I. The towns and villages in the study area have a current population range of approximately 200 to 5,600. Assuming the average decrease rate experienced between 2010 and 2020, it is possible that the region population decrease by another 8.5 percent between 2020 and 2025. See Figure A5 and Figure A7 in Appendix I for a watershed population density map and a population change map, respectively.

Watershed Land Use

The Lower Sabine watershed is predominately evergreen forest, which makes up about 39 percent of its land area. Woody wetlands comprise another 22 percent of the watershed's land area, while the rest of the watershed consists of developed areas, open water, and patches of deciduous forests, mixed forests, hay/pasture, grassland, crops, barren land, and shrub. Excluding the combined areas of previously developed land and open water, roughly 2,379 sq. mi. of the Lower Sabine watershed has the potential for new development. Table 1 shows both population and land use within the Louisiana study area in the Lower Sabine watershed. See Figure A6 in Appendix I for a land cover map.

Table 1: Population and Area Characteristics

Risk Map Project	Total Population in Louisiana Study Area (2020)	Average % Population Growth Yearly (2010-2020)	Predicted Population (2025)	Land Area (sq. mi.)*	Developed Area (sq. mi.)	Open Water (sq. mi.)
Lower Sabine	56,085	-1.83	56,870	2,643	8.30	1.93

*Total Land Area includes land and water

National Flood Insurance Program (NFIP) Status and Regulation

To be a participant of the NFIP, all interested communities must adopt and submit floodplain management ordinances that meet or exceed the minimum NFIP regulations. These regulations can be found in the Code of Federal Regulations and most of the community ordinance requirements are in Title 44 parts 59 and 60. The level of regulation depends on the level of information available and the flood hazards in the area. The levels are as follows:

- A: The Federal Emergency Management Agency (FEMA) has not provided any maps or data – 60.3(a)
- B: Community has maps with approximate A zones – 60.3(b)
- C: Community has a Flood Insurance Rate Map (FIRM) with Base Flood Elevations (BFE) – 60.3(c)
- D: Community has a FIRM with BFEs and floodways – 60.3(d)
- E: Community has a FIRM that shows coastal high hazard areas (V zones) – 60.3(e)

To help mitigate the risk to areas where increased population and development are expected, communities can adopt (or exceed) the minimum standards of the NFIP. This is recommended as a proactive strategy to manage construction within the floodplain and avoid negative impacts to existing and future development. The Association of State Floodplain Managers (ASFPM) No Adverse Impact Floodplain Management is a good example.

To increase mitigation efforts and community flood awareness through potentially discounted premium rates, an NFIP community that has adopted more stringent ordinances or is actively completing mitigation and outreach activities is encouraged to consider joining the Community Rating System (CRS). The CRS is a voluntary incentive-based program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions.

Communities can review their current ordinances and reflect potential flood hazard changes by adopting updated ordinances early. This action can reduce future flood losses by affecting how substantial improvements or new construction are regulated. Figure A10 in Appendix 1 illustrates the NFIP flood losses within the project scope.

Hazard Mitigation Plan (HMP)

State and local governments must develop and adopt HMPs to be eligible for certain types of funding. To remain eligible, communities need to update and resubmit their plans every five years for FEMA approval. HMPs are created to increase education and awareness, identify strategies for risk reduction, and identify other ways to develop long-term strategies to reduce risk and protect people and property.

HMPs for Sabine Parish, Vernon Parish, Beauregard Parish, Calcasieu Parish, and Cameron Parish are set to expire in February 2027, February 2029, May 2026, September 2026, and January 2026, respectively.

HMPs effectively allow for FEMA to assess hazards identified through local, state, and federal partnerships and mitigation action items that communities have identified. These HMPs were used in the compilation and preparation of this report.

Community Rating System (CRS)

CRS is a voluntary incentive-based program that recognizes and encourages community floodplain management activities that communities undertake in addition to the minimum requirements they must meet when joining the NFIP. Individuals that carry flood insurance in a community that participates in the CRS program can receive a discount on their flood insurance premium. Discounts can range from five to 45 percent. As of October1, 2024, Calcasieu Parish is the only CRS participating community within the watershed. Table 2 depicts NFIP and CRS participation status and provides an overview of the effective flood data availability within the study area.

Table 2: NFIP and CRS Participation

Risk Map Project	Participating NFIP Communities / Total Communities*	Number of CRS Communities*	CRS Rating Class Range*	Average Years Since Latest FIRM Update*	Level of Regulations (44 CFR 60.3)
Lower Sabine	11/12	1	8	18	60.3(b) 60.3(c) 60.3(d)

*Counting only Louisiana Communities, includes Parish unincorporated areas.

Flood Insurance Rate Maps (FIRMs)

The average age of the effective FIRMs within the study watershed is 17 years. The oldest effective map panel is in Sabine Parish; it is 34 years old and has an effective date of August 1991. The newest effective maps in Beauregard Parish are seven years old with an effective date of January 2018. As of March 24, 2025, all communities except Sabine Parish have modernized parish-wide effective digital firms (DFIRMs).

Dams and Levees

As recorded by the United States Army Corps of Engineers (USACE) National Inventory of Dams (NID) datasets and the FEMA DFIRM databases, there are 32 dams in the Lower Sabine watershed. There are three dams in Beauregard Parish, two dams in Sabine Parish, and 12 dams in Vernon Parish. In Texas, there are two dams in Jasper County, eleven dams in Newton County, and two dams in Orange County, within the watershed area. Figure 3 shows the locations of dams and levees in the study watershed.

There are nine levees within the study area, located in Texas, of which all nine are non-accredited. There are five levees within Cameron Parish of which are non-accredited or do not have a public status available. The longest levee in the study area is the Orange County Levee System, located in Orange County, Texas with a length of 22.37 miles.

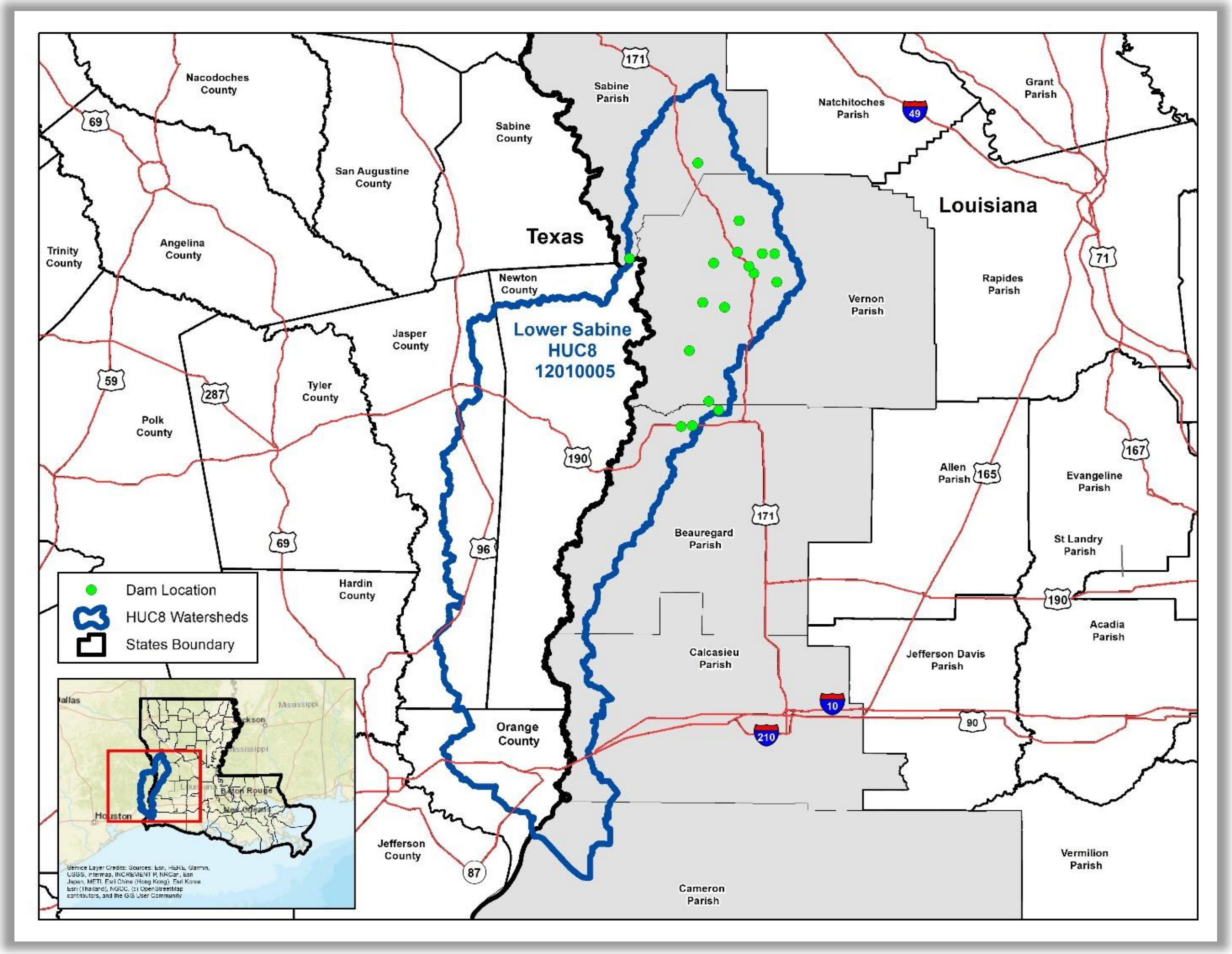


Figure 3: Dam and Levee Location Map for Lawer Sabine watershed within Louisiana

Over half of the dams are used for recreation, and other uses include hydroelectric and water supply. Most dams are privately-owned, but some are owned by the state government and local government. Seventy-two percent of these dams are classified as low hazard dams. The National Inventory of Dams (NID) has an estimated 32 dams in the study area. These NID dams are primarily used for recreation. The largest dams in the project area are the Toledo Bend Dam, Toledo Bend Saddle Dike 2, and Toledo Bend Saddle Dike 3, located in Sabine Parish and Newton County and can store up to 5,097,500 acre-feet of water within the reservoir. They were constructed in 1966 and are used for Hydroelectric purposes. Table 3 provides the characteristics of the dams identified in the entire study area.

Table 3: Risk Map Project Dam Characteristics

Risk Map Project	Total Number of Identified Dams	Number of Dams Requiring EAP	Percentage of Dams Without EAP	Average Years Since Inspection	Average Storage
Lower Sabine	32	20	65%	6.5	484,149

Project Phases and Map Maintenance

Background

FEMA manages several risk analysis programs, including Flood Hazard Mapping, National Dam Safety, the Earthquake Safety Program, Multi-Hazard Mitigation Planning, and the Risk Assessment Program, all of which assess the impact of natural hazards and lead to effective strategies for reducing risk. These programs support the Department of Homeland Security's objective to "strengthen nationwide preparedness and mitigation against natural disasters."

FEMA manages the NFIP, which is the cornerstone of the national strategy for preparing American communities for flood hazards. In the nation's comprehensive emergency management framework, the analysis and awareness of natural hazard risk remains challenging. A consistent risk-based assessment approach and a robust communication system are critical tools to ensure a community's ability to make informed risk management decisions and take mitigation actions. Flood hazard mapping is a basic and vital component for a prepared and resilient nation.

> *Flood-related damage between 1980 and 2013 totaled $260 billion [dollars], but the total impact to our Nation was far greater—more people lose their lives annually from flooding than any other natural hazard.*
>
> *FEMA, "Federal Flood Risk Management Standard (FFRMS)" (2015)*

In Fiscal Year 2009, FEMA's Risk MAP program began to synergize the efforts of federal, state, and local partners to create timely, viable, and credible information identifying natural hazard risks. The intent of the Risk MAP program is to share resources to identify the natural hazard risks a community faces and ascertain possible approaches to minimizing them. Risk MAP aims to provide technically sound flood hazard information to be used in the following ways:

- To update the regulatory flood hazard inventory depicted on FIRMs and the National Flood Hazard Layer
- To provide broad releases of data to expand the identification of flood risk (flood depth grids, water-surface elevation grids, etc.)
- To support sound local floodplain management decisions
- To identify opportunities to mitigate long-term risk across the nation's watersheds

How are FEMA's Flood Hazard Maps Maintained?

FEMA's flood hazard inventory is updated through several types of revisions.

Community-submitted Letters of Map Change (LOMCs)

First and foremost, FEMA relies heavily on the local communities that participate in the NFIP to carry out the program's minimum requirements. These requirements include the obligation for communities to notify FEMA of changing flood hazard information and to submit the technical supporting data needed to update the FIRMs.

Although revisions may be requested at any time to change information on a FIRM, FEMA generally will not revise an effective map unless the changes involve modifications to Special Flood Hazard Areas (SFHAs). Be aware that the best floodplain management practices and proper assessments of risk result when the flood hazard maps present information that accurately reflects current conditions.

Under the current minimum NFIP regulations, a participating community commits to notifying FEMA if changes take place that will affect an effective FIRM no later than 6 months after project completion.

Section 65.3, Code of Federal Regulations

Letters of Map Amendment (LOMAs)

The scale of an effective FIRM does not always provide the information required for a site-specific analysis of a property's flood risk. FEMA's LOMA process provides homeowners with an official determination on the relation of their lot or structure to the SFHA. Requesting a LOMA may require a homeowner to work with a surveyor or engineering professional to collect site-specific information related to the structure's elevation; it may also require the determination of a site-specific BFE. Fees are associated with collecting the survey data and developing a site-specific BFE. Local surveying and engineering professionals usually provide an Elevation Certificate to the homeowner, who can use it to request a LOMA. A successful LOMA may remove the Federal mandatory purchase requirement for flood insurance, but lending companies may still require flood insurance if they believe the structure is at risk.

FEMA-Initiated Flood Risk Project

Each year, FEMA initiates a number of Flood Risk Projects to create or revise flood hazard maps. Because of funding constraints, FEMA can study or restudy only a limited number of communities, parishes, or watersheds each year. As a result, FEMA prioritizes study needs based on a cost-benefit approach whereby the highest priority is given to studies of areas where development has increased, and the existing flood hazard data has been superseded by information based on newer technology or changes to the flooding extent. FEMA understands communities require products that reflect current flood hazard conditions to best communicate risk and implement effective floodplain management.

Flood Risk Projects may be delivered by FEMA or one of its Cooperating Technical Partners (CTPs). The CTP initiative is an innovative program created to foster partnerships between FEMA and participating NFIP communities, as well as regional and state agencies. Qualified partners collaborate in maintaining up-to-date flood maps. In FEMA Region VI, which includes the State of Louisiana, CTPs are generally statewide agencies that house the State Floodplain Administrator. However, some Region VI CTPs are also large river authorities, flood control districts, regional planning agencies, or cities. They provide enhanced coordination with local, state, and federal entities, engage community officials and technical staff, and provide updated technical information that informs the national flood hazard inventory.

Risk MAP has modified FEMA's project investment strategy from a single investment by fiscal year to a multi-year phased investment, which allows FEMA to be more flexible and responsive to the findings of the project as it moves through the project lifecycle. Flood Risk Projects are funded and completed in phases.

General Flood Risk Project Phases

Each phase of the Flood Risk Project provides both FEMA and its partner communities with an opportunity to discuss the data that has been collected and to determine a path forward. Local engagement throughout each phase enhances the opportunities for partnership, furthers the discussion on current and future risk, and helps identify local projects and activities to reduce long-term natural hazard risk.

Flood Risk Projects may be funded for one or more of the following phases:

- Phase Zero – Investment
- Phase One – Discovery
- Phase Two – Risk Identification and Assessment
- Phase Three – Regulatory Product Update

Local input is critical throughout each phase of a Flood Risk Project. More details about the tasks and objectives of each phase are included below.

Phase Zero: Investment

Phase Zero of a Flood Risk Project initiates FEMA's review and assessment of the inventories of flood hazards and other natural hazards within a watershed area. During the Investment Phase, FEMA reviews the availability of information to assess the current floodplain inventory. FEMA maintains several data systems to perform watershed assessments and selects watersheds for a deeper review of available data and potential investment tasks based on the following factors:

Availability of High-Quality Ground Elevation Data

FEMA reviews readily available and recently acquired ground elevation data. This information helps identify development and earth-moving activities near streams and rivers. Where necessary, FEMA may partner with local, state, and other federal entities to collect necessary ground elevation information within a watershed.

If The National Map - Advanced Viewer can provide high-quality ground elevation data that is both available for a watershed area and compliant with FEMA's quality requirements, FEMA and its mapping partners may prepare engineering data to assess, revise, replace, or add to the current flood hazard inventory.

Mile Validation Status within Coordinated Needs Management Strategy (CNMS)

FEMA uses the CNMS database to track the validity of the flood hazard information prepared for the NFIP. The CNMS database reviews 17 criteria to determine whether the flood hazard information shown on the current FIRM is still valid.

Communities may also inform and request a review or update of the inventory through the CNMS website at https://msc.fema.gov/cnms/. The Coordinated Needs Management Strategy (CNMS) Technical Reference (fema.gov) provides an overview of the online tool. Requests should be directed to the appropriate FEMA Regional Offices for review.

Local Hazard Mitigation Plans

Reviewing current and historic hazard mitigation plans provides an understanding of a community's comprehension of its flood risk and other natural hazard risks. The mitigation strategies within a local hazard mitigation plan provide a lens to local opportunities and underscore a potential for local adoption of higher standards related to development or other actions to reduce long-term risk.

Cooperating Technical Partner (CTP) State Business Plans

In some states, a CTP generates an annual state business plan that identifies future Flood Risk Project areas that are of interest to the state. The Louisiana Department of Transportation and Development (LADOTD) works to develop user-friendly data. In this project area, FEMA has worked closely with LADOTD to develop the project scope and determine the necessary project tasks.

Communities that have identified local issues are encouraged to indicate their data needs and revision requests to the State CTP so that they can be prioritized and included in the State Business Plans.

Possible Investment Tasks

After a review of the data available within a watershed, FEMA may choose to (1) purchase ground elevation data and/or (2) create some initial engineering modeling against which to compare the current inventory, also known as BLE modeling.

Phase One: Discovery

Phase One, the Discovery Phase, provides opportunities both internally (between the state and FEMA) and externally (with communities and other partners interested in flood potential) to discuss local issues with flooding and examine possibilities for mitigation action. This effort is made to determine where communities currently are with their examination of natural hazard risk throughout their community and to identify how state and federal support can assist communities in achieving their goals.

The Discovery process includes an opportunity for local communities to provide information about their concerns related to natural hazard risks. Communities may continue to inform the project identification effort by providing previously prepared survey data, as-built stream crossing information, and engineering information.

For a holistic community approach to risk identification and mapping, FEMA relies heavily on the information and data provided at the local level. Flood Risk Projects are focused on identifying (1) area where the current flood hazard inventory does not provide adequate detail to support local floodplain management activities, (2) areas of mitigation interest that may require more detailed engineering information than is currently available, and (3) community intent to reduce the risk throughout the watershed to assist FEMA's future investment in these project areas. Watersheds are selected for Discovery based on these evaluations of flood risk, data needs, availability of elevation data, regional knowledge of technical issues, identification of a community-supported mitigation project, and input from federal, state, and local partners.

Possible Discovery Tasks

Discovery may include a mix of interactive webinar sessions, conference calls, informational tutorials, and in-person meetings to reach out to and engage with communities for input. Data collection, interviews, and interaction with community staff and data-mining activities provide the basis for watershed-, community-, and stream-level reviews to determine potential projects that may benefit the communities. A range of analysis approaches are available to determine the extent of flood risk along streams of concern. FEMA and its mapping partners will work closely with communities to determine the appropriate analysis approach, based on the data needs throughout the community.

These potential projects may include local training sessions, data development activities, outreach support to local communities wanting to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

Phase Two: Risk Identification and Assessment

Phase Two (Risk Identification and Assessment) continues the risk awareness discussion with communities through watershed analysis and assessment. Analyses are prepared to review the effects of physical and meteorological changes within the project watershed. The new or updated analysis provides an opportunity to identify how development has affected the amount of stormwater generated during a range of storm probabilities and shows how effectively stormwater is transported through communities in the watershed.

Coordination with a community's technical staff during engineering and model development allows FEMA and its mapping partners to include local knowledge, based on actual on-the-ground experience, when selecting modeling parameters.

The information prepared and released during Phase Two is intended to promote better local understanding of the existing flood risk by allowing community officials to review the variability of the risk throughout their community. As FEMA strives to support community-identified mitigation actions, it also looks to increase the effectiveness of community floodplain management and planning practices, including local hazard mitigation planning, participation in the NFIP, use of actions identified in the CRS Manual, risk reduction strategies for repetitive loss and severe repetitive loss properties, and the adoption of stricter standards and building codes.

FEMA is eager to work closely with communities and technical staff to determine the current flood risk in the watershed. During the Risk Identification and Assessment phase, FEMA would like to be alerted to any community concerns related to the floodplain mapping and analysis approaches being taken. During this phase, FEMA can engage with communities and review the analysis and results in depth.

Possible Risk Identification and Assessment Tasks

Phase Two may include a mixture of interactive webinars, conference calls, informational tutorials, and in-person meetings to reach out to and engage with communities for input. Flood Risk Project tasks may include hydrologic or hydraulic engineering analysis and modeling, floodplain mapping, risk assessments using Hazus-Multi Hazard software, and preparation of flood risk datasets (water-surface elevation, flood depth, or other analysis grids). Additionally, projects may include local training sessions, data development activities, outreach support to local communities that want to step up their efforts, or the development of flood risk datasets within areas of concern to allow a more in-depth discussion of risk.

Phase Three: Regulatory Products Update

If the analysis prepared in the previous Flood Risk Project phases indicates that physical or meteorological changes in the watershed have significantly changed the flood risk since the last FIRM was printed, FEMA will initiate the update of the regulatory products that communities use for local floodplain management and NFIP activities.

Delivery of the preliminary FIRM and Flood Insurance Study (FIS) report begins another period of coordination between community officials and FEMA to discuss the required statutory and regulatory steps both parties will perform before the preliminary FIRM and FIS report can become effective. As in the previous phases, FEMA and its mapping partners will engage with communities through a variety of conference calls, webinars, and in-person meetings.

Once the preliminary FIRMs are prepared and released to communities, FEMA will initiate the statutory portions of the regulatory product update. FEMA will coordinate a Consultation Coordination Officer meeting and initiate a 90-day comment and appeal period. During this appeal period, local developers and residents may coordinate the submittal of their comments and appeals through their community officials to FEMA for review and consideration.

FEMA welcomes this information because additional proven scientific and technical information increases the accuracy of the mapping products and better reflects the community's flood hazards identified on the FIRMs.

Communities may host or hold Open House meetings for the public. The Open House layout allows attendees to move at their own pace through several stations, collecting information in their own time. This format allows residents to receive one-on-one assistance and ask questions pertinent to their situations or their interests in risk or flood insurance information.

All appeals and comments received during the statutory 90-day appeal period, including the community's written opinion, will be reviewed by FEMA to determine the validity of the appeal. Once FEMA issues the appeal resolution, the associated community and all appellants will receive an appeal resolution letter and FEMA will revise the preliminary FIRM, if warranted. A 30-day period is provided for review and comment on successful appeals. Once all appeals and comments are resolved, the flood map is ready to be finalized.

After the appeal period, FEMA will send community leaders a Letter of Final Determination stating that the preliminary FIRM will become effective in six months. The letter also discusses the actions each affected community participating in the NFIP must take to remain in good standing in the NFIP.

After the preceding steps are complete and the six-month compliance period ends, the FIRMs are considered effective maps and new building and flood insurance requirements become effective.

The following sections describe FEMA's Risk MAP investment in the Northwest Louisiana watersheds to date.

Lower Sabine Watershed Risk MAP Project

Watershed Selection Factors

All FEMA Risk Map Project life cycles begin with Phase Zero (Investment) and Phase One (Discovery). The investment in these two phases in the Lower Sabine watershed paves the way for the local communities to pursue greater flooding resilience. FEMA selected and prioritized the watershed for BLE Investment and Discovery with the overall goal of assisting the local governments in identifying flood risks and strengthening their ability to make informed decisions about reducing these risks. Figure 4 shows communities within the Lower Sabine watershed.

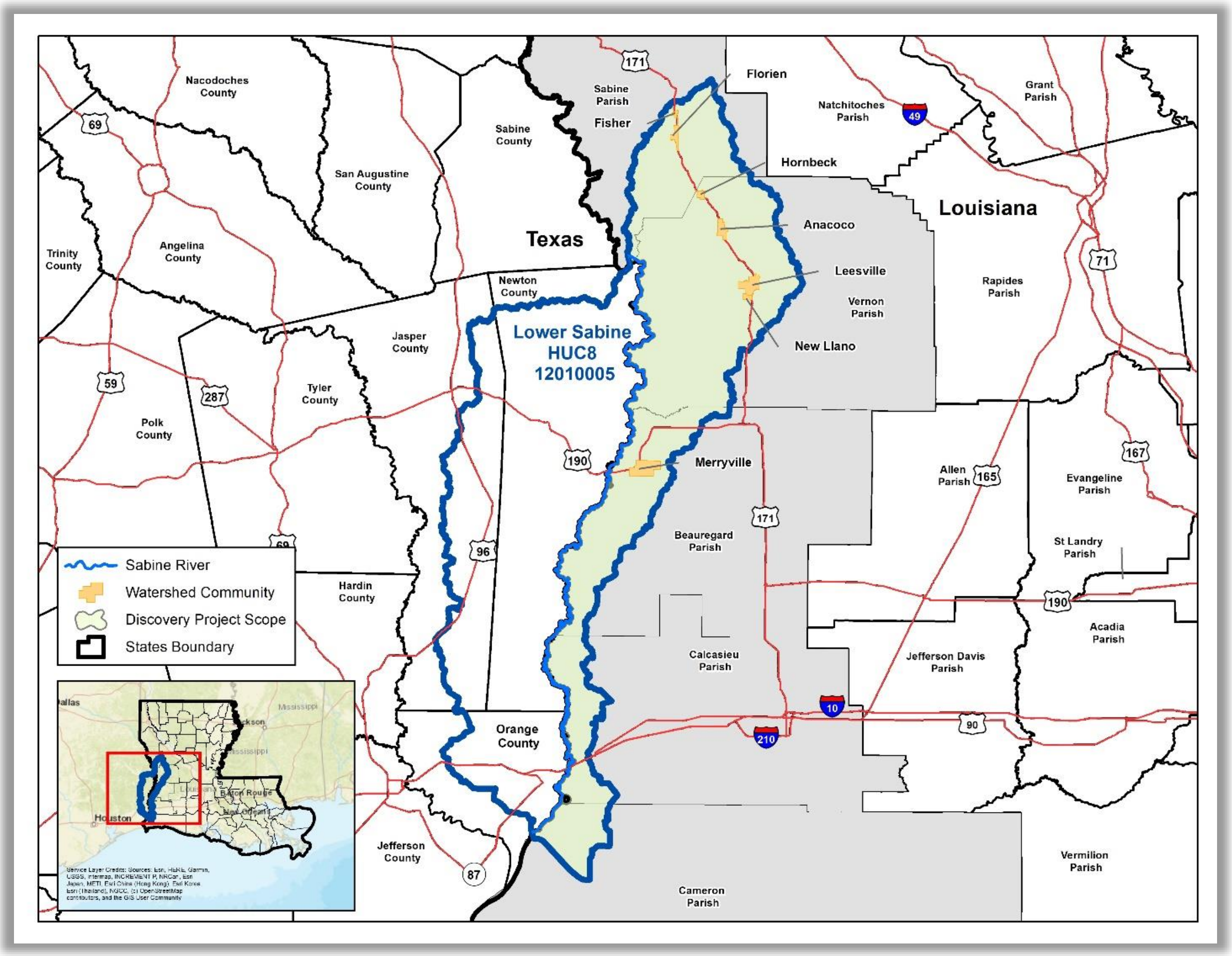


Figure 4: Overview of communities located within the Lower Sabine watershed within Louisiana

Many factors and criteria are reviewed for watershed selection: flood risk, the age of the current flood hazard data, population growth trends and potential for growth, recent flood claims, and disaster declaration history. The availability of local data and high-quality ground elevation data is reviewed for use in preparing flood hazard data. The CNMS database is reviewed to identify large areas of unknown or unverified data for streams. FEMA consults the State of Louisiana CTP, the State NFIP Coordinator, and the State Hazard Mitigation office when watersheds are identified for further study.

Flood Risk

In March of 2016, Louisiana experienced a heavy rainfall event resulting in extensive flooding. This included parts of Vernon and Beauregard parishes receiving over 18 inches of rain. According to a The Weather Channel website article, the increase in rainfall caused many rivers in the state to crest. One in the Lower Sabine watershed included the Sabine River at Orange, TX cresting at 7.62 feet. This was believed to be largely due to the releases from Toledo Bend Reservoir.

Many additional flood related damages have been recorded in the various communities within this watershed. These flood events cause extensive damage to local infrastructure and illustrate the ongoing threats within this watershed. Despite an overall population decline, most communities in these watersheds have increased their urban area footprint with more impermeable surfaces.

Growth Potential

The watershed is predominantly evergreen forest with little developed area. The study area is comprised of a variety of towns and villages, all with populations under 12,000 people each. The Lower Sabine watershed experienced a decline in population over the last decade. Cameron Parish experienced the highest decline of 17.87%, while Vernon Parish experienced the lowest decline with 6.85%. Because of this steady decline in total population, future development is expected to be limited, but should still happen gradually over time as citizens sprawl from congested cities to suburban areas within the unincorporated regions of the parishes.

Age of Current Flood Information

All parishes, except Sabine Parish, in the Lower Sabine watershed have been updated to modernized parish-wide DFIRMs and FIS reports as part of FEMA's Map Modernization (Map Mod) program that began in 2004. Studies in Beauregard and Vernon Parishes went effective in 2018, while the studies in Cameron and Calcasieu Parishes went effective in 2012 and 2011, respectively. However, Sabine Parishes' respective studies are over 34 years old. All but four panels of the mapping shown on these FIRMs are also Zone A or Zone X special flood hazard areas with no readily available Base Flood Elevations (BFEs). These dates represent the most recent parish mapping coverage although some small studies for LOMRs or adjacent watersheds have been mapped and made public on the Map Service Center in more recent years. Some of the hydrologic and hydraulic models supporting the mapping currently shown on the FIRMs in the parishes within the watersheds have not been updated since the late 1980s through the early 2000s. The models in Sabine, and Red River Parishes were last updated in 1989, and 2000, respectively.

The combination of related severe floods and outdated flood information indicate that these watersheds need updated flood hazard information at a parish-wide level to support floodplain management activities, especially in our non-modernized parishes.

Availability of High-Quality Ground Elevation Data

FEMA's data availability review indicated that high-quality ground elevation data was available for the Lower Sabine watershed in the form of Light Detection and Ranging (LiDAR) data. This data provides a great basis for preparing hydrologic and hydraulic modeling and help identifying development and earth-moving activities near the streams and creeks. The available LiDAR data was collected by USGS between

2018 and 2023. The source and date of the LiDAR topographic data coverage used in the Discovery and BLE projects for the Lower Sabine watershed is shown in Figure 5. See Figure A9 in Appendix I for topographic data sources for the whole watershed.

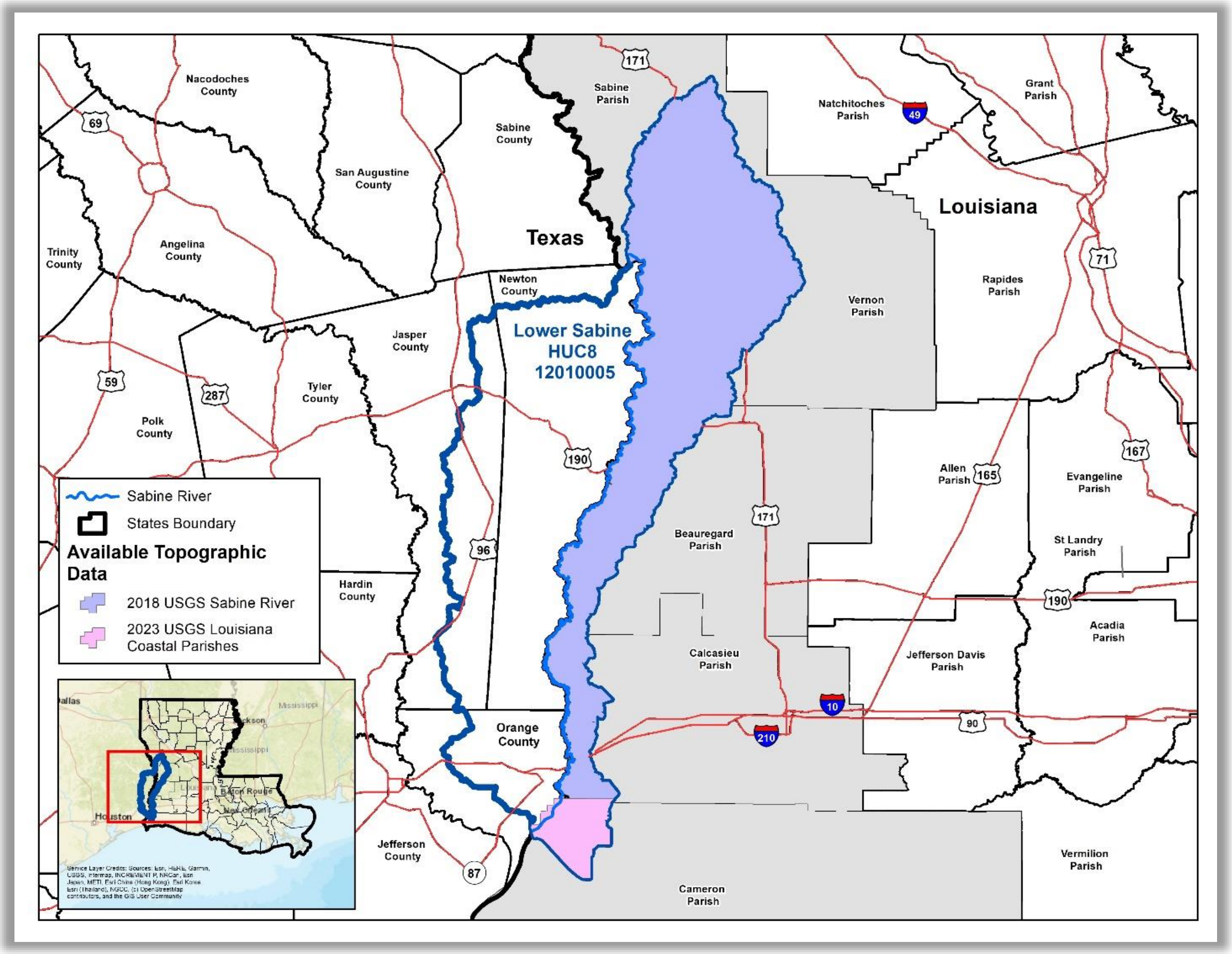


Figure 5: Availability of LiDAR Data

Coordinated Needs Management Strategy (CNMS) Database Review

The CNMS database indicates the validity of FEMA's flood hazard inventory. CNMS reviews 17 criteria to determine whether flood hazard information shown on the current FIRMs is still valid. Streams that are indicated ***Unverified*** or ***Unknown*** in the database indicate that the information used to map the floodplains currently shown on the FIRM is inaccessible or that a complete evaluation of the critical and secondary CNMS elements could not be performed. Figure 6 shows the CNMS-based attributed streams for the study area.

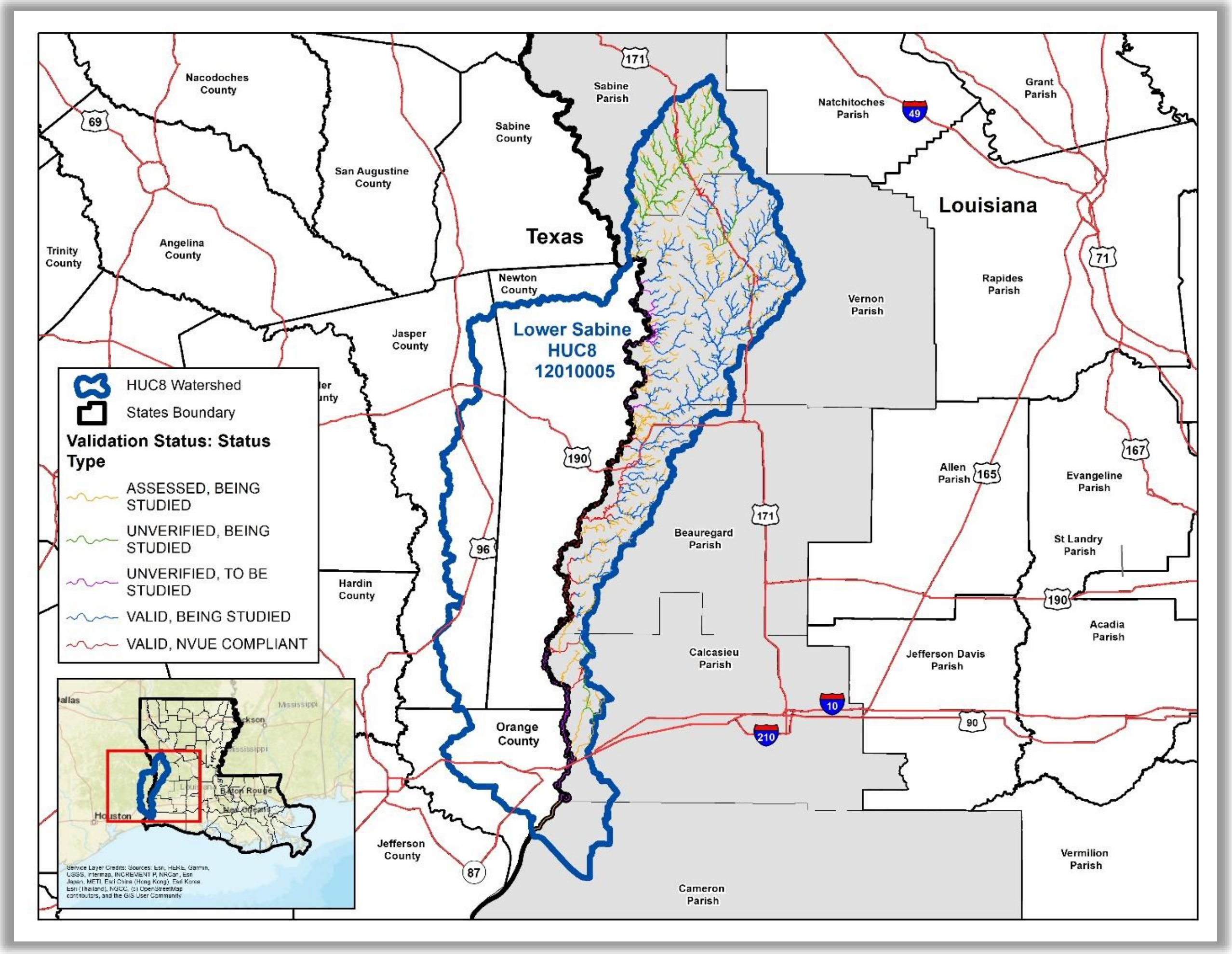


Figure 6: Overview of CNMS streams

Unmapped Stream Coverage

FEMA also reviewed the current stream coverage and reviewed the areas against the National Hydrography Dataset (NHD). The NHD medium-resolution data inventoried by the USGS maps created at a 1:100,000 scale was used to review the watercourses within the Lower Sabine watershed. Population centers of 1,000 or more were reviewed for additional mileage against the high-resolution data inventoried by the USGS Quadrangle maps created at a 1:24,000 scale. CNMS was completed as part of the Lower Sabine watershed BLE project in December 2021. The intent of this review was to identify streams and watercourses and create a complete stream network for preparing BLE data.

Phase Zero – Base Level Engineering (BLE) –Lower Sabine (2021)

In fiscal year 2020, FEMA began investing in BLE data development for the Lower Sabine watershed on the Texas and Louisiana state lines. This 1D approach prepares multi-profile hydrologic (how much water) and hydraulic (how is water conveyed in existing drainage) data for a large stream network or river basin to generate floodplain and other flood risk information for the basin area. BLE utilizes USGS regression equations and gage analysis to calibrate flows. The BLE project was published in December of 2021 as MIP case number 20-06-0094S for the Lower Sabine watershed. The completed BLE reports are included in Appendix III.

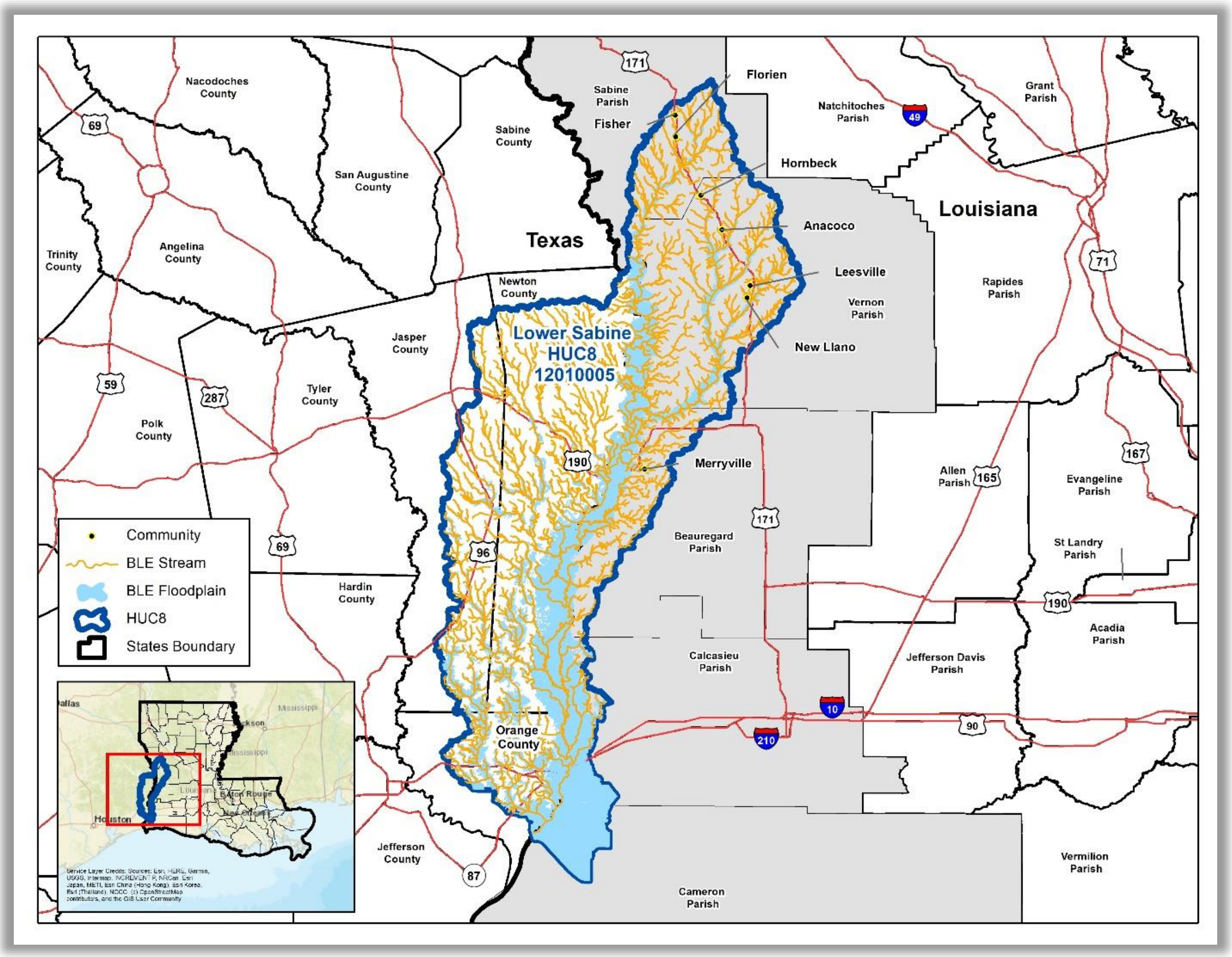


Figure 7: Overview of BLE streams and BLE floodplain

BLE provides an opportunity for FEMA to produce and provide non-regulatory flood risk information for a large watershed area in an expedited timeline. The data prepared through BLE provided planning-level data that is modeled to meet FEMA's Standards for Floodplain Mapping. BLE is scalable and can be updated for use as regulatory and non-regulatory products. Communities can choose to adopt the BLE as approximate, model-backed mapping in locations without model-backed Zone A mapping. Detailed studies can add structures to the BLE modeling for further refinement into Limited Detail studies or Detailed studies with or without floodway. Figure 7 shows the network of streams analyzed using the BLE approach. The results of this BLE study have been incorporated into the Discovery process to support the engagement and communication activities that take place during the Discovery phase.

FEMA Base Level Engineering (BLE) Deliverables

The BLE provided the following items for use in the Lower Sabine watershed:

- Hydrologic modeling (regression) flow values for the 10%, 4%, 2%, 1%, 1%+ and 0.2%, and 1%- frequencies
- Hydraulic (HEC-RAS) modeling for all study streams (for the same frequencies listed above)
- 10-, 1-, and 0.2-percent-annual-chance floodplain boundaries
- 1- and 0.2-percent-annual-chance Water Surface Elevation Grids
- 1- and 0.2-percent-annual-chance Flood Depth Grids
- HAZUS flood analysis for the watershed
- Point file indicating the location of culverts and inline structures that may be informed by local as-built information
- Flood Risk Map (See Appendix I)

The BLE information is available on FEMA’s Estimated BFE viewer for communities to use for planning, risk communication, floodplain management and permitting activities.

CNMS Validation and Assessment

Per the Lower Sabine BLE report, “[as] described in Title 42 of the Code of Federal Regulations, Chapter III, Section 4101(e), once every five years, FEMA must evaluate whether the information on Flood Insurance Rate Maps (FIRMs) reflects the current risks in flood prone areas. FEMA makes this determination of flood hazard data validity by examining flood study attributes and change characteristics, as specified in the Validation Checklist of the Coordinated Needs Management Strategy (CNMS) Technical Reference. The CNMS Validation Checklist provides a series of critical and secondary checks to determine the validity of flood hazard areas studied by detail methods (e.g., Zone AE, AH, or AO).”

The Regional CNMS database, National Flood Hazard Layer, and paper inventory were used as reference data to ensure extent of the BLE results represents appropriate flooding extent. The BLE CNMS database report tables are available in Appendix I.

Phase One – Discovery

The LADOTD-led Discovery project focused on the “Discovery” of flood hazards and risks throughout the Lower Sabine watershed. Through the Discovery process, flood risks are identified, and local communities have an opportunity to collaborate with the State CTP to identify specific regions within the watershed that may benefit from future FEMA funded studies and assessments. Discovery initiates open lines of communication and relies on local involvement for productive discussions about flood risk. The process provides a forum for a watershed-wide effort to understand the interrelationships between upstream and downstream community flood risk throughout the watershed. At the conclusion of the Discovery process, the identified needs of the watershed will be considered for future investment in the Risk MAP process.

The Lower Sabine watershed Discovery project was completed through the following activities:

- Data Gathering
- Pre-Discovery Engagement Efforts
- Discovery Meeting
- Watershed Findings and Prioritizations

All possible efforts were made to ensure that stakeholders understood Discovery and the Risk MAP process through emails, phone calls, newsletters, and a developed website created for this Discovery project.

Data Gathering

Federal and state databases were downloaded and reviewed during the Pre-Discovery phase to highlight areas of concern where additional information from stakeholders would be most beneficial to fully understand the flood risk and damages in the area. Dams, levees, soils classification, recent developments, various population metrics, collections of high-water marks and low water crossings, historical flooding information, and more were reviewed to best prepare for in-depth conversations surrounding local action and impact. Additionally, the BLE water surface elevation rasters were compared to the effective flood extents and base flood elevations to check for any differences that might have been the result of changes in terrain or modeling considerations used in the non-regulatory model development. The final BLE Report is available in Appendix III. Table 4 summarizes the geospatial data collected.

Table 4: Geospatial Data Collection

Data Type	Data Source	Data Description
HUC watershed Boundaries	USGS	HUC boundary for the Lower Sabine HUC-8
Roadways	US Census Bureau	2023 TIGER Line Roads
Jurisdictional Boundaries - Louisiana	LADOTD	Data includes municipality and parish boundaries
Current Effective Floodplain Information	FEMA DFIRMs	Data includes Floodplains, BFEs, and Cross Sections
Stream Lines	FEMA DFIRMs	Stream Centerlines and Profile Baselines from DFIRM
BLE Floodplains and Stream	FEMA	Base Level Engineering Study for the Lower Sabine watershed, 2021
Coordinated Needs Management Strategy	FEMA	CNMS database dated April 31, 2024
Topography	USGS	2018 - 2023 State wide LiDAR
HAZUS-based Loss Estimates	FEMA	HAZUS 5.0 (2022) building exposure and flood loss estimates per Census Tract
Location of Dams	National Inventory of Dams	Dam locations with Emergency Action Plan (EAP) status
Flood Claims	FEMA NFIP	Total number and value of claims by community for Louisiana
Land Cover	USGS	National Land Cover Dataset for 2023
Land Use	USGS	Derived from National Land Cover Dataset 2023
Population	US Census Bureau	2020 U.S. Census
Population Growth	US Census Bureau	Calculated change between the 2010 and 2020 U.S. Census
U.S. Congressional Districts - Louisiana	LADOTD	Congressional District Boundaries
State House & Senate Districts - Louisiana	LADOTD	State House and Senate District Boundaries
National Risk Index	FEMA	NRI Rating data at the census tract level
National Flood Hazard Layer	FEMA	Beauregard (2018), Calcasieu (2016), Cameron (2012), Sabine (1991), and Vernon Parish(2016) and Incorporated areas NFHL

The Discovery engagement process included the development of a user-friendly website for data collection, verification, and coordination. The website was developed to become a repository to collect project information such as community background data, newsletters, planned meeting dates, times, and locations, project data deliverables, and reports. Figure 8 and Figure 9 show the website splash screen and navigation page.

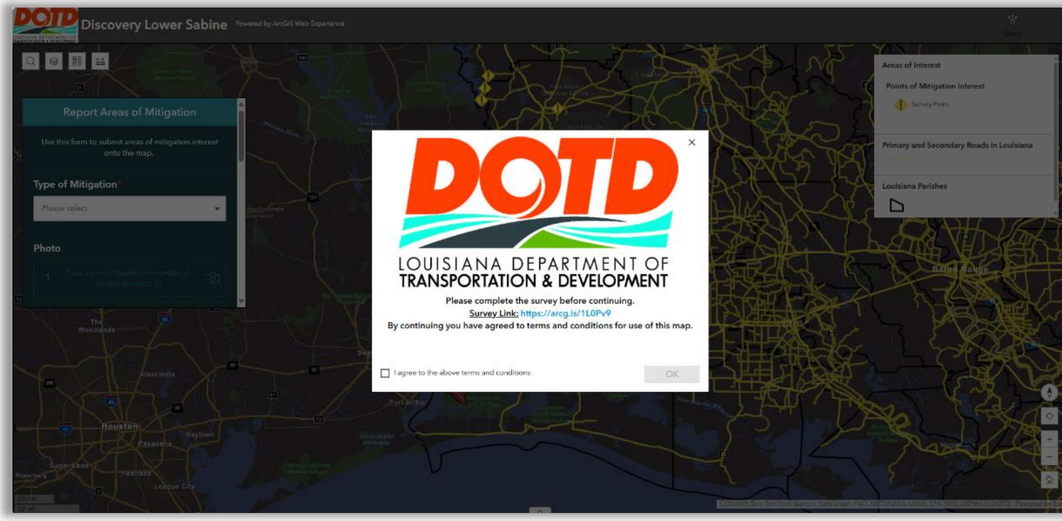


Figure 8: Website Splash Screen

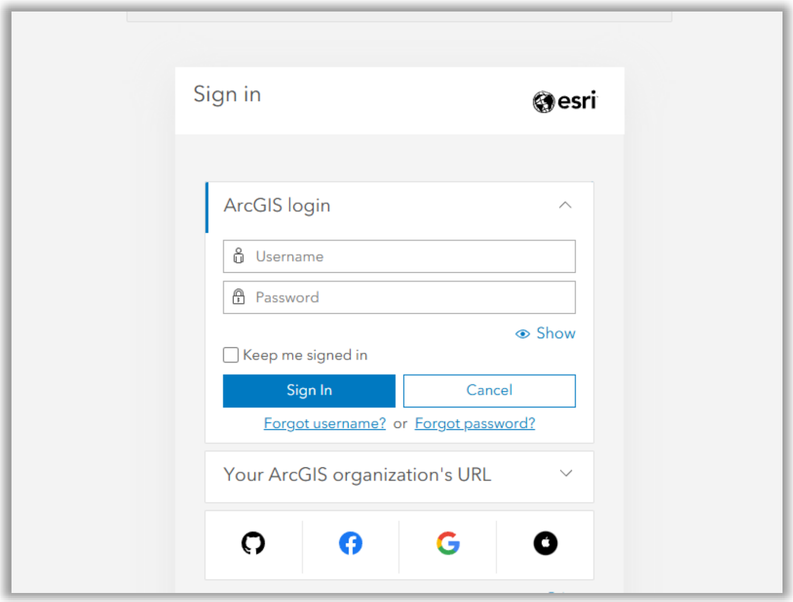


Figure 9: Website Progress Tracking Page

For the Discovery project, the Discovery website allowed participating stakeholders to view basemap layers pertinent to the study area, including BLE rasters and polygons, effective FIRM layers, and satellite and street view imagery. Users were then able to update flood-related information about their community, including local flood risks, flood hazards, mitigation plans, mitigation activities, flooding history, development plans, and floodplain management activities. It also allowed stakeholders to input Areas of Mitigation Interest (AOMI) such as infrastructure, mapping needs, repetitive flooding, and requests on a web map. The website tracked community participation and helped accelerate the Discovery process by creating easy-to-use GIS shapefiles with attribute tables relevant to flood sources and community comments. Figure 10 shows the webmap interface.

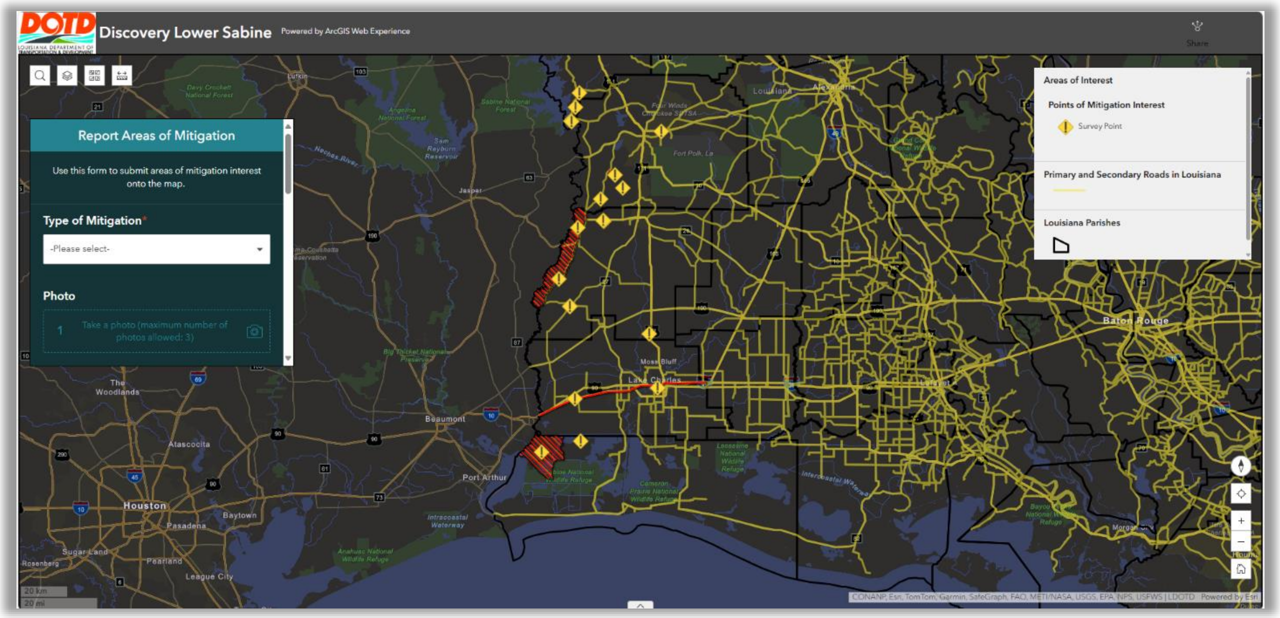


Figure 10: Webmap Interface

Pre-Discovery Engagement Efforts

A Discovery flyer was emailed out to the communities prior to the Pre-Discovery Meeting. A Discovery newsletter was also developed and distributed to all stakeholders to gain public awareness of the Lower Sabine Discovery process. The newsletter contained information about FEMA's Risk MAP program, the Discovery process, details of the upcoming Pre-Discovery Meeting, the data collection process, and the Risk MAP process beyond Discovery. A copy of the flyer and newsletter is included in Appendix I.

LADOTD held a virtual informational Pre-Discovery Meeting on August 24, 2022, for stakeholders in the study watershed. A copy of the presentation is available in Appendix I. The Pre-Discovery informational meeting was held to increase awareness of the Discovery process prior to the Discovery Meeting so that the stakeholders would be prepared to fully participate in the Discovery process. Stakeholders participated in the meeting and were encouraged to ask questions to gain further clarity. The goals of the Pre-Discovery Meeting were to:

- Explain the Discovery process

- Explain why LADOTD was conducting Discovery in the Lower Sabine watershed
- Explain FEMA's Risk MAP program and benefits
- Introduce the website with a tutorial and open website enrollment
- To obtain information for Discovery in the watershed

Discovery Meeting

Three in-person Discovery Meetings were held in the watershed area with the goals of gathering additional flood risk data, discussing the communities' flooding history, development plans, flood mapping needs, and flood risk concerns, and discussing the vision for the watershed's future and the importance of mitigation planning and community outreach. The first Discovery Meeting occurred on October 11, 2022, from 10:00 am – 3:00 pm in Deridder, Louisiana, at the Beauregard Parish Library. Another in-person Discovery Meeting was held on October 12, 2022 from 10:00 am – 12:00 pm at the Cameron Parish Police Jury in Cameron, Louisiana and a final in-person Discovery Meeting was held on October 13, 2022 from 10:00 am – 12:00 pm at the Vernon Parish Library in Leesville, Louisiana. Local stakeholders were invited to join for any of these meetings to offer flexibility in schedules and ideally collect more data.

Community stakeholders were able to participate in the meeting when most convenient to them. Discovery Ambassadors assisted stakeholder attendees through a presentation followed by hands-on watershed review and discussions.

Stakeholders were contacted through email and phone calls to discuss their concerns and comments in detail. Through these efforts, community participation and representation were achieved via either phone/email coordination, in person meetings, or webmap usage.

The Lower Sabine Discovery project gathered 26 comments, including 20 from the Discovery Meetings and six from the online webmap. Of these 26 comments, there was one new mapping requests.

Watershed Findings and Project Prioritizations

Watershed Findings

Following the Discovery Meeting, the gathered community comments were placed into categories by comment type and summarized by Parish as shown in Table 5.

Table 5: Comment Distribution by Parish

Parish Names	Mapping Comments					Total Number of Comments
	Other Flood Risk Areas	Dams	At-Risk Essential Facilities	Areas of Mitigation Success	Notes (as submitted):	
Beauregard	1				- Repetitive flooding in Lower Sabine River west of Hwy 389	1
Calcasieu	1				- Coastal Flooding impacts as far north as I10	1
Cameron	1				- Sea level rise makes Cameron Parish a bowl for runoff. Parish doesn't have any outlets	1
Sabine	1				- 2016 Flood Event exacerbated by release from Toledo Bend Reservoir causing flooding in Sabine Parish	1
Vernon	1		1		- Should spillway fail could cause serious issues - US 171 Flooding between Anacoco and Leesville	2

Note: Some comments were general to watershed naming, do not provide flooding or pertinent information, or are conversations had and are not represented in this table. The 20 comments collected at the Discovery meetings were not added to this table.

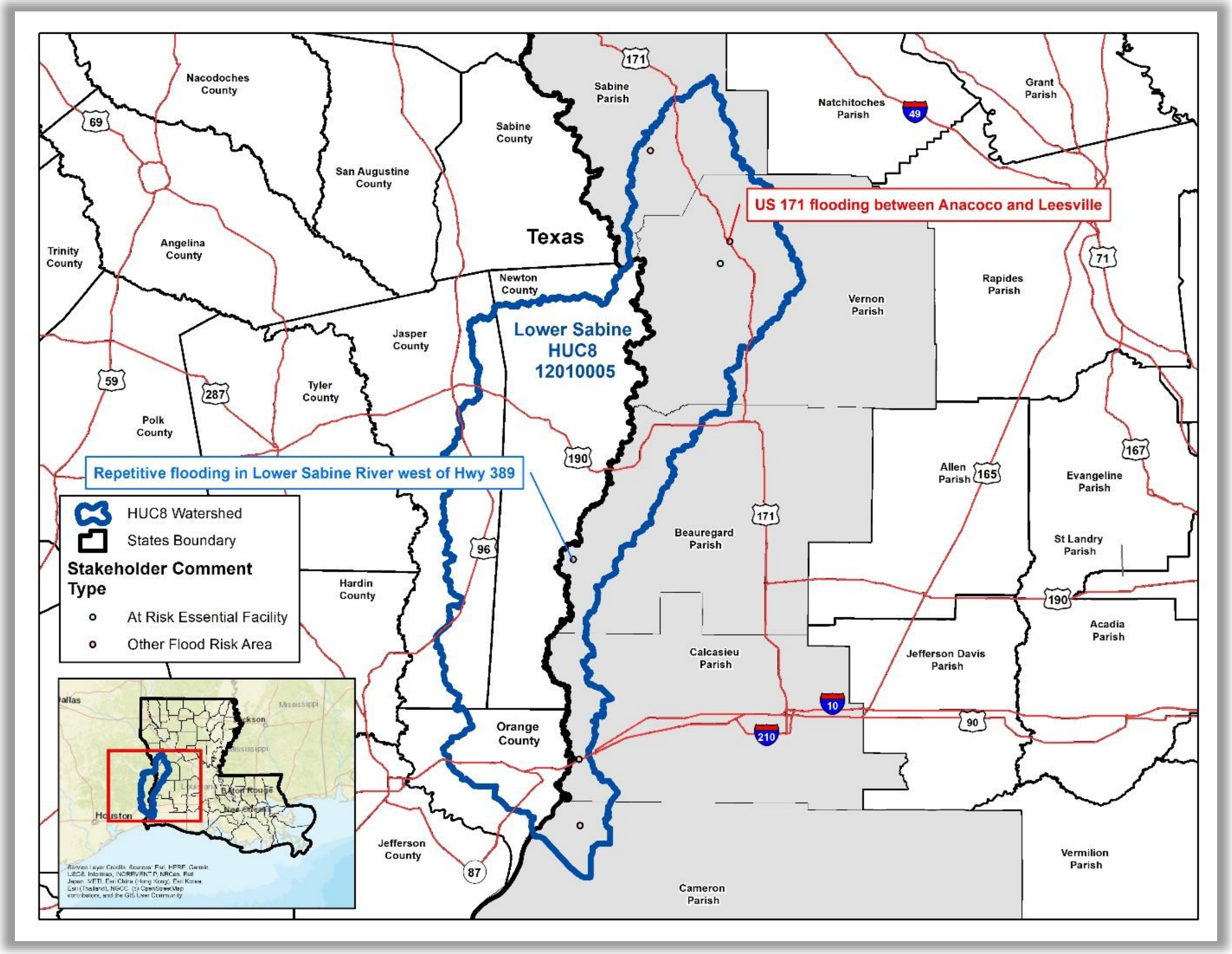


Figure 11: Stakeholder Comment Examples

Figure 11 shows a sample of the comments submitted by communities. There were 5 comments about other flood risk areas and one comment about at-risk essential facilities. All stakeholder comments were submitted to FEMA in the digital supplemental data deliverable associated with this project.

Figure 12 shows the type and distribution of stakeholder comments across the watershed. Most comments were submitted in the Vernon Parish.

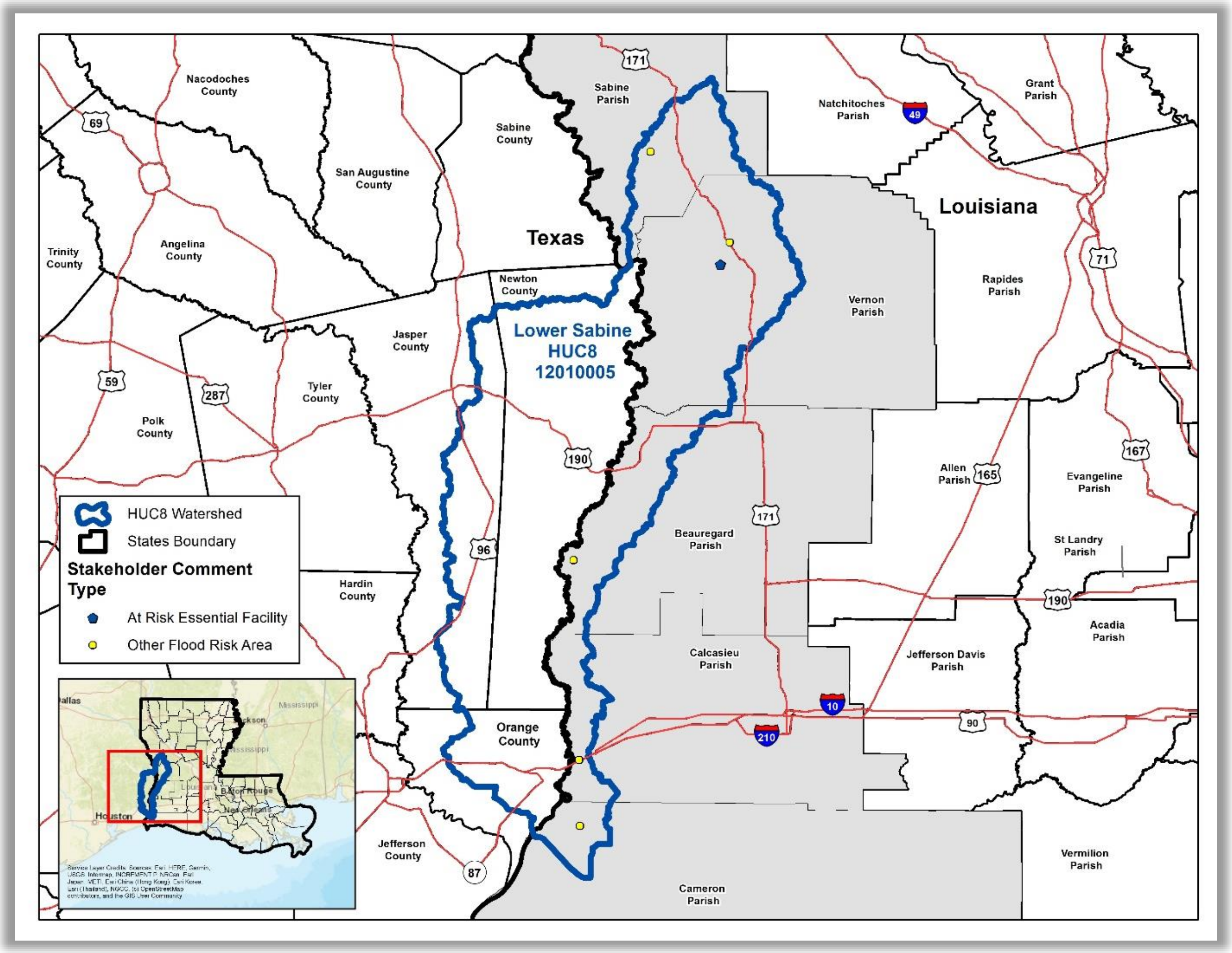


Figure 12: Stakeholder Comment Distribution

Figure 13 demonstrates the differences in numbers per comment type. Six comments were submitted for flood related concerns, such as coastal flooding impacts as far north as I-10.

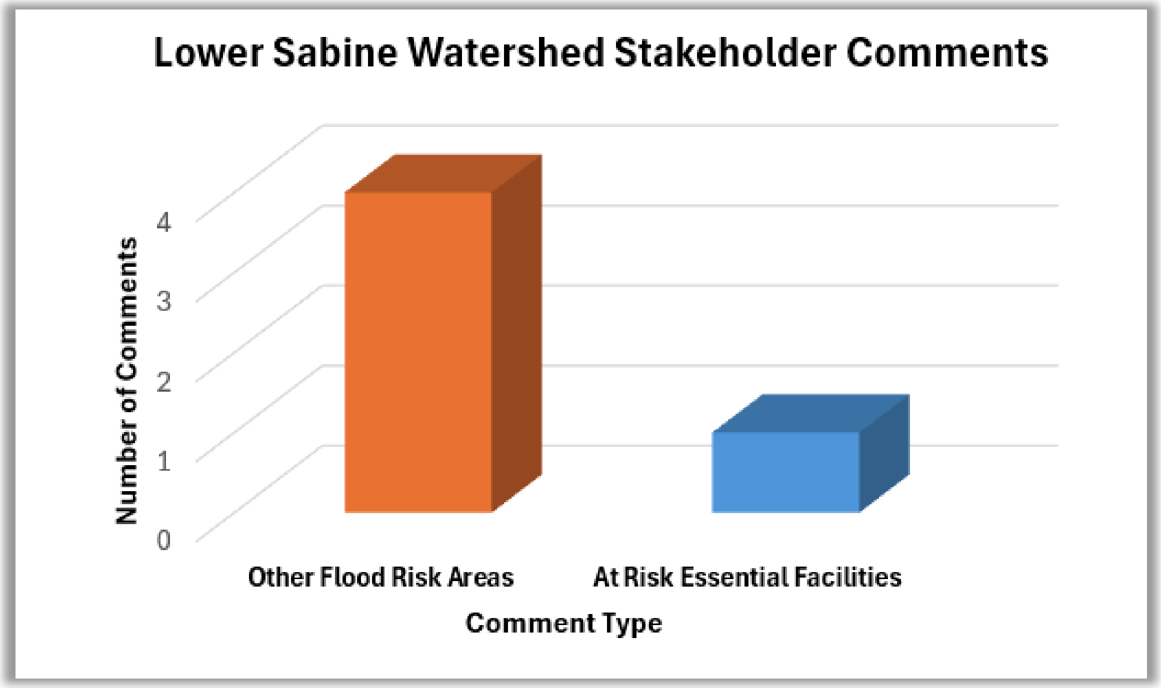


Figure 13: Stakeholder Comment Totals

Project Selection and Prioritization

Because of the presence of approximately 960 unverified CNMS stream miles in either Zone A or AE in the rural communities of this HUC-8 watershed, it is recommended that mapping updates be performed at a parish-wide level, rather than at the level of the individual flooding sources. This recommended approach to mapping updates would bring the number of modernized parishes from four to five (currently the parishes of Beauregard, Calcasieu, Cameron, and Vernon have digital FIRMs) with this approach brings additional value in updating the mapping for the full parish extents. Table 6 gives a more in-depth review of the parish CNMS data for all five parishes that intersect the Lower Sabine watershed.

Table 6: CNMS Data in the Study Area of the Parish

CNMS Data by Study Area							
Parish	Total Area (mi^2)	Oldest Effective FIRM Date	Total Stream Miles in Parish	Total Streams Unverified			Percent of Unverified Mileage in Parish
				Zone	Segment Count	Miles	
Beauregard	243.74	11/26/2010	359	A	58	161	67%
				AE	21	80	
Calcasieu	122.65	2/18/2011	98	A	9	14	62%
				AE	12	47	
Cameron	73.92	11/16/2012	6	A	0	0	0.3%
				AE	1	.02	
Sabine	199.94	8/5/1991	299	A	69	227	78%
				AE	5	5	
Vernon	537.02	11/26/2010	778	A	182	566	79%
				AE	24	45	

Using the age of the oldest effective FIRM in the parish in conjunction with the percentage of unverified CNMS stream mileage, these parishes' needs for FIRM updates were prioritized from a low to moderate to high ranking with Sabine Parish rated as the highest priority. In addition to the CNMS data listed above, additional information such as partial update coverage and dates, DFIRM status, and stakeholder comments and requests were considered for this ranking. The outcome of this exercise can be seen in Table 7.

Table 7: Mapping Needs Prioritization

Mapping Needs Prioritization by Parish within the Study Area		
Parish	**Priority**	**Reason**
Sabine	Highest	78% of the streams are unverified, and the oldest effective date exceeds the last 30 years. DFIRM data is not available for this parish.
Vernon	High	79% of the streams are unverified, but the oldest effective date is within the last 20 years. The Parish has modernized DFIRM data.
Beauregard	Moderate	67% of the streams are unverified, but the oldest effective date is within the last 20 years. The Parish has modernized DFIRM data.
Calcasieu	Moderate	62% of the streams are unverified, but the oldest effective date is within the last 15 years. The Parish has modernized DFIRM data.
Cameron	Low	Less than 1% of the streams are unverified, and the oldest effective FIRM is within the last 15 years. The Parish has modernized DFIRM data.

Cameron Parish received a 'Low' ranking due to effective FIRM data within the last 15 years, DFIRM availability, and a lower percentage of unverified stream miles. Beauregard and Calcasieu Parish received a 'Moderate' ranking for different reasons. Calcasieu's oldest effective data is within the last 20 years, but 62% of the streams are unverified. Beauregard has 67% of streams unverified, but their oldest effective FIRM date is more than one year older than Calcasieu's. Sabine and Vernon received 'Highest' and 'High' rankings, respectively, due to the absence of digital FIRM data and the oldest effective FIRM dates exceeding the last 20 to 30 years. Sabine received the 'Highest' ranking with approximately 78% of the streams in the parish being unverified. A heatmap outlining the parishes' ranks and unverified CNMS Zone A and AE streams can be seen in Figure 14.

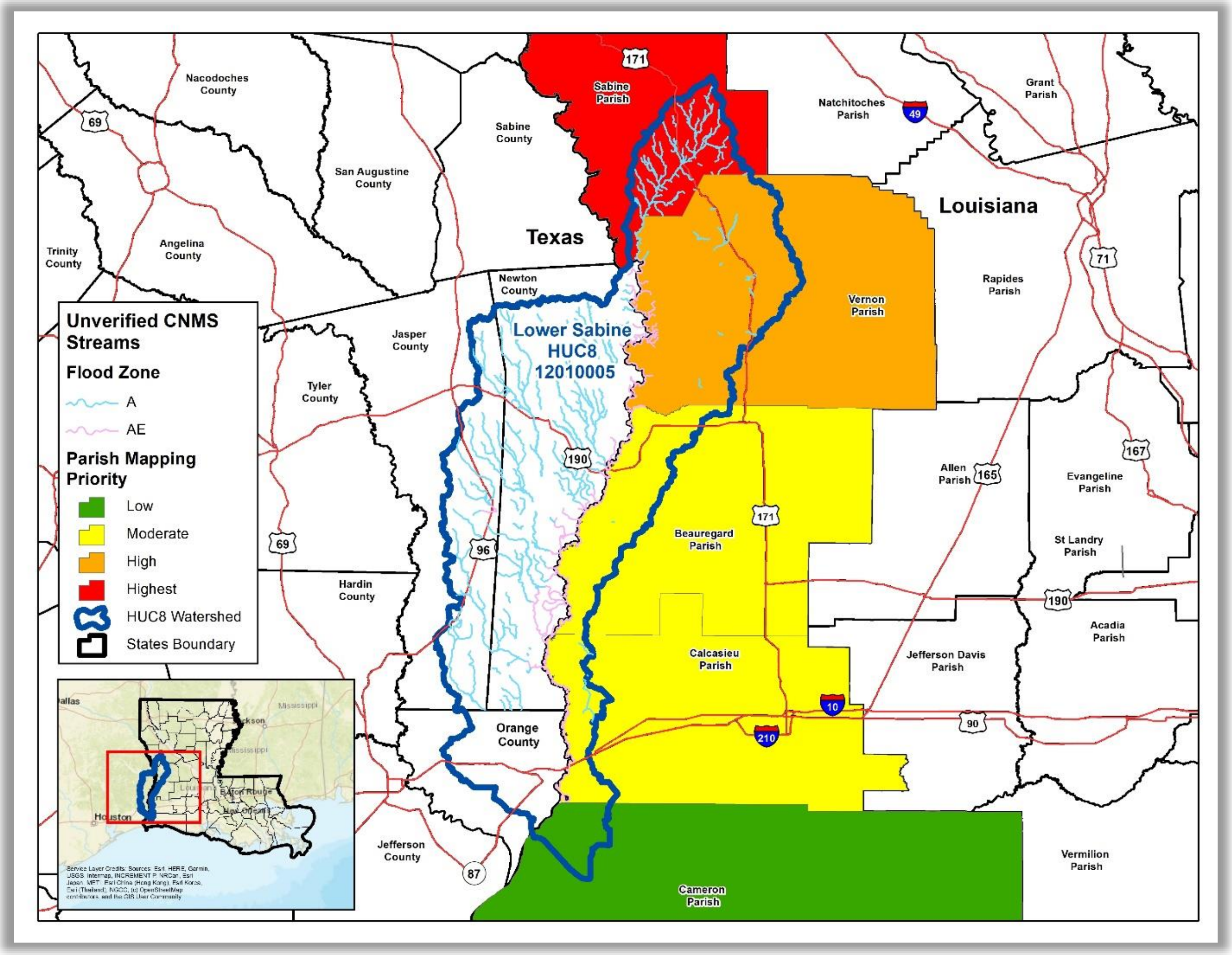


Figure 14: Parish Prioritization with Unverified CNMS A and AE Streams

When considering these projects, effort and cost associated with that effort must be weighed. The bulk of stream miles in need of update for these parishes fall under Zone A. Given the BLE availability and recent practices of adopting BLE for FIRM map creation, it is expected that these miles will incur a reduced cost from previous Zone A modeling and mapping tasks. The parishes of Beauregard, Calcasieu, Cameron, Sabine, and Vernon have Zone AE streams as well. These will require enhancement of the BLE models with structure survey and further refinement before being used for any FIRM production.

Data availability for enhancement and limiting factors, such as lack of levee accreditation, must also be weighed when considering parishes for updates and modernization. For parishes with non-accredited levee systems, further discussions on the status and schedule of accreditation should happen before the investment in the adoption of BLE.

Table 8 and Table 9 below outline the data availability and limitations as described.

Table 8: Parish Levee Accreditation Status

Parish	Modernized	Levee Accreditation	
		Levee	Accreditation
Beauregard	Y	-	-
Calcasieu	Y	-	-
Cameron	Y	Creole Watershed Coastal System* Lacassine National Wildlife Refuge 1 System** Wild Island Levee** North of Lacassine National Wildlife Refuge** Lacassine National Wildlife Refuge 2 System**	- N N N N
Sabine	N	-	-
Vernon	Y	-	-

Note: Includes all levees in the parishes affected by the watersheds.

* This levee system does not have publicly available levee accreditation status. There is also no “leveed area” noted for this levee.

**These levee systems are intended for aquaculture and crops.

Table 9: Parish BLE Status

Parish	Additional Intersecting BLE Models		
	Watershed Name	Fiscal Year	Level of Study
Beauregard	Whiskey Chitto Upper Calcasieu West Fork Calcasieu (in progress)	20 20 20	2D 2D 2D
Calcasieu	West Fork Calcasieu (in progress) Upper Calcasieu Lower Calcasieu (in progress) Mermentau	20 20 20 21	2D 2D 2D 2D
Cameron	Sabine Lake Lower Calcasieu (in progress) Mermentau	20 20 21	2D 2D 2D
Sabine	Bayou Pierre Lower Red-Lake Iatt Toledo Bend Reservoir	20 20 20	2D 2D 1D
Vernon	Lower Red-Lake Iatt Upper Calcasieu Whiskey Chitto	20 20 20	2D 2D 2D

Flood Risk Assessments Results

HAZUS is a risk assessment software program for analyzing potential losses in dollars from floods, hurricane winds, and earthquakes. The BLE flood data developed for this project was used as input data for the HAZUS-based flood risk assessment. The Lower Sabine watershed has an estimated $5.87 billion worth of vulnerable assets, including residential, commercial, and other asset types. If a 100-year storm event were to occur throughout the watershed, HAZUS estimated nearly four percent of the assets will be damaged, with losses estimated at over $191 million dollars to physical assets. There will also be other economic losses, including lost wages, inventory losses, losses in production, and economic opportunity losses, valued at over $73 million dollars. Figure 15 and Figure 16 show the capital stock inventory within the study watersheds and the corresponding 100-year event losses. Figure A11 in Appendix I shows a more detailed potential loss risk map for the watersheds.

Because the parishes in the Lower Sabine watershed have land in other watersheds, these HAZUS-based 100-year flood loss estimates are not indicative of their total potential loss estimates. Hence, the losses shown in the report do not necessarily represent community-wide totals.

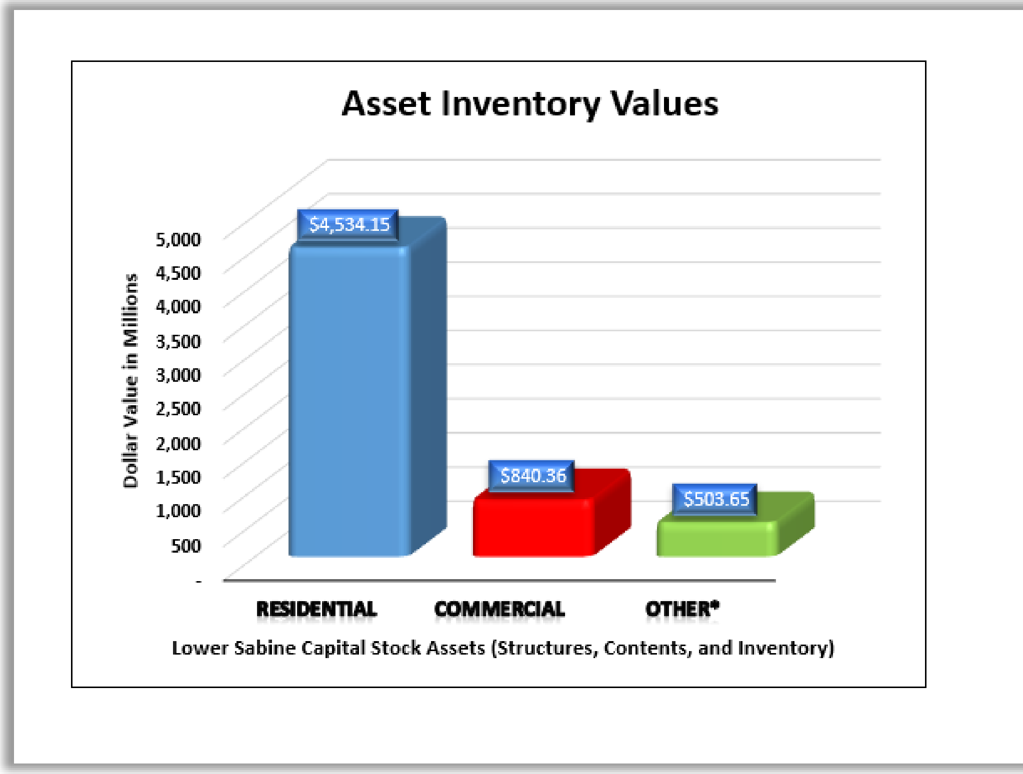


Figure 15: Asset Inventory Value Totals

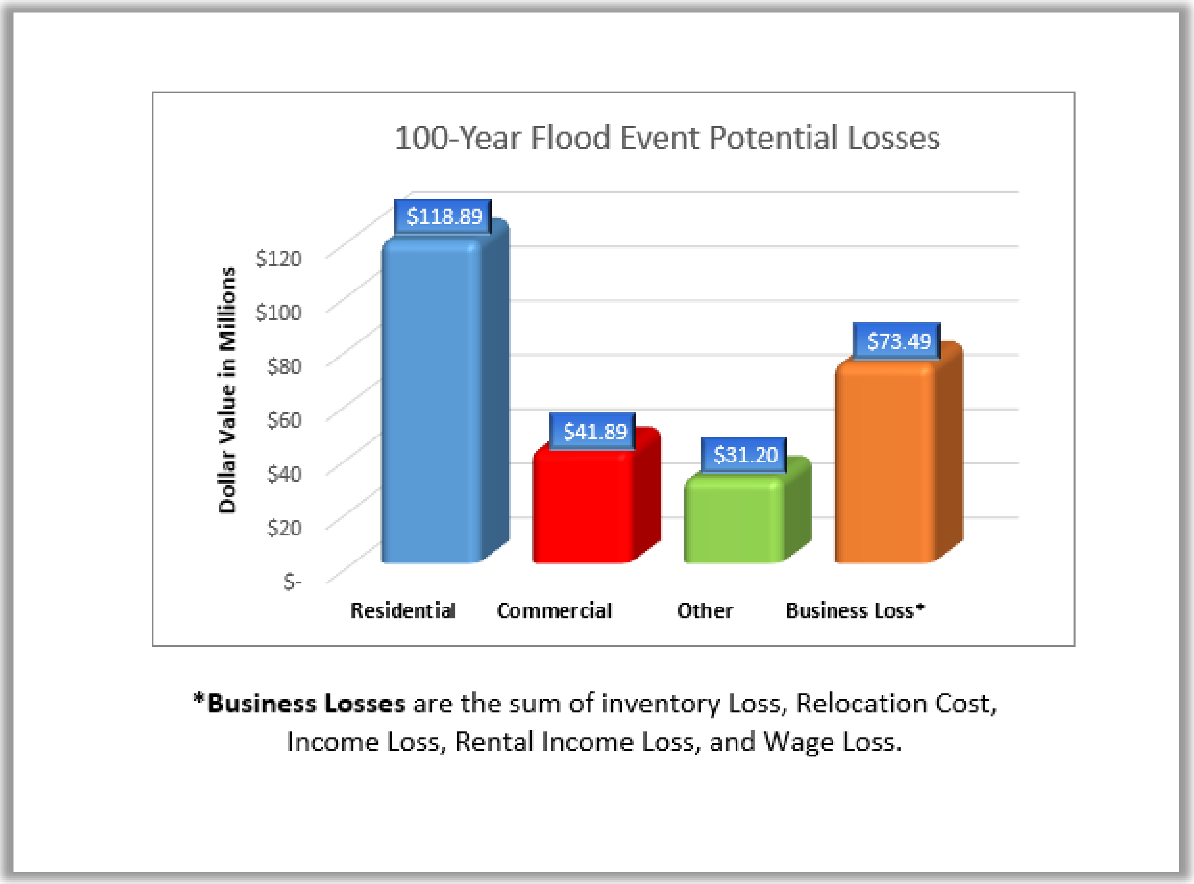


Figure 16: 100-Year Flood Event Potential Loss Totals

Aggregating the HAZUS-based 100-year flood loss estimates to parishes provides another method to prioritize new studies and hazard mitigation projects in the watersheds. Figure 17 ranks the HUC-12s by estimated flood losses. Most of the parishes within the watershed are at risk of under $14 million in potential loss if there is a 100-year flood event. The northwestern corner of Cameron Parish and the West side of Calcasieu Parish risk $60 million to $75 million in potential losses based on the 100-year flood loss estimates.

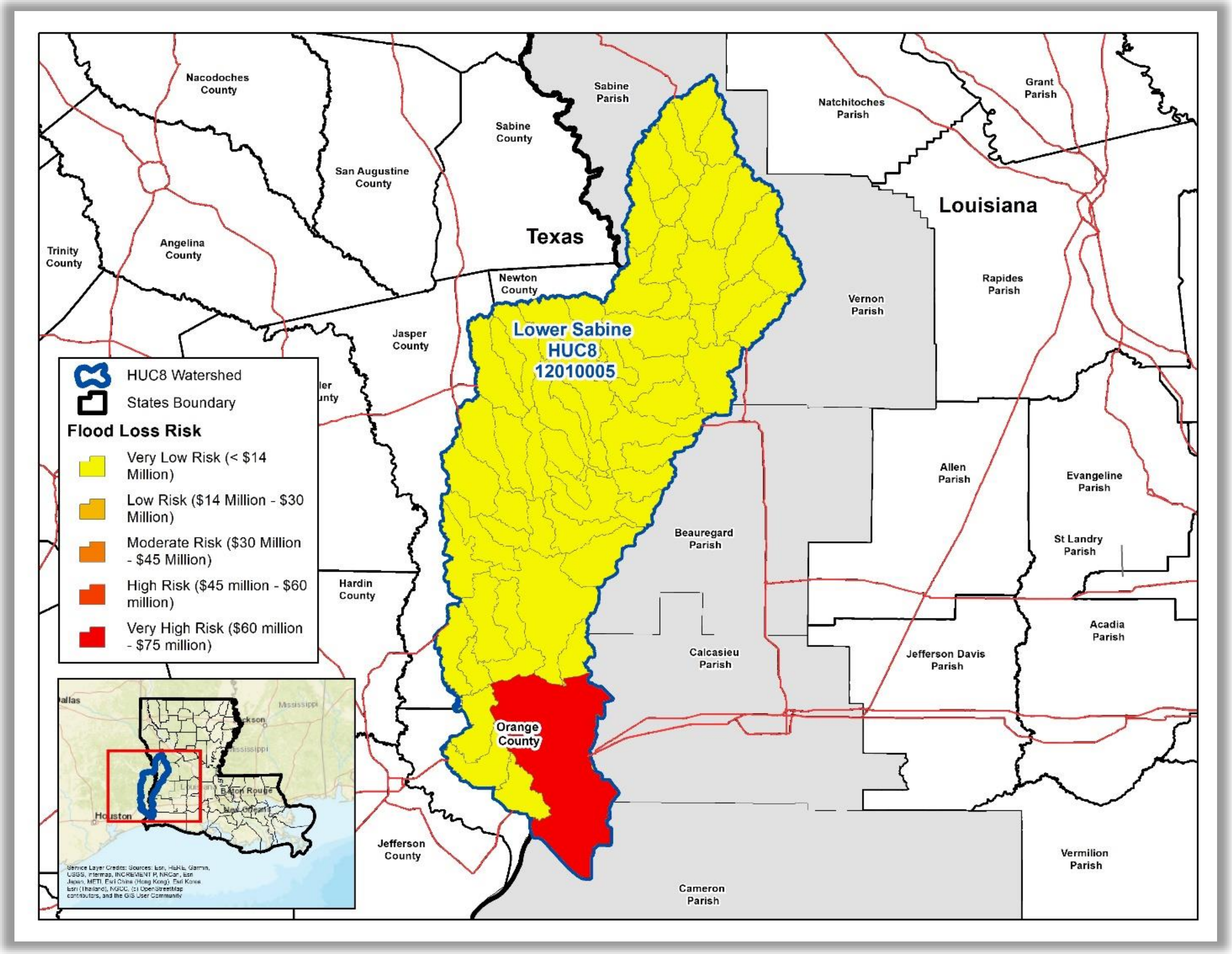


Figure 17: HAZUS-based 1% Annual Chance Loss Estimates by HUC-12s

Project Recommendation

Based on the needs of the communities, the availability of the data, and the current FEMA investment process, the proposed projects were prioritized for FEMA investment based on the following criteria. First, non-digital parishes with no levees are recommended as primary considerations for immediate investment. The projects would enhance the BLE data in areas with effective Zone AE streams and advance BLE data to FIRMs. The next tier is the digital parishes with non-accredited levees. These projects require additional coordination with the levee owners to determine accreditation status and schedule before BLE enhancement and advancement of the recommended projects can occur. The readiness of the community to provide support can also be considered in the project prioritization.

From the outlined criteria for consideration and available data for reference, the following projects are recommended.

Beauregard Parish Partial BLE Enhancement and Regulatory Update– Beauregard Parish FIRMs are digitized and were updated in 2010. There are 161 miles of non-model backed Zone A and 80 miles of

Zone AE streams in the study area. The study would leverage the four BLE datasets that intersect the parish before enhancing the 80 miles of Zone AE streams. The enhanced data would be combined with the BLE data to update the parish regulatory data. The Parish Social Vulnerability Index Score is 0.5498.

Calcasieu Parish Regulatory Update – Calcasieu Parish FIRMs are digitized and were updated in 2011. There are 14 miles of non-model backed Zone A and 47 miles of Zone AE streams in the study area. Future study would entail community review of the five BLE datasets that intersect the parish before enhancing the 47 miles of Zone AE streams and adopting the Zone A floodplains. The Parish Social Vulnerability Index Score is 0.7149.

Cameron Parish BLE Outreach and 2D BLE Adoption – Cameron Parish FIRMs are digitized and were updated in 2012. There are currently zero miles of non-model backed Zone A and 0.02 miles of Zone AE streams in the study area. BLE outreach and utilization training will provide the parish with tools for future planning. There are also non-accredited levees along with an unknown accreditation levee within the parish. The Parish Social Vulnerability Index Score is 0.2984.

Sabine Parish Regulatory Update – Sabine Parish in non-digital with 227 miles of Effective Zone A and five miles of Zone AE. The study would leverage the four BLE datasets to modernize the Parish FIRMs. The Parish Social Vulnerability Index Score is 0.8848.

Vernon Parish Partial Regulatory Update – Vernon Parish FIRMs are digital and were updated in 2010. There are 566 miles of non-model backed Zone A and 45 miles of Zone AE. The study would leverage the four BLE datasets and partially update the regulatory Zone A data. The Parish Social Vulnerability Index Score is 0.832.

Follow-Up On Phase Project Decisions

The BLE results and the effective DFIRM floodplains were compared to identify any areas of significant change. If the results show large areas of change (expansions and contractions of the floodplain, increases and decreases of the computed BFEs, and increases in expected flow values) FEMA will continue to coordinate with the communities to identify the streams that should be considered for FIRM updates. These updates could be Letter of Map Revisions for small project areas, or a Physical Map Revision for large areas with mapping changes.

To identify other streams for future refinement, community growth patterns and potential growth corridors should be discussed with FEMA. These areas of expected community growth and development may benefit from updated flood hazard information. BLE can be further refined to provide detailed study information for a Flood Risk Identification Study and a FIRM update.

Areas of communities that were developed prior to 1970 (pre-FIRM areas) may include repetitive and severe repetitive loss properties. They may also be areas where re-development is likely to occur. Having updated flood hazard information before re-development and reconstruction activities take place may benefit communities by providing guidance to mitigate future risk.

The Discovery process aims to identify a subset of the BLE stream studies to be updated and included on the FIRMs. Communities may wish to review these possible areas and provide *feedback once the BLE data has been received. Local communities can also refine BLE information and submit it through the Letter of Map Revision (LOMR) process to revise the existing flood hazard information and maintain the FIRMs throughout their community.*

Post-Discovery Findings Meetings

LADOTD held one Post-Discovery Meeting on June 4, 2025, for stakeholders in the study watershed. A copy of the presentation is available in Appendix 1.

The Post-Discovery informational webinar was held to discuss the results of the Discovery process and findings, including a review of comments received, preliminary HAZUS results, and BLE data. The FEMA Estimated BFE viewer, which can be used for reporting and downloading data, was presented and demonstrated to community stakeholders. The goals of the Post-Discovery webinar were to:

- Recap the FEMA's Risk MAP program's benefits and the Discovery process
- Discuss comments received by stakeholders
- Explain watershed prioritization and stream study requests
- Review HAZUS results
- Demonstrate the permanent FEMA BFE viewer
- Release a draft report to the communities prior to the release of the final report.

Future Investments Decisions

FEMA will work closely with communities to identify additional areas for model refinement and FIRM panel updates. Communities will be provided information and training to support the use of BLE for planning, floodplain management, permitting, and risk communication activities. FEMA will work with communities to review, interpret, and incorporate the BLE information into their daily and future community management and planning activities.

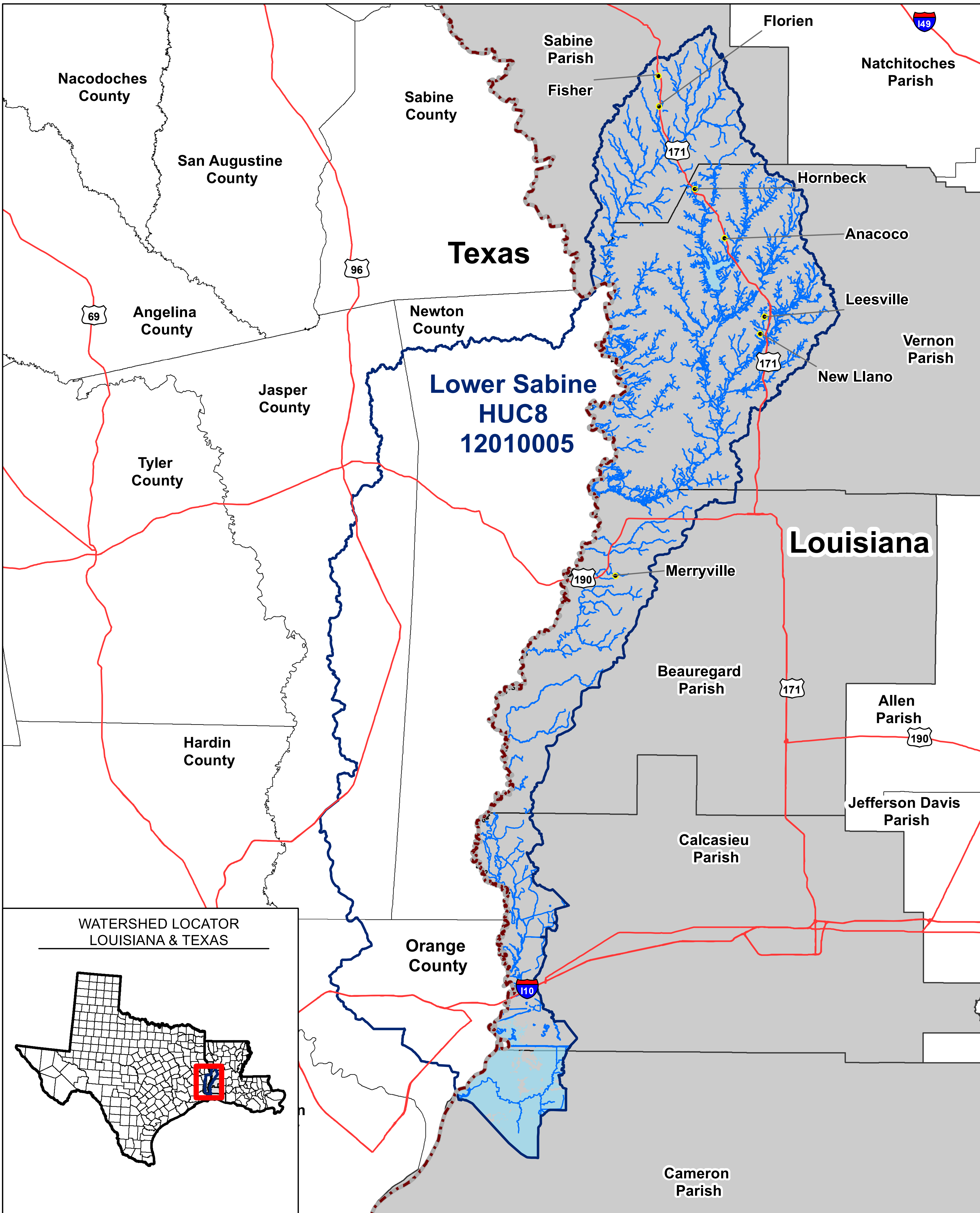
Next Steps

Once the Discovery process is completed, FEMA will review project recommendations and determine if a project will move forward to update the regulatory products (FIS report, FIRM, and DFIRM database). A cursory review of the modeling results indicates that this study area has significant changes in floodplain width and depth.

FEMA will work with communities to collect any outstanding technical inquiries within the study area after delivering the hydrologic and hydraulic analysis and floodplain work maps. After coordinating with communities, FEMA will likely initiate the Phase Three effort to update the regulatory products.

Appendix I: Additional Data

Appendix Figures



Map Symbology

- Communities
- Major Highways
- HUC Mainstems
- Lake
- Lower Sabine Parishes
- Lower Sabine HUC8
- State Boundary

Figure A1:

Watershed (HUC-8) Locations

Lower Sabine Watershed

June 30, 2025

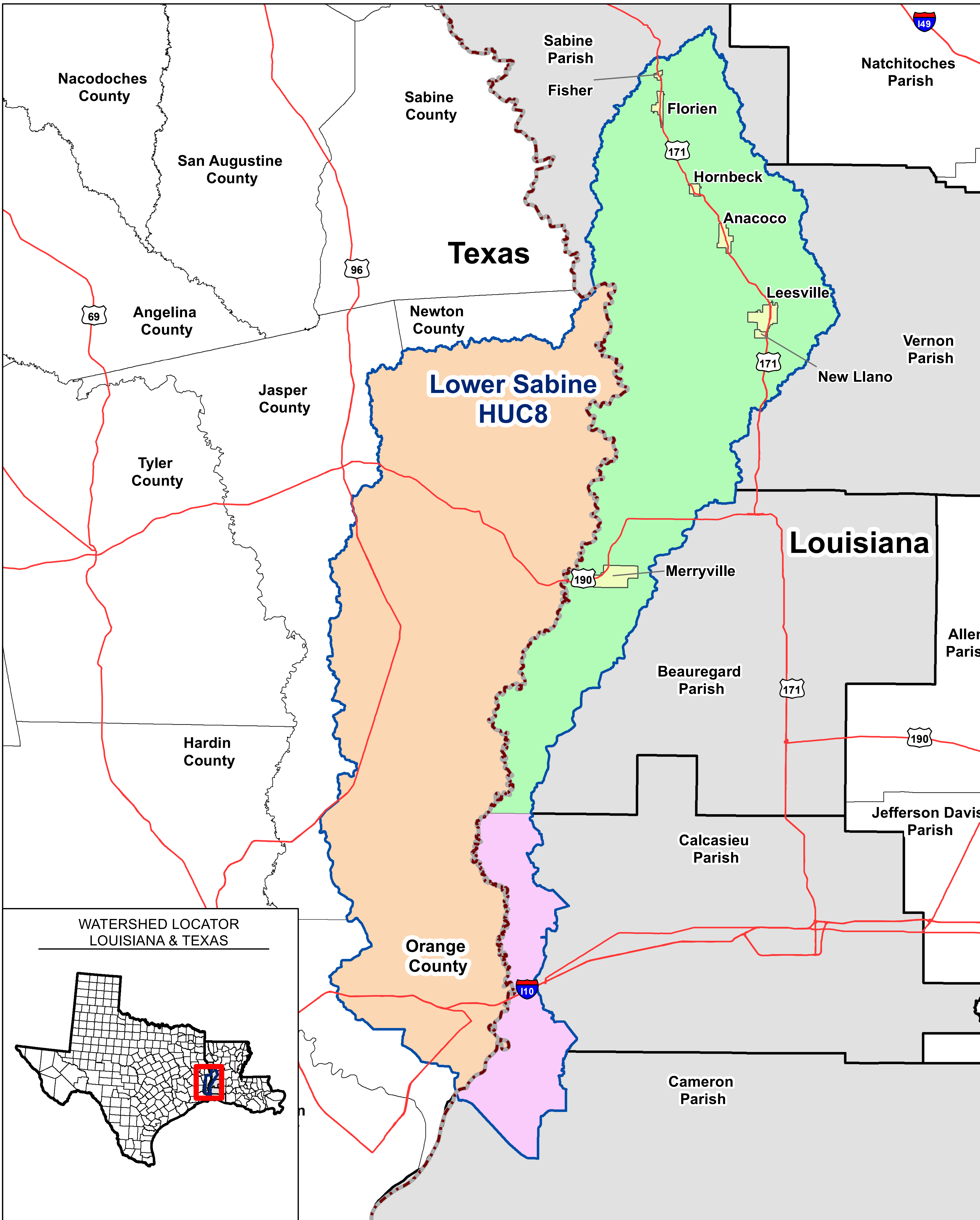
FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N

* NRI is the National Risk Index, created by the Federal Emergency Management Agency



Map Symbology

Major Highways

Communities

Lower Sabine HUC-8 Boundary

US Congressional Districts

NAMELSAD

Congressional District 3

Congressional District 36

Congressional District 4

U.S. House of Representatives

Louisiana District 3: Rep. Clay Higgins (R)
Louisiana District 4: Rep. Mike Johnson (R)

U.S. Senators

Sen. Bill Cassidy (R)
Sen. John Kennedy (R)

Figure A2:

U.S. Congressional Districts

Lower Sabine Watershed

June 30, 2025

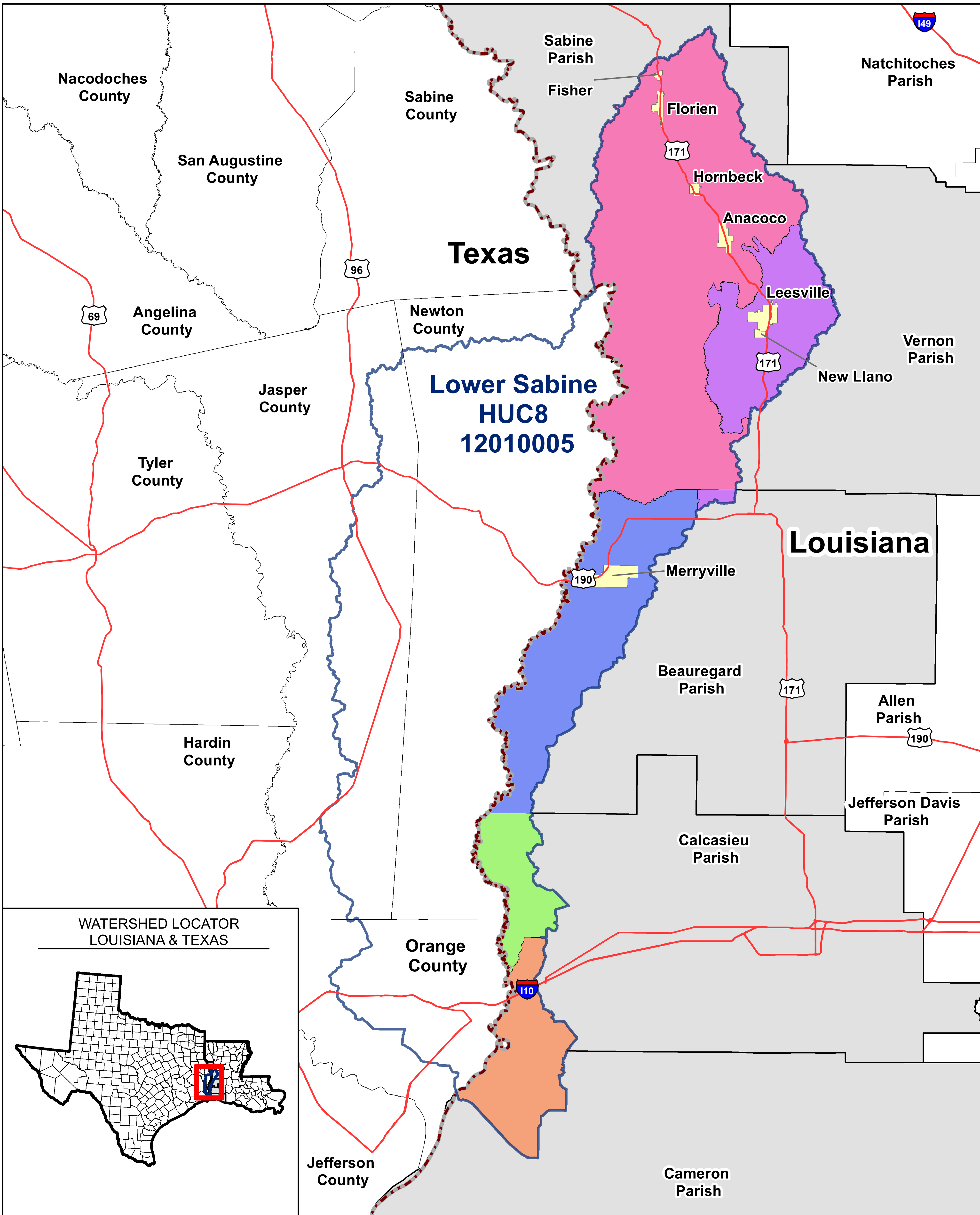
FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N

* NRI is the National Risk Index, created by the Federal Emergency Management Agency



Map Symbology

- Major Highways
- Communities
- Lower Sabine Parishes
- Lower Sabine HUC8
- State Boundary

Louisiana State House Districts

- House District 7
- House District 24
- House District 30
- House District 32
- House District 33
- House District 35
- House District 37
- House District 47

District 7: Larry Bagley (R)
District 24: Rodney Schamerhorn (R)
District 30: Charles Anthony Owen (R)
District 32: Dewith R. Carrier (R)
District 33: Les Farnum (R)
District 35: Brett F. Geymann (R)
District 37: Troy Romero (R)
District 47: Ryan Bourriaque (R)

Figure A3:

State House Districts

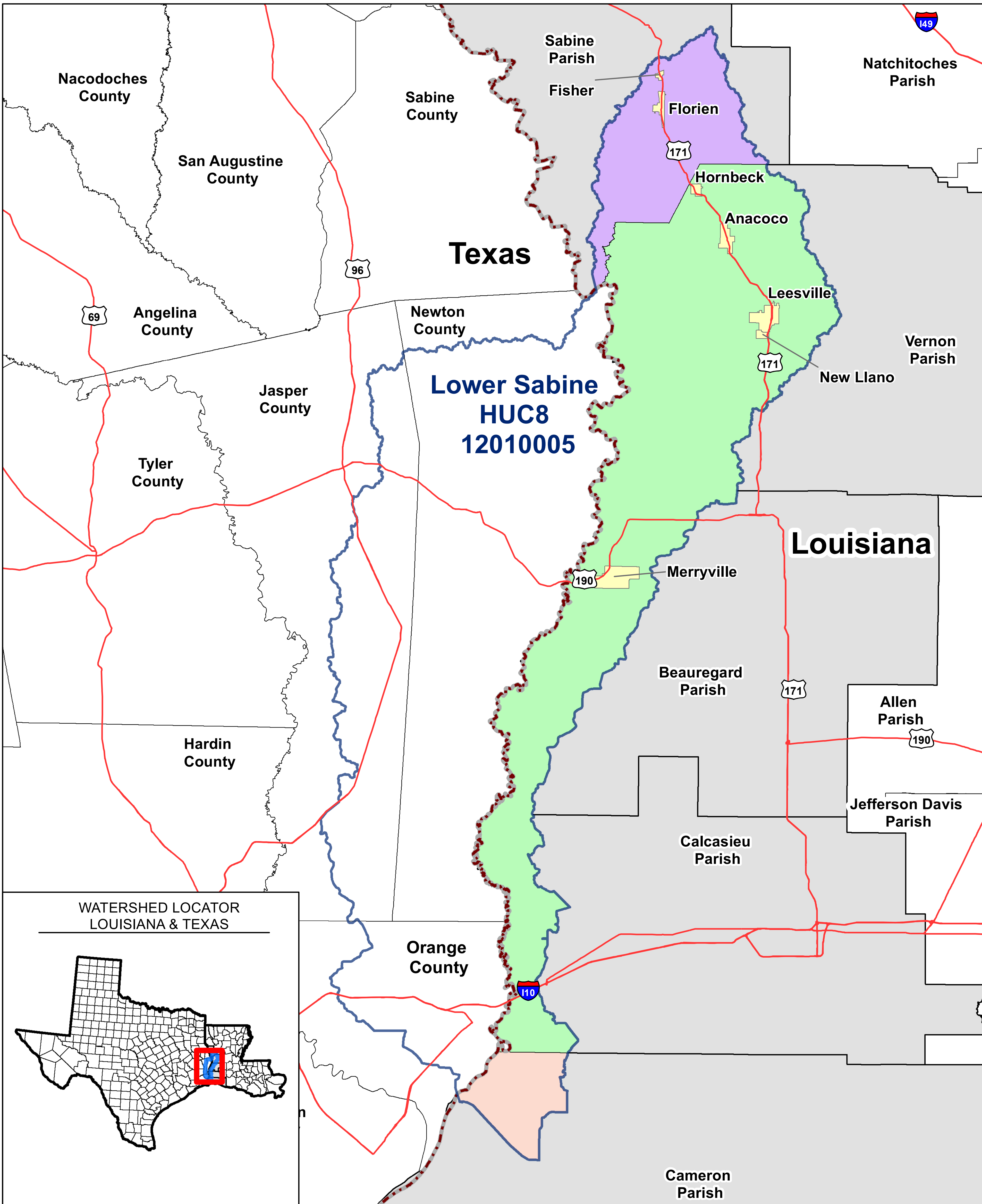
Lower Sabine Watershed

June 30, 2025

0 10 20 Miles

N

* NRI is the National Risk Index, created by the Federal Emergency Management Agency



Map Symbology

- Major Highways
- Communities
- Lower Sabine Parishes
- Lower Sabine HUC8
- State Boundary

Louisiana State Senate District

- Senate District 25
- Senate District 30
- Senate District 31

Louisiana State Senate Districts

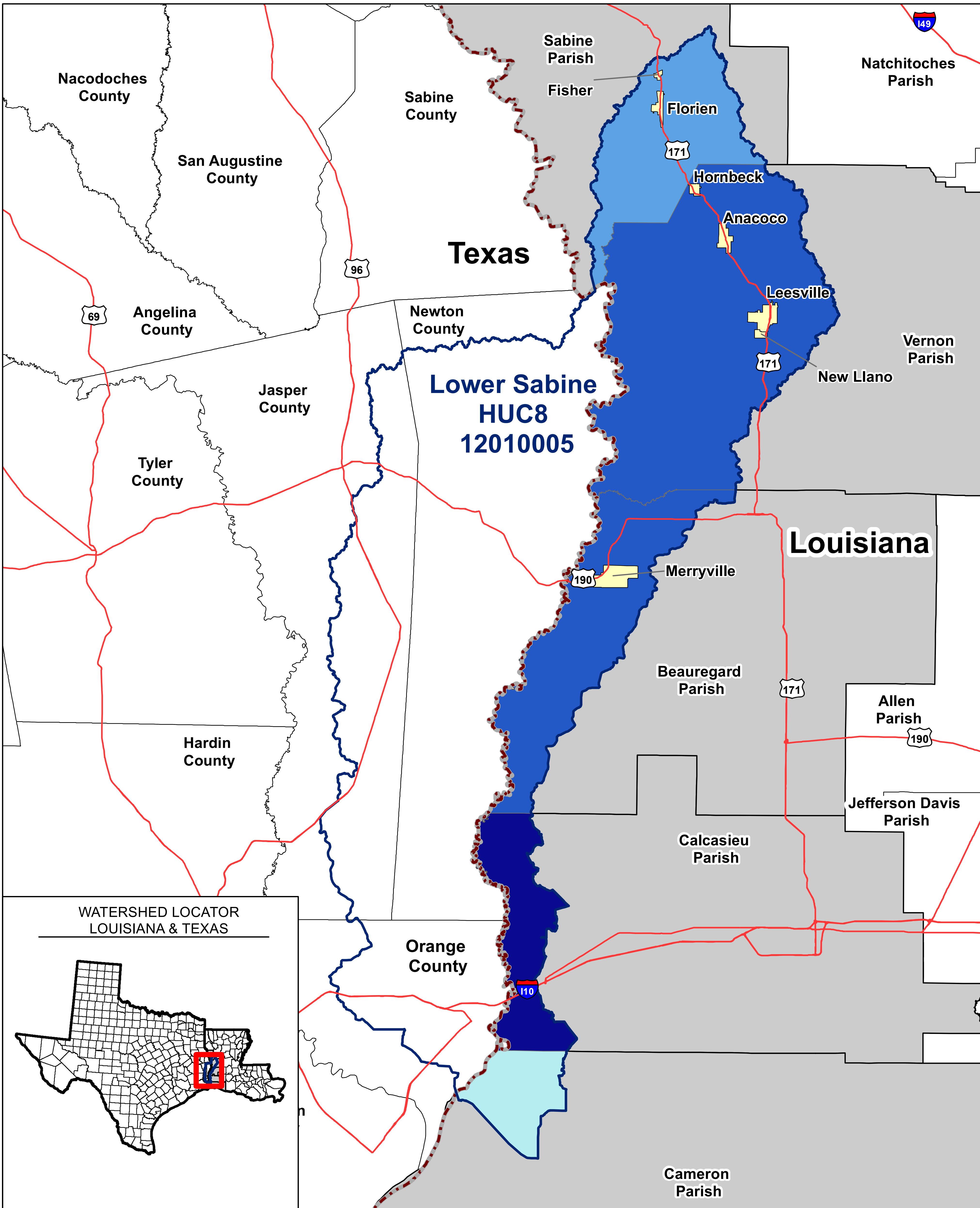
District 25: Mark Abraham (R)
District 27: Jeremy Stine (R)
District 30: Mike Reese (R)
District 31: Alan Seabaugh (R)

Figure A4:

State Senate Districts

Lower Sabine Watershed

June 30, 2025



Map Symbology

- Major Highways
- Communities
- Lower Sabine Parishes
- Lower Sabine HUC8
- State Boundary

Population Density (2020)

- Very Low
- Low
- Medium
- High

Figure A5:

Population Density

Lower Sabine Watershed

June 30, 2025

FEMA

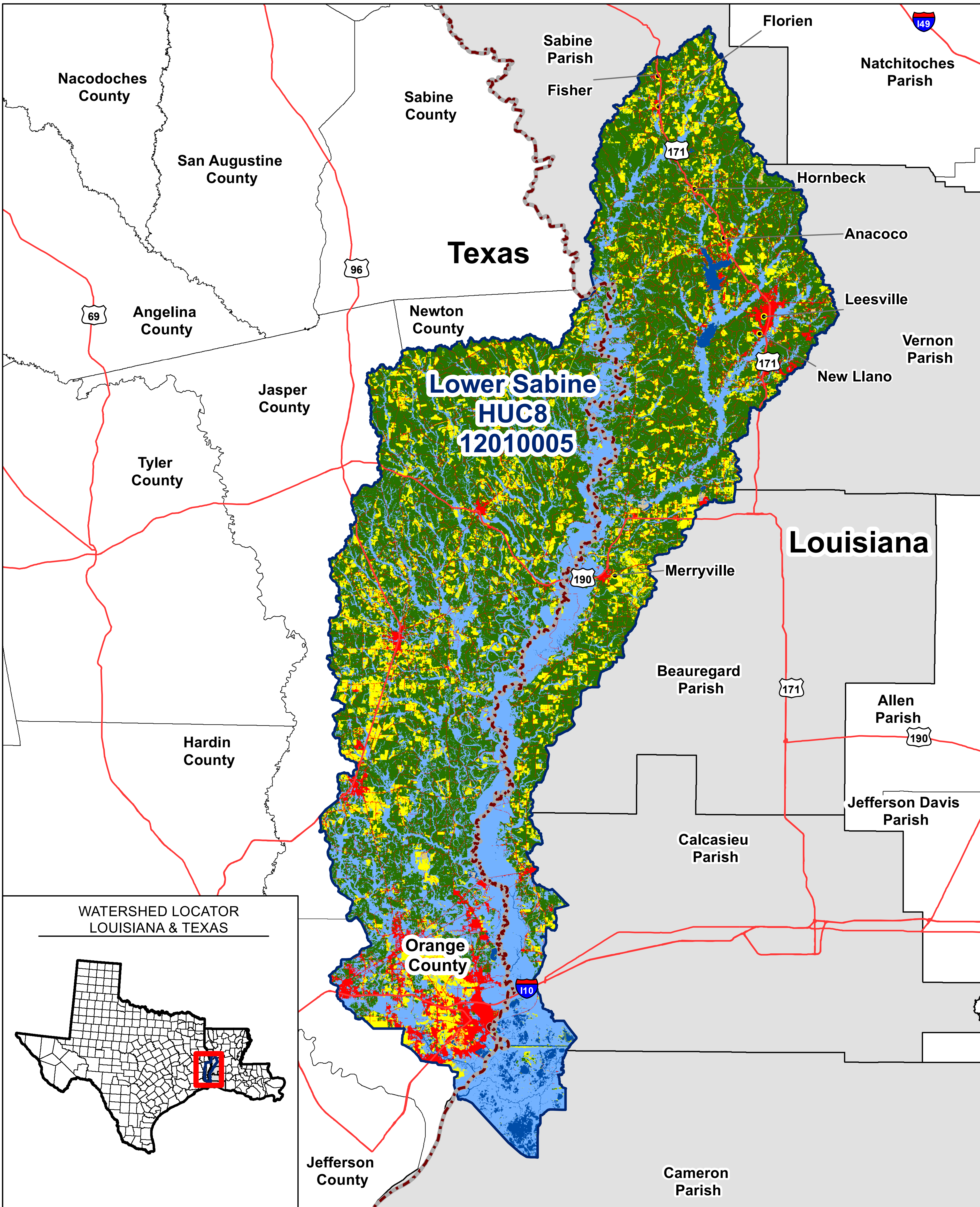
DOTD

LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N

* Source: 2020 U.S. Census



Map Symbology

- Major Highways
- Community
- Discovery Parish/County Boundary
- Lower Sabine HUC8
- State Boundary

Land Cover (NLCD* 2023)

- Barren Land
- Farmland
- Forestry
- Open Water
- Urban Development
- Wetlands

* National Land Cover Dataset

Figure A6:

Land Cover

Lower Sabine Watershed

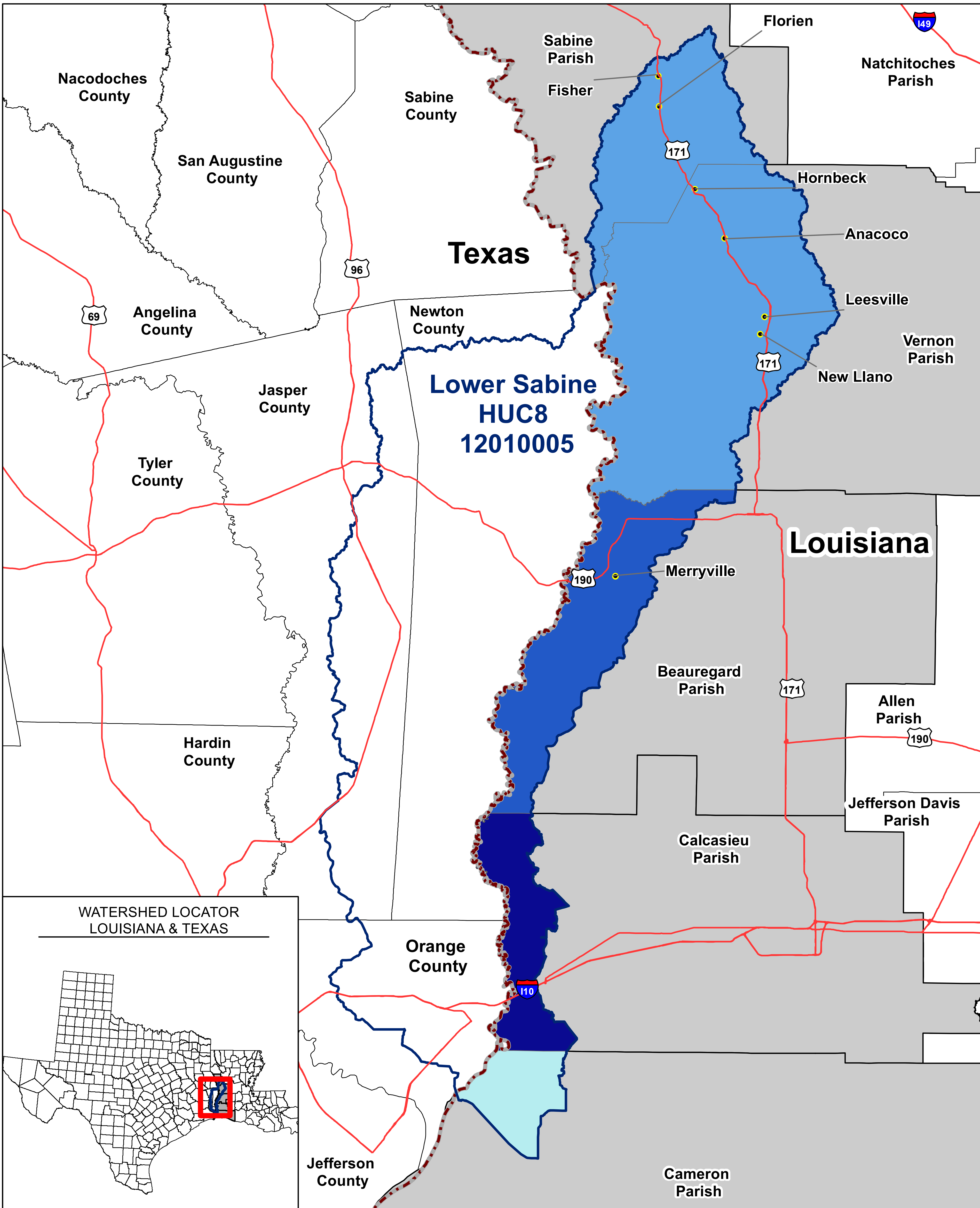
June 30, 2025

FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N



Map Symbology

- Major Highways
- Communities
- Lower Sabine Parishes
- Lower Sabine HUC8
- State Boundary

Population Change (2010-2020)

- -17% or less
- -17 - -6.9%
- -6.9 - 2.5%
- 2.5% or more

Figure A7:

Percent Change in Population

Lower Sabine Watershed

June 30, 2025

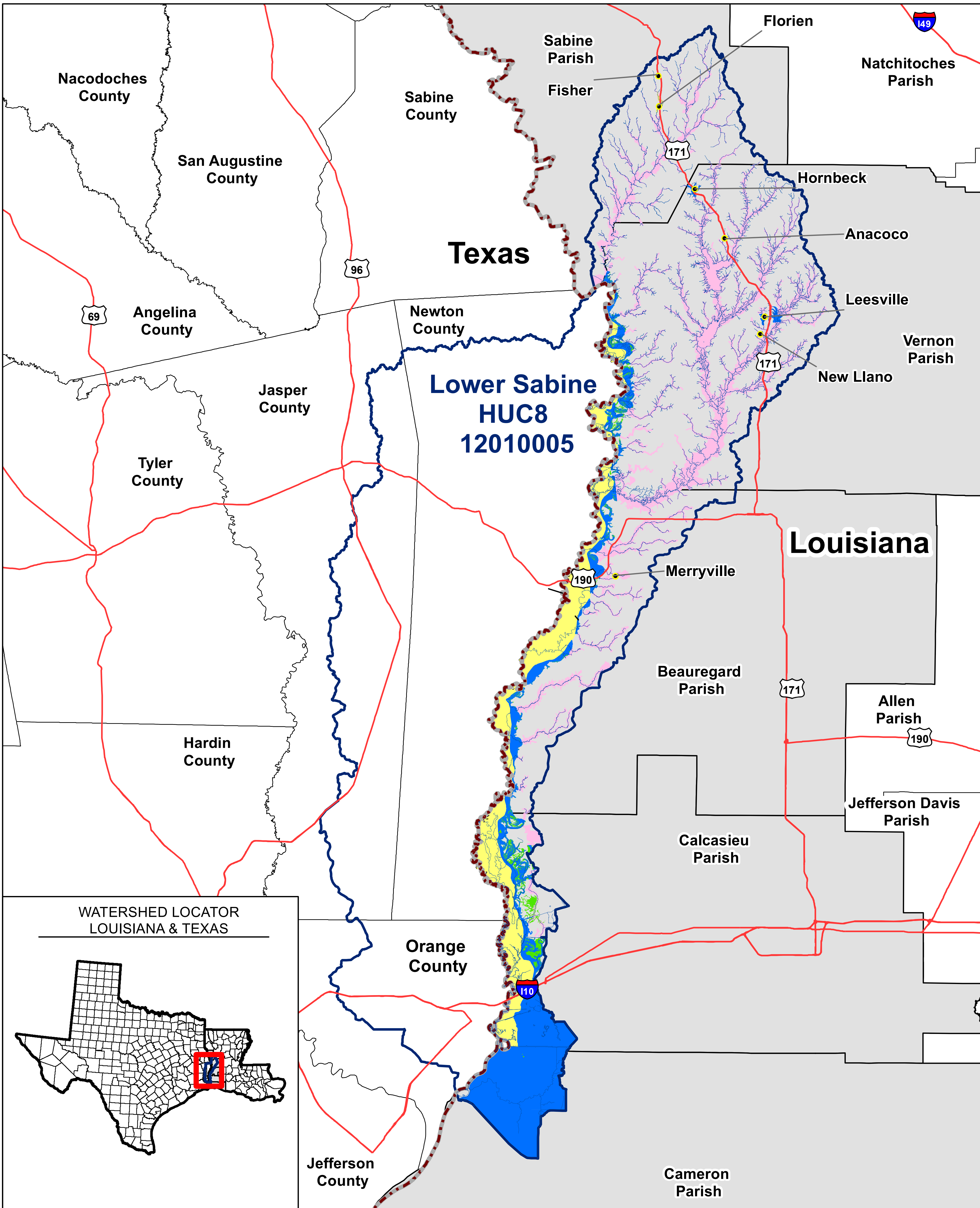
FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N

* Source: 2020 U.S. Census



Map Symbology

- Major Highways
- HUC8 Mainstreams
- Communities
- Lower Sabine Parishes
- Lower Sabine HUC8
- State Boundary

Effective FEMA Floodplains (2024)

- Zone AE, Floodway (100-Year Detailed)
- Zones AE, AO (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X (500-Year)
- Zone X, Area with reduced flood risk due to levee

* Source: 2020 U.S. Census

Figure A8:

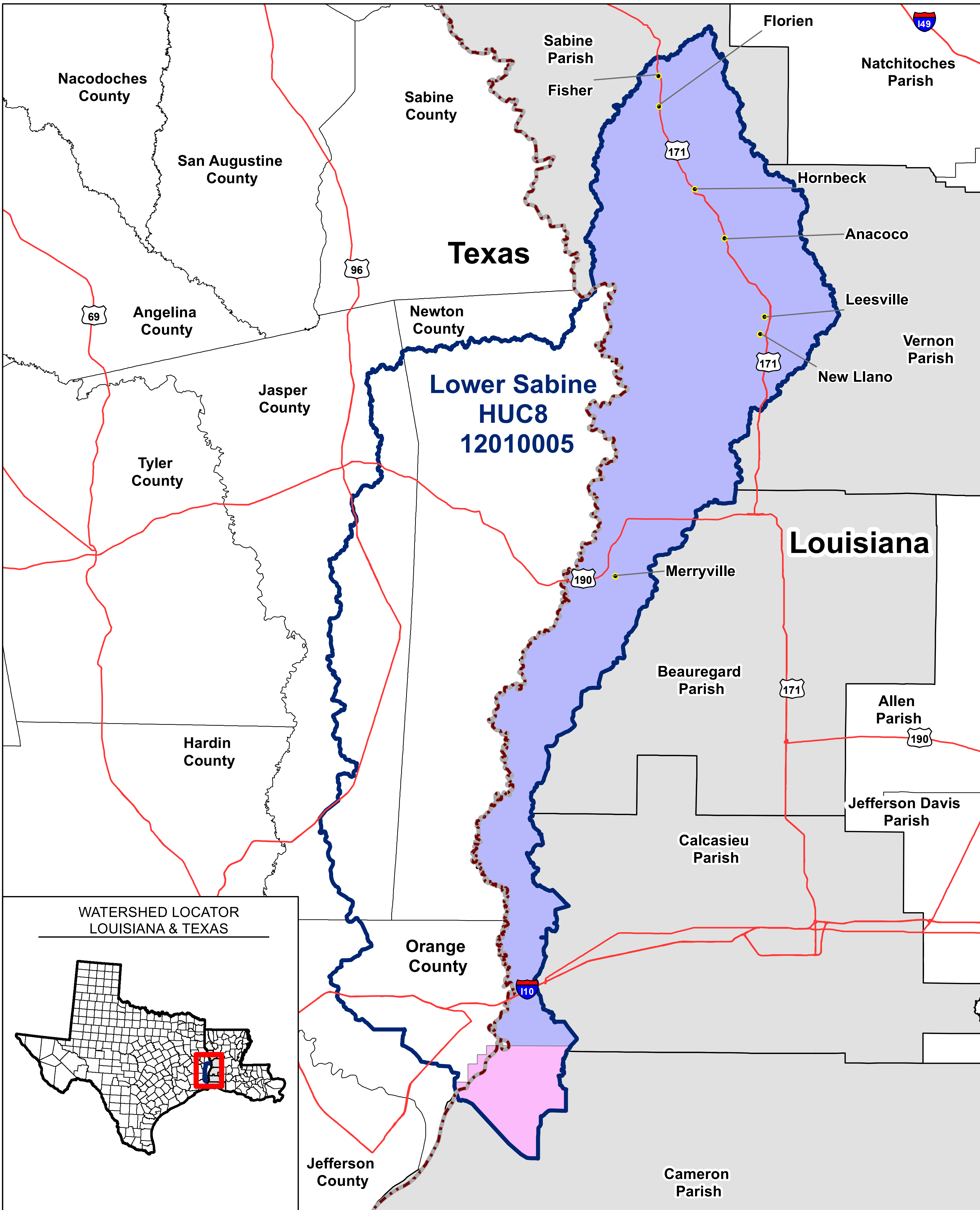
Effective Floodplains

Lower Sabine Watershed

June 30, 2025

0 10 20 Miles

N



Map Symbology

- Communities
- Major Highways
- Lower Sabine Parishes
- Lower Sabine HUC8
- State Boundary

Available Topographic Data

- 2018 USGS Sabine River
- 2023 USGS Louisiana Coastal Parishes

Figure A9:

Available Topographic Data

Lower Sabine Watershed

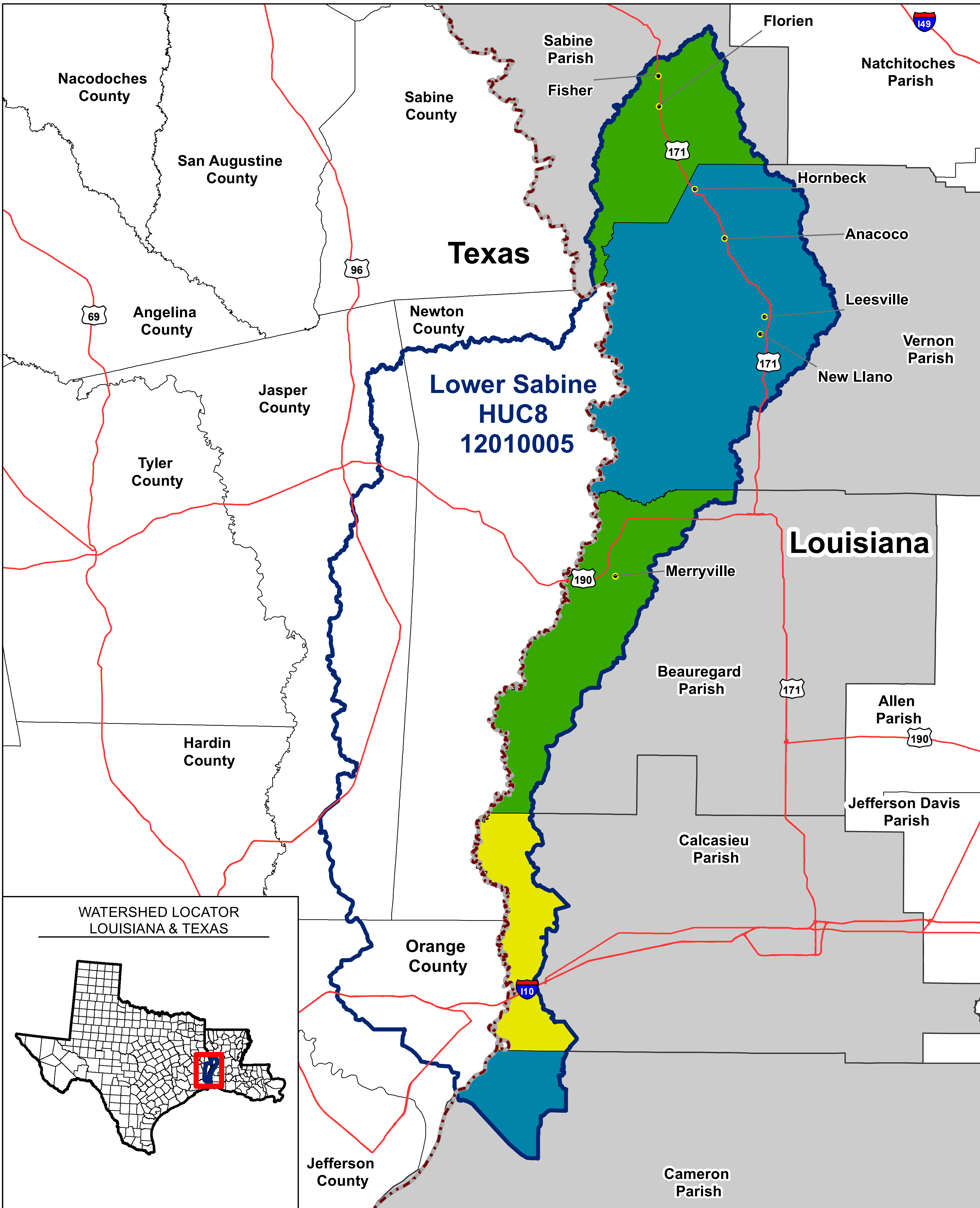
June 30, 2025

FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N



Map Symbology

- Community_Point
- Major Highways
- Lower Sabine Parishes
- Lower Sabine HUC8 Boundary
- State Boundary

Community Total NFIP Claims*

- 0
- 1-100
- 101-1000
- 1000+

* Data only includes Louisiana communities

Figure A10:

NFIP Claims By Community

Lower Sabine Watershed

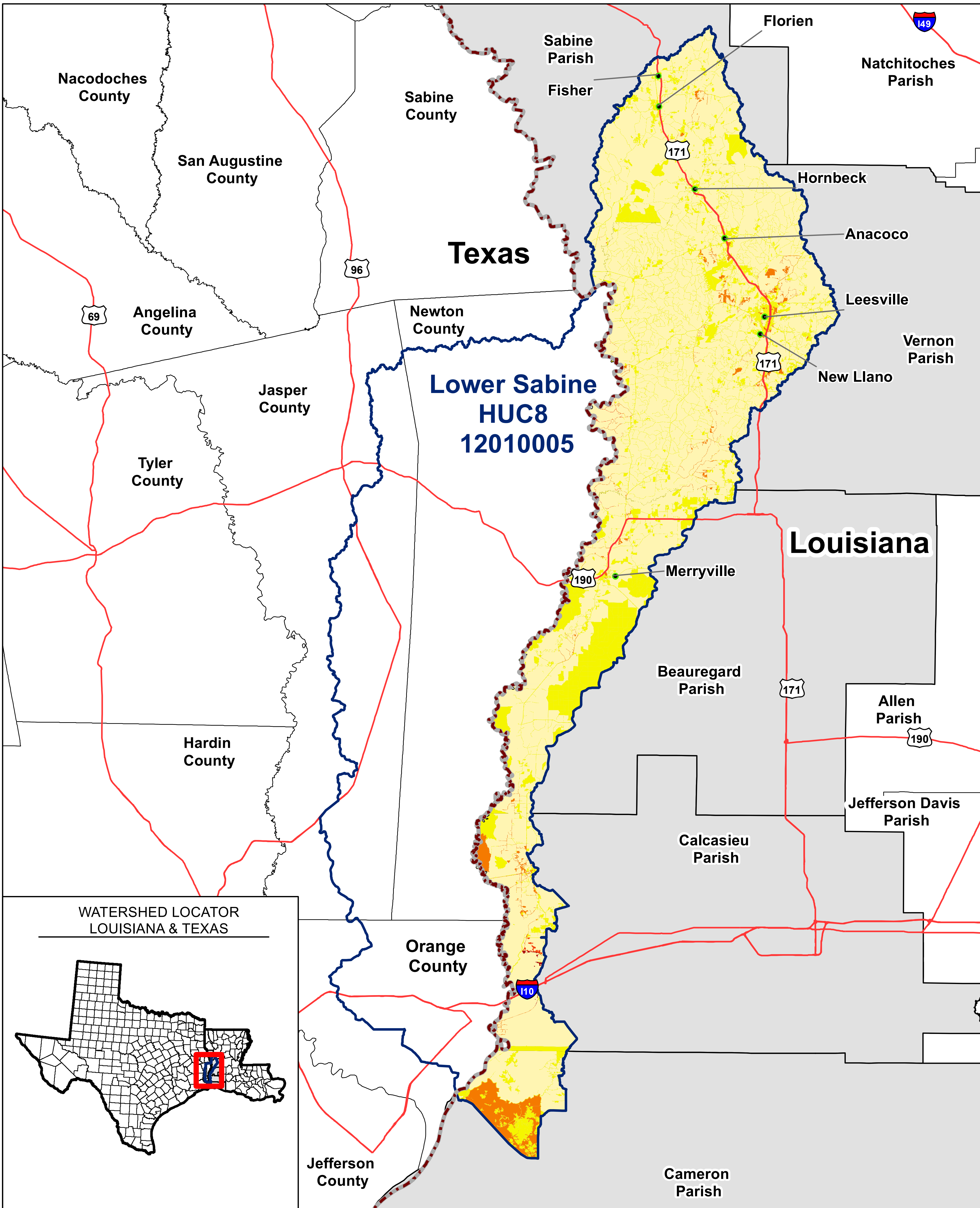
June 30, 2025

FEMA

DOTD
LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N



Map Symbology

- Communities
- Major Highways
- Lower Sabine Parishes
- Lower Sabine HUC8 Boundary
- State Boundary

Hazus 1% -Annual-Chance Loss Study*

- Very Low
- Low
- Medium
- High
- Very High

*Flood risk data obtained from the FEMA Base Level Engineering studies

Figure A11: Flood Risk - Potential Losses

Lower Sabine Watershed

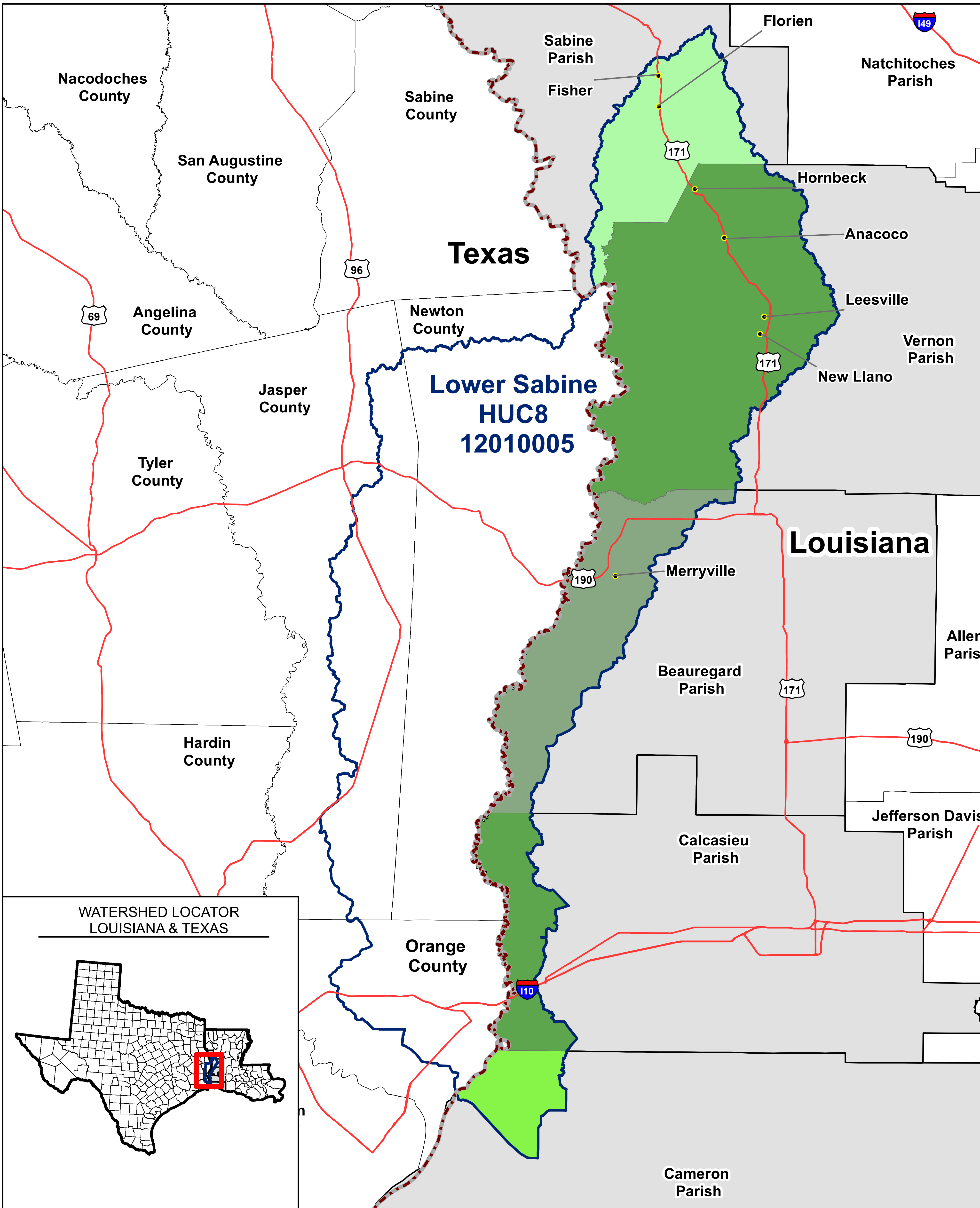
June 30, 2025

FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N



Map Symbology

- Communities
- Major Highways
- Lower Sabine Parishes
- Lower Sabine HUC8 Boundary
- State Boundary

Social Vulnerability Rating (NRI 2024*)

- Relatively Low
- Relatively Moderate
- Relatively High
- Very High

Figure A12:

Social Vulnerability Rating

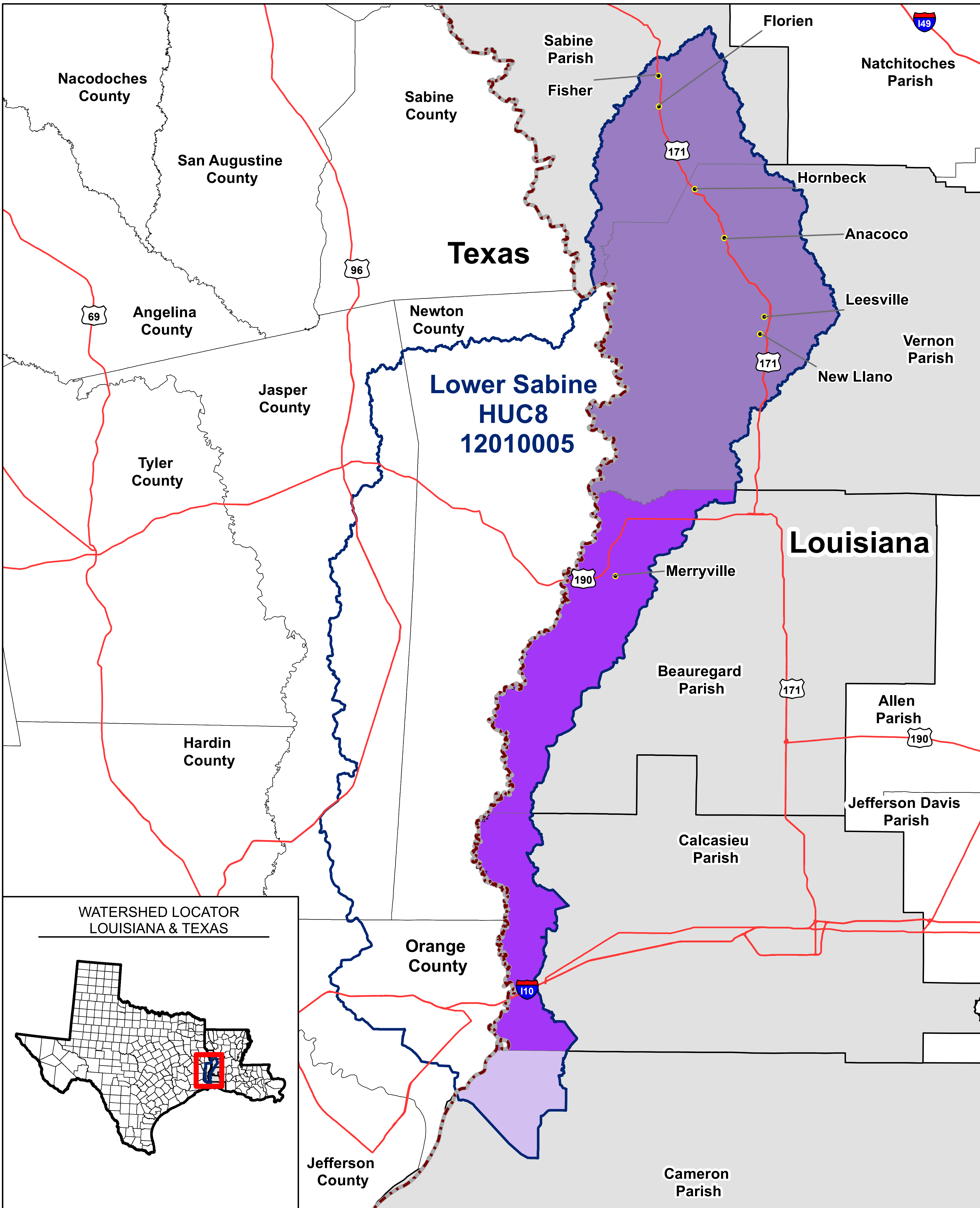
Lower Sabine Watershed

June 30, 2025

0 10 20 Miles

N

* NRI is the National Risk Index, created by the Federal Emergency Management Agency



Map Symbology

- Communities
- Major Highways
- Lower Sabine Parishes
- Lower Sabine HUC8 Boundary
- State Boundary

Resilience Rating (NRI 2024*)

- Very Low
- Relatively Low
- Relatively High
- Very High

Figure A13:

Resilience Rating

Lower Sabine Watershed

June 30, 2025

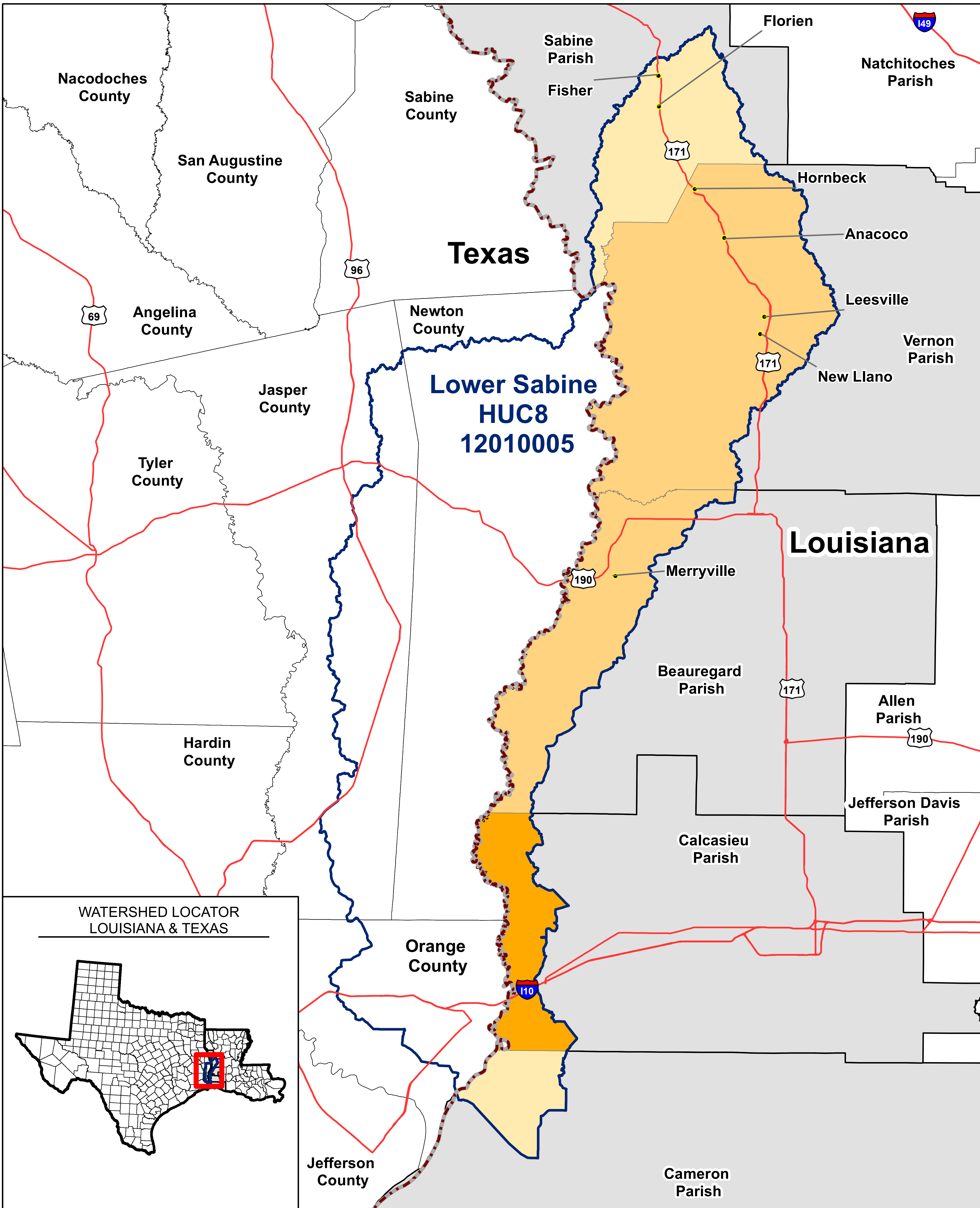
FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N

* NRI is the National Risk Index, created by the Federal Emergency Management Agency



Map Symbology

- Communities
- Major Highways
- Lower Sabine Parishes
- Lower Sabine HUC8 Boundary
- State Boundary

Riverine Flooding Risk Rating (NRI 2024*)

- Relatively Low
- Relatively Moderate
- Relatively High
- Very High

* NRI is the National Risk Index, created by the Federal Emergency Management Agency

Figure A14:

Riverine Flood Risk Rating

Lower Sabine Watershed

June 30, 2025

FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

0 10 20 Miles

N

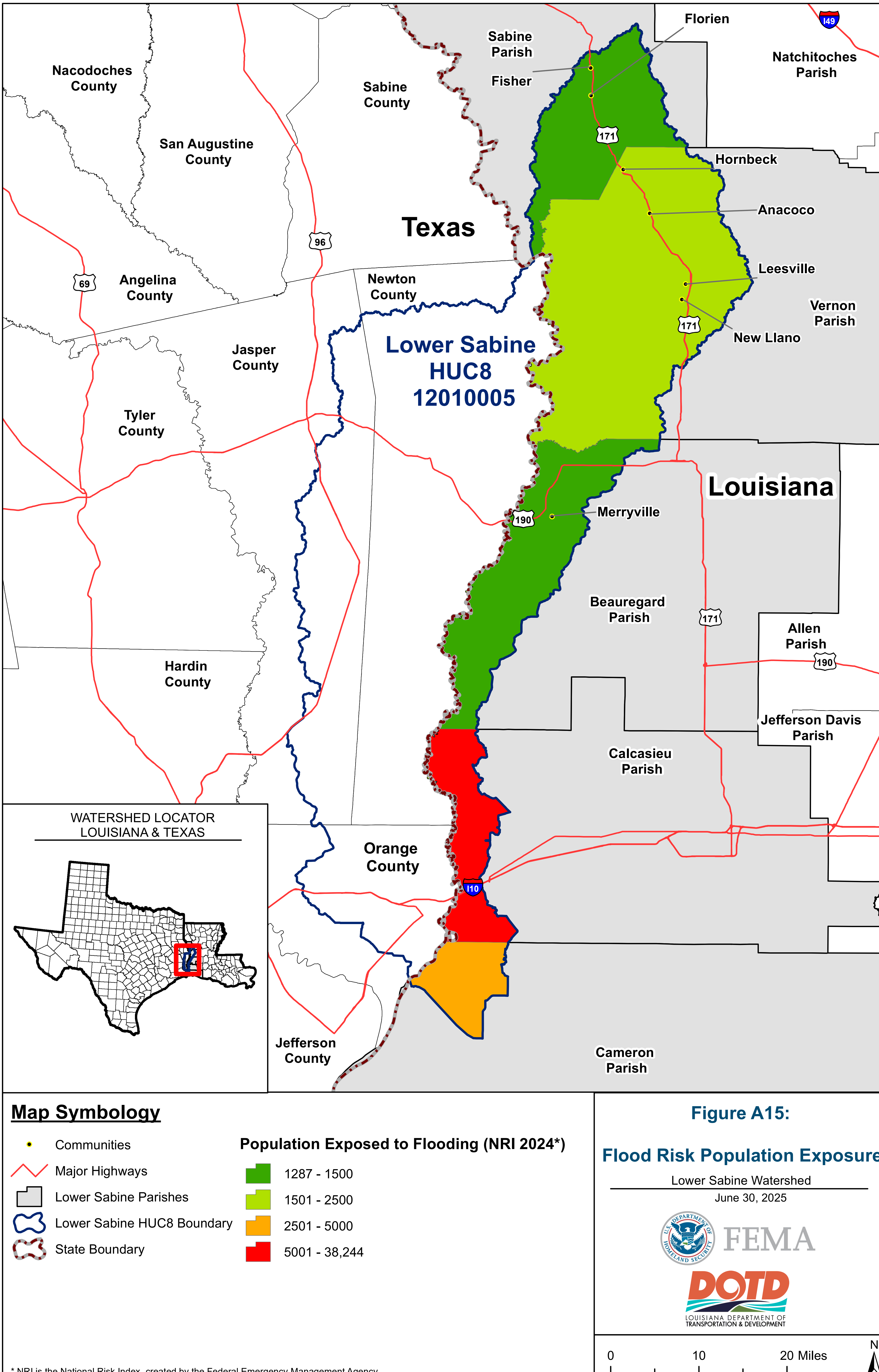


Figure A15:

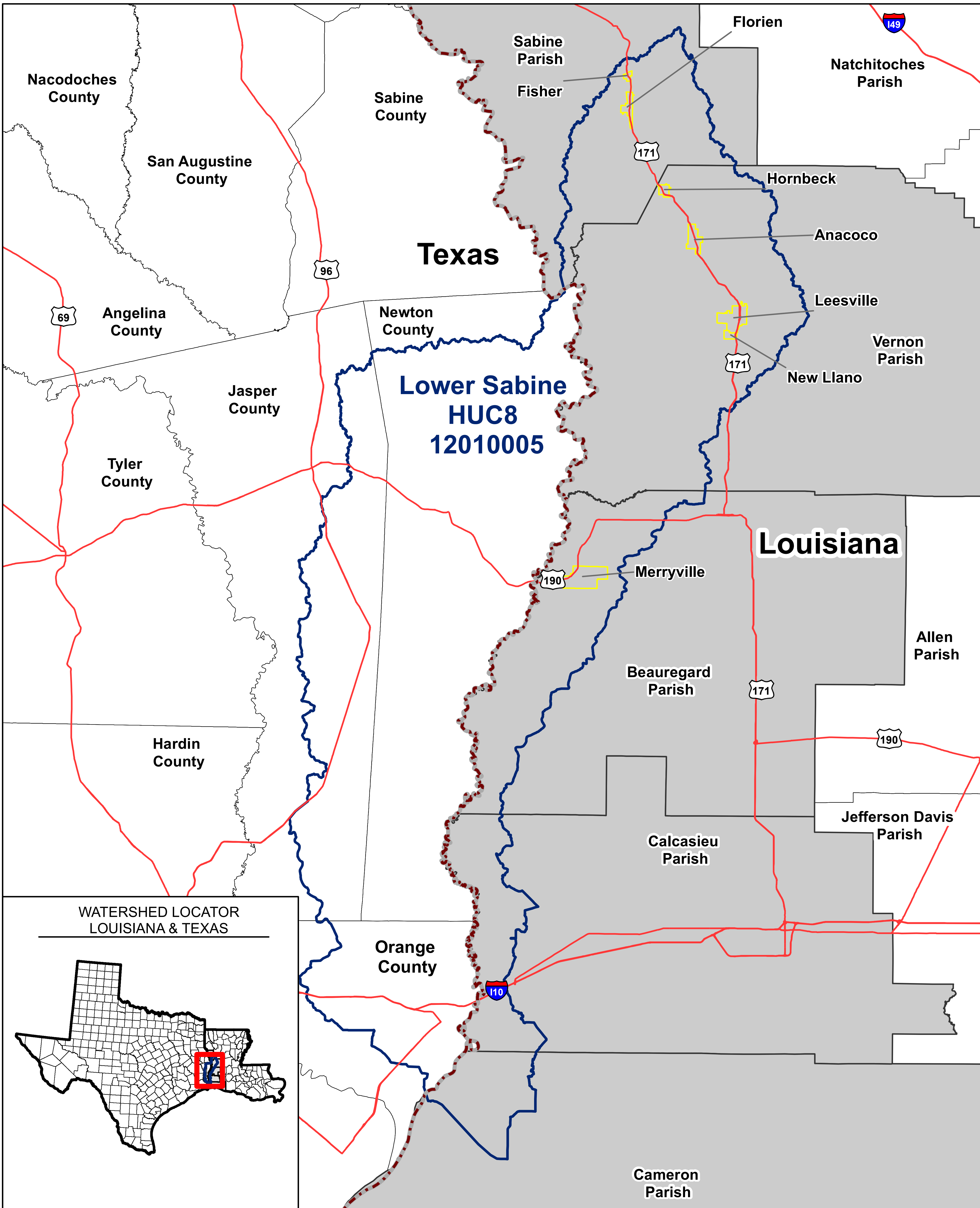
Flood Risk Population Exposure

Lower Sabine Watershed

June 30, 2025

FEMA

DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT



Map Symbology

Major Highways

Lower Sabine Parishes

Lower Sabine HUC8

State Boundary

CRS Class

Not Participating

Figure A16: Community Rating System (CRS) Participating Communities

Lower Sabine Watershed

June 30, 2025

FEMA

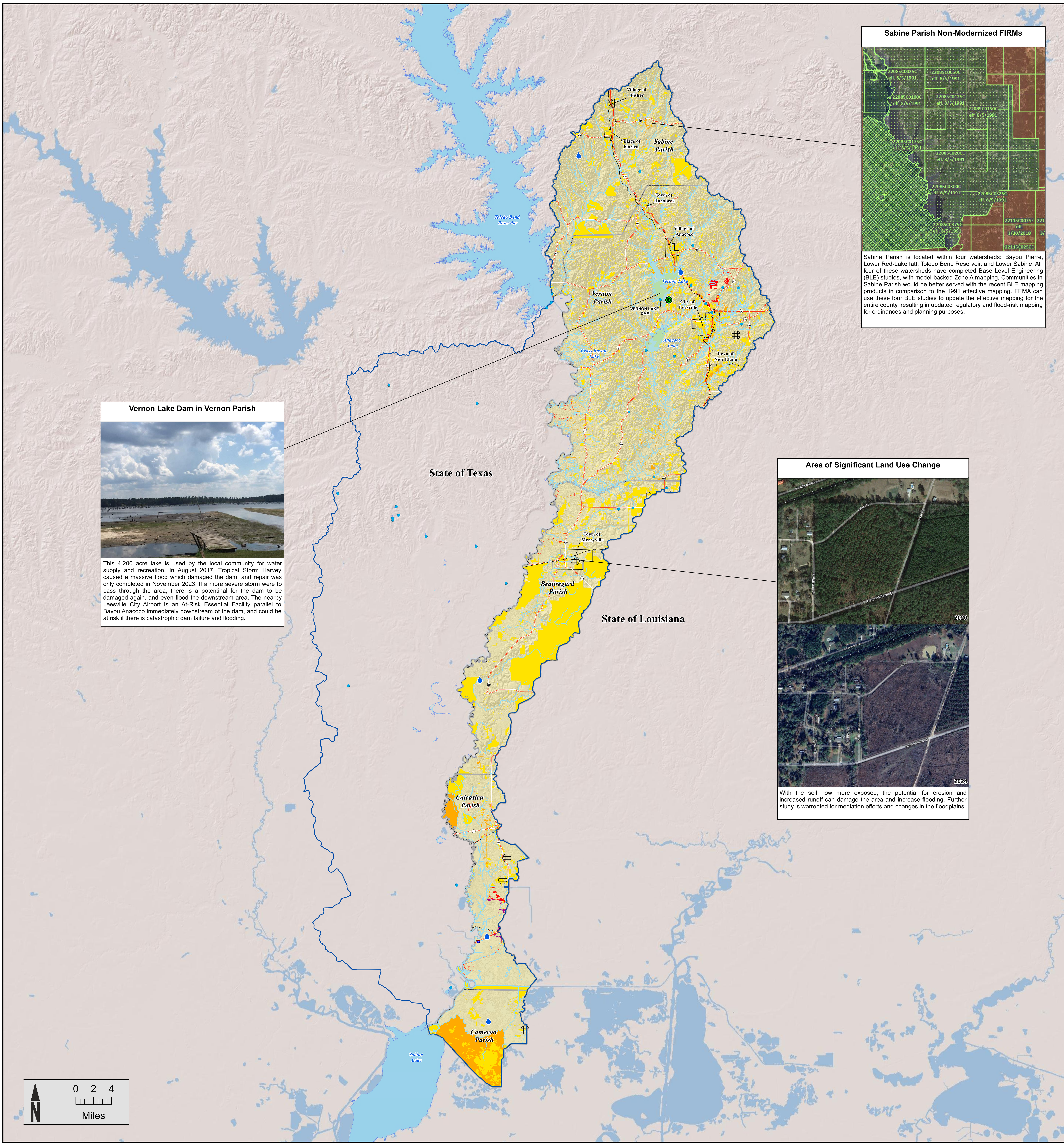
DOTD Louisiana Department of Transportation & Development

0 10 20 Miles

N

Flood Risk Maps

Flood Risk Map: *Lower Sabine HUC 8 Watershed*



MAP SYMBOLOGY

Base Data
- Major Roads
- Levees
- Railroads
- State Boundary
- Watershed Boundary
- Waterbodies
- City Boundary
- County Boundary

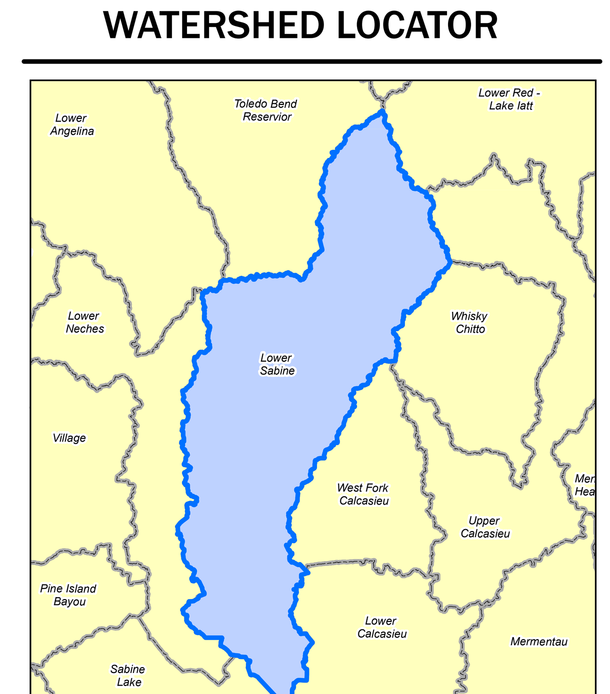
Flood Data
- Rivers and Streams
- New SFHA

Flood Risk*
- Very Low
- Low
- Medium
- High
- Very High

Areas of Mitigation Interest
- Dams
- At Risk Essential Facilities
- Other Flood Risk Areas
- Significant Land Use Change

***Flood Risk Data Source**
Base Level Engineering (BLE) data and HAZUS Level 2 Analysis

WATERSHED LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FRM FLOOD RISK MAP

Lower Sabine Watershed

FEMA

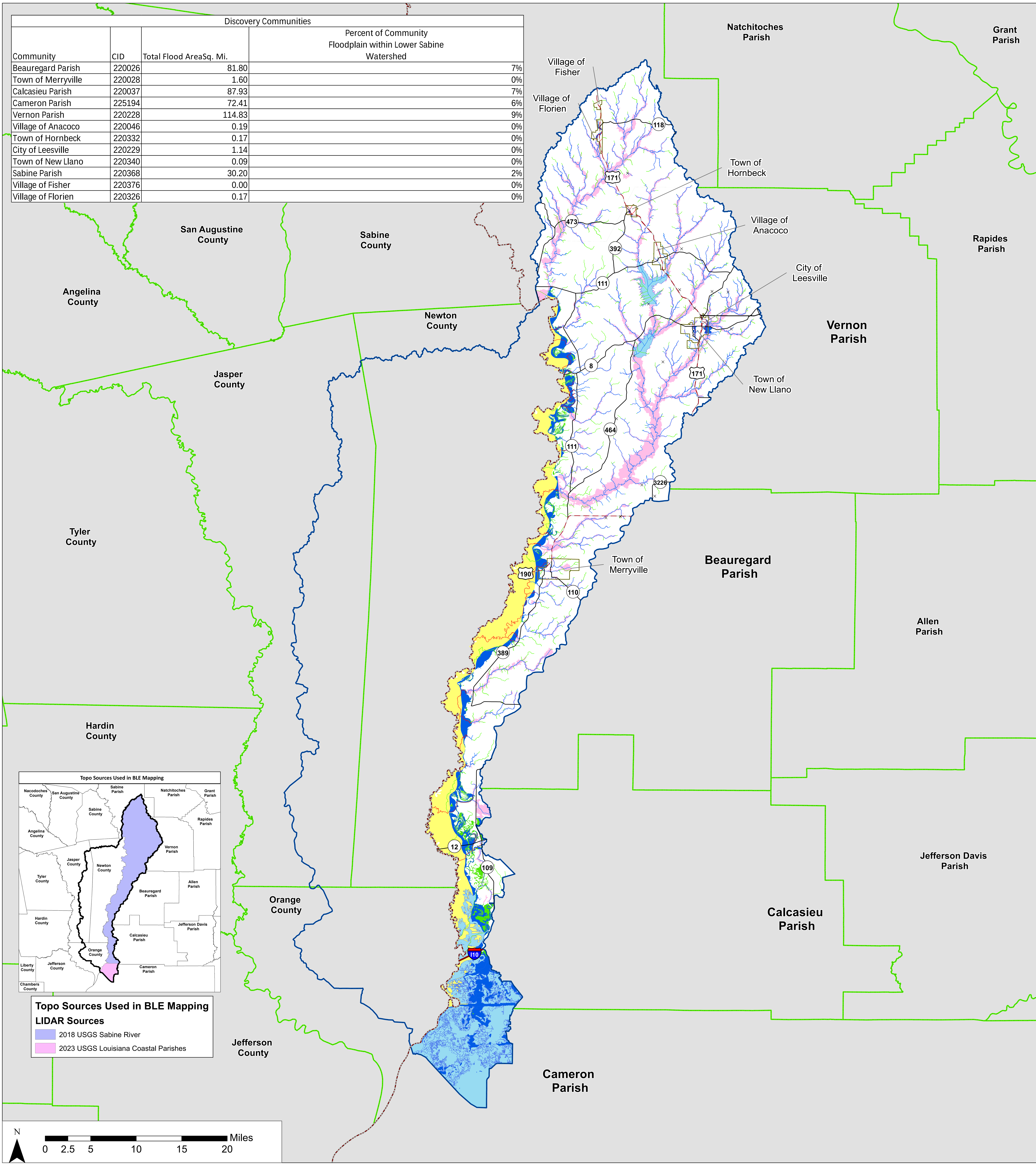
HUC-8 Code
12010005

RELEASE DATE
07/31/2025

For more information of data used for this map, please consult the Lower Sabine Watershed Flood Risk Database and Flood Risk Report.

Pre-Discovery Maps

Discovery Communities			
Community	CID	Total Flood AreaSq. Mi.	Percent of Community Floodplain within Lower Sabine Watershed
Beauregard Parish	220026	81.80	7%
Town of Merryville	220028	1.60	0%
Calcasieu Parish	220037	87.93	7%
Cameron Parish	225194	72.41	6%
Vernon Parish	220228	114.83	9%
Village of Anacoco	220046	0.19	0%
Town of Hornbeck	220332	0.17	0%
City of Leesville	220229	1.14	0%
Town of New Llano	220340	0.09	0%
Sabine Parish	220368	30.20	2%
Village of Fisher	220376	0.00	0%
Village of Florien	220326	0.17	0%

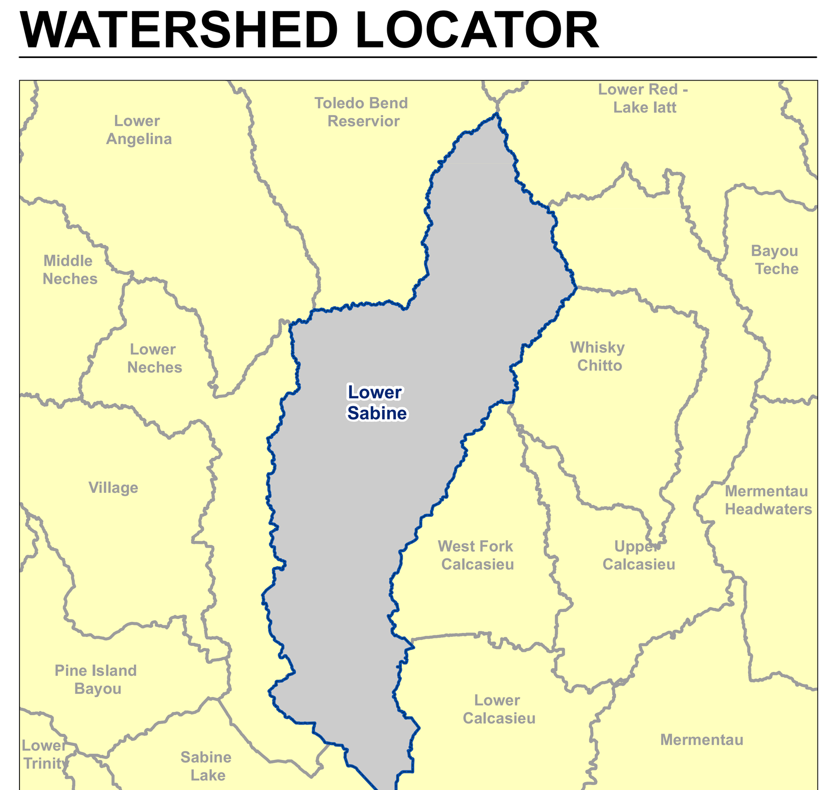


Map Symbology

Dam	**Effective FEMA Floodplains***
Lake	Floodway
City Boundary	Zone AE, VE, AO (100-Year, Detailed)
County Boundary	Zone A (100-Year, Approximate)
Watershed Boundary	Zones AH, 100-Year Depth <1 Foot; X500 (500-Year, Detailed)
State Boundary	Zone X, Reduced Flood Risk Due to Levee
Major Roads	**Effective Streams Study Type***
SHIELD	Zone AE (100-Year, Detailed)
Interstate Highway	Zone A (100-Year, Approximate)
US Highway	Zone X (Unshaded X, Areas of Minimal Flood Risk)
State Highway	

*Data as of May 2023

WATERSHED LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Pre-Discovery Map

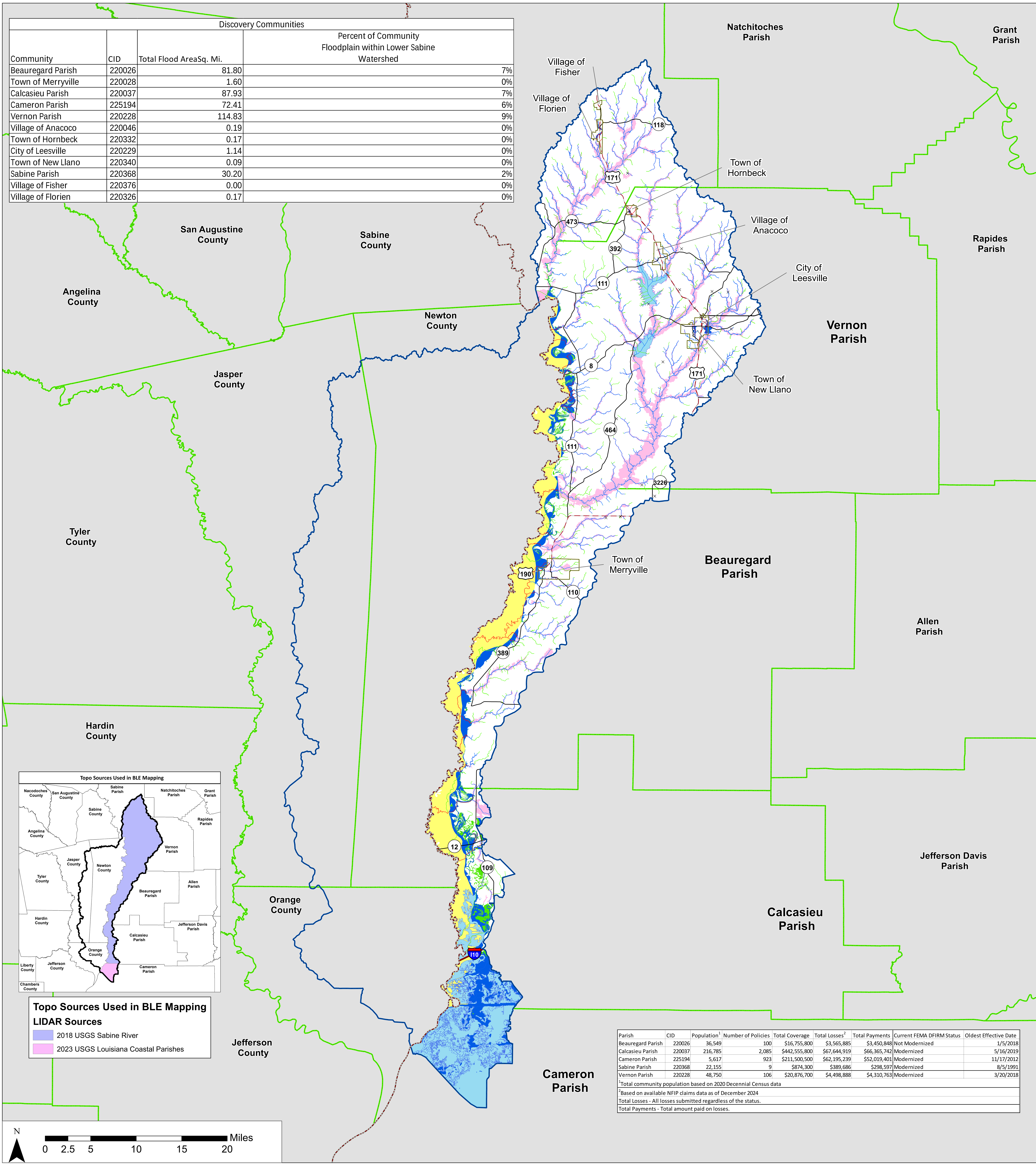
LOWER SABINE WATERSHED, LOUISIANA

Stream Miles: 2,029
Zone AE Miles: 20
Zone A Miles: 1,215
Zone X Miles: 1,411
Population: 56,084

HUC-8 Code
12010005

U.S. DEPARTMENT OF HOMELAND SECURITY
FEMA

Discovery Maps



Discovery Communities			
Community	CID	Total Flood AreaSq. Mi.	Percent of Community Floodplain within Lower Sabine Watershed
Beauregard Parish	220026	81.80	7%
Town of Merryville	220028	1.60	0%
Calcasieu Parish	220037	87.93	7%
Cameron Parish	225194	72.41	6%
Vernon Parish	220228	114.83	9%
Village of Anacoco	220046	0.19	0%
Town of Hornbeck	220332	0.17	0%
City of Leesville	220229	1.14	0%
Town of New Llano	220340	0.09	0%
Sabine Parish	220368	30.20	2%
Village of Fisher	220376	0.00	0%
Village of Florien	220326	0.17	0%

Parish	CID	Population[1]	Number of Policies	Total Coverage	Total Losses[2]	Total Payments	Current FEMA DFIRM Status	Oldest Effective Date
Beauregard Parish	220026	36,549	100	$16,755,800	$3,565,885	$3,450,848	Not Modernized	1/5/2018
Calcasieu Parish	220037	216,785	2,085	$442,555,800	$67,644,919	$66,365,742	Modernized	5/16/2019
Cameron Parish	225194	5,617	923	$211,500,500	$62,195,239	$52,019,401	Modernized	11/17/2012
Sabine Parish	220368	22,155	9	$874,300	$389,686	$298,597	Modernized	8/5/1991
Vernon Parish	220228	48,750	106	$20,876,700	$4,498,888	$4,310,763	Modernized	3/20/2018

[1]Total community population based on 2020 Decennial Census data

[2]Based on available NFIP claims data as of December 2024

Total Losses - All losses submitted regardless of the status.

Total Payments - Total amount paid on losses.

Map Symbology

Dam
Lake
City Boundary
County Boundary
Watershed Boundary
State Boundary

Major Roads

SHIELD

Interstate Highway
US Highway
State Highway

Effective FEMA Floodplains*

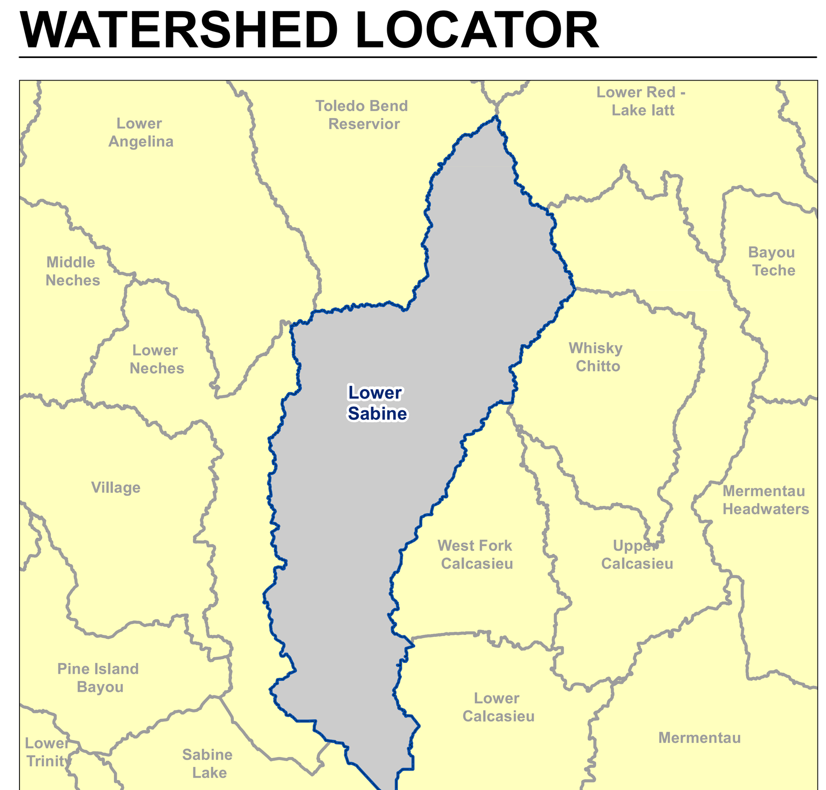
Floodway
Zone AE, VE, AO (100-Year, Detailed)
Zone A (100-Year, Approximate)
Zones AH, 100-Year Depth <1 Foot; X500 (500-Year, Detailed)
Zone X, Reduced Flood Risk Due to Levee

Effective Streams Study Type*

Zone AE (100-Year, Detailed)
Zone A (100-Year, Approximate)
Zone X (Unshaded X, Areas of Minimal Flood Risk)

***Data as of May 2023**

WATERSHED LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Discovery Map

LOWER SABINE WATERSHED, LOUISIANA

Stream Miles: 2,029
Zone AE Miles: 20
Zone A Miles: 1,215
Zone X Miles: 1,411
Population: 56,084

HUC-8 Code
12010005

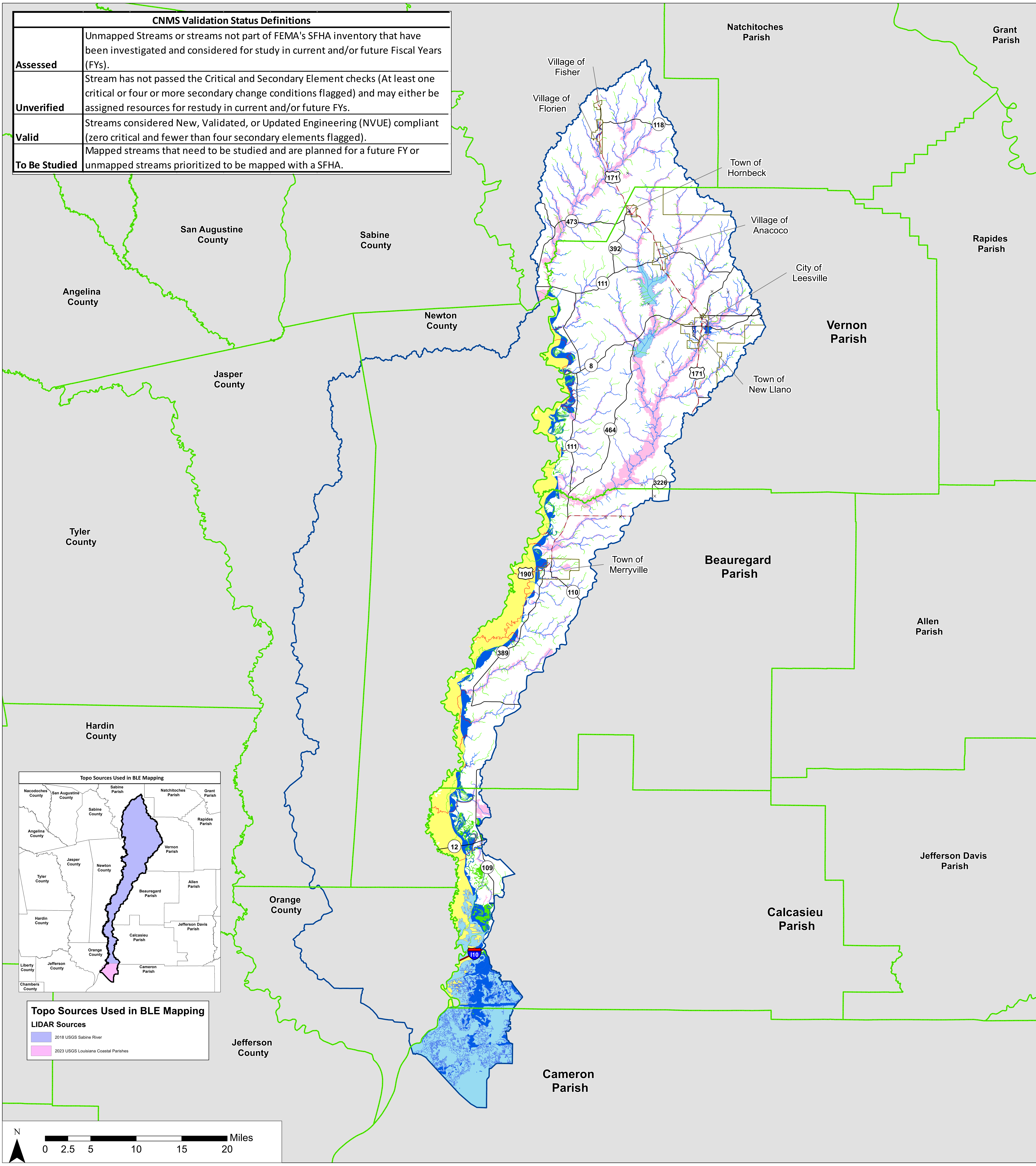
U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

Post-Discovery Maps

CNMS Validation Status Definitions

Assessed	Unmapped Streams or streams not part of FEMA's SFHA inventory that have been investigated and considered for study in current and/or future Fiscal Years (FYs).
Unverified	Stream has not passed the Critical and Secondary Element checks (At least one critical or four or more secondary change conditions flagged) and may either be assigned resources for restudy in current and/or future FYs.
Valid	Streams considered New, Validated, or Updated Engineering (NVUE) compliant (zero critical and fewer than four secondary elements flagged).
To Be Studied	Mapped streams that need to be studied and are planned for a future FY or unmapped streams prioritized to be mapped with a SFHA.



Map Symbology

- Dam
- Lake
- City Boundary
- County Boundary
- Watershed Boundary

Major Roads

SHIELD

- Interstate Highway
- US Highway
- State Highway

Effective FEMA Floodplains*

- Floodway
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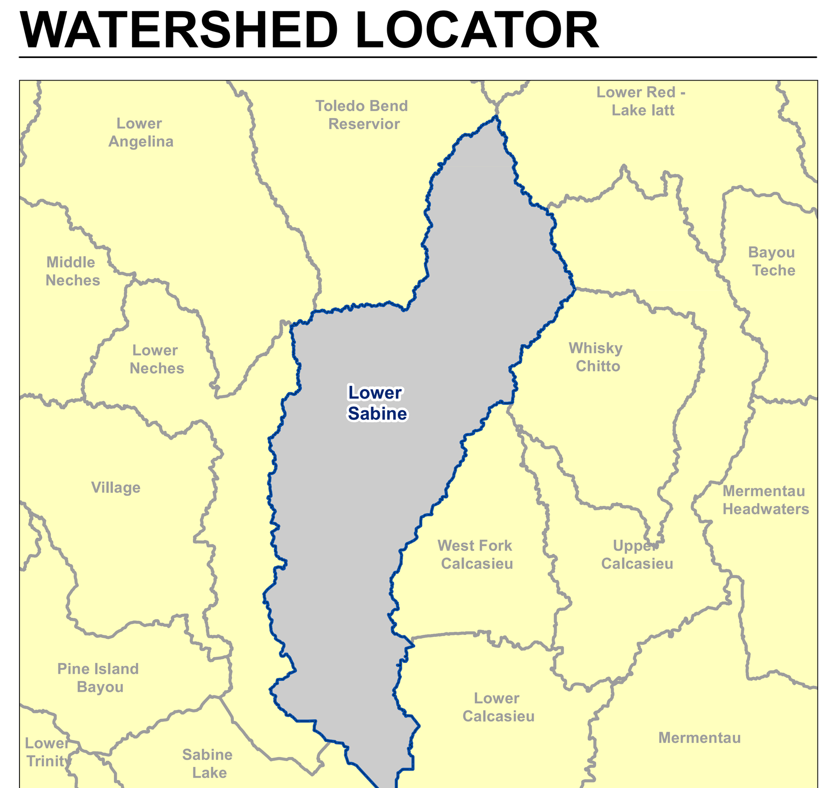

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FEMA

Pre-Discovery Newsletter

Pre-Discovery Newsletter
Lower Sabine Watershed

"Capturing a More Complete Picture of Your Community and Your Watershed" *Spring 2022*

The Who: Risk MAP Process and Discovery

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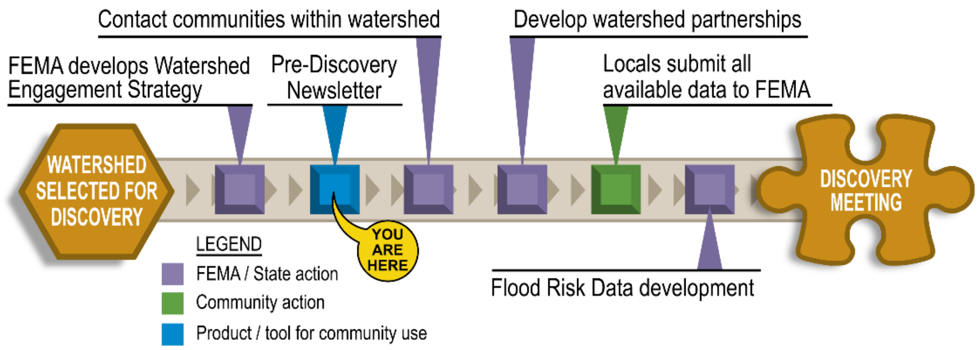
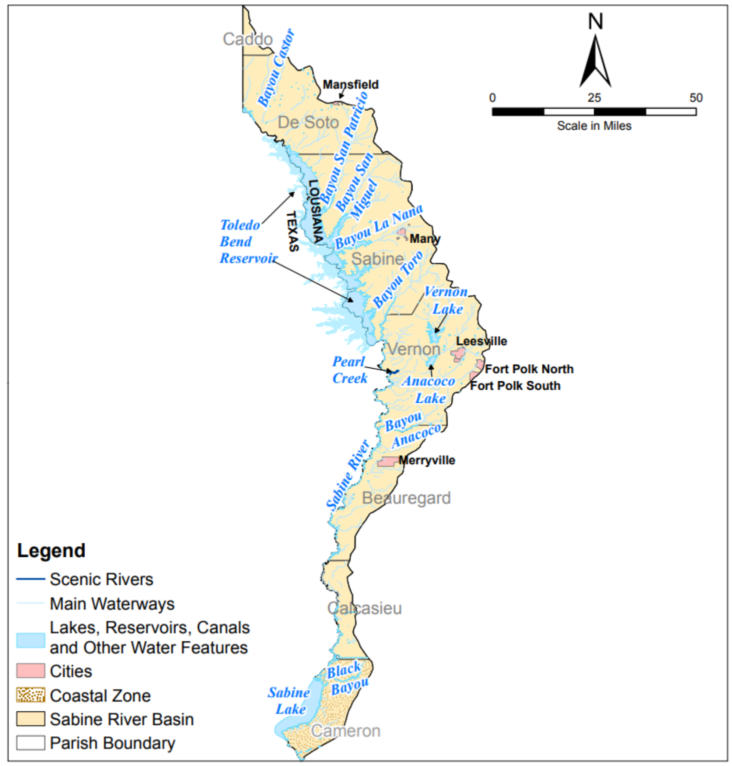


The Goal: To work closely with communities to better understand local flood risk, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Pre-Discovery Meeting
TBD - Spring 2022

Hybrid Meetings



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- Infrastructure information, especially for levees and new bridges, dams, culverts and road improvements
- Mitigation activities and grant projects (ongoing or planned)
- Local development and floodplain management plans
- Stormwater management activities
- Regional watershed plans
- Flood study needs

Customize Discovery:
After the meeting, enter your community's data at: (Need add shareable link)

Discovery Data Collection

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The Why: DOTD requests communities share whatever data they have, to provide as complete a picture as possible.

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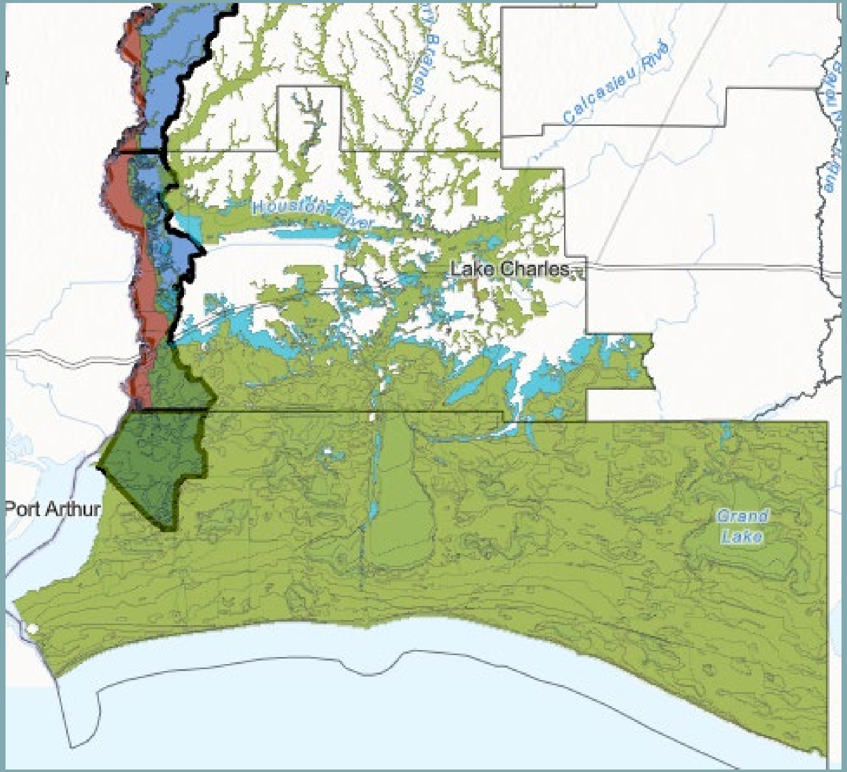
Pre-Discovery Meeting Slides

Pre-Discovery Meeting

Lower Sabine Watershed



QUALITY ENGINEERING & SURVEYING

"Discovery - Trust the process and enjoy the quality"

The Louisiana Department of Transportation & Development (DOTD) has been awarded a FEMA grant to conduct Discovery in the Lower Sabine watershed in 2022.

We need your help

STAKEHOLDERS
LOWER SABINE WATERSHED

- VILLAGE OF ANACOCO
- BEAUREGARD PARISH
- CALCASIEU PARISH
- CAMERON PARISH
- VILLAGE OF FLORIEN
- TOWN OF HORNBECK
- CITY OF LEESVILLE
- VILLAGE OF MERRYVILLE
- TOWN OF NEW LLANO
- SABINE PARISH
- VERNON PARISH

THE GOAL: To allow All Project Stakeholders to obtain a more comprehensive and holistic understanding of the flood risk and flood mitigation capabilities and opportunities of communities within the Lower Sabine watershed.

Risk MAP Project Lifecycle:

(Guidance for Stakeholder Engagement, November 21, 2021, Page 5)

QUALITY ENGINEERING & SURVEYING

PRE-DISCOVERY

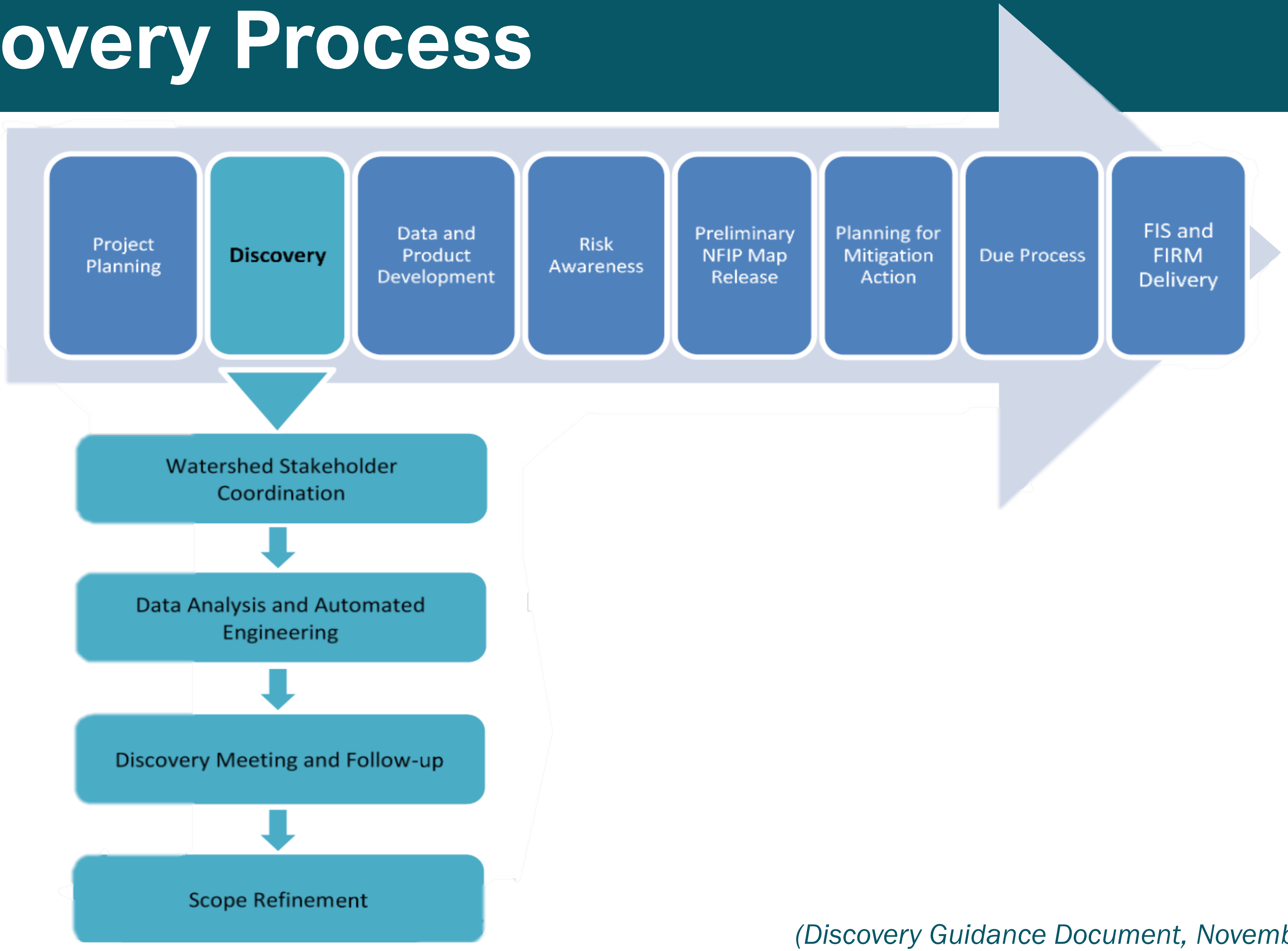
- Notification for flood risk data development
- Set expectations for Discovery Meeting
- Describe meeting attendees
- Communicate ongoing data collection

DISCOVERY

FEMA's process for identifying and assessing flood risk to document needs and projects to address those requests within communities.

- Understand the watershed or project area—and the communities within
- Establish the trust and transparency required for collaboration with communities
- Determine the level and types of mitigation planning and other assistance the communities need.
- Learn about the communities' capabilities, including GIS knowledge
- Determine data availability
- Identify factors contributing positively or negatively to flooding and flood losses

Discovery Process



(Discovery Guidance Document, November 5 2019, Page 3)

O&E + Project Coordination

Discovery Meetings

Time: October 11, 12, and 13th

Locations: TBD

- BEAUREGARD PARISH
- CALCASIEU PARISH
- CAMERON PARISH
- SABINE PARISH
- VERNON PARISH

Coordination for (3) Discovery Meetings will begin after Pre-Discovery

What information are we interested in?

Exploring all available data for…

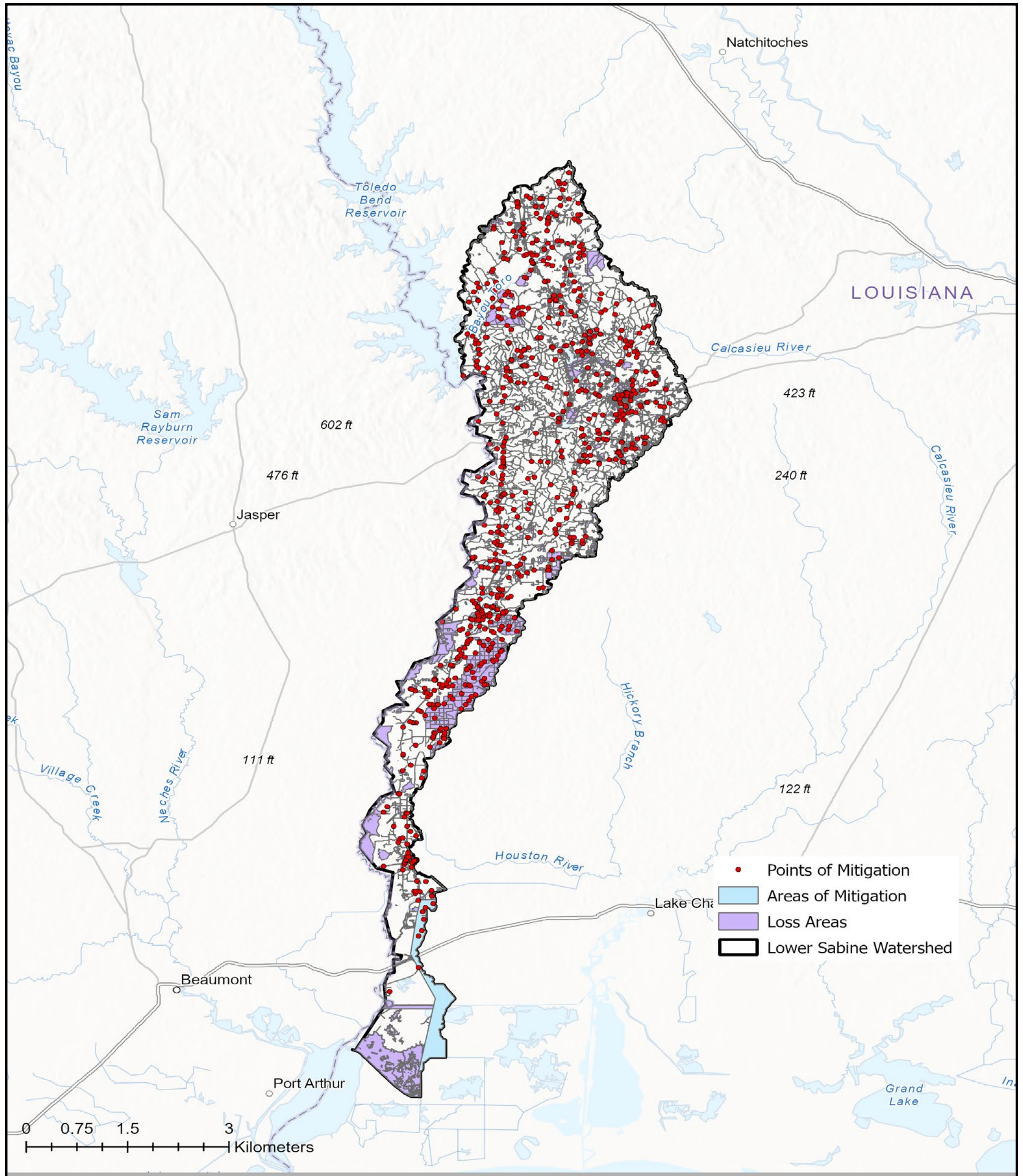
Community Engagement

Data gathered during Discovery includes information that currently influences flood risk decision-making, historical flooding information, existing flood hazard data and information, mitigation activities/projects, and AoMIs.

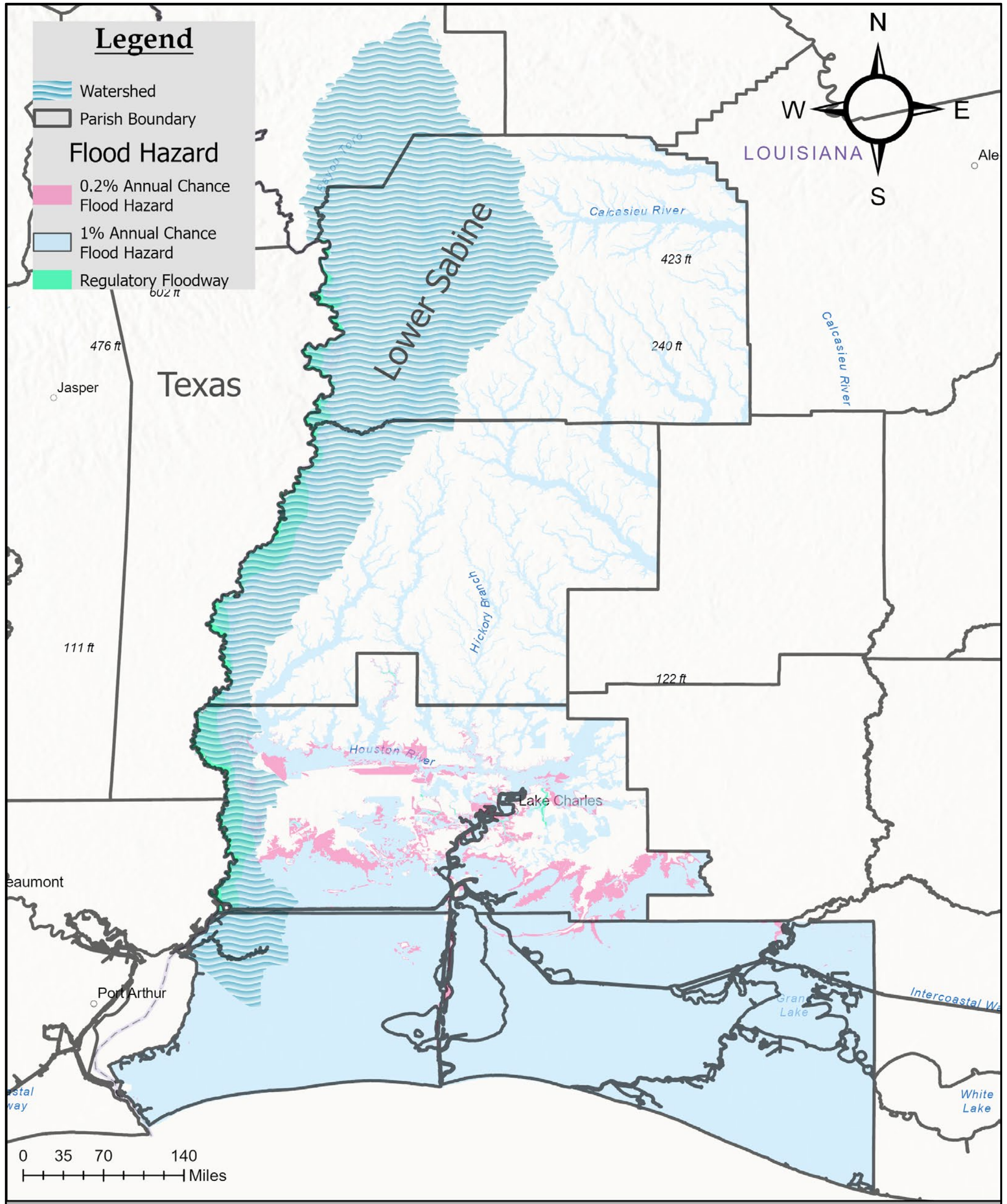
Collected data uses:

- Create Flood Risk Products: Flood Risk Databases, Flood Risk Reports, and Flood Risk Maps
- Create regulatory products, including Flood Insurance Rate Maps (FIRMs), Flood Insurance Study (FIS) reports, and FIRM databases

Risk Assessment

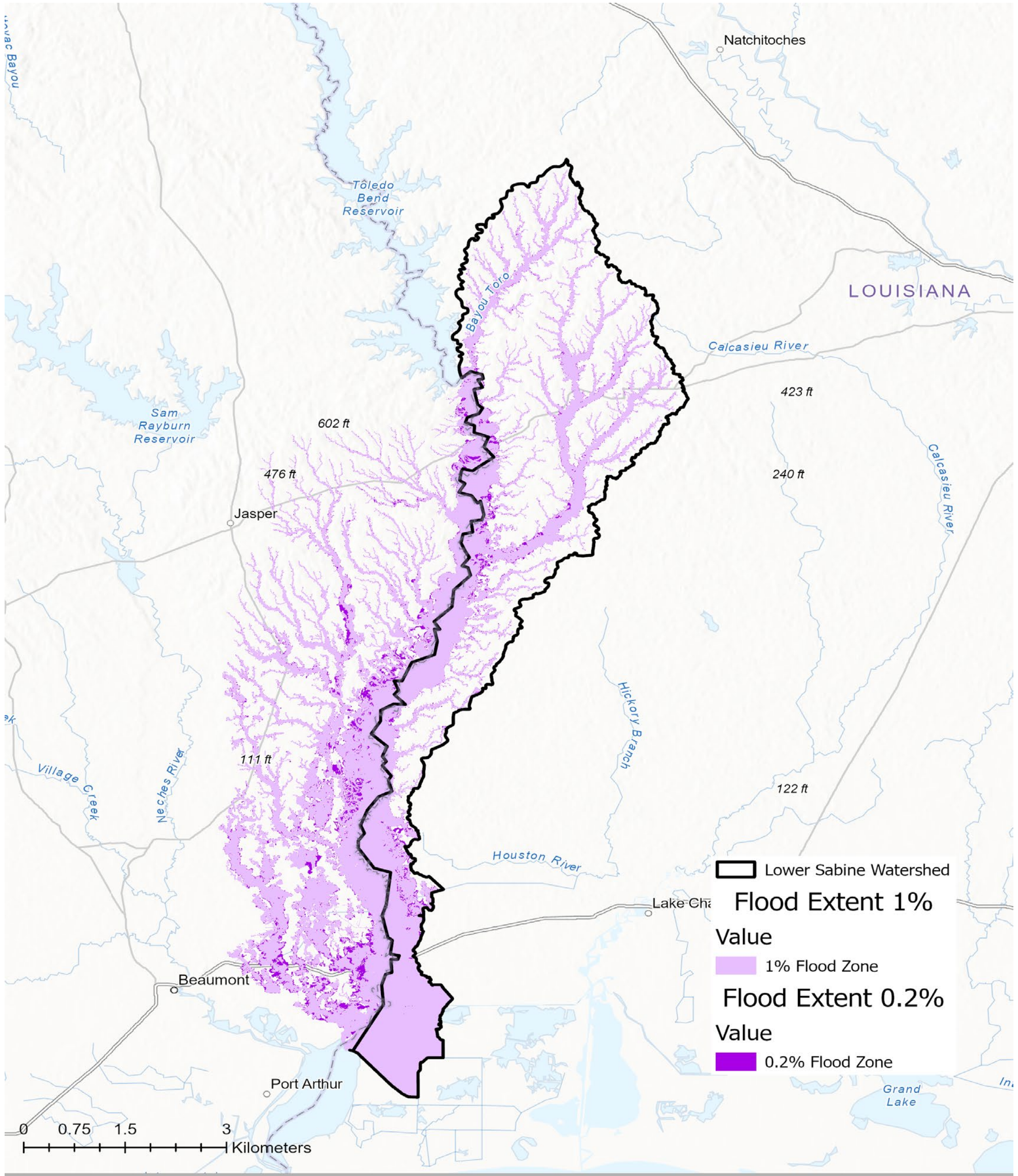


Risk Assessment Map



Lower Sabine SFHA

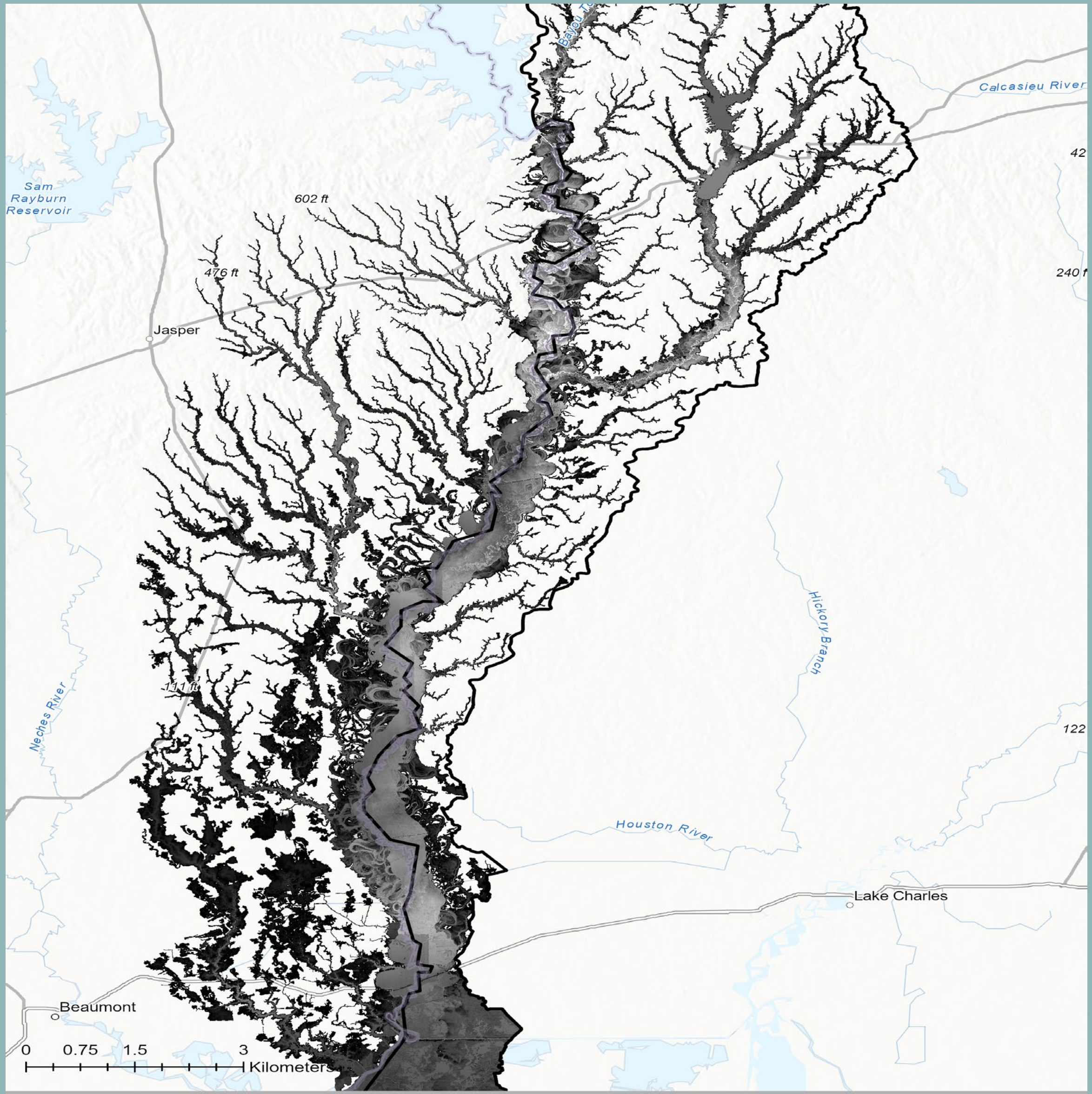
Flood Data Review



Flood Extent Map

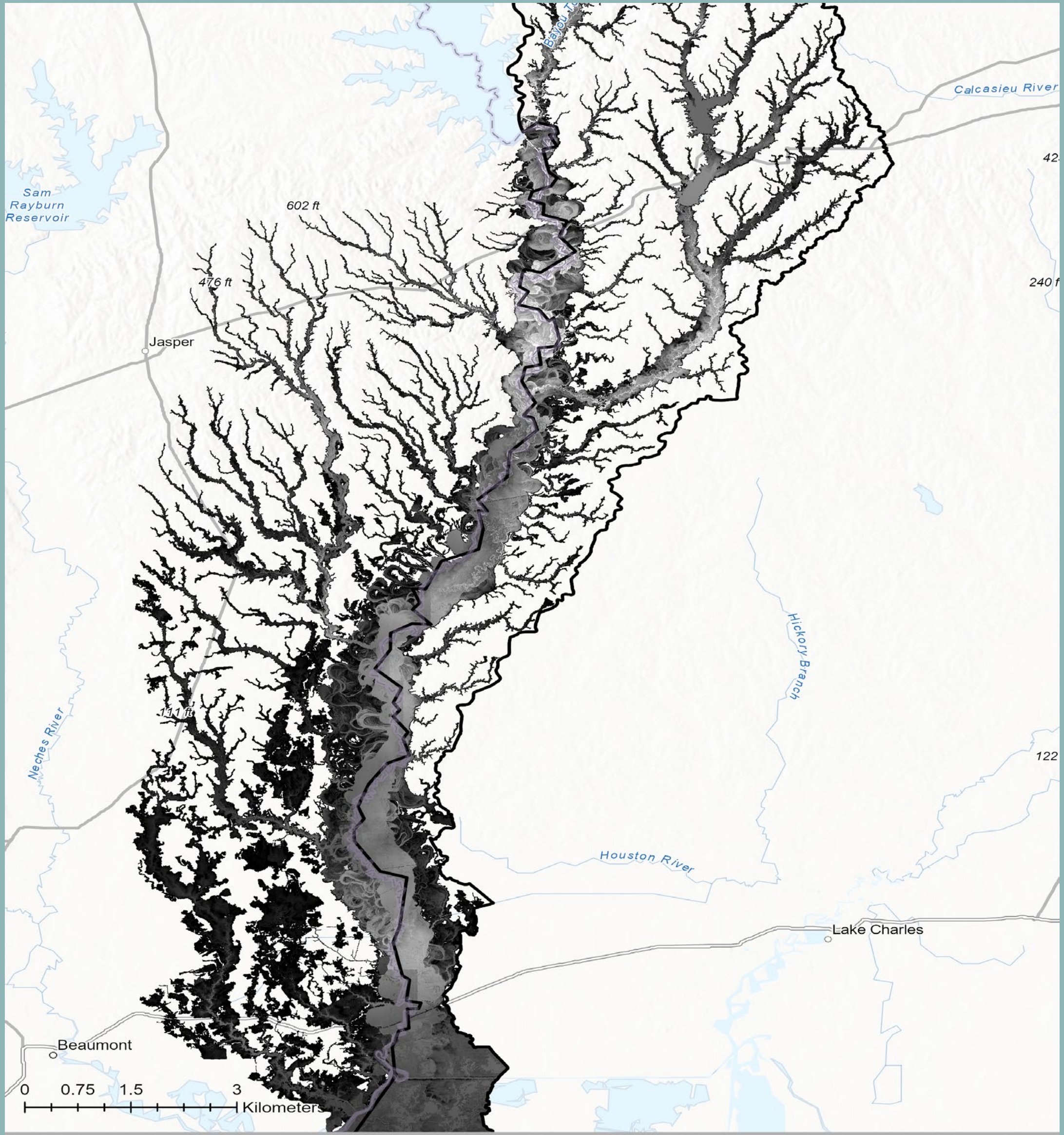
Esri, NASA, NGA, USGS, CONANP, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, USGS

QUALITY
ENGINEERING & SURVEYING



BLE Depth 1%

Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, USGS



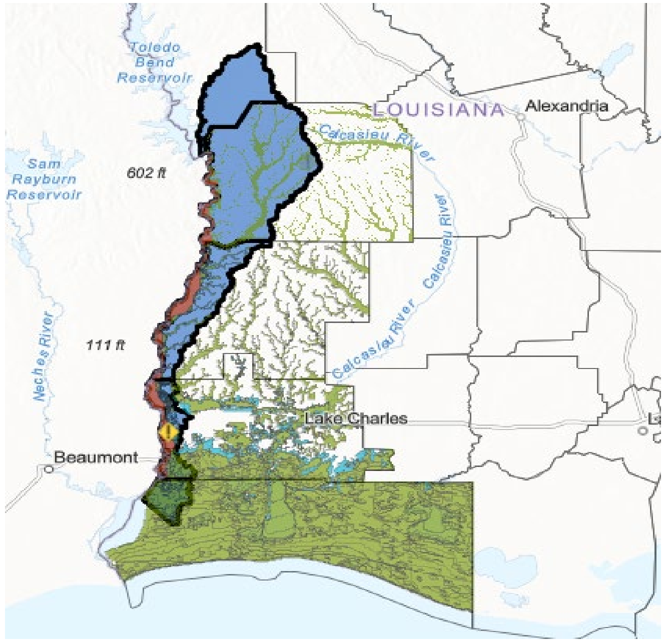
BLE Depth 0.2%

Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, USGS

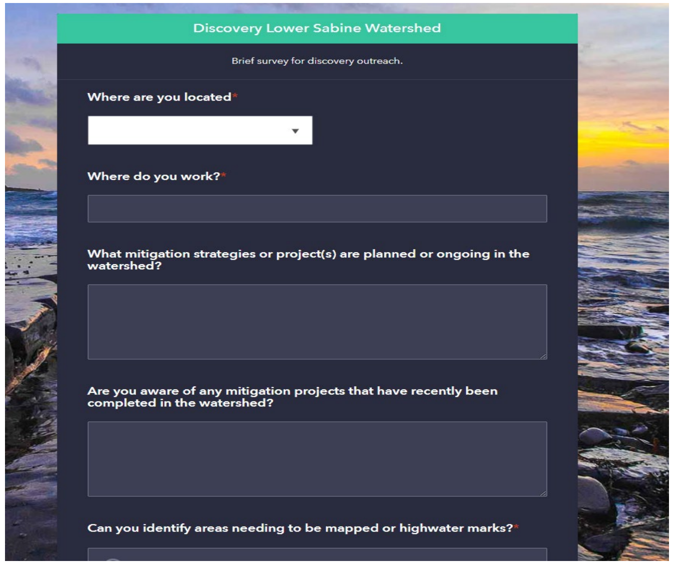
QUALITY
ENGINEERING & SURVEYING

Data Collection

Webpage



Survey



Discovery Lower Sabine Watershed

Brief survey for discovery outreach.

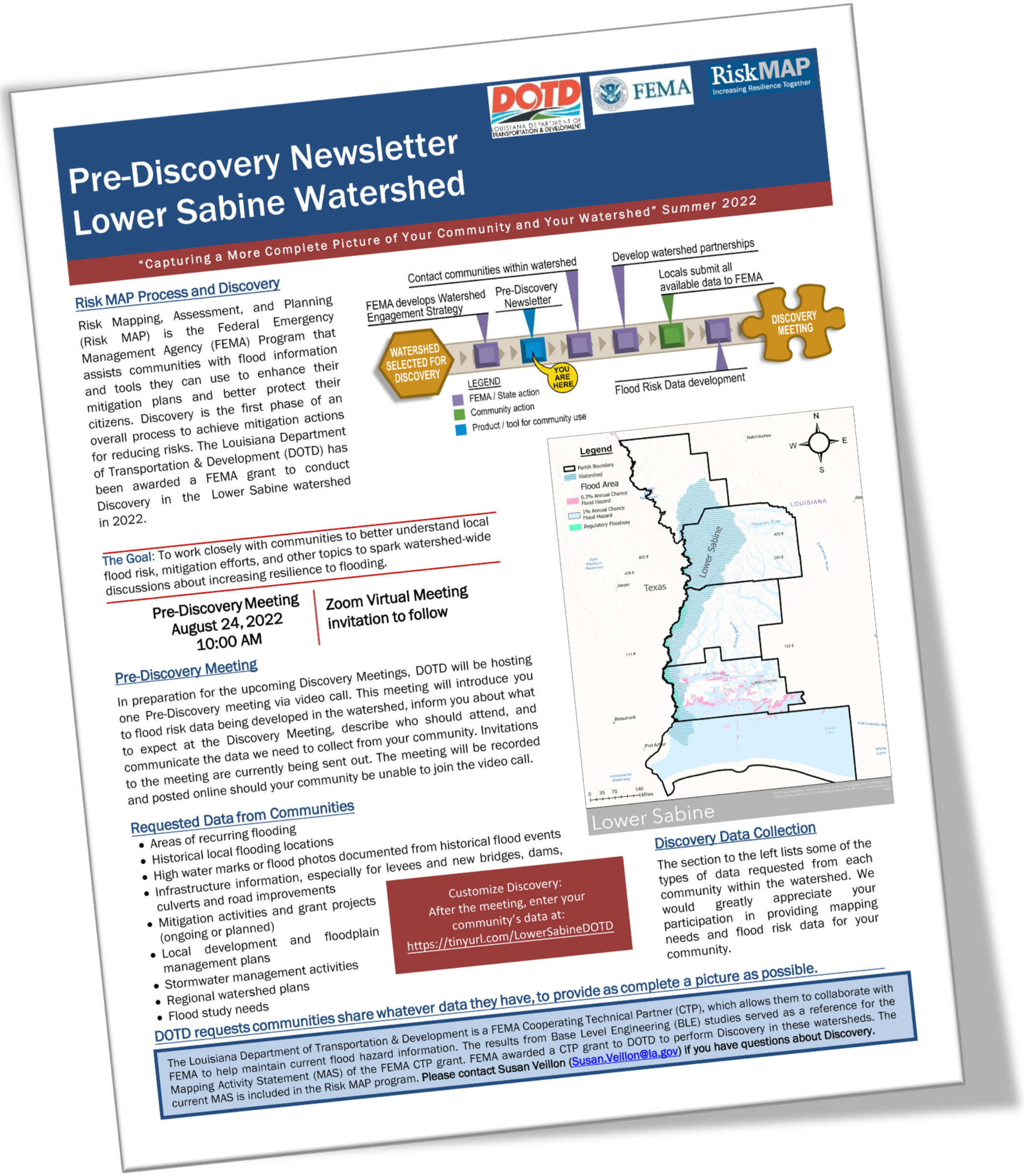
Where are you located*

Where do you work?*

What mitigation strategies or project(s) are planned or ongoing in the watershed?

Are you aware of any mitigation projects that have recently been completed in the watershed?

Can you identify areas needing to be mapped or highwater marks?*



DOTD LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT
FEMA
RiskMAP Increasing Resilience Together

Pre-Discovery Newsletter Lower Sabine Watershed

"Capturing a More Complete Picture of Your Community and Your Watershed" Summer 2022

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The Goal: To work closely with communities to better understand local flood risk, mitigation efforts, and other topics to spark watershed-wide discussions about increasing resilience to flooding.

Pre-Discovery Meeting August 24, 2022 10:00 AM | Zoom Virtual Meeting invitation to follow

Pre-Discovery Meeting

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- Stormwater management activities
- Regional watershed plans
- Flood study needs

Customize Discovery: After the meeting, enter your community's data at: https://tinyurl.com/LowerSabineDOTD

Discovery Data Collection

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Webpage Instructions

1. Begin by entering the URL into the address bar.

2. Next click on the survey link that appears on the pop up screen.

3. Once you have completed the survey hit the back button at the top left and click the box "I agree to the above terms and conditions" on the pop up screen

4. In order to turn on and off layer you will use the layer icon and the eyeball icon next to the specified layer

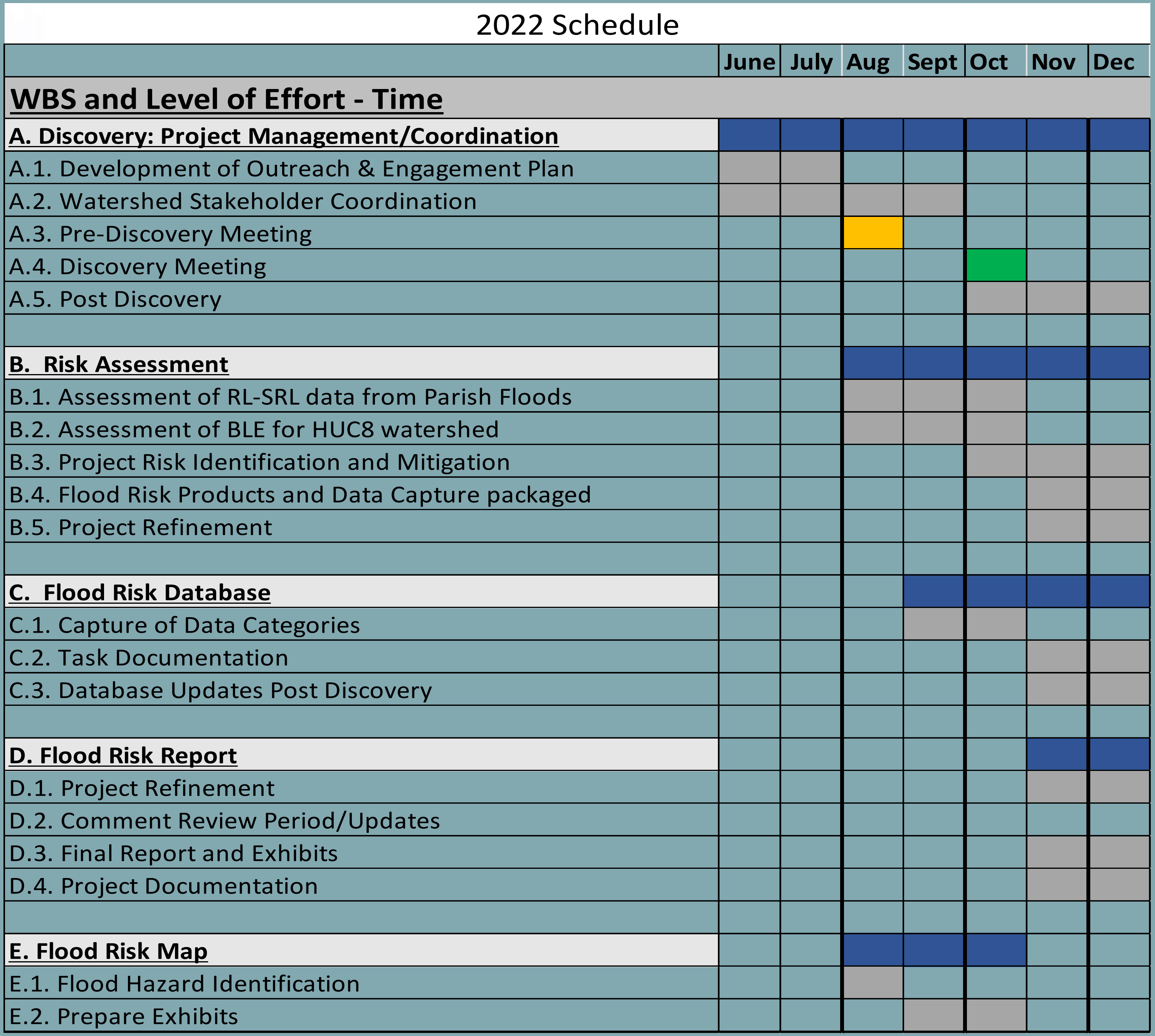
5. To see what is within the specific layer you will click the drop down arrow next to the eyeball icon

6. In order to view the Legend you will click the Legend icon located at the top right of the map

Project Schedule

So, what's next?

DOTD requests communities share whatever data they have, to provide as complete a picture as possible.



THE PROJECT TEAM

Contacts:

Susan Veillon
CTP Program Manager
(225) 379-3005
susan.veillon@la.gov

Cindy O'Neal, CFM
Louisiana NFIP State Coordinator
(225) 379-3005
cindy.oneal@la.gov

Edward Anthony, PMP
Project Manager
(225) 271-4040
eanthony@qesla.com

Phil Fan, PE
Water Resource Manager
(225) 698-1600
pfan@qesla.com

Jacob Reeves
GIS Project Manager
(225) 698-1600
jreeves@qesla.com

QUALITY ENGINEERING & SURVEYING

Discovery Findings Webinar Slides

POST-DISCOVERY MEETING

LOUISIANA DISCOVERY

"Capturing a more complete picture of your watershed"

June 4, 2025

CONTACTS

Pam Lightfoot
NFIP & CTP Program Manager
(225) 379-3016
Pam.ligthfoot@la.gov

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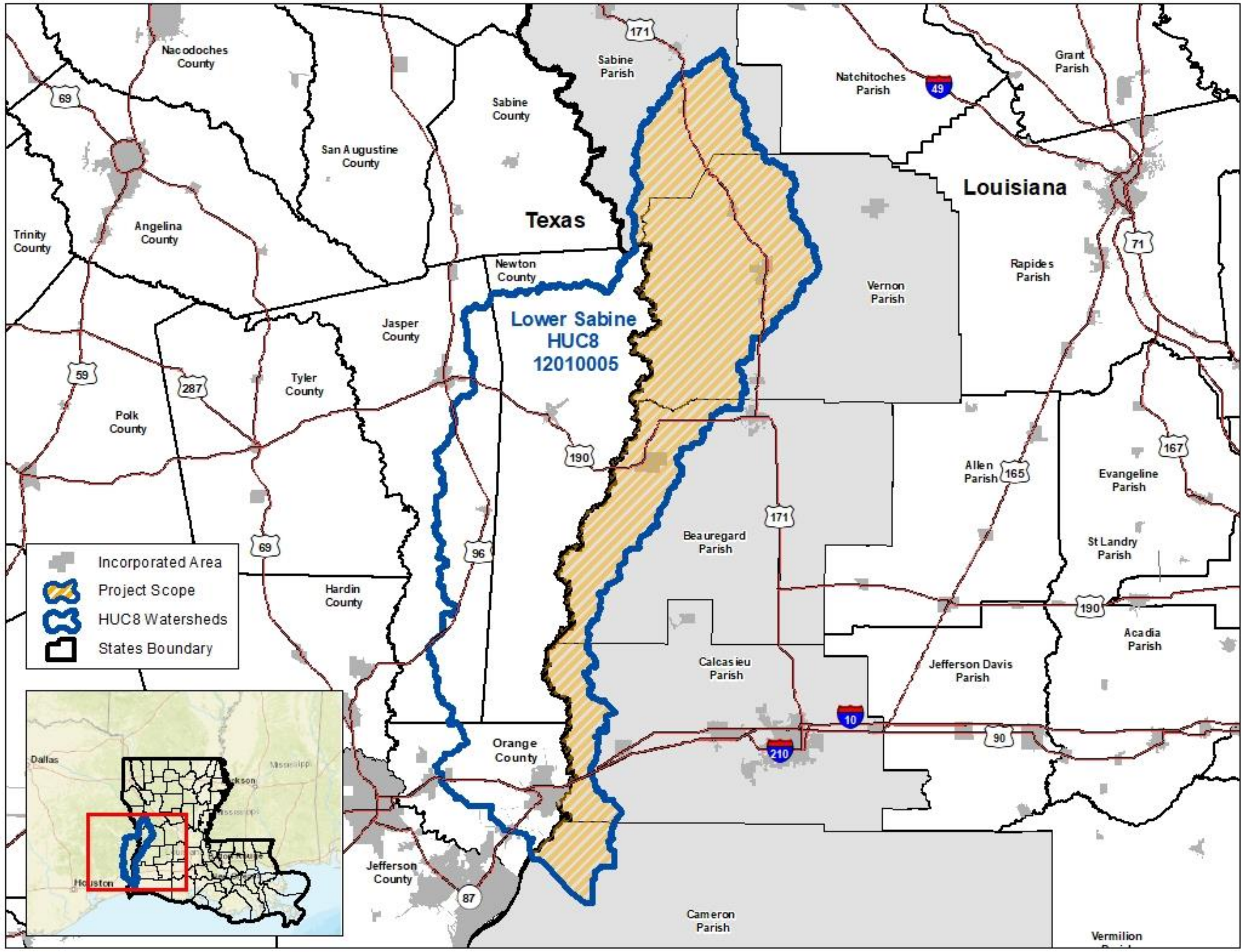
Project Manager
(210) 875-0541
jyoung@Halff.com

Victor Bivens
Discovery Task Manager
(318) 716-6134
vbivens@Halff.com

Thomas Lejeune
Discovery GIS Lead
(318) 575-3103
tlejeune@Halff.com

AGENDA

- Discovery Overview
- Overview of Risk MAP
- LaDOTD Discovery Activities
  - Pre-Discovery Activities
  - Discovery Activities
    - Data Gathering Website and Walk-through
  - Post-Discovery Activities
  - Post-Discovery Results
    - Base Level Engineering
    - HAZUS Results
- Post Meeting Coordination
- BFE Overview
- Project Recommendations to FEMA



DISCOVERY OVERVIEW

Discovery is FEMA’s process for identifying and accessing flood risk to better prepare a list of needs and projects to address those needs within communities.

- Heighten community involvement and understanding
- Gather all flood-related information available
  - Knowledge of Flood Risks and Past Flooding in your community
  - Hazard Mitigation Projects – ongoing, planned or completed
  - Master Drainage Plans and floodplain studies – ongoing, planned or completed
  - Current flood risk communication process
  - GIS data

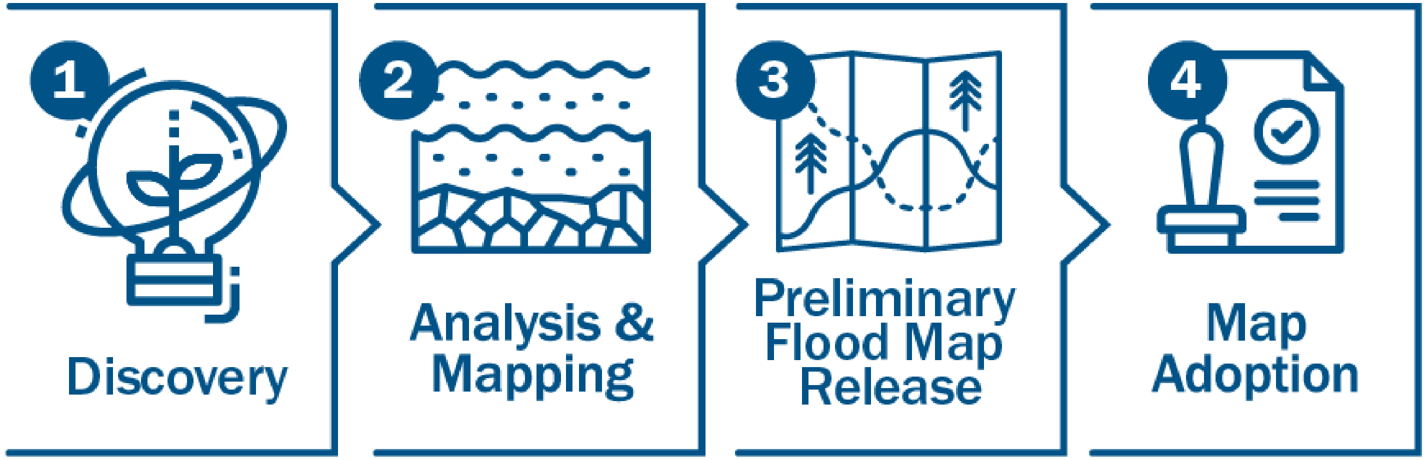
DISCOVERY OVERVIEW

- Request needs in the community
  - Questions and concerns for DFIRM maps
  - All questions and concerns for dams and levees
  - Study request in areas of repetitive loss
  - Areas of new development or other causes of concern for the future
  - Funding needs for identified flood risk projects

- Present Projects for Consideration
  - Modeling and Mapping needs
  - Structural improvements listed in the Flood Risk Map

FEMA'S RISK MAP PROGRAM

Life Cycle of Risk MAP Project

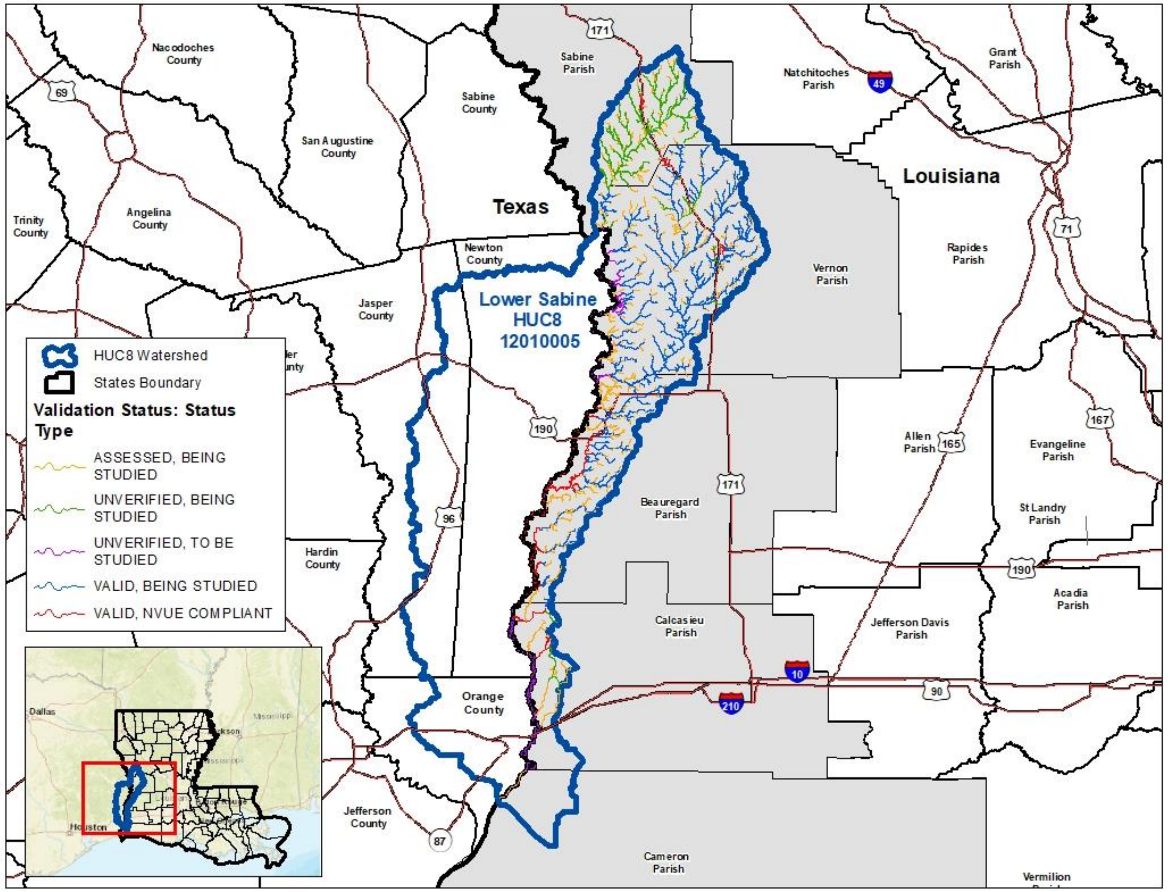


- Provide flood information and tools for better **protection**
- **Action-Driven** through local understanding and ownership of risk

LOUISIANA DOTD DISCOVERY GOALS

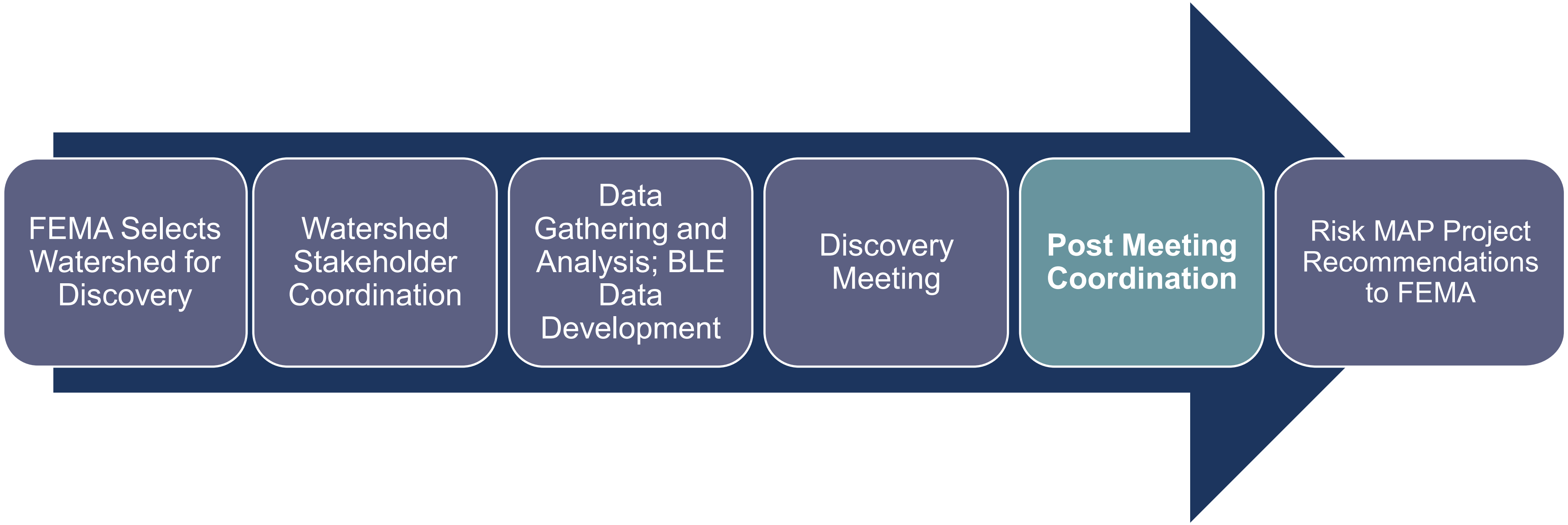
Lower Sabine Watershed Discovery

- Goals
  - Inform Community of Present Flood Risk
  - Gather local data to supplement National, Regional and State data
  - Present FEMA with areas of highest concern and need for additional study

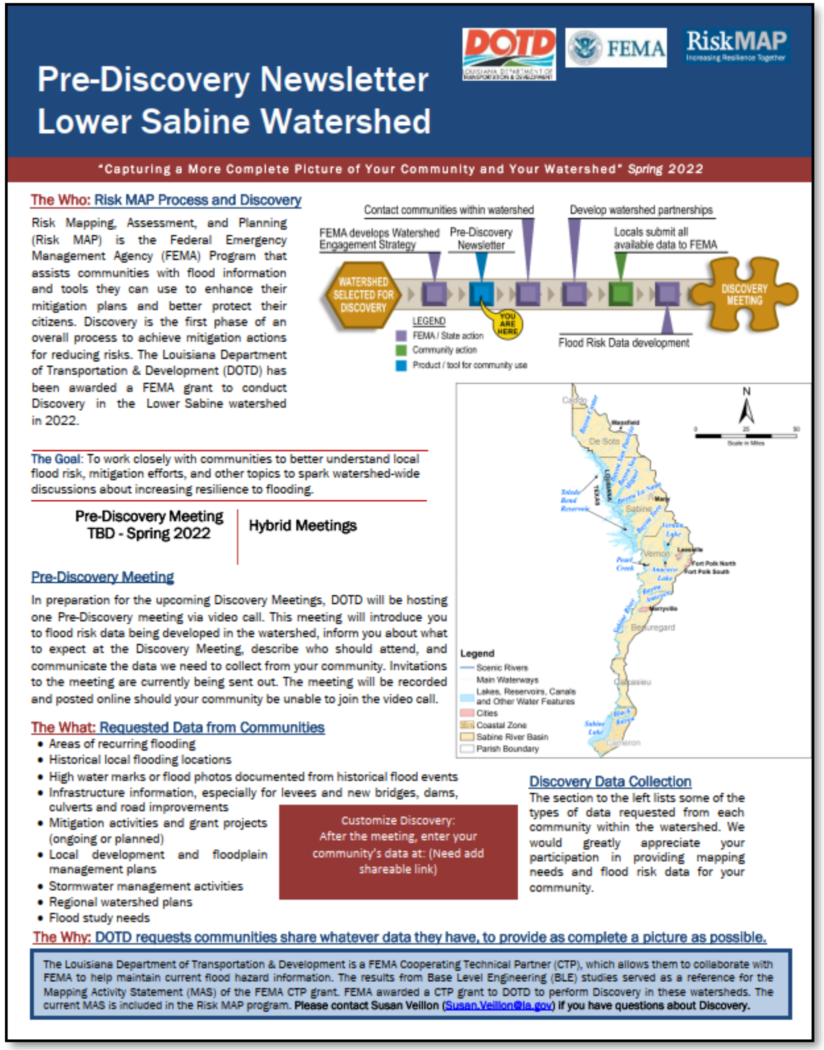


DISCOVERY STEPS

- ***Capture a more complete picture of your watershed by working closely with local communities…***



DISCOVERY NEWSLETTER



DOTD | FEMA | RiskMAP Increasing Resilience Together

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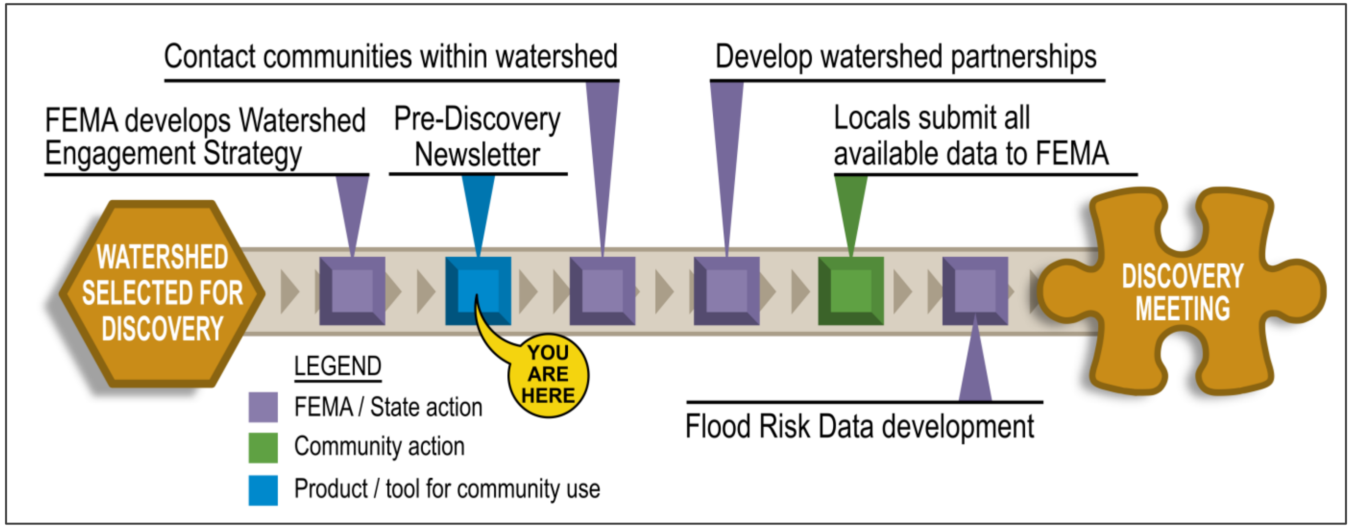


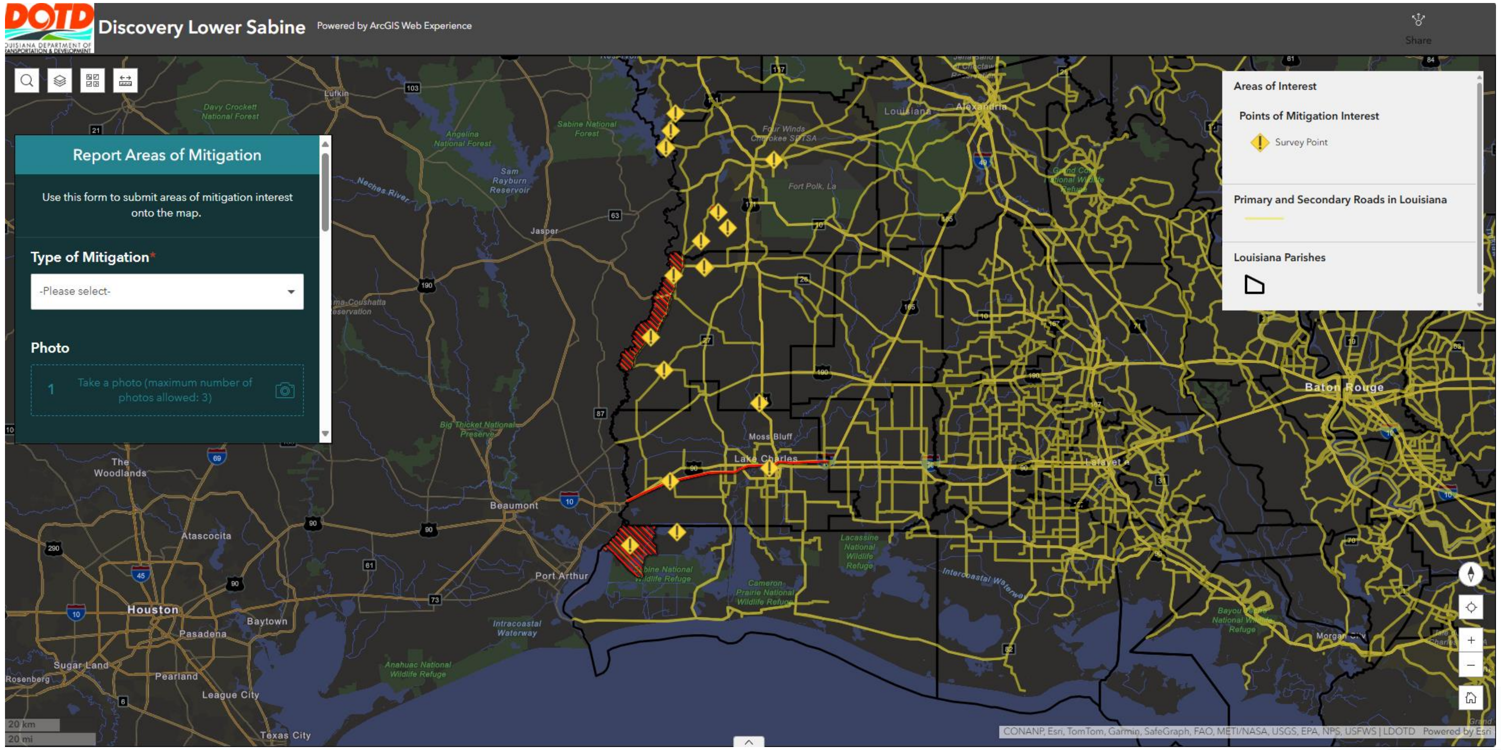
Pre-Discovery Meeting
August 22, 2022

Online Invitations for Microsoft Teams Meeting to be sent out

DISCOVERY ACTIVITIES - WEBSITE

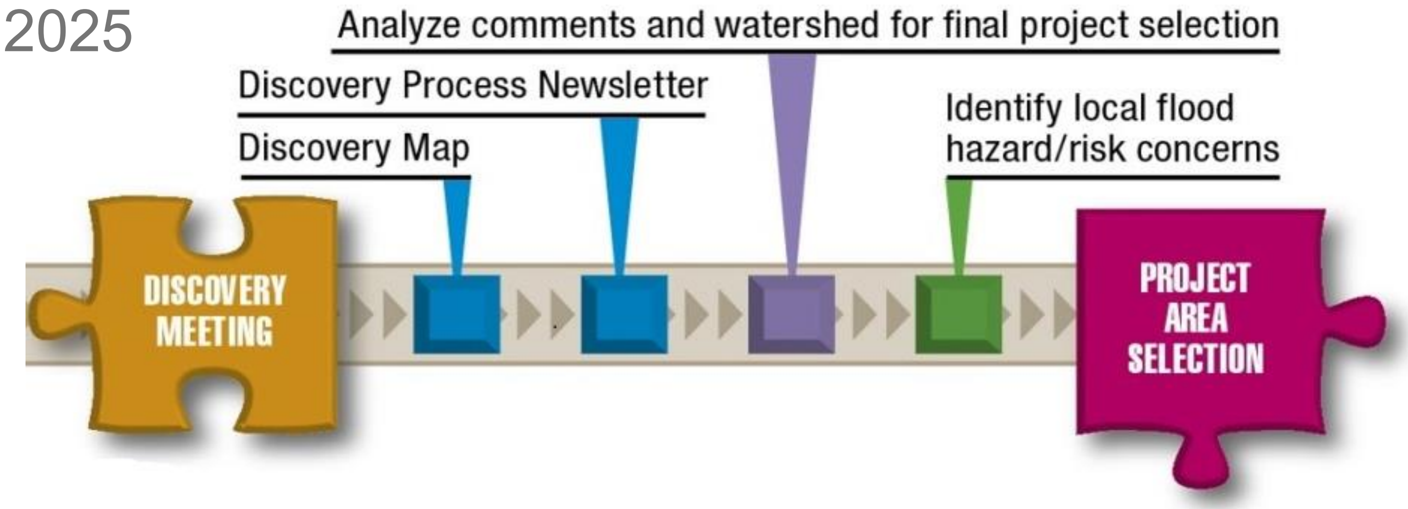
Interactive Webmap

- Areas of Mitigation Interest (AOMI)
- Gathering information on at risk facilities, significant erosion areas, past claim hotspots, low water crossings, streamflow constrictions, and other flood risk areas
- Place for all additional data and mapping risk location



POST-DISCOVERY ACTIONS

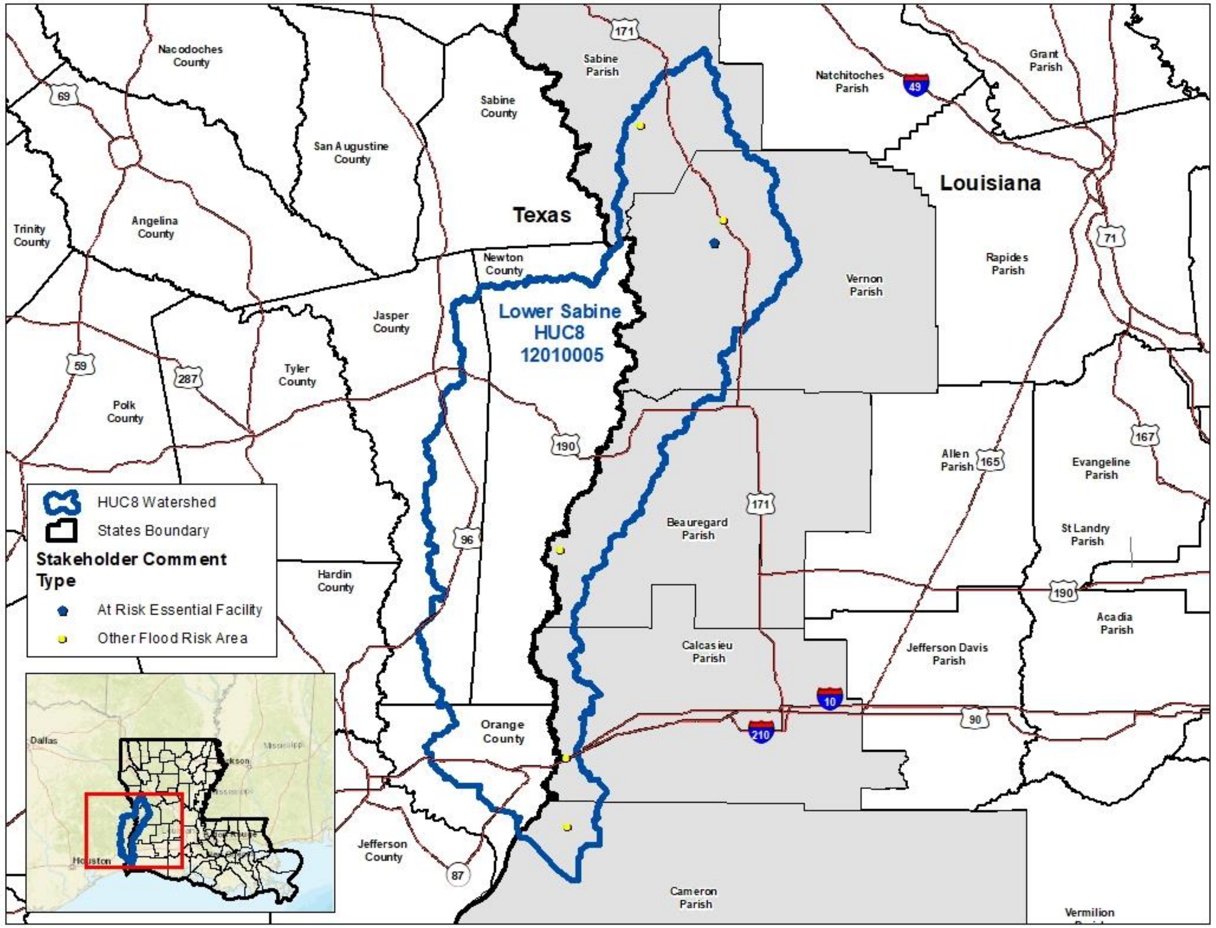
- Post-Discovery Actions
  - -Analyze data collected
    -Review findings with LaDOTD
    -Preliminary project selections provided to communities
    -Evaluate community input
    -Discovery Report
- Post Discovery Meeting – June 4, 2025



FINDINGS

6 STAKEHOLDER MAP COMMENTS

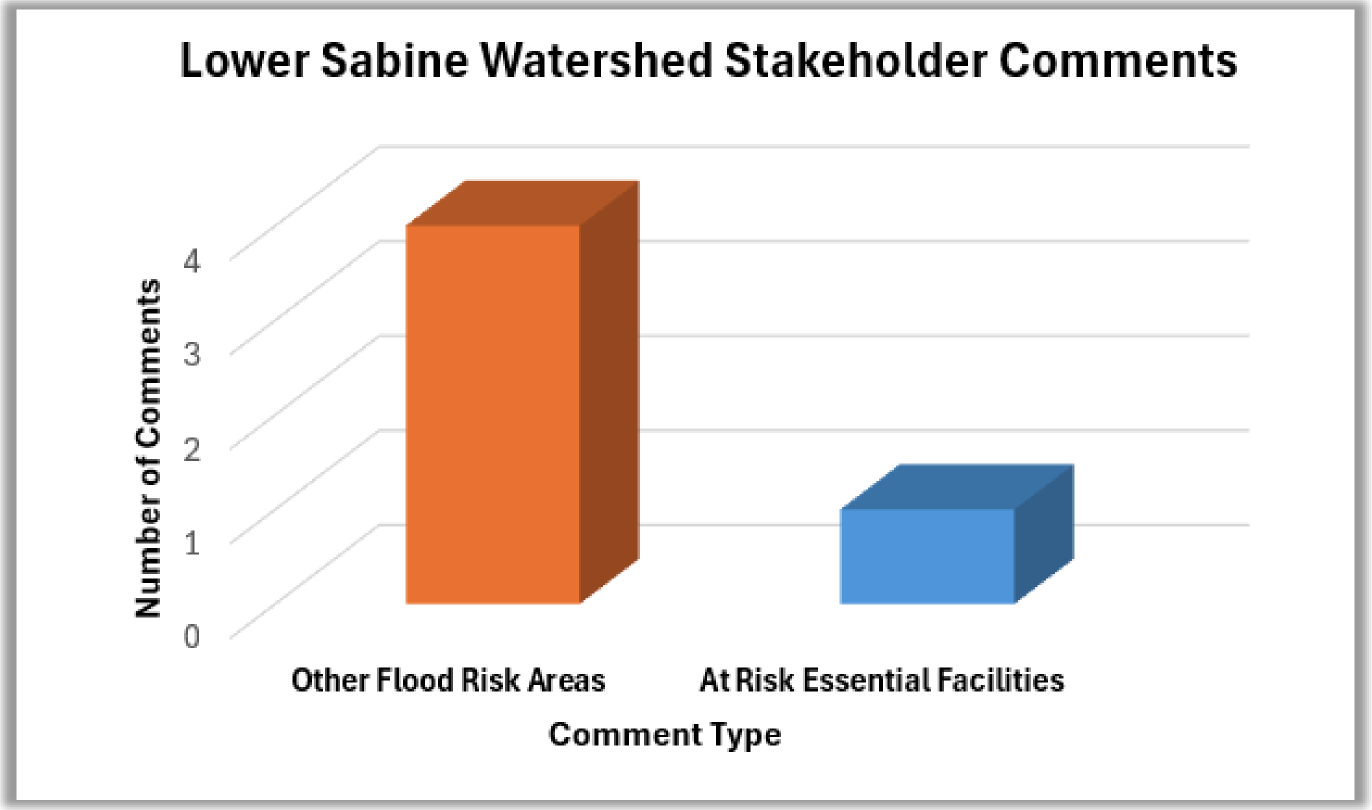
Number of Comments	Community
1	Beauregard Parish
1	Calcasieu Parish
1	Cameron Parish
1	Sabine Parish
2	Vermilion Parish



The primary result of Discovery is a list of projects to be considered for funding!

POST-DISCOVERY RESULTS

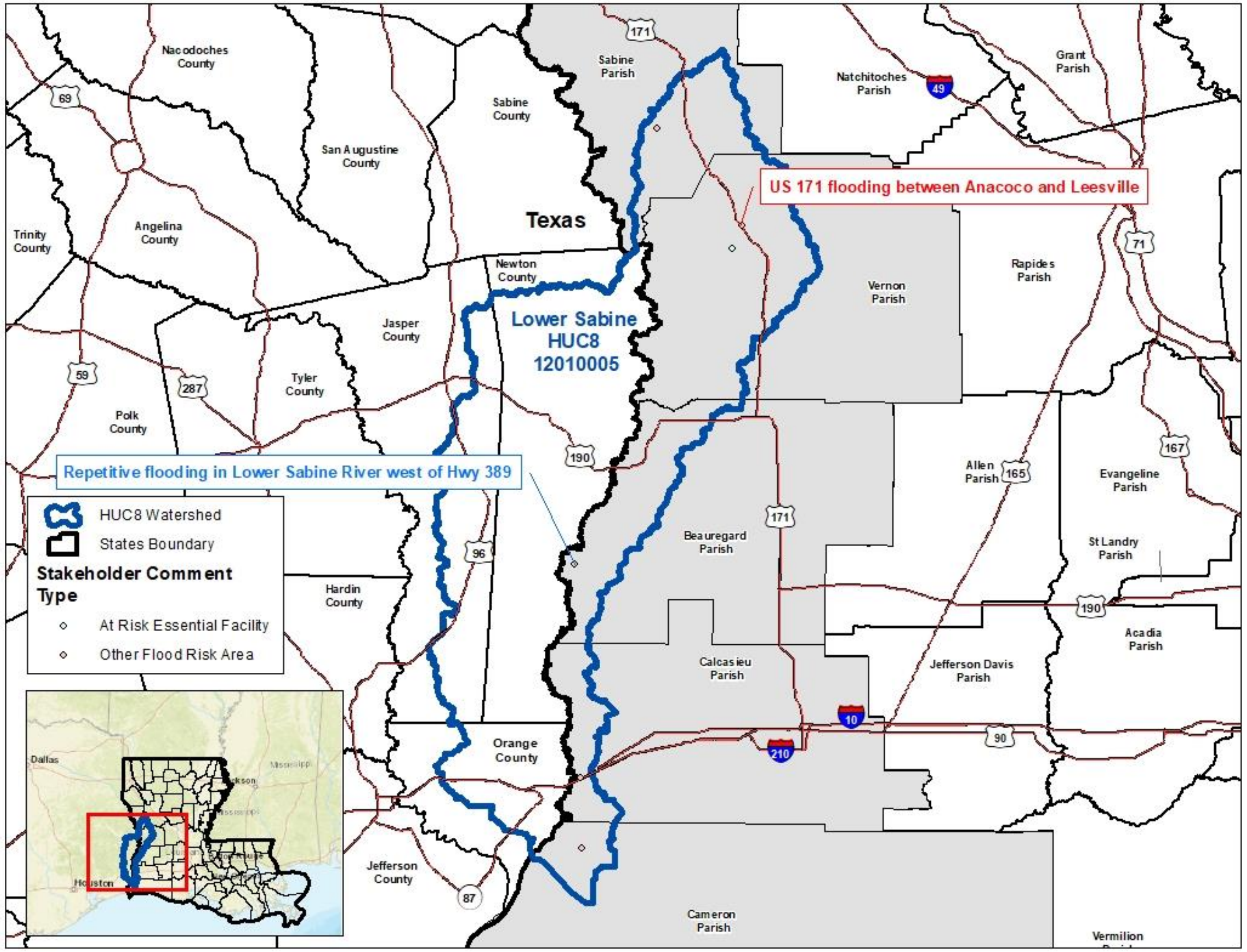
STAKEHOLDER COMMENTS BY TYPE



POST-DISCOVERY RESULTS

SAMPLE COMMENTS SUBMITTED

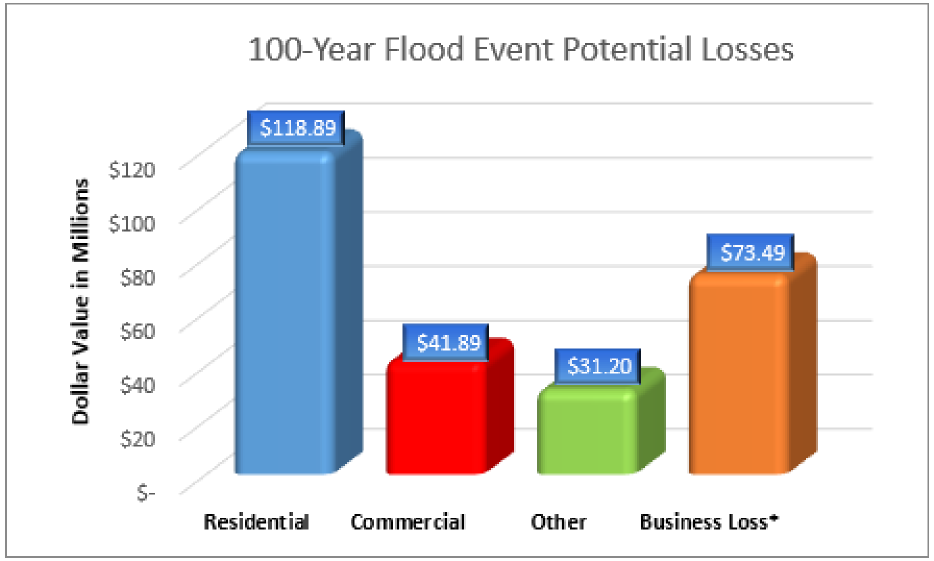
- Area of mitigation Success: Drainage Improvements 25yr storm
- At Risk Essential Facilities: Only one gate works, the water goes under the spillway, in disrepair
- Dams: Vernon Lake Dam
- Other: Future Developments
- Other Flood Risk Areas: In Zone X but portion of street floods



POST-DISCOVERY RESULTS

HAZUS-BASED 100-YEAR POTENTIAL LOSS ESTIMATES

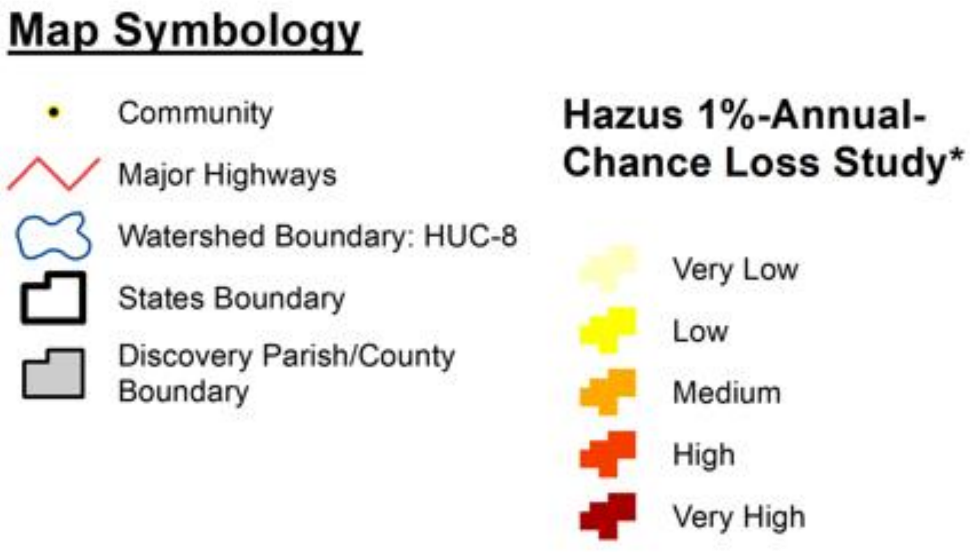
- Identify flooding consequences in damages and other losses
- Based on 100 Year Depth Grids and at-risk assets
- Can be further refined

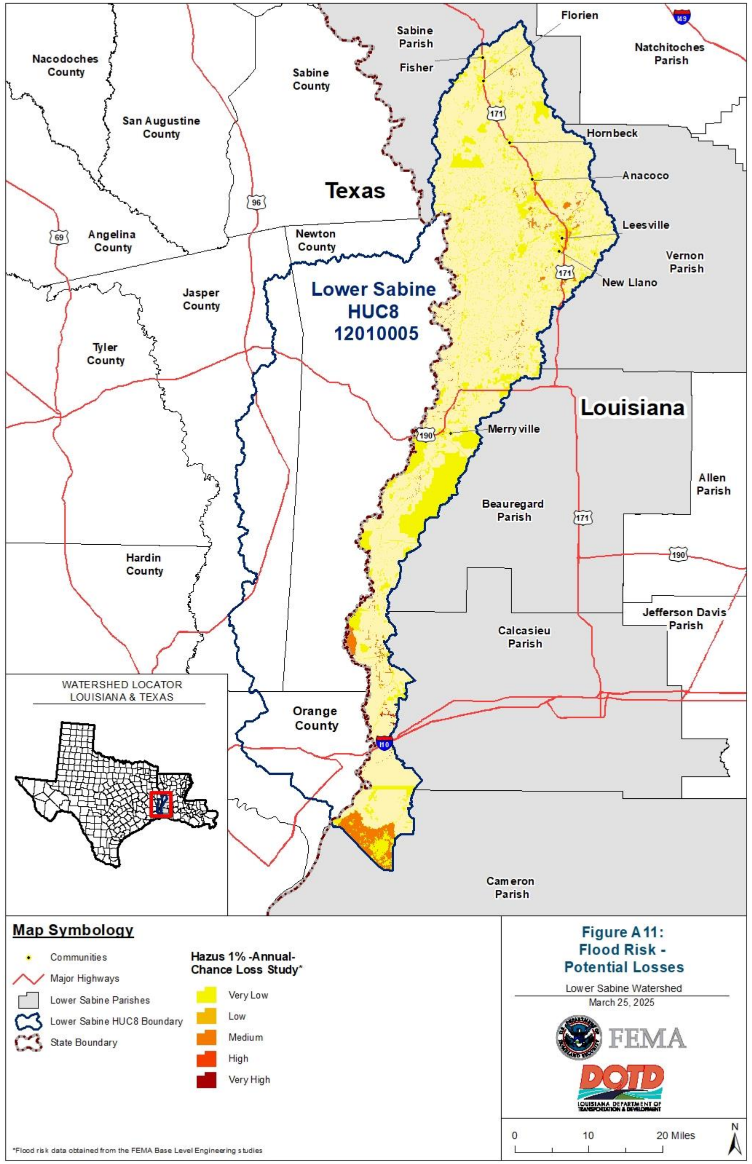


***Business Losses** are the sum of inventory Loss, Relocation Cost, Income Loss, Rental Income Loss, and Wage Loss.

POST-DISCOVERY RESULTS

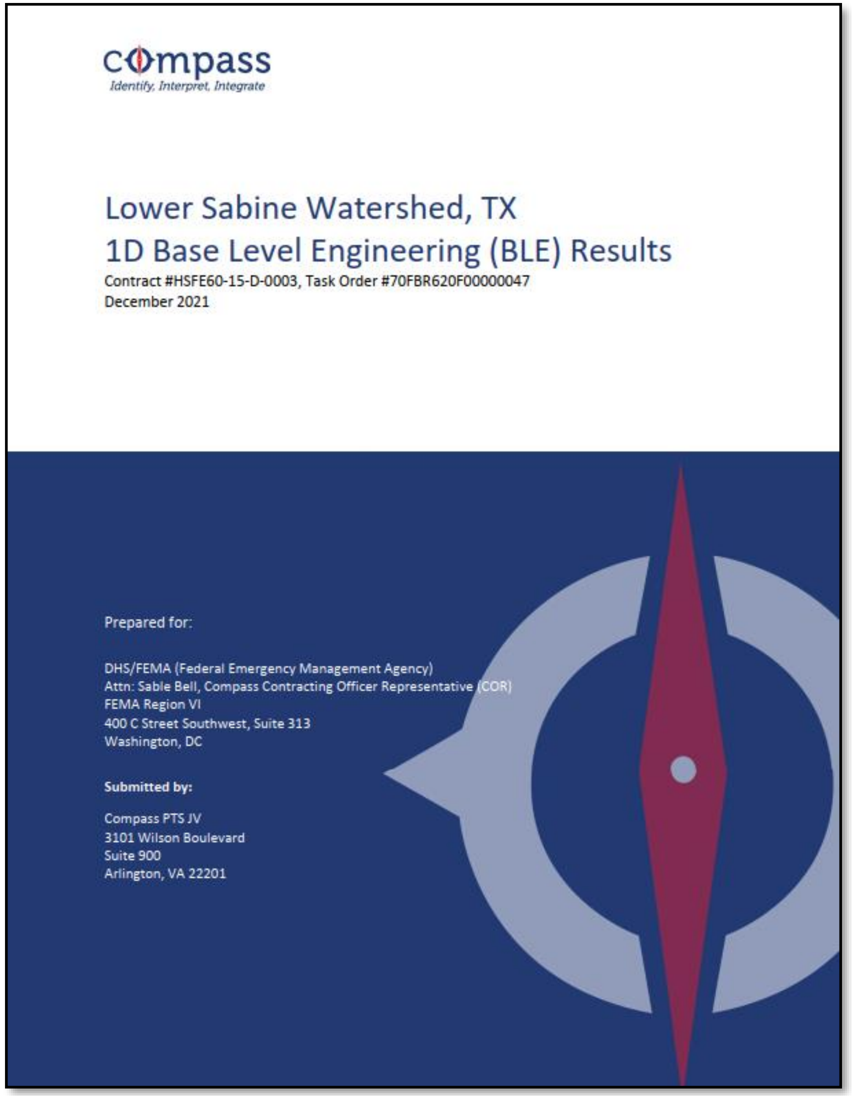
HAZUS-BASED 1% ANNUAL CHANCE LOSS ESTIMATES





BASE LEVEL ENGINEERING (BLE)

- BLE is developed at a larger scale (HUC8)
- LiDAR must be available
- Steps of Hydrology, Hydraulics & Terrain
- Model review and adjustments
- Gage review included in hydrology
- Used to assess flood risk


compass
Identify, Interpret, Integrate

Lower Sabine Watershed, TX
1D Base Level Engineering (BLE) Results
Contract #HSFE60-15-D-0003, Task Order #70FBR620F00000047
December 2021

Prepared for:

DHS/FEMA (Federal Emergency Management Agency)
Attn: Sable Bell, Compass Contracting Officer Representative (COR)
FEMA Region VI
400 C Street Southwest, Suite 313
Washington, DC

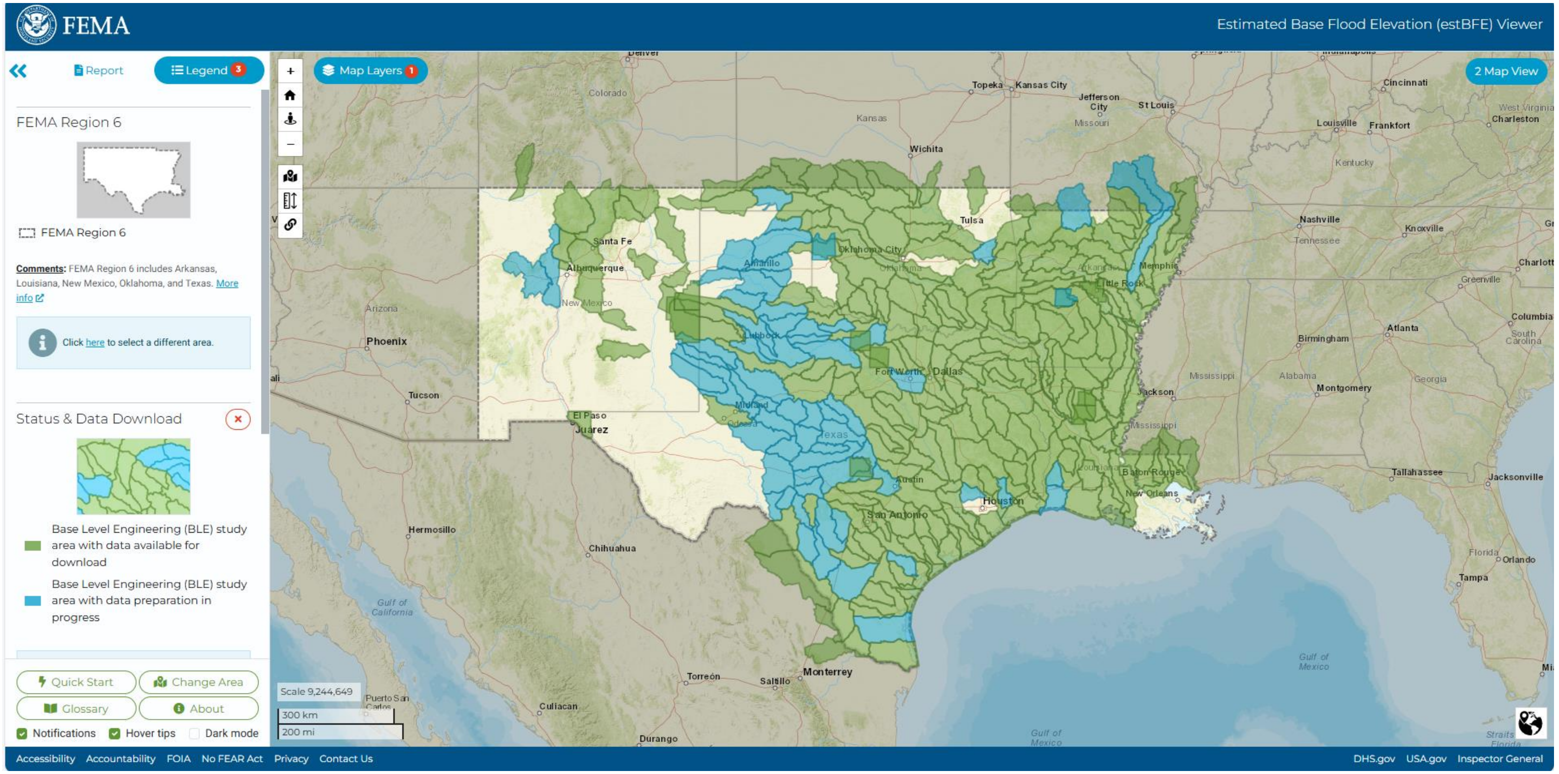
Submitted by:

Compass PTS JV
3101 Wilson Boulevard
Suite 900
Arlington, VA 22201

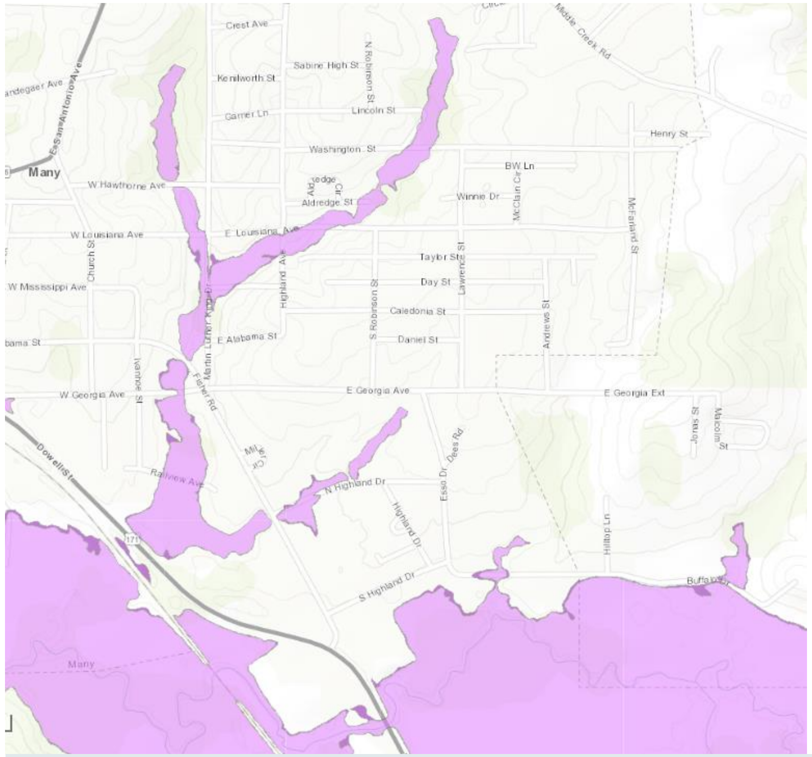
BASE LEVEL ENGINEERING (BLE)

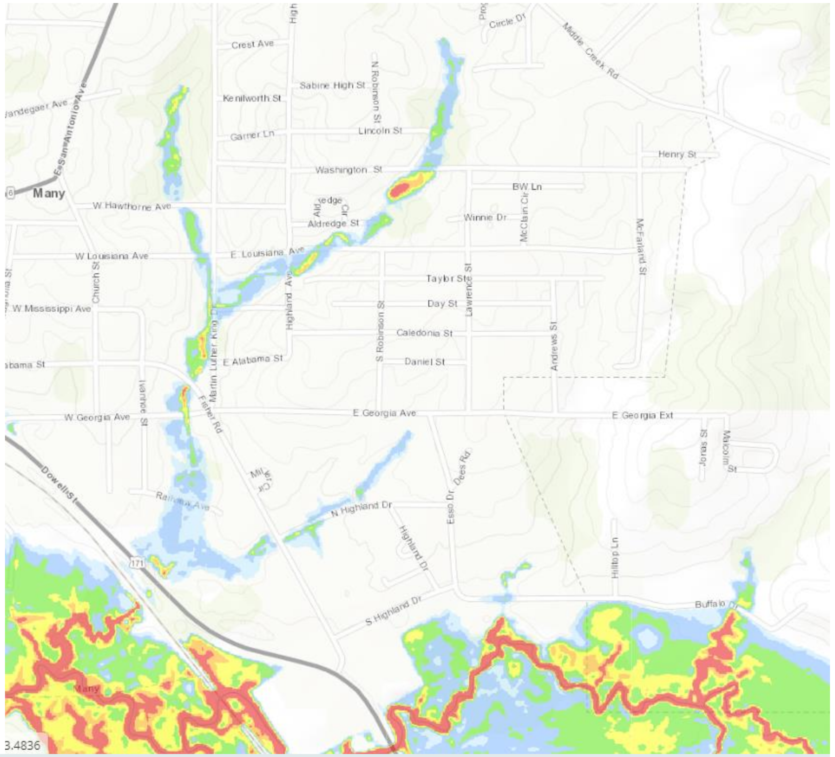
- View and download completed BLE data
- Useful for determining BFEs for development

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



BASE LEVEL ENGINEERING (BLE)





OUTPUTS

- Hydrology modeling (Regression) flows w/gage analysis
- Hydraulic modeling (HEC-RAS) for 10%, 4%, 2%, 1% and 0.2% storm events
- 10%, 1% and 0.2% floodplain boundaries

Non-Regulatory

- Areas of Expanded Flood Risk
- Depth and Analysis Grids
- Flood Risk Assessment

High risk (1% flood zone)	Low to moderate risk (0.2% flood zone)

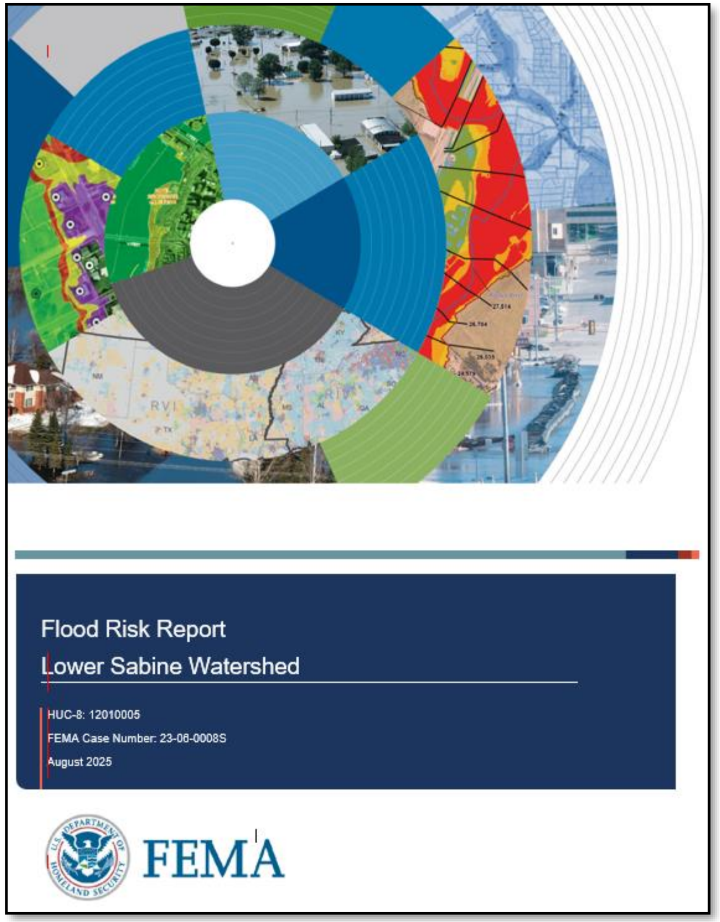
≤ 1 foot	> 3 to 4 feet
> 1 to 2 feet	> 4 to 5 feet
> 2 to 3 feet	> 5 feet

POST DISCOVERY MEETING COORDINATION

.

FLOOD RISK REPORT

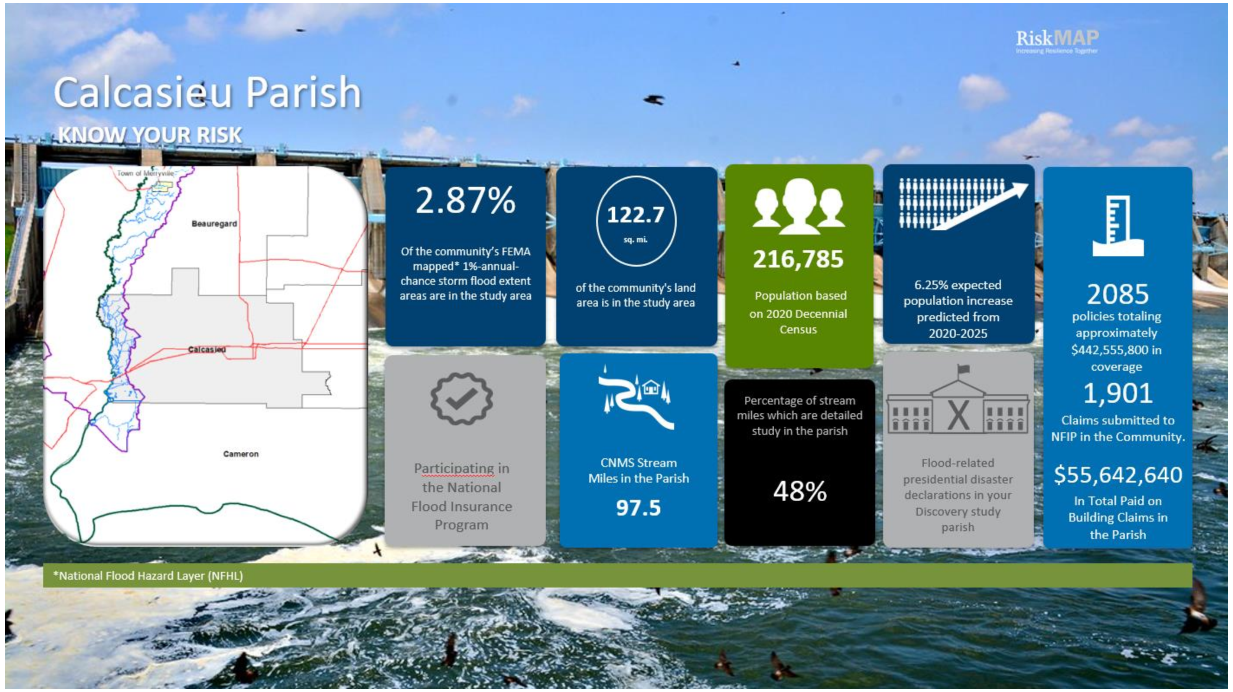
- Prioritization Results
- Summary of Discovery Activities
- Historical Flooding
- Figures and Maps
- Community Snapshots
- Stakeholder Comments

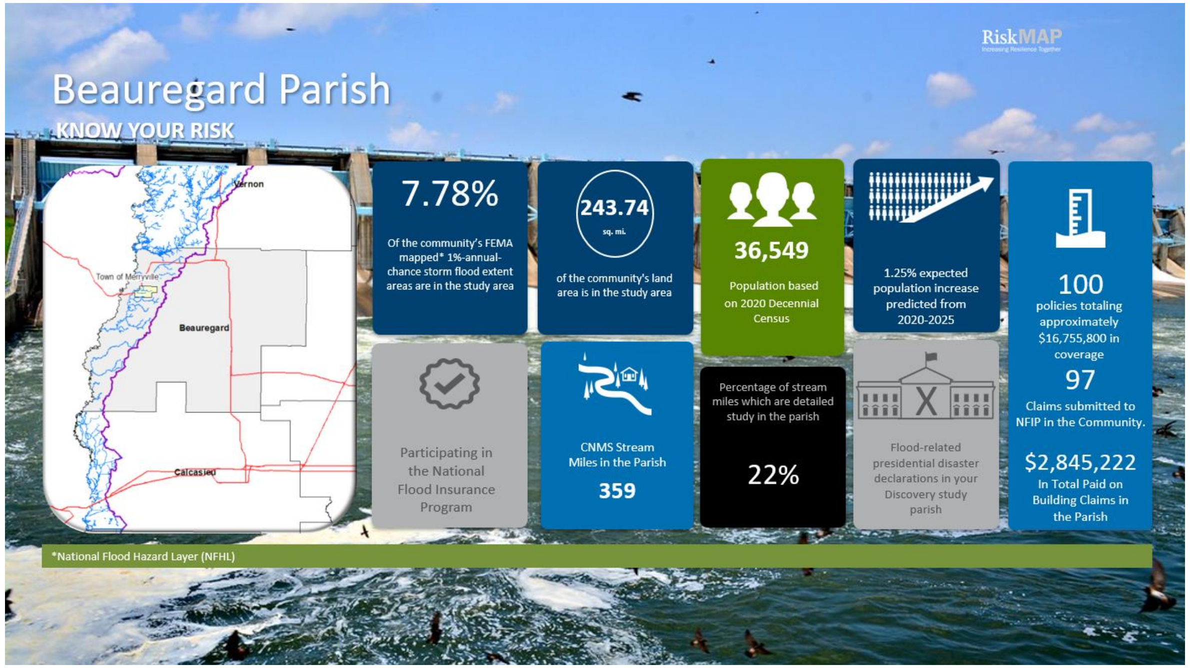

Flood Risk Report
Lower Sabine Watershed
HUC-8: 12010005
FEMA Case Number: 23-06-0008S
August 2025
FEMA

DISCOVERY – POST MEETING COORDINATION

EXAMPLE SNAPSHOTS FROM REPORT

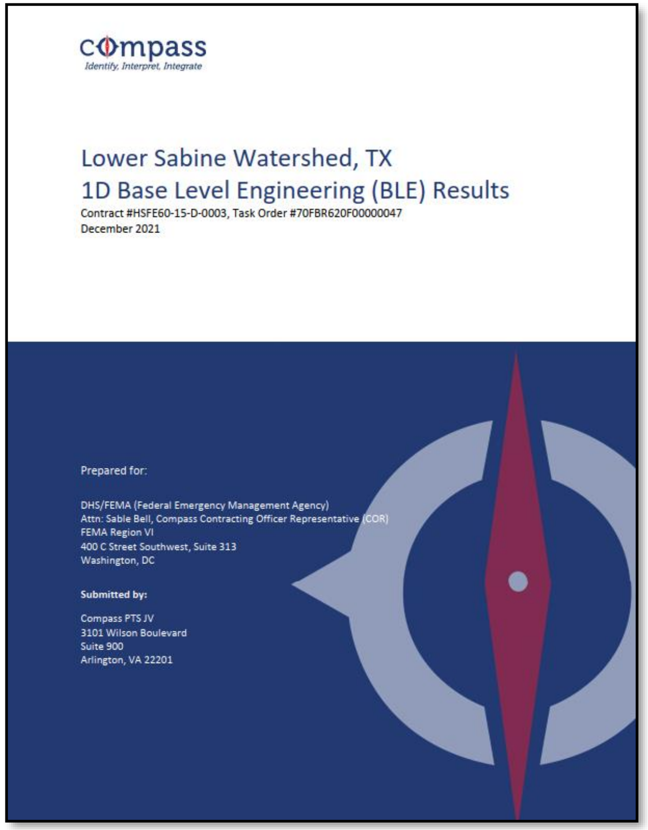
- Population growth
- NFIP claims history
- CNMS stream miles





POST-DISCOVERY MEETING COORDINATION

BLE DATASET AND REVIEW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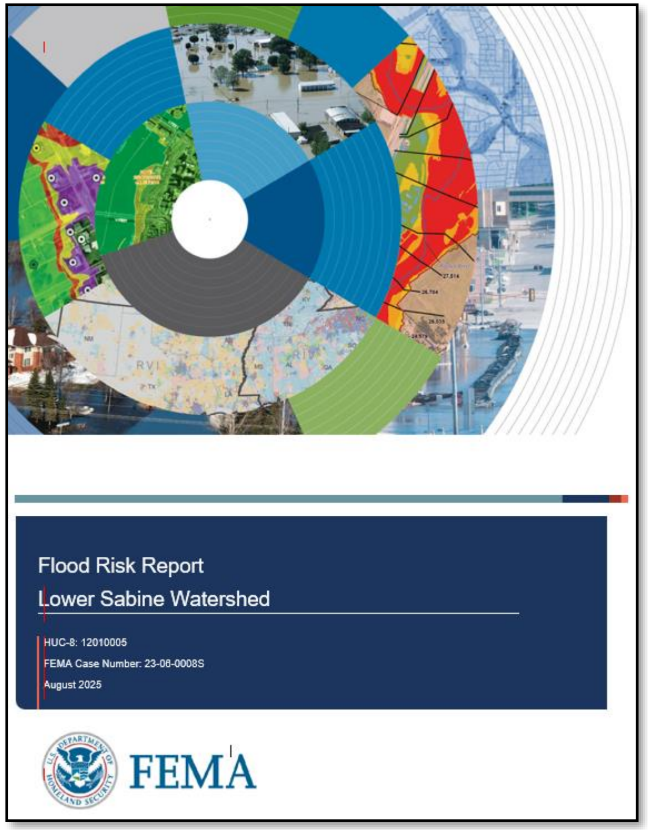
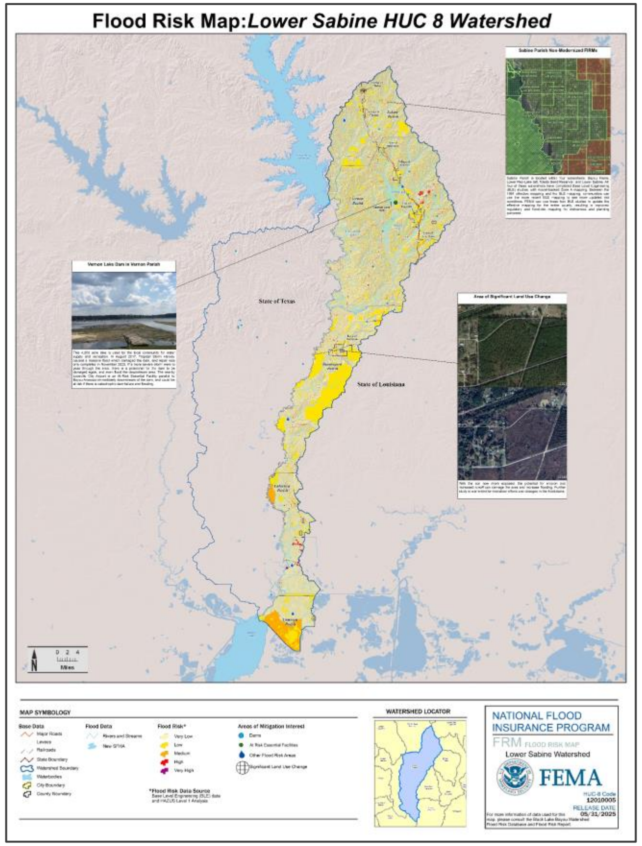
FLOOD RISK REPORT


Flood Risk Report
Lower Sabine Watershed

HUC-8: 12010005
FEMA Case Number: 23-06-0008S
August 2025

FEMA

FLOOD RISK MAP



RISK MAP PROJECT RECOMMENDATIONS TO FEMA

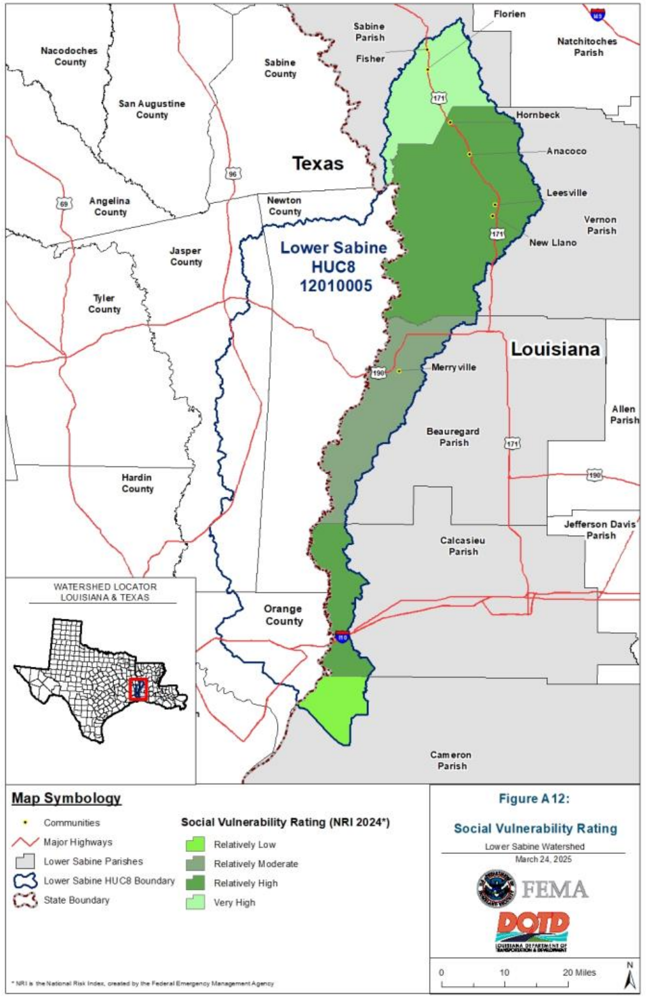
OTHER CONSIDERATIONS FOR MAPPING UPDATES

Map Symbology

- Interstate Highways
- Watershed Boundary: HUC-8
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Social Vulnerability Rating (NRI 2024*)

- Relatively High
- Very High



RISK MAP PROJECT RECOMMENDATIONS TO FEMA

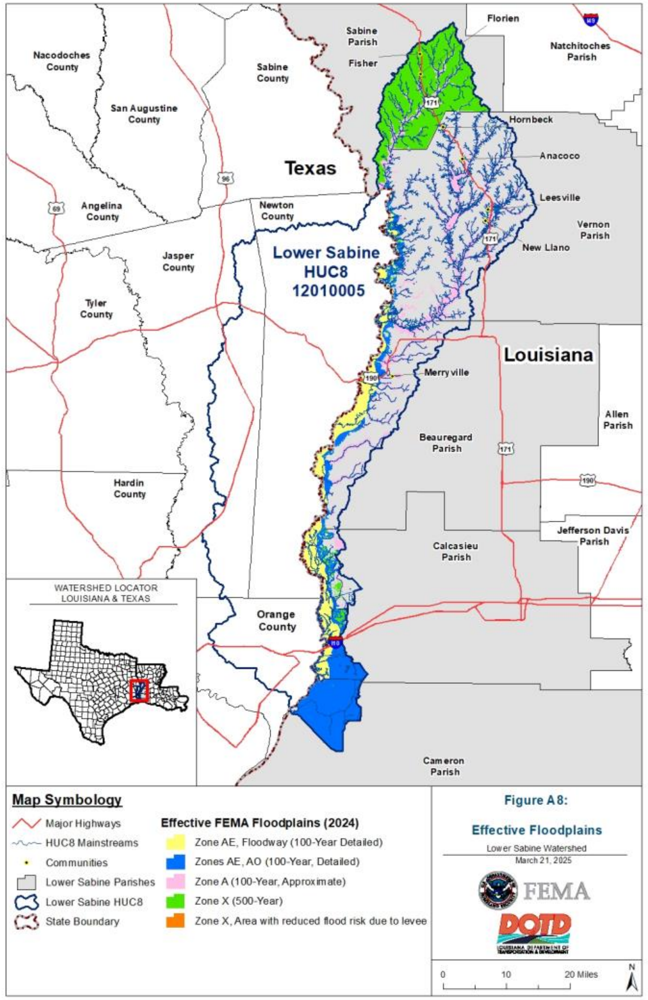
OTHER CONSIDERATIONS FOR MAPPING UPDATES

Map Symbology

- Community
- Other Streams
- Interstate Highways
- Watershed Boundary: HUC-8
- States Boundary
- Discovery Parish/County Boundary
- Other Parish/County Boundary

Effective FEMA Floodplains (2024)

- Zone AE, Floodway (100-Year Detailed)
- Zones AE, AO (100-Year, Detailed)
- Zone A (100-Year, Approximate)
- Zone X (500-Year)
- Zone X, Area with reduced flood risk due to levee

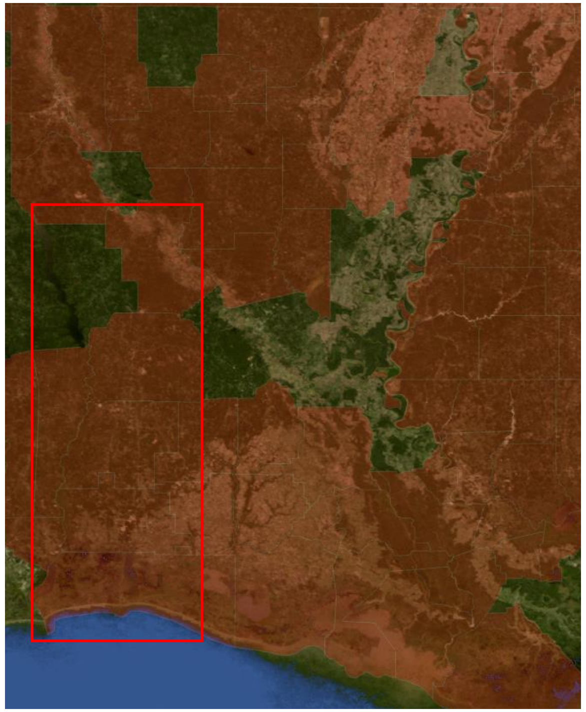


RISK MAP PROJECT RECOMMENDATIONS TO FEMA

OTHER CONSIDERATIONS FOR MAPPING UPDATES

Vernon Lake Dam in Vernon Parish

This 4,200 acre lake is used by the local community for water supply and recreation. In August 2017, Tropical Storm Harvey caused a massive flood which damaged the dam, and repair was only completed in November 2023. If a more severe storm were to pass through the area, there is a potentinal for the dam to be damaged again, and even flood the downstream area. The nearby Leesville City Airport is an At-Risk Essential Facility parallel to Bayou Anacoco immediately downstream of the dam, and could be at risk if there is catastrophic dam failure and flooding.



- Screenshot from FEMA NFHL Viewer

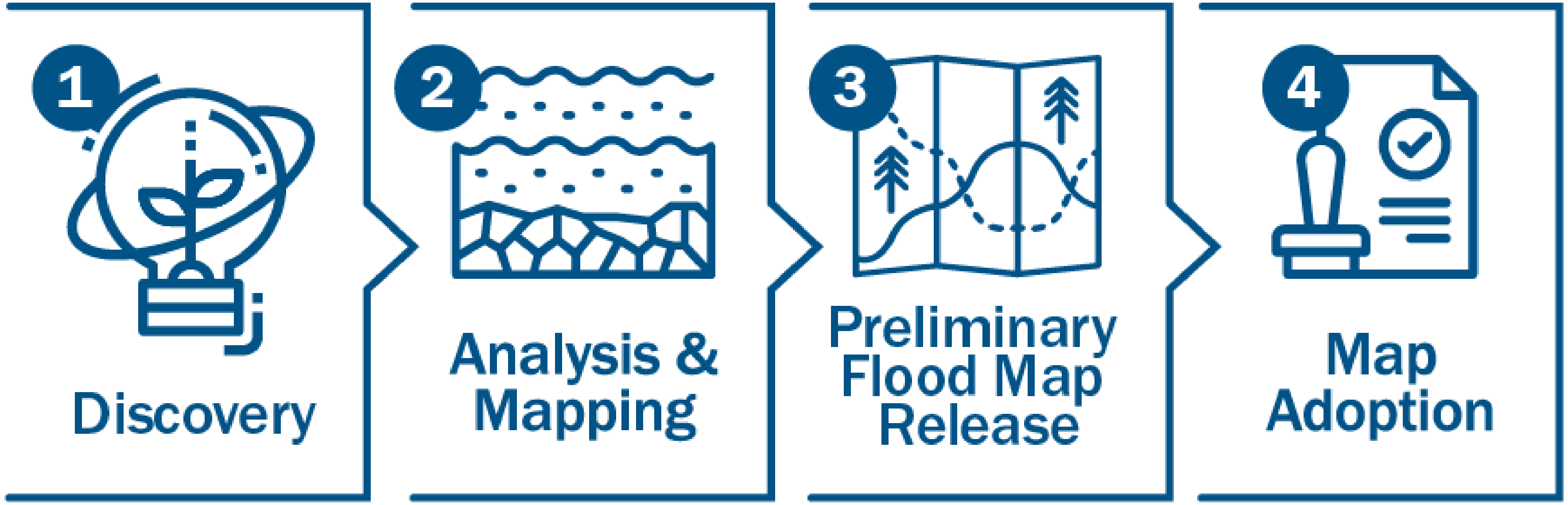
POST-DISCOVERY RESULTS

MAPPING NEEDS PRIORITIZATION BY PARISH

Mapping Needs Prioritization by Parish		
Parish	**Priority**	**Reason**
Sabine	Highest	78% of the streams are unverified, and the oldest effective date exceeds the last 30 years. DFIRM data is not available for this parish.
Vernon	High	79% of the streams are unverified, but the oldest effective date is within the last 20 years. The Parish has modernized DFIRM data.
Beauregard	Moderate	67% of the streams are unverified, but the oldest effective date is within the last 20 years. The Parish has modernized DFIRM data.
Calcasieu	Moderate	62% of the streams are unverified, but the oldest effective date is within the last 15 years. The Parish has modernized DFIRM data
Cameron	Low	Less than 1% of the streams are unverified, and the oldest effective FIRM is within the last 15 years. The Parish has modernized DFIRM data.

RISK MAP NEXT STEPS

FEMA'S RISK MAPPING, ASSESSMENT, AND PLANNING (MAP) PROGRAM



THANK YOU!

QUESTIONS?

THANK YOU!

Pam Lightfoot
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(225) 379-3016
Pam.ligthfoot@la.gov

Jack Young
Project Manager
(210) 875-0541
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vbivens@Halff.com

Thomas Lejeune
Discovery GIS Lead
(318) 575-3103
tlejeune@Halff.com

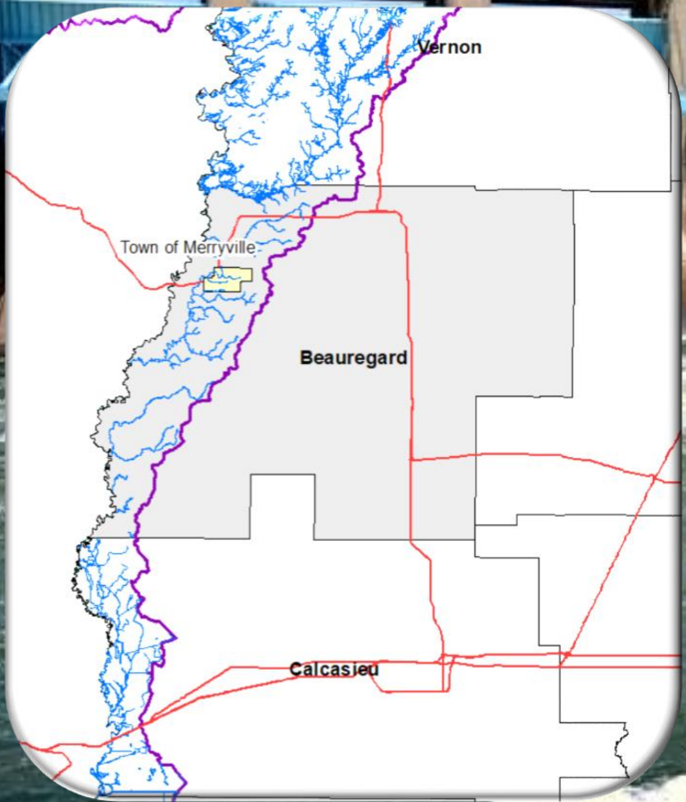
Appendix II: Community-Specific Reports

Snapshots

RiskMAP
Increasing Resilience Together

Beauregard Parish

KNOW YOUR RISK



7.78%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

243.74 sq. mi.

of the community's land area is in the study area

36,549

Population based on 2020 Decennial Census

1.25% expected population increase predicted from 2020-2025

100
policies totaling approximately $16,755,800 in coverage

97
Claims submitted to NFIP in the Community.

$2,845,222
In Total Paid on Building Claims in the Parish

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

359

Percentage of stream miles which are detailed study in the parish

22%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Beauregard Parish

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **May 2026.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

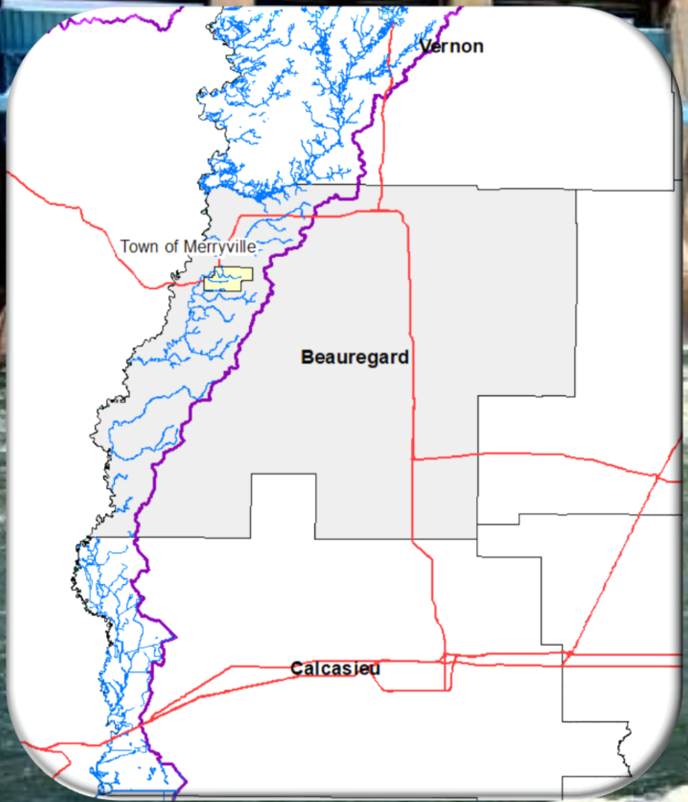
The Louisiana Watershed Initiative (LWI) provides funding for local governments for flood risk reduction projects and project development capacity building through CDBG-Mitigation dollars. These funds are distributed through three rounds of competitive funding opportunities focused on projects that result in demonstrable flood mitigation[4].

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

Town of Merryville

KNOW YOUR RISK



18%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

8.16 sq. mi.

of the community's land area is in the study area

1,214

Population based on 2020 Decennial Census

14.9% expected population increase predicted from 2020-2025

1

policies totaling approximately $137,500 in coverage

0

Claims submitted to NFIP in the Community.

$0

In Total Paid on Building Claims in the town

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

359

Percentage of stream miles which are detailed study in the parish

22%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Town of Merryville

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **May 2026.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

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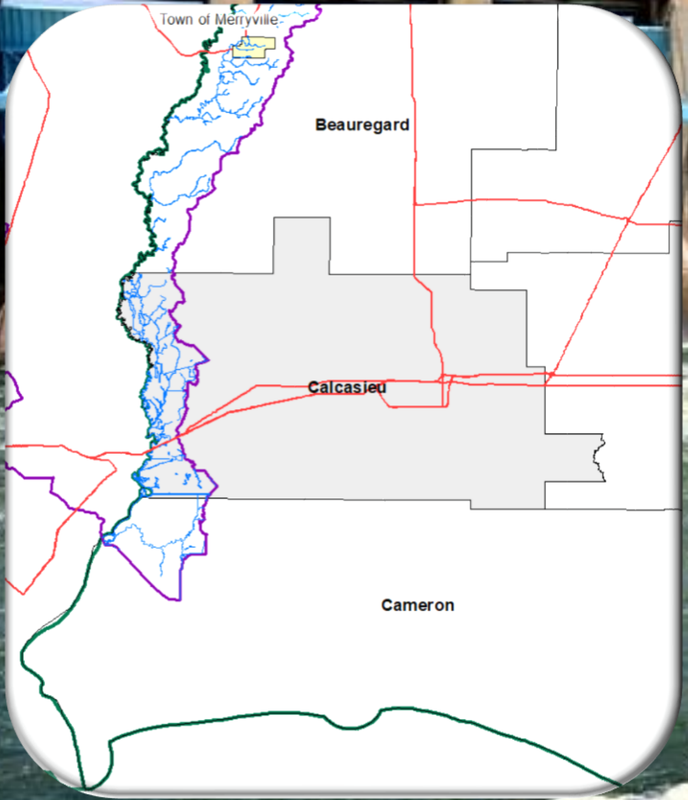
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

RiskMAP
Increasing Resilience Together

Calcasieu Parish

KNOW YOUR RISK



2.87%
Of the community’s FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

122.7 sq. mi.
of the community's land area is in the study area

216,785
Population based on 2020 Decennial Census

6.25% expected population increase predicted from 2020-2025

2085
policies totaling approximately $442,555,800 in coverage

1,901
Claims submitted to NFIP in the Community.

$55,642,640
In Total Paid on Building Claims in the Parish

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish
97.5

Percentage of stream miles which are detailed study in the parish
48%

X
Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Calcasieu Parish

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **September 2026.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

FEMA's Hazard Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation Grant (PDM), and GOHSEP's Flood Mitigation Assistance (FMA) Grant Program all fund localized Flood Risk Reduction Projects. There may be eligibility, benefit cost analysis, and cost-share requirements. The 5% Initiative in the HMGP is used for projects for which it may be difficult to conduct a standard BCA to prove cost-effectiveness, such as emergency notification, public awareness, or sirens. Information about FEMA's HMA grants[1] can be found on our website, as well as on the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)[2] website. The State Hazard Mitigation Officer may be contacted for additional information. Participation in FEMA's Community Rating System[3] (CRS) reduces insurance premiums up to 45%, and FEMA will provide free technical assistance in designing and implementing programs designed to reduce flood damage. The State Hazard Mitigation Officer may be contacted for additional information.

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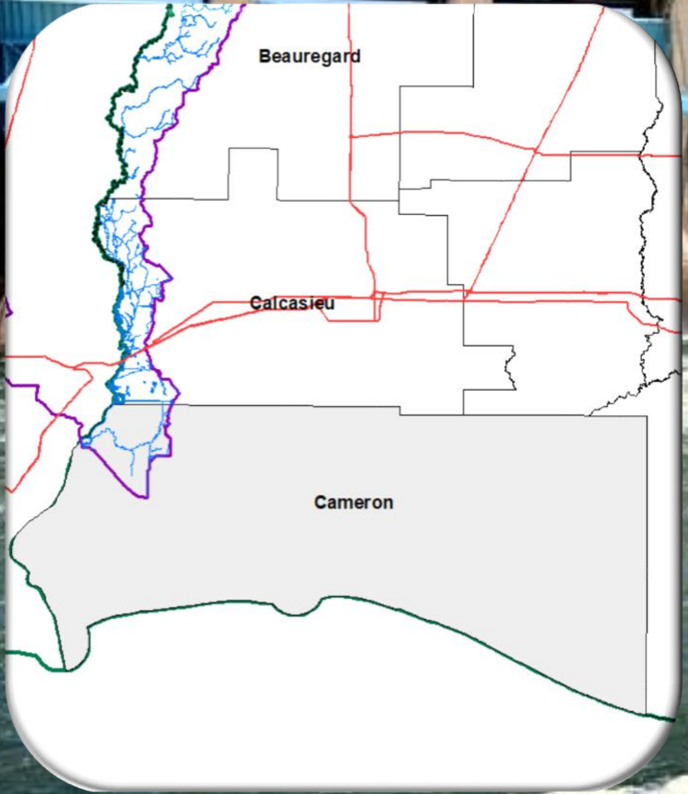
2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

RiskMAP
Increasing Resilience Together

Cameron Parish

KNOW YOUR RISK



0%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

73.9
sq. mi.

of the community's land area is in the study area

5,617

Population based on 2020 Decennial Census

-8.95 expected population decline predicted from 2020-2025

923
policies totaling approximately $211,500,500 in coverage

833
Claims submitted to NFIP in the Community.

$41,299,801
In Total Paid on Building Claims in the Parish

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

5.71

Percentage of stream miles which are detailed study in the parish

0.3%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Cameron Parish

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **January 2026.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

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4. https://watershed.la.gov/local-regional-projects-programs

Sabine Parish

KNOW YOUR RISK

15.1%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

199.9
sq. mi.

of the community's land area is in the study area

22,155

Population based on 2020 Decennial Census

-4.3% expected population decline predicted from 2020-2025

9
policies totaling approximately $874,300 in coverage

9
Claims submitted to NFIP in the Community.

$230,018
In Total Paid on Building Claims in the parish

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

298.8

Percentage of stream miles which are detailed study in the parish

1.7%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Sabine Parish

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

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4. https://watershed.la.gov/local-regional-projects-programs

RiskMAP
Increasing Resilience Together

Village of Fisher

KNOW YOUR RISK

0%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

0.61 sq. mi.

of the community's land area is in the study area

198

Population based on 2020 Decennial Census

-11.9% expected population decline predicted from 2020-2025

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community.

$0

In Total Paid on Building Claims in the village

Not participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

298.8

Percentage of stream miles which are detailed study in the parish

1.7%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Village of Fisher

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

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The Louisiana Watershed Initiative (LWI) provides funding for local governments for flood risk reduction projects and project development capacity building through CDBG-Mitigation dollars. These funds are distributed through three rounds of competitive funding opportunities focused on projects that result in demonstrable flood mitigation[4].

The minimum requirements for floodplain regulations are outlined in 44 Code of Federal Regulations 60.3, and local communities may choose to adopt more restrictive codes. FEMA Regional Office VI offers assistance in developing stricter codes, such as regulating construction or elevational changes in the floodplain.

1. https://www.fema.gov/hazard-mitigation-assistance.
2. https://gohsep.la.gov/GRANTS/RECOVERY-GRANTS/Hazard-Mitigation-Assistance/Hazard-Mitigation-Overview
3. https://www.fema.gov/national-flood-insurance-program-community-rating-system
4. https://watershed.la.gov/local-regional-projects-programs

RiskMAP
Increasing Resilience Together

Village of Florien

KNOW YOUR RISK

1%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

2.23 sq. mi.

of the community's land area is in the study area

197

Population based on 2020 Decennial Census

-7.15% expected population decline predicted from 2020-2025

4

policies totaling approximately $220,500 in coverage

4

Claims submitted to NFIP in the Community.

$37,845

In Total Paid on Building Claims in the village

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

298.8

Percentage of stream miles which are detailed study in the parish

1.7%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Village of Florien

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2027.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

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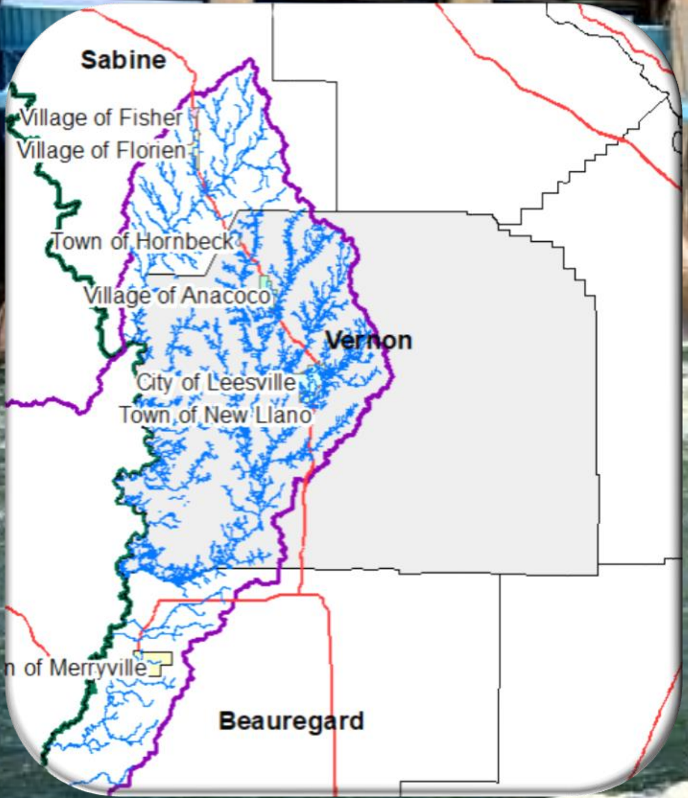
4. https://watershed.la.gov/local-regional-projects-programs

Vernon Parish

KNOW YOUR RISK



16%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

537 sq. mi.

of the community's land area is in the study area

48,750

Population based on 2020 Decennial Census

-3.4% expected population decline predicted from 2020-2025

106

policies totaling approximately $20,876,700 in coverage

104

Claims submitted to NFIP in the Community.

$3,768,783

In Total Paid on Building Claims in the Parish

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

777.6

Percentage of stream miles which are detailed study in the parish

5.7%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Vernon Parish

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2029.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

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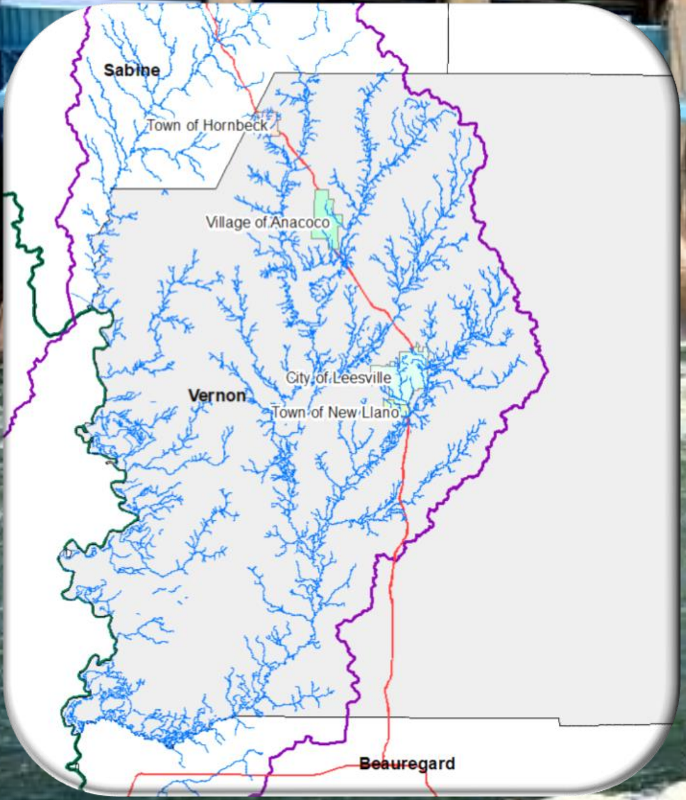
4. https://watershed.la.gov/local-regional-projects-programs

RiskMAP
Increasing Resilience Together

Village of Anacoco

KNOW YOUR RISK



6%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

3.11 sq. mi.

of the community's land area is in the study area

962

Population based on 2020 Decennial Census

-2.25% expected population decline predicted from 2020-2025

0

policies totaling approximately $0 in coverage

0

Claims submitted to NFIP in the Community.

$0

In Total Paid on Building Claims in the village

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

777.6

Percentage of stream miles which are detailed study in the parish

5.7%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Village of Anacoco

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2029.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

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RiskMAP
Increasing Resilience Together

Town of Hornbeck

KNOW YOUR RISK

0%
Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

1.22 sq. mi.
of the community's land area is in the study area

763
Population based on 2020 Decennial Census

11.45% expected population increase predicted from 2020-2025

0
policies totaling approximately $0 in coverage

0
Claims submitted to NFIP in the Community.

$0
In Total Paid on Building Claims in the town

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish
777.6

Percentage of stream miles which are detailed study in the parish
5.7%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Town of Hornbeck

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2029.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
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City of Leesville

KNOW YOUR RISK

7%
Of the community’s FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

5.6 sq. mi.
of the community's land area is in the study area

5,649
Population based on 2020 Decennial Census

-7.3% expected population decline predicted from 2020-2025

20
policies totaling approximately $3,826,200 in coverage

18
Claims submitted to NFIP in the Community.

$358,655
In Total Paid on Building Claims in the city

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish
777.6

Percentage of stream miles which are detailed study in the parish
5.7%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

City of Leesville

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2029.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
- Expand and coordinate Early Warning Systems currently in use
- Provide public education materials to residents and private sector
- Increase participation in the National Flood Insurance Program (NFIP) and Community Rating System (CRS)

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Town of New Llano

KNOW YOUR RISK

10%

Of the community's FEMA mapped* 1%-annual-chance storm flood extent areas are in the study area

0.94 sq. mi.

of the community's land area is in the study area

2,777

Population based on 2020 Decennial Census

8.1% expected population increase predicted from 2020-2025

2

policies totaling approximately $56,000 in coverage

2

Claims submitted to NFIP in the Community.

$20,000

In Total Paid on Building Claims in the town

Participating in the National Flood Insurance Program

CNMS Stream Miles in the Parish

777.6

Percentage of stream miles which are detailed study in the parish

5.7%

Flood-related presidential disaster declarations in your Discovery study parish

*National Flood Hazard Layer (NFHL)

Town of New Llano

TAKE ACTION: Potential Next Step

Your Hazard Mitigation Plan expiration date is **February 2029.**

The hazard mitigation goals identified projects for:

- Limit development in floodplain areas
- Buy-out repetitive loss properties
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Appendix III: Base Level Engineering Reports

Lower Sabine Watershed, TX
1D Base Level Engineering (BLE) Results

Contract #HSFE60-15-D-0003, Task Order #70FBR620F00000047
December 2021

Prepared for:

DHS/FEMA (Federal Emergency Management Agency)
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DOCUMENT HISTORY

DOCUMENT LOCATION

K:/FY2020/20-06-0094S/Hydraulics - Lower Sabine (Newton County, TX)|BLE (FY20) 06/Hydraulic Data Capture - Hydraulic Data Capture|Lower Sabine (Newton County, TX) - 01

REVISION HISTORY

Version Number	Version Date	Summary Changes	Team/Author
1.0	December 2021	Initial Draft	AECOM

APPROVALS

This document requires the approval of the following persons:

Role	Name	Review Date	Approved Date
Project Manager	Sean Sutton	December 17,2021	December 27,2021

CLIENT DISTRIBUTION

Name	Title/Organization	Location
FEMA's MIP	Region VI	See path above
Diane Howe	FEMA Region VI	Denton, TX
Larry Voice	FEMA Region VI	Denton, TX

Table of Contents

Executive Summary

FEMA Region VI contracted Compass to complete a Base Level Engineering (BLE) analysis for Area E – Sabine River in southeastern Texas, to support FEMA's Discovery process and validation of effective Zone A Special Flood Hazard Areas (SFHAs). Area E includes the Upper Sabine, Lake Fork, Middle Sabine, Lower Sabine, and Sabine Lake HUC-8 watersheds. This report focuses on the Lower Sabine HUC-8 watershed at the Texas/Louisiana border. This BLE study will provide significant data for several Texas counties previously lacking modernized flood models.

The BLE process involves using best available data and incorporating automated techniques with traditional model development procedures to produce regulatory-quality flood hazard boundaries for the 1-percent annual chance event as well as estimates of flood hazard boundaries for multiple recurrence intervals.

The source digital terrain data used for surface model development in support of hydrologic and hydraulic analysis as well as mapping activities were leveraged from various local, State, and Federal partners. Details regarding the different datasets used are provided below in Section 1.1.

Flood discharges in Texas for this study were calculated using both the United States Geological Survey (USGS) regression equations and gage analysis, where stream gages with sufficient record exist. Regression equations were obtained from the USGS Scientific Investigations Report (SIR) 2009-5087, *Regression Equations for Estimation of Annual Peak-Streamflow Frequency for Undeveloped Watersheds in Texas Using an L-moment Based, PRESS-Minimized, Residual-Adjusted Approach* (2009). For flood discharges in Louisiana, regression equations were obtained from the USGS Fact Sheet 099-01, *Methods for Estimating Flood Magnitude and Frequency in Rural Areas in Louisiana* (2001).

The Hydrologic Engineering Center's River Analysis System (HEC-RAS) program version 5.0.5 was used to compute water surface elevations on a stream by stream basis. All hydraulic models were computed using 1-D steady state analysis.

The stream mile network that was validated for these watersheds was compiled using FEMA's Community Needs Management Strategy (CNMS) inventory. CNMS is an inventory of flood hazard studies and flood hazard mapping needs for areas where a study is needed. This data is helpful for community officials in analyzing and depicting flood hazards to enhance the understanding of flood risks. Communities may use this information to make informed decisions on their planning and flood mitigation efforts. Table ES-1 lists the Zone A stream miles associated with this validation analysis.

Table ES-1: Summary of Stream Miles

Source	Lower Sabine Stream Miles
CNMS	1,864.1

The full inventory of Zone A studies in the watershed were classified in CNMS. Total miles validated in CNMS are summarized in and illustrated in Figure ES-1 below.

Table ES-2: Zone A Validation Results

Validation Status	Status Type	Total Miles
VALID	BEING STUDIED	904.0
UNVERIFIED	BEING STUDIED	960.1

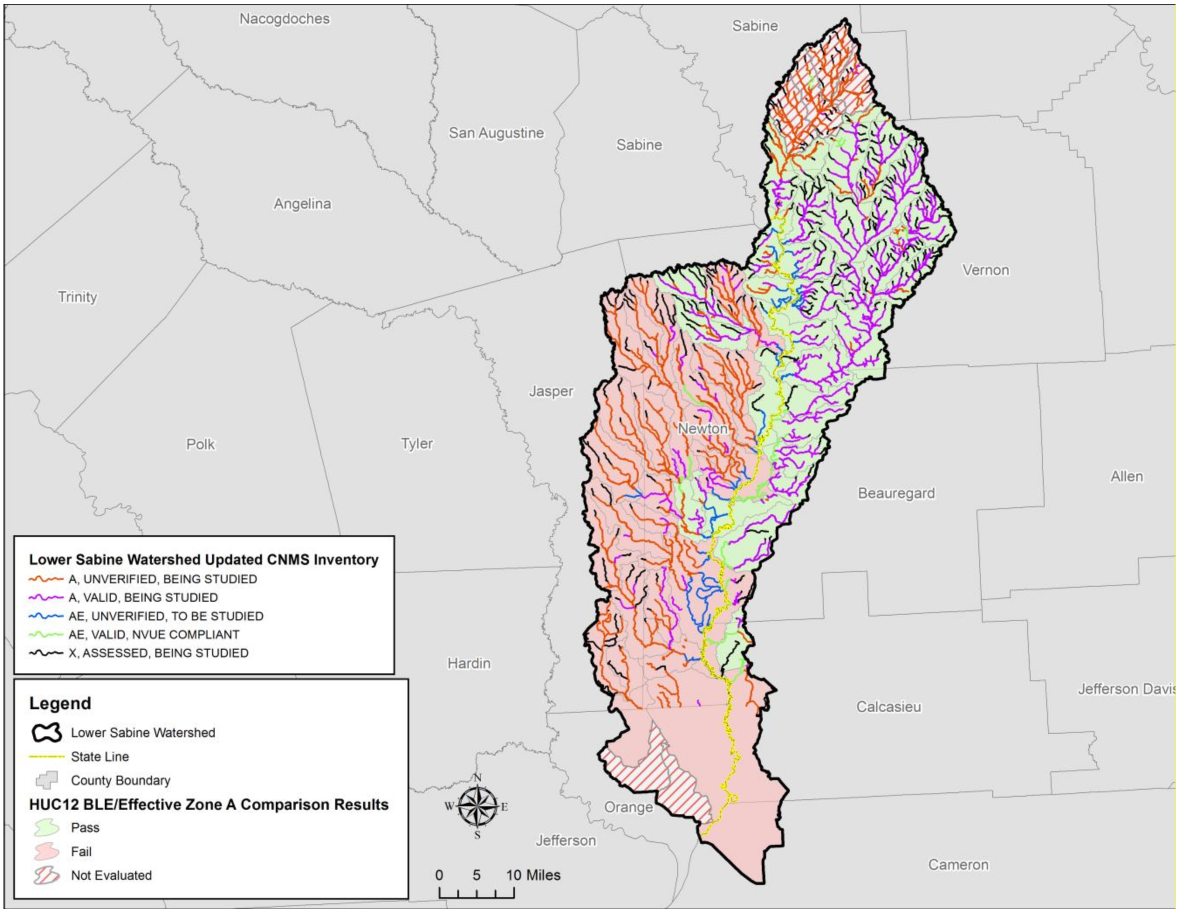

Figure ES-1: Lower Sabine Watershed CNMS Validation Results

An overall risk for each HUC-12 watershed was calculated using the National Flood Risk Percentages Dataset and its proportional area. The weighted risk was multiplied by the percentage of points in the watershed that failed the CNMS comparison to effective to determine the priority score. Figure ES-2 below shows the range of the Lower Sabine HUC-8 priority scores which can be used to initiate discussions during the Discovery phase.

McGraw Creek HUC-12 was determined to have the highest priority score and the most need while Namby Creek HUC-12 had the lowest scores.

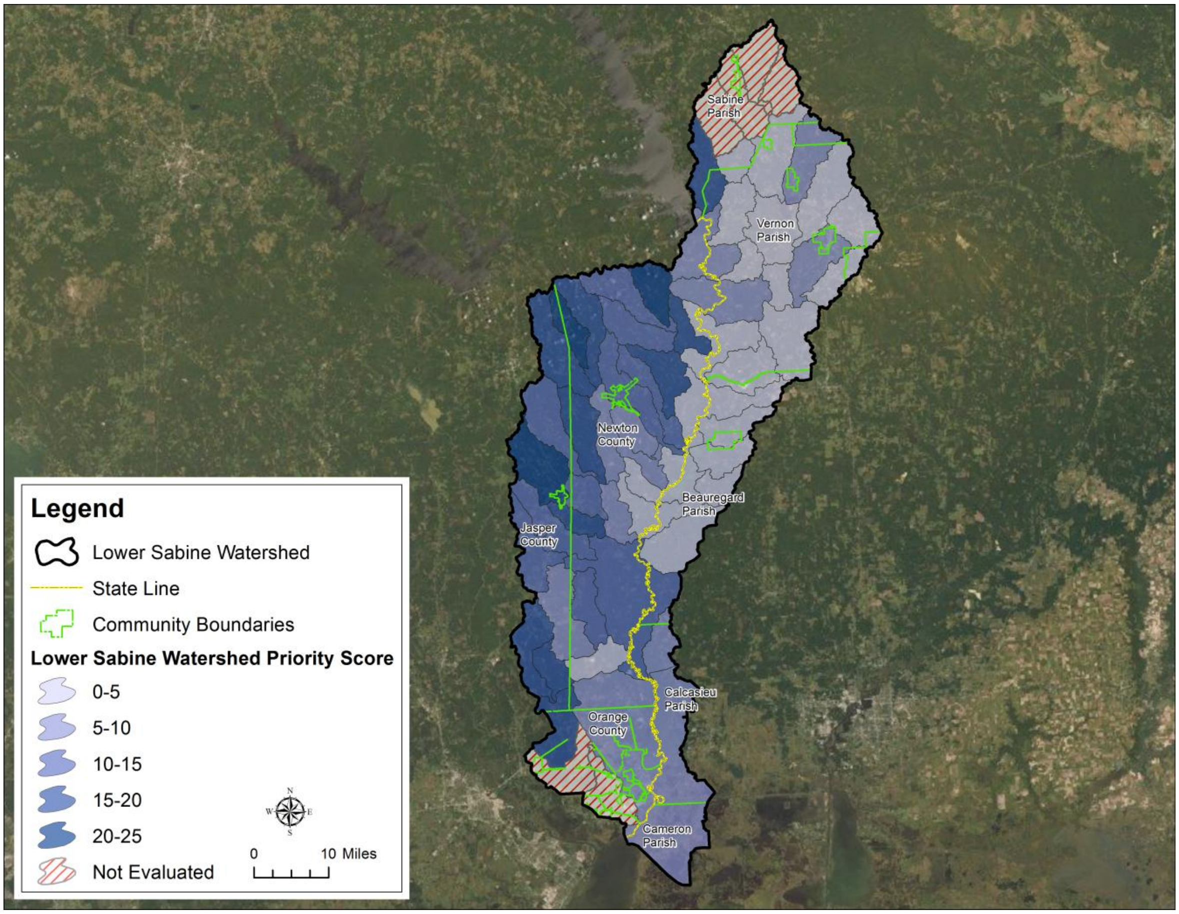

Figure ES-2: Ranking of Lower Sabine Watershed HUC-12s

Base Level Engineering (BLE) Methodology

Recent innovations and efficiencies in floodplain mapping have allowed the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) to develop a process called Base Level Engineering (BLE), which can be used to address current program challenges, including the validation of Zone A studies and the availability of flood risk data in the early stages of a Flood Risk Project. The BLE process involves using best available data and incorporating automated techniques with traditional model development procedures to produce regulatory quality flood hazard boundaries for the 1-percent annual chance event as well as estimates of flood hazard boundaries for multiple recurrence intervals. The cost for developing the data and estimates resulting from the BLE process are lower than standard flood production costs. The BLE results may be used for eventual production of regulatory and non-regulatory products.

As described in Title 42 of the Code of Federal Regulations, Chapter III, Section 4101(e), once every five years, FEMA must evaluate whether the information on Flood Insurance Rate Maps (FIRMs) reflects the current risks in flood-prone areas. FEMA makes this determination of flood hazard data validity by examining flood study attributes and change characteristics, as specified in the Validation Checklist of the Coordinated Needs Management Strategy (CNMS) Technical Reference. The CNMS Validation Checklist provides a series of critical and secondary checks to determine the validity of flood hazard areas studied by detailed methods (e.g., Zone AE, AH, or AO). While the critical and secondary elements in CNMS provide a comprehensive method of evaluating the validity of Zone AE studies, a cost-effective approach for evaluating Zone A studies has been lacking.

In addition to the need for Zone A validation guidance, FEMA standards require flood risk data to be provided in the early stages of a Flood Risk Project. FEMA Program Standard SID #29 requires that during Discovery, data must be identified that illustrates potential changes in flood elevation and mapping that may result from the proposed project scope. If available data does not clearly illustrate the likely changes, an analysis is required that estimates the likely changes. This data and any associated analyses should be shared and results should be discussed with stakeholders.

An important goal of the BLE process is the scalability of the results. Scalability means that the results of a BLE analysis can not only be used for CNMS evaluations of Zone A studies, but can also be leveraged throughout the Risk MAP program. The data resulting from a BLE analysis can be updated as needed and used for the eventual production of regulatory and non-regulatory products, outreach and risk communication, and MT-1 processing. Leveraging this data outside the Risk MAP program may also be valuable to external stakeholders.

FEMA Region 6 contracted Compass to complete a BLE analysis for the Lower Sabine Watershed in Eastern Texas and Western Louisiana to support FEMA's Discovery process and validation of effective Zone A Special Flood Hazard Areas (SFHA). The study extents include portions of Beauregard, Calcasieu, Cameron, Sabine, and Vernon Counties, Louisiana and Jasper, Newton, and Orange Counties, Texas. The study extents include the following communities: City of Bridge City, City of Kirbyville, City of Newton, City of Orange, City of Vidor, and City of West Orange in Texas, as well as City of Leesville, Town of Hornbeck, Town of Merryville, Town of New Llano, Village of Anacoco, Village of Fisher, and Village of Florien in Louisiana.

The study area consists of eleven HUC-10 basins: Adams Bayou-Sabine River, Bayou Anacoco, Bayou Toro, Big Cow Creek, Cow Bayou, Dempsey Creek-Sabine River, Little Cow Creek, Little Cypress Creek-Cypress Creek, Nichols Creek-Sabine River, Quicksand Creek-Sabine River, and

Sandy Creek-Sabine River. Figure 1 shows the orientation of the Lower Sabine Watershed HUC-10 basins with respect to the counties.

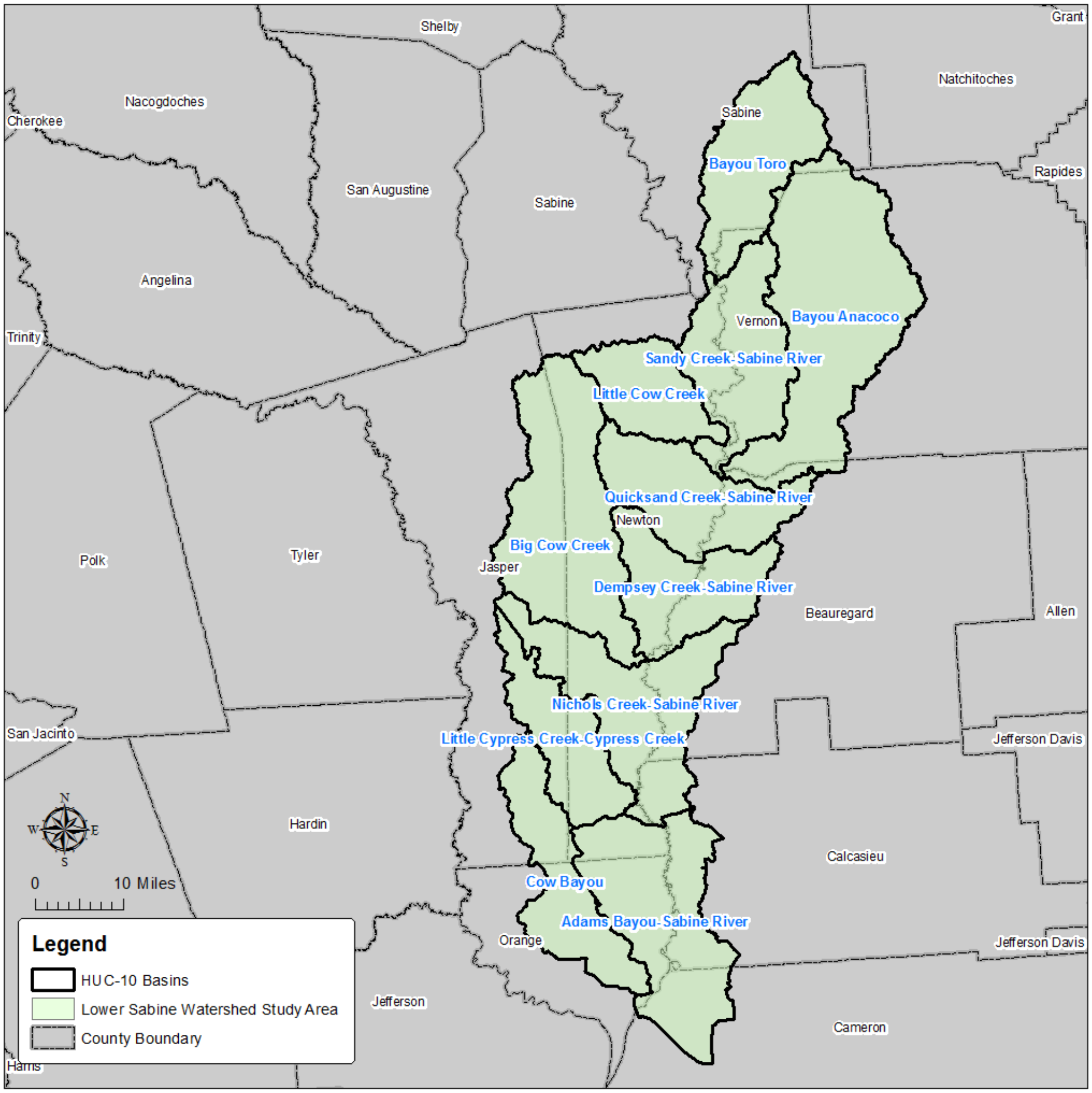

Figure 1: Lower Sabine Watershed HUC-10 Basins

Compass studied approximately 3,470 miles of stream reaches within the Lower Sabine Watershed with a minimum drainage area tolerance of one square mile outside of population centers and half a square mile inside population centers. The selection and extent of stream reaches studied were based upon the number of stream miles with a minimum drainage area of one square mile and not the number of effective Zone A stream miles. Study reaches were extended above this threshold as appropriate to ensure all effective Zone A flood areas received an updated analysis. Topographic data from multiple sources were used to determine the hydrologic and hydraulic characteristics of the watershed. The following sections summarize the BLE process and discuss the results along with their recommended use.

1.1 Topographic Data

Topographic data from multiple sources were used to determine the hydrologic and hydraulic characteristics of the watershed. Topographic data were obtained from the Texas Natural Resources Information System (TNRIS), and the United States Geological Survey (USGS).

All available metadata, survey reports, and other leverage documentation are available with the source dataset. Figure 2 shows the extents of the source Digital Terrain Model (DTM) data used for the Lower Sabine Watershed.

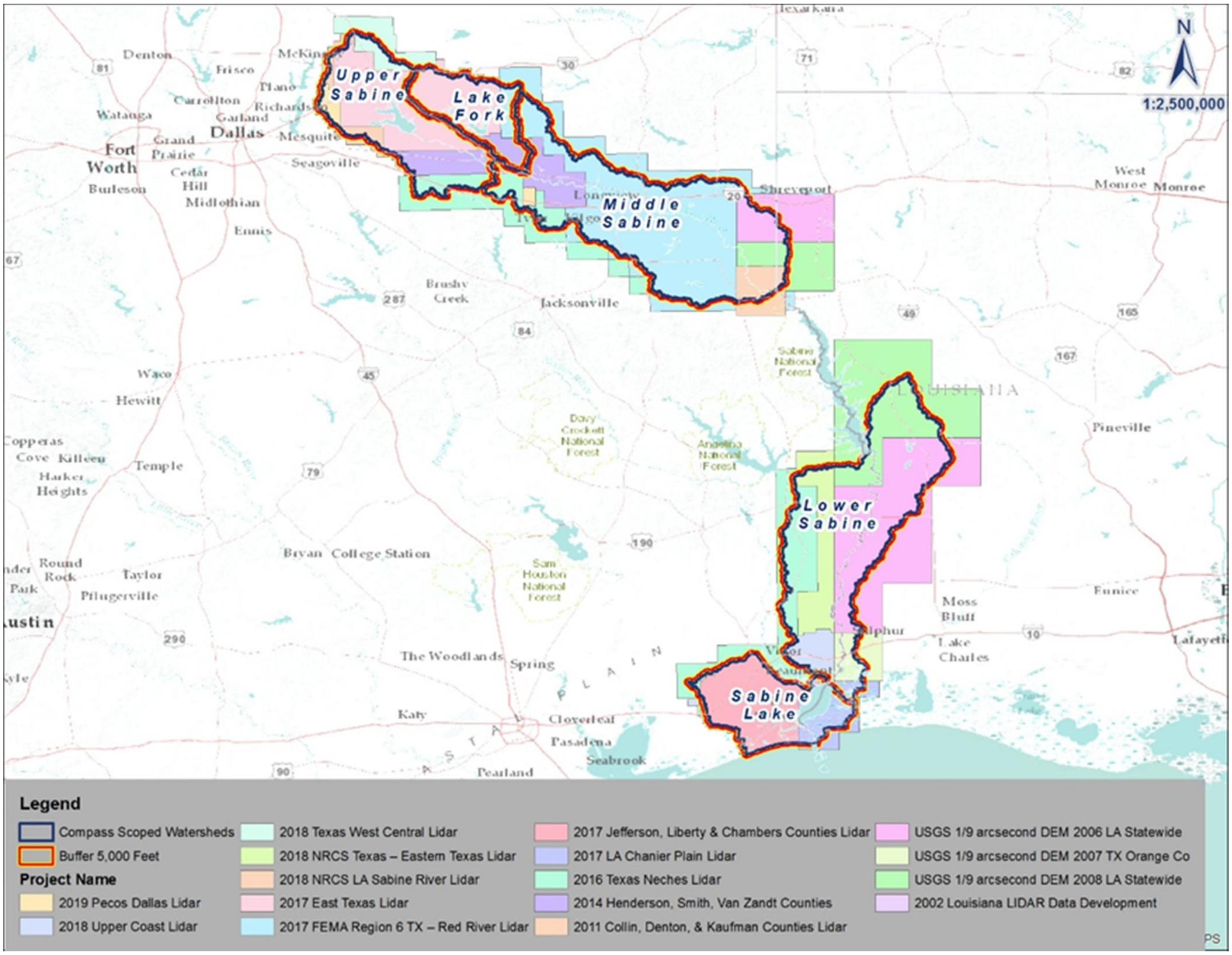

Figure 2: Extent of LiDAR Data for Lower Sabine Watershed

1.1.1 Source Terrain Data

Eight topographic datasets were used in the development of the Lower Sabine Watershed BLE hydraulic models. Details on each dataset are outlined below.

1.1.1.1 2018 NRCS Texas – Eastern Texas LiDAR 1 Meter DEM

Digital Aerial Solutions was tasked to collect and process a LiDAR derived elevation dataset for the Texas counties of Leon, Washington, Sabine, San Jacinto, Shelby, Grimes, Lee, Madison, Milam, Trinity, and Newton with Quality Level (QL) 2 Specification. LiDAR data was acquired from March 6, 2018 to March 21, 2018.

Data Specification:

Modern era LiDAR data collection is typically expected to meet specifications of the NGP - LBS. The national LBS have been modified through a series of revisions throughout time and can be accessed at 'LiDAR Base Specification Online' for reference (https://www.usgs.gov/core-science-systems/ngp/ss/LiDAR-base-specification-online). This LiDAR survey and derivative products produced in compliance with the task order are based on:

- USGS LiDAR Base Specifications v1.2
- ASPRS Positional Accuracy Standards for Digital Geospatial Data

The measured accuracy was 0.098 meters for raw NVA and NVA with VVA measured as 0.144 meters.

1.1.1.2 2018 Upper Coast LiDAR 1 Meter DEM

Fugro was tasked to collect and process a LiDAR-derived elevation dataset for the Texas counties of Austin, Brazoria, Calcasieu, Cameron, Chambers, Colorado, Fort Bend, Galveston, Grimes, Harris, Houston, Jasper, Jefferson, Liberty, Madison, Matagorda, Montgomery, Newton, Orange, Polk, San Jacinto, Trinity, Walker, Waller, Washington, and Wharton with QL 2 Specification.

The 2018 Upper Coast LiDAR was available as 1 meter rasters from TNRIS (https://data.tnris.org/collection/b5bd2b96-8ba5-4dc6-ba88-d88133eb6643). The data was downloaded on September 9, 2020. The data was in NAD83 UTM Zone 15 projection with elevations in NAVD88 with units in meters. The data was collected from January 13, 2018 to March 22, 2018.

Data Specification:

Modern era LiDAR data collection is typically expected to meet specifications of the NGP - LBS. The national LBS have been modified through a series of revisions throughout time and can be accessed at 'LiDAR Base Specification Online' for reference (https://www.usgs.gov/core-science-systems/ngp/ss/LiDAR-base-specification-online). This LiDAR survey and derivative products produced in compliance with the task order are based on:

- USGS LiDAR Base Specifications v1.2
- ASPRS Positional Accuracy Standards for Digital Geospatial Data

The measured accuracy was 0.098 meters for NVA at 95% confidence level and the VVA measured as 0.116 meters.

1.1.1.3 2017 LA Chenier Plain LiDAR 1 Meter DEM

Woolpert and Aerial Services, Inc. were tasked to collect and process a LiDAR-derived elevation dataset for the Louisiana parishes of Calcasieu, Cameron, Vermillion, Iberia, and St. Mary with QL 2 Specification.

The 2017 LA Chenier Plain data was available as 1 meter rasters from the USGS National Map (ftp://rockyftp.cr.usgs.gov/vdelivery/Datasets/Staged/Elevation/1m/Projects/LA_Chenier_Plain_2017/). The data was downloaded on September 9, 2020. The data was in NAD83 UTM Zone 15 projection with elevations in NAVD88 with units in meters. The data was collected from January 8, 2017 to March 3, 2017.

Data Specification:

Modern era LiDAR data collection is typically expected to meet specifications of the NGP - LBS. The national LBS have been modified through a series of revisions throughout time and can be accessed at 'LiDAR Base Specification Online' for reference (https://www.usgs.gov/core-science-systems/ngp/ss/LiDAR-base-specification-online). This LiDAR survey and derivative products produced in compliance with the task order are based on:

- USGS LiDAR Base Specifications v1.2
- ASPRS Positional Accuracy Standards for Digital Geospatial Data

The measured accuracy was 0.122 meters for NVA at 95% confidence level and the VVA measured as 0.121 meters.

1.1.1.4 2017 Jefferson, Liberty, & Chambers Counties 1 Meter DEM

Sanborn was tasked to collect and process a LiDAR-derived elevation dataset for the Texas counties of Jefferson, Liberty, and Chambers with QL 2 Specification for the Jefferson County Area of Interest (AOI) and QL0 Specification for the Liberty and Chambers Counties AOI.

The Jefferson, Liberty, and Chambers Counties LiDAR data was available as 1 meter rasters from TNRIS (https://data.tnris.org/collection/12342f12-2d74-44c4-9f00-a5c12ac2659c). The data was downloaded on September 9, 2020. The data was in NAD83 UTM Zone 15 projection with elevations in NAVD88 with units in meters. The data was collected from February 22, 2017 to March 23, 2017.

Data Specification:

Modern era LiDAR data collection is typically expected to meet specifications of the NGP - LBS. The national LBS have been modified through a series of revisions throughout time and can be accessed at 'LiDAR Base Specification Online' for reference (https://www.usgs.gov/core-science-systems/ngp/ss/LiDAR-base-specification-online). This LiDAR survey and derivative products produced in compliance with the task order are based on:

- USGS LiDAR Base Specifications v1.2
- ASPRS Positional Accuracy Standards for Digital Geospatial Data

The measured accuracy was 0.196 meters for NVA at 95% confidence level and the VVA measured as 0.286 meters.

1.1.1.5 2016 Texas Neches LiDAR 1 Meter DEM

Dewberry was tasked to collect and process a LiDAR-derived elevation dataset for the USGS Texas Neches Project Area with QL 2 Specification. Quantum Spatial and Precision Aerial Reconnaissance completed LiDAR data acquisition and data calibration for the project area which includes the Texas counties of Kaufman, Navarro, Freestone, Leon, Madison, Van Zandt, Henderson, Smith, Anderson, Cherokee, Rusk, Shelby, Nacogdoches, Houston, Trinity, Angelina, San Augustine, Sabine, Newton, Jasper, Tyler, Hardin, Polk, Liberty, Jefferson, and Orange.

The 2016 Texas Neches LiDAR data was available as 1 meter rasters from the USGS National Map (ftp://rockyftp.cr.usgs.gov/vdelivery/Datasets/Staged/Elevation/1m/Projects/TX_Neches_B5_2016/ and ftp://rockyftp.cr.usgs.gov/vdelivery/Datasets/Staged/Elevation/1m/Projects/TX_Neches_B1_2016/ and ftp://rockyftp.cr.usgs.gov/vdelivery/Datasets/Staged/Elevation/1m/Projects/TX_Neches_B2_2016/) The data was downloaded on September 9, 2020. The data was in NAD83 UTM Zone 15 projection with elevations in NAVD88 with units in meters. The data was collected from March 3, 2016 to February 25, 2017.

Data Specification:

Modern era LiDAR data collection is typically expected to meet specifications of the NGP - LBS. The national LBS have been modified through a series of revisions throughout time and can be accessed at 'LiDAR Base Specification Online' for reference (https://www.usgs.gov/core-science-systems/ngp/ss/LiDAR-base-specification-online). This LiDAR survey and derivative products produced in compliance with the task order are based on:

- USGS LiDAR Base Specifications v1.2
- ASPRS Positional Accuracy Standards for Digital Geospatial Data

The measured accuracy was 0.129 meters for NVA at 95% confidence level and the VVA measured as 0.167 meters.

1.1.1.6 2008 LA Statewide West LiDAR

Watershed Concepts was tasked to collect and process a LiDAR-derived elevation dataset for the state of Louisiana.

The 2008 LA Statewide West LiDAR DEM was available as 1/9 arc-second rasters from the USGS National Map (https://prd-tnm.s3.amazonaws.com/index.html?prefix=StagedProducts/Elevation/19/IMG/). The data was downloaded September 9, 2020. The data was in NAD83 UTM Zone 15 projection with elevations in NAVD88 with units in meters.

There is no documentation that references vertical accuracy for this data.

1.1.1.7 2006 LA Statewide LiDAR

Watershed Concepts was tasked to collect and process a LiDAR-derived elevation dataset for the state of Louisiana.

The 2006 LA Statewide LiDAR DEM was available as 1/9 arc-second rasters from the USGS National Map (https://prd-tnm.s3.amazonaws.com/index.html?prefix=StagedProducts/Elevation/19/IMG/). The data was downloaded September 9, 2020. The data was in NAD83 UTM Zone 15 projection with elevations in NAVD88 with units in meters.

There is no documentation that references vertical accuracy for this data.

1.1.1.8 2002 Louisiana LiDAR Data Development 5 meter DEM

3001 Inc. was tasked to collect and process a LiDAR-derived elevation dataset for the state of Louisiana.

The 2002 Louisiana LiDAR Data Development Project DEM was available as 5 meter rasters from the Atlas Louisiana GIS (https://atlas.ga.lsu.edu/datasets/LiDAR2000/). The data was downloaded October 20, 2020. The data was in NAD83 UTM Zone 15 projection with elevations in NAVD88 with units in feet.

Vertical accuracy was calculated for the data at 0.115 meters RMSE.

1.1.2 Terrain Data Processing

The LiDAR data were processed in Environmental System Research Institute (ESRI) ArcGIS software to create a composite DTM dataset for the project area. The outputs from the processing described below were used during the hydrology, hydraulics, floodplain mapping and CNMS processes and validations.

Stream centerlines were manually digitized using the 10-foot DEMs as a source for horizontal alignment and vertical elevation. These stream centerlines are created for use in the hydraulic analysis-and hydro-enforcement of the 50-foot DEMs. Several routines were then used to take localized elevations from the source topographic data and apply them to the streams. This gave the stream vertices elevation information along the Z axis. The resulting elevations ensure that the streams are lower in elevation than any overbank sumps. A separate routine was then used to ensure that the elevations of these vertices descend in height down to an outfall. The final streams file is then “burned” into the 50-foot DEMs to force flow through structures while preventing it from jumping out of the channel banks.

After the DEM was imported, an additional 50-foot DEM was created from the same mosaic and tile index used for the 10-ft DEM. This 50-foot DEM was used for hydro enforcement of the project area. Proprietary software was used to identify natural sinks, peaks and flat areas in the 50-foot DEM surface. Elevations of the cells in the DEM were algorithmically calculated and the best path to route flow was determined without filling sinks in the DEM. Once all calculations were completed, the flow was checked confirming that all drainage flowed downstream correctly and routed to outside of the project area.

In addition to the quantitative assessment of the source digital terrain, a qualitative visual inspection of the composite DEM was performed using a hillshade derived from the 10-foot DEM. The visual inspection indicated no unusual or non-terrestrial features were observed in the composite DEM assuring the surface files used for hydrologic and hydraulic analyses and floodplain mapping activities are sufficient for BLE analysis.

1.2 Hydrology

Flood discharges for this study were calculated using both the USGS regression equations and gage analysis, where stream gages with sufficient record exist. Regression equations obtained from the USGS Scientific Investigations Report (SIR) 2009-5087, *Regression Equations for Estimation of Annual Peak-Streamflow Frequency for Undeveloped Watersheds in Texas Using an L-moment Based, PRESS-Minimized, Residual-Adjusted Approach* (2009) contain the most recent regression equations for Texas. For Louisiana, regression equations were obtained from the USGS

Fact Sheet 099-01, *Methods for Estimating Flood Magnitude and Frequency in Rural Areas in Louisiana* (2001). Although some HUC-10 boundaries (Adams Bayou – Sabine River, Sandy Creek – Sabine River, Quicksand Creek – Sabine River, Dempsey Creek Sabine River, Nichols Creek – Sabine River) include reaches in both Louisiana and Texas, the respective regression equations were used for the basins and reaches existing in each state. There were no instances of a studied reach utilizing both Texas and Louisiana regression equations due to the Sabine River flowing along the state boundary. There are differences in the parameters used in the Texas and Louisiana regression equations discussed in the following sections. USGS Peak FQ Version 7.3 was used to perform the Flood Frequency Analysis (FFA) for the twenty gages within the Lower Sabine Watershed (see below for further discussion).

1.2.1 Regression Analysis

The WISE software was used to delineate drainage basins in shapefile format using the 50-foot DEM. WISE was also used to calculate the main-channel slope for each basin. The basin shapefile attribution was automated by WISE with drainage area, main-channel slope, precipitation, and OmegaEM, all inputs for the USGS regression equations.

Table 1 shows the published equations used in this study for Texas. In these equations, Q_i represents peak streamflow for i-recurrence interval (annual chance exceedance (a.c.e.)) in cubic feet per second (cfs), P represents mean annual precipitation in inches, S represents dimensionless main-channel slope, Ω represents the OmegaEM parameter, and A represents cumulative drainage area in square miles.

Table 1: Summary of Regression Equations in Texas (SIR 2009-5087)

Recurrence Interval	Equation
$Q_{10\%}$	$P^{1.203} \times S^{0.403} \times 10^{[0.918\Omega + 13.62 - 11.97A\text{^}(-0.0289)]}$
$Q_{4\%}$	$P^{1.140} \times S^{0.446} \times 10^{[0.945\Omega + 11.79 - 9.819A\text{^}(-0.0374)]}$
$Q_{2\%}$	$P^{1.105} \times S^{0.476} \times 10^{[0.961\Omega + 11.17 - 8.997A\text{^}(-0.0424)]}$
$Q_{1\%}$	$P^{1.071} \times S^{0.507} \times 10^{[0.969\Omega + 10.82 - 8.448A\text{^}(-0.0467)]}$
$Q_{0.2\%}$	$P^{0.988} \times S^{0.569} \times 10^{[0.976\Omega + 10.40 - 7.605A\text{^}(-0.0554)]}$
Variables: Q_i, peak flow for i recurrence interval (a.c.e.), in cubic feet per second; P, mean annual precipitation, in inches; S, Main-channel slope (dimensionless); Ω, OmegaEM parameter; A, cumulative drainage area, in square miles	

Discharges for the 1-percent plus and 1-percent minus a.c.e. were calculated as well. These values were computed as $Q_{1\%+/-} = Q_{1\%} \pm 10^{1.6*0.30}$, where 0.30 is the mean residual standard error for the $Q_{1\%}$ equation.

The mean annual precipitation values were determined based on a shapefile coverage obtained from the TWDB and is available for download at the following location: https://www.twdb.texas.gov/mapping/gisdata.asp

The annual precipitation values reflect data for the climatological period 1981-2010 as recorded by the Natural Resources Conservation Service (NRCS).

Main-channel slope was calculated in WISE. An automated routine determined the longest flowpath from upstream of a reach to the outlet of the sub-basin of interest. Two points along the channel, one at 0 percent and the other at 100 percent of the channel length, determined the endpoints of the segment used in the main-channel slope calculation. The elevations for those endpoints were based on the 10-foot DEM developed from the LiDAR.

From SIR 2009-5087, the OmegaEM parameter is a generalized terrain and climate index that expresses relative differences in peak-streamflow potential. A shapefile was developed and populated with OmegaEM values based on Figure 2 in SIR 2009-5087. This shapefile was used to determine OmegaEM values on a sub-basin basis. For sub-basins spanning more than one OmegaEM grid, the sub-basin's centroid determined its OmegaEM parameter.

Table 2 shows the published equations used in this study for Louisiana. The study area is within the Pine hills physiographic region. In these equations, Q_i represents peak streamflow for i-recurrence interval (annual chance exceedance (a.c.e.)) in cubic feet per second (cfs), AP represents mean annual precipitation in inches, SLP represents channel slope channel slope measured between two points along the main channel, one at 10% of the channel length and the other at 85% of the channel length, in feet per mile, and DA represents cumulative drainage area in square miles.

Table 2: Summary of Regression Equations in Louisiana (Pine Hills Region) (FS099-01)

Recurrence Interval	Equation
$Q_{10\%}$	$19.5DA^{0.768} \times SLP^{0.392} \times (AP-35)^{0.658}$
$Q_{4\%}$	$28.0DA^{0.778} \times SLP^{0.401} \times (AP-35)^{0.629}$
$Q_{2\%}$	$34.6DA^{0.785} \times SLP^{0.407} \times (AP-35)^{0.616}$
$Q_{1\%}$	$41.2DA^{0.791} \times SLP^{0.412} \times (AP-35)^{0.610}$
$Q_{0.2\%}$	$56.0DA^{0.803} \times SLP^{0.425} \times (AP-35)^{0.608}$

Variables:

Q_i, peak flow for i recurrence interval (a.c.e.), in cubic feet per second;
DA, cumulative drainage area, in square miles
AP, mean annual precipitation, in inches;
SLP, channel slope measured between two points along the main channel, one at 10% of the channel length and the other at 85% of the channel length, in feet per mile

Discharges for the 1-percent plus and 1-percent minus a.c.e. were calculated as well. These values were computed as $Q_{1\%+/-} = Q_{1\%} \pm 10^{1.6*0.30}$, where 0.49 is the standard of error, in percent.

The annual precipitation values reflect data for the climatological period 1981-2010 as recorded by the PRISM Climate group.

Main-channel slope was calculated in WISE. An automated routine determined the longest flowpath from upstream of a reach to the outlet of the sub-basin of interest. Two points along the channel, one at 10 percent and the other at 85 percent of the channel length, determined the endpoints of the segment used in the main-channel slope calculation. The elevations for those endpoints were based on the 10-foot DEM developed from the LiDAR.

Drainage area for each sub-basin was determined based on automated basin delineations performed by WISE. Basin break points were set by the user with a sub-basin target size of one square mile. This criterion was adjusted for the main stem of the Lower Sabine River to avoid excessive and unnecessary discharge breaks. Break points were also set immediately upstream of stream confluences. Cumulative drainage area was determined based on these automated delineations performed by WISE in combination with a stream connectivity routine that defined the stream reach segments with upstream and downstream neighbors.

The sub-basin shapefile was attributed with the computed regression discharges, and those discharges were incorporated into the Hydrologic Engineering Center's River Analysis System (HEC-RAS) models using an automated routine in WISE. Discharges, as well as water surface elevation results, were associated with the hydraulic cross-sections prior to generation of floodplain boundaries and grid mapping. Those results are available in GIS format as part of this BLE submittal package. Final discharges can be found in the Vector and raster GIS data, file geodatabase dataset (SUBBASINS) on the eBFE viewer and in the SUBBASINS.shp file on FEMA's Mapping Information Platform (MIP) in the hydraulics task.

1.2.2 Stream Gage Analysis

Figure 3 shows the location of the 15 USGS stream gages in the Lower Sabine River Watershed used to develop discharges for the study (Table 3). FFA were performed for all gages, according to USGS Bulletin 17C guidelines. 3 USGS stream gages along the Sabine River were used to directly develop flows for the mainstem model, while the 12 gages along tributaries were used for gage weighted regression adjustments.

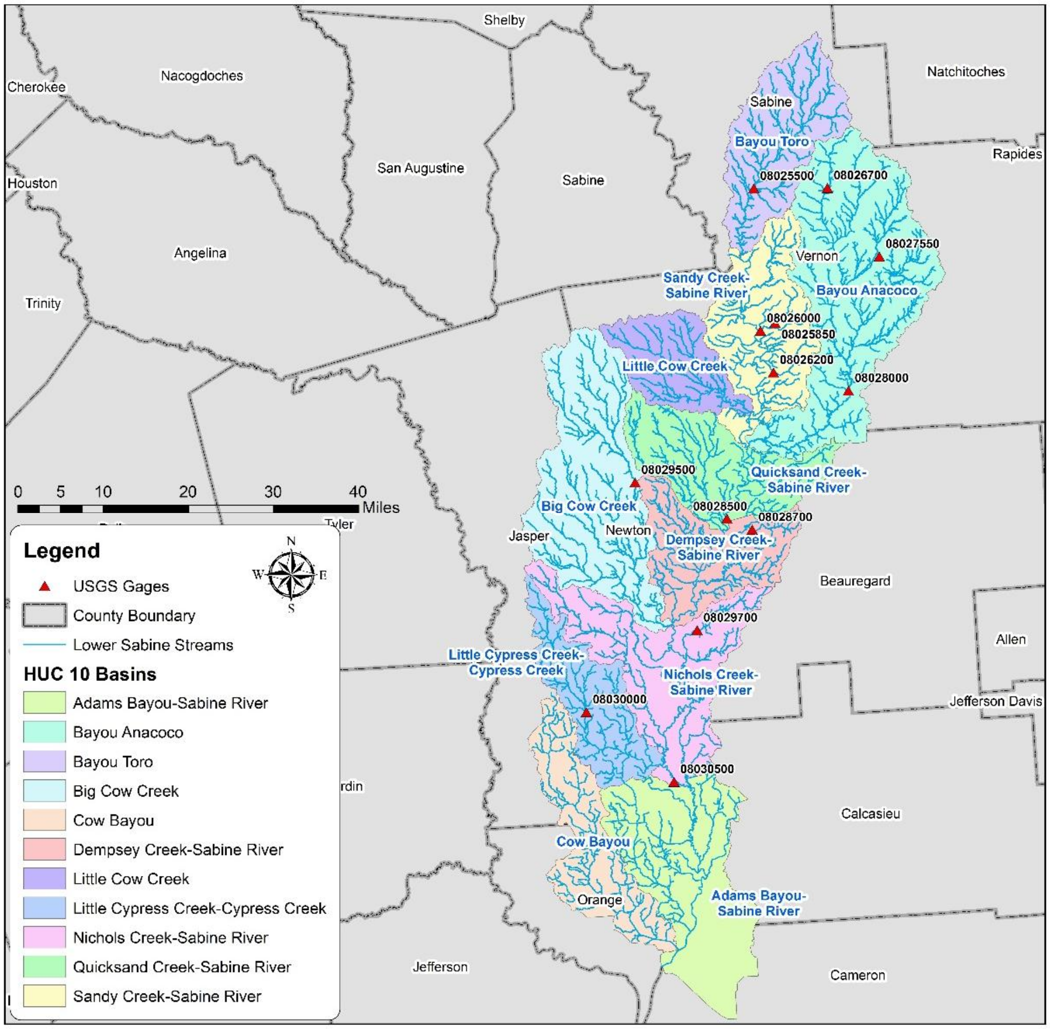

Figure 3: Locations of USGS Gages Utilized in Flood Frequency Analyses

Table 3: USGS Stream Gages in Lower Sabine Watershed

Gage ID	Flooding Source and Location	Computed Drainage Area (mi.^{2})	Published Drainage Area (mi.^{2})	Period of Record
08025400	Bayou Toro near Florien, LA	74.8	78.6	1950-1968
08025500	Bayou Toro near Toro, LA	147.9	148	1956-2020
08025850	Pearl Creek at State Highway #111 at Burr Ferry, LA	9.1	9.66	1967-2006
08026200	Red Bank Creek at Evans, LA	17.6	17.2	1966-1982
08028700	Hoosier Creek near Merryville, LA	12.1	13.1	1956-1982

Table 3 continued: USGS Stream Gages in Lower Sabine Watershed

08029500	Big Cow Creek near Newton, TX	128.49	128	1922-2019
08029700	Brushy Creek at Bancroft, LA	23.8	25.9	1954-1982
08030000	Cypress Creek near Buna, TX	69.11	69.2	1952-1983
08031000	Cow Bayou near Mauriceville, TX	87.49	83.3	1940-2019
08026700	W. Anacoco Creek near Hornbeck, LA	22.44	22.22	1950-1982
08027550	Prairie Creek near Leesville, LA	39	40.0	1949-1982
08028000	Bayou Anacoco near Rosepine, LA	363.6	365	1952-2020
08026000	Sabine River near Burkeville, TX	7496	7482	1945-2020
08028500	Sabine River near Bon Wier, TX	8259	8229	1913-2020
08031000	Sabine River near Ruliff, TX	9289	9329	1908-2020

The flood flow frequency data from tributary gages were weighted with the regression developed discharges using the procedures described in SIR 2009-5087 and FS099-01.

Gage variances for each storm event were used to develop weighted discharges. These variances are provided in Table 4.

Table 4: Summary of Gage Variances Used

Gage ID	Variance				
	10PCT	4PCT	2PCT	1PCT	0.2PCT
08025400	0.0304	0.0449	0.0588	0.0751	0.1228
08025500	0.056	0.0090	0.0126	0.0171	0.0313
08025850	0.0065	0.0100	0.0137	0.0183	0.0324
08026200	0.0045	0.0085	0.0132	0.0194	0.0401
08028700	0.0062	0.0099	0.0136	0.0181	0.0319
08029500	0.0065	0.0110	0.0158	0.0218	0.0409
08029700	0.0111	0.0159	0.0210	0.0273	0.0473
08030000	0.0042	0.0063	0.0063	0.0110	0.0188
08031000	0.0021	0.0034	0.0049	0.0068	0.0130
08026700	0.0092	0.0139	0.0187	0.0245	0.0423
08027550	0.0142	0.0229	0.0317	0.0426	0.0762
08028000	0.0057	0.0093	0.0132	0.0181	0.0335

Weighted discharges were adjusted using a gage adjustment factor developed from a comparison between the rural and gage discharges and rounded to determine final discharges. Final discharges estimated by gage analysis adjustment, and used in the final BLE hydraulic models, are presented in Table 5.

Table 5: Final Discharges at USGS Stream Gages in Lower Sabine Watershed

Gage ID	10PCT (cfs)	4PCT (cfs)	2PCT (cfs)	1PCT (cfs)	0.2PCT (cfs)
08025400	10,450	17,170	23,550	31,860	56,930
08025500	15,710	24,960	33,790	44,750	79,000
08025850	2,100	3,160	4,100	5,170	8,290
08026200	3,450	5,930	8,350	11,520	21,740
08028700	2,010	2,850	3,590	4,410	6,810
08029500	11,210	18,010	24,580	32,610	59,090
08029700	3,230	4,710	6,010	7,510	11,730
08030000	4,620	6,150	7,430	8,740	12,310
08031000	3,420	4,770	5,920	7,210	10,810
08026700	5,640	8,340	10,750	13,680	21,820
08027550	9,460	15,360	21,220	29,060	54,730
08028000	30,070	48,810	66,940	89,610	161,680

Sabine River flows were determined based on the results of the gage FFA, as regression equations would not be appropriate due to the large drainage areas of the mainstem. Basin breaks were placed at gage locations and at large confluences leading to significant jumps in drainage area. Any modeling at a higher level of detail than the Base Level Engineering should utilize a more detailed method to determine hydrology, including hydrologic modeling or more detailed, site-specific gage comparison and adjustment.

A review of the stream gages with respect to Hurricane Harvey was performed to determine whether an additional adjustment factor would be appropriate. After the review, it was determined that the Hurricane Harvey event did not warrant an additional watershed adjustment factor. For Sabine River, all three gages had an annual max peak flow as a result Harvey (2017). However, for all three stations these peak flows were significantly less than the 2016 peak. No adjustment was needed for the Sabine River to account for Harvey.

For the tributary gages, 4 stream gages had an annual max peak flow as a result of Harvey. For 3 of these stations, the Harvey flows were less than annual peak flows from other years and no adjustment was needed. For Gage 08031000 (Cow Bayou near Mauriceville, TX), the Harvey peak was the highest annual peak flow on record. The calculated gage flows were within the standard error of the regression equations, and it was determined that an adjustment was not needed for this location.

1.3 Hydraulics

The hydraulic approach for this BLE analysis of the Lower Sabine Watershed consisted of using the terrain model described in Section 1.1 in combination with the hydrologic outputs from Section 1.2 to establish water surface elevations using 1-D steady state analysis. HEC-RAS program version 5.0.7 was chosen as the computer model to compute water surface elevations on a stream by stream basis. The WISE software was used to establish model stream orientation, generate initial hydraulic cross section layout and stationing, assign n-values to cross-sections, and develop all input files for the HEC-RAS program. ESRI's ArcGIS program was used to review and refine cross-section layout orientation.

First pass cross-section layout was performed using an automated routine in WISE that varies cross-section spacing based on the cumulative drainage area at the cross-section location. A first draft model was created based on this initial cross-section layout, and draft boundaries were developed. Next, a second pass inspection for cross-section placement and alignment occurred. Significant refinement occurred during this step. To improve the hydraulic models, additional cross-sections were added as needed to better define the BLE floodplain boundary. Cross-sections were extended in locations where overtopping occurred. Orientation of cross-sections was refined to improve on the perpendicular orientation to flow. Additional cross-sections were added at floodplain constrictions and at downstream portions of tributaries to ensure a proper tie-in with receiving streams. Cross-sections were adjusted to remove sections that intersected hydraulic crossings in the floodplain. For some of the largest studied streams, cross-sections were laid out manually in order to have more reasonable spacing and better capture the constrictions in the floodplain.

Cross-sections were not drawn on top of roadways or railroads but were placed at the upstream and downstream face of major roads and railroads. Ineffective flow stations were placed in the hydraulic models as appropriate to account for flow constrictions and other locations deemed by the engineer to be ineffective at conveying flow downstream.

Cross-sections were drawn on dam crests for dams with well-defined spillways in order to better represent ponded water upstream of the structures. In so doing, it was assumed that the vast majority of the flow during a flood event would pass the spillway and that the hydraulic model would reasonably estimate flow across the spillway as represented in the hydraulic cross-section. The elevations used in the modeling were checked against effective Zone A boundaries, and the results were deemed reasonable.

The relationship between cumulative drainage area and assigned channel geometry is shown in Table 6. These default values for dimensions and spacing were subject to change based on engineering judgment.

Table 6: Cross-Section Default Parameters

Drainage area (upper limit)	XS Spacing	Channel Top Width	Channel Bottom Width	Channel Depth
1	300	6	5	0.8
2	300	7	6	0.8
4	300	10	8	0.8
8	400	12	11	0.8
10	500	13	12	0.8
15	500	18	13	0.8

Table 6 continued: Cross-Section Default Parameters

Drainage area (upper limit)	XS Spacing	Channel Top Width	Channel Bottom Width	Channel Depth
20	500	19	14	0.8
25	500	20	15	0.8
30	500	21	16	0.8
40	500	25	17	0.8
50	600	28	18	0.8
75	600	30	19	1
100	750	33	20	1
150	750	36	21	1
250	1,000	38	22	2
500	1,500	40	23	2
1,000	2,500	100	50	3
2,000	2,500	150	75	3
5,000	2,500	200	100	3

In typical BLE projects, Manning's roughness coefficients (n-values) are determined using the 2016 National Land Cover Data (NLCD) dataset in combination with n-values from Chow (1959) and Calenda et al. (2005). For this watershed, the n-values for the developed areas indicated an underestimation of the roughness coefficients when compared to the aerial imagery and were adjusted accordingly. The association between the n-values and the NLCD Classification is shown in Table 7. Manning's n-value takeoffs are performed by WISE (default values taken from the "Normal" column). N-values within channel banks are constrained by the automated routine to a range of 0.030 to 0.070. Then, overbank and channel n-values are manually adjusted in certain locations based on engineering judgment.

Table 7: Manning's "n" Roughness Based on 2016 NLCD Classification (Moore, 2011)

NLCD Classification	Selected Manning's n	Minimum	Normal	Maximum	Source
Open Water	0.033	0.025	0.03	0.033	Chow 1959
Developed, Open Space	0.04	0.01	0.013	0.016	Calenda et al. 2005
Developed, Low Intensity	0.08	0.038	0.05	0.063	Calenda et al. 2005
Developed, Medium Intensity	0.1	0.056	0.075	0.094	Calenda et al. 2005
Developed, High Intensity	0.15	0.075	0.1	0.125	Calenda et al. 2005
Barren Land	0.025	0.025	0.03	0.035	Chow 1959
Deciduous Forest	0.16	0.1	0.12	0.16	Chow 1959
Evergreen Forest	0.16	0.1	0.12	0.16	Chow 1959
Mixed Forest	0.16	0.1	0.12	0.16	Chow 1959
Scrub/Shrub	0.1	0.035	0.05	0.1	Chow 1959
Grassland/Herbaceous	0.035	0.025	0.03	0.035	Chow 1959
Pasture/Hay	0.03	0.03	0.04	0.05	Chow 1959
Cultivated Crops	0.035	0.025	0.035	0.045	Chow 1959
Woody Wetlands	0.12	0.08	0.1	0.12	Chow 1959
Emergent Herbaceous Wetland	0.07	0.07	0.1	0.15	Chow 1959

The downstream boundary condition used for the majority of the study streams was normal depth with a default value of 0.005 ft/ft. For streams with large drainage areas (generally greater than 8 square miles), the normal depth slope was calculated based on the channel inverts of the downstream cross-sections.

In cases where streams tie in to a lake, a normal depth slope was calculated based on the channel inverts of the downstream cross-sections (typically between 0.0001 and 0.001 ft/ft). Several HUC-10s within this watershed are located in urban areas with storm drain systems, which are unaccounted for in the BLE models. Implications of these systems may considerably affect risk.

1.4 Quality Control

Following the initial hydraulic model analysis in each watershed, the resulting flood hazard area delineations were reviewed for areas where the results were not ideal.

QC results indicated that some of the models should be extended to cover the scope of effective flood hazard data. Those streams were extended farther upstream to match the extents of the effective SFHA data.

Typical revisions resulting from reasonability checks included adding cross-sections, adjusting orientation of cross-sections, trimming cross-sections and reduction of the default "V" angle of cross-sections. Examples of default "V" angled cross-sections are shown in Figure 4. It is estimated that 75 percent of cross-sections were adjusted in some work areas while other areas did not require as much editing. Other examples of manual editing included the addition of cross-sections at confluence areas (see Figure 5 below), modifications to improve perpendicular orientation at the channel, adjustment of discharge breaks to better represent flow addition points, revisions to cross-sections at dams, additional cross-sections bounding major hydraulic structures, and revisions to n-values.

A major component of the QC process was an automated check that identified locations where the 1-percent a.c.e profile was crossed by any other frequency profile. Significant effort was made to reasonably resolve all of these instances. Another automated check identified locations where there was a drawdown of greater than 0.5 foot on the 1-percent a.c.e. water surface profile. This check is particularly useful for identifying errors in the model such as a channel that is too wide, a poorly placed cross-section, or a need for additional cross-sections. Again, significant effort was made to reasonably resolve these drawdown situations.

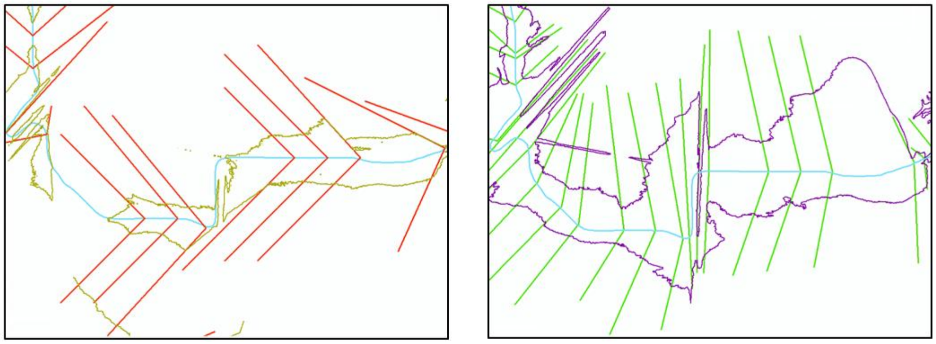

Figure 4: Default "V" angle cross-sections automated by WISE (left). Manually edited cross-sections to more accurately capture terrain (right). Resulting flood boundaries shown in gold (left) or purple (right) for clarity.

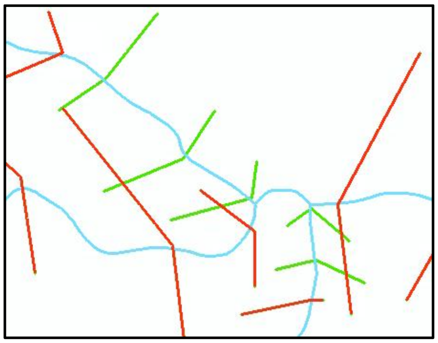

Figure 5: Manually added cross-sections (green) to improve accuracy of tie-ins at confluences.

1.5 Floodplain Delineation (10%, 1% and 0.2% events)

The 1-percent and 0.2-percent boundaries were mapped using a routine that develops water surface elevation grids based on the 10-foot cell size DEM developed from the LiDAR dataset used for this project (see Section 1.1). This product was converted to a polygon for cleaning. The cleaning routine involved manual inspection of the polygons to identify and remove areas of disconnected flooding. In general, all polygons greater than 5,000 square feet are investigated, but all polygons, including those less than 5,000 square feet that intersect the stream lines were included in the final output. This investigation was aided by the ground DEM and aerial imagery. Manual adjustments to the polygons were made to account for spillways on dams which could not be accurately modeled using HEC-RAS as well as disconnected areas along the flooding source that should reasonably be connected.

Following the removal of disconnected flooding areas and other boundary adjustments, the small islands in the floodplain were filled. In general, islands less than 2 acres were inspected and filled.

Once the island filling process was complete, the water surface raster mapping routine was run and set to conform to the polygon boundary. This ensures that the water surface raster and the floodplain boundary are consistent with each other. The depth raster product was created at the end of the process by performing a raster subtraction with the water surface elevation raster and the ground DEM.

Challenges

Due to the coastal location of the watershed, flow containment was particularly challenging in many of the downstream HUC10's. Many areas also include significant flow diversions and shared floodplains, which proved difficult for 1D BLE modeling. As this section will discuss in further detail, more detailed hydrologic and hydraulic modeling is strongly recommended if results are to be used for regulatory or development purposes.

SABINE RIVER MAINSTEM

For the downstream portion of the Sabine River, particularly the left overbank area, flow containment was not feasible due to the extremely flat terrain of the Texas/Louisiana Coast. Much of this portion of the study area is within the Sabine National Wildlife Refuge, which consists primarily of wetlands. Upon further investigation of the effective floodplains, this area is primarily coastally dominated, with the VE and AE zones extending from the Coast up to I-10 in

Louisiana. Cross sections were trimmed to the basin limit, and floodplains will be clipped to the study area boundary.

ADAMS BAYOU – SABINE RIVER

As discussed above, most of the Louisiana streams in the Adams Bayou HUC-10 are coastally dominated. Basin delineations were performed for these areas, but Hydraulic analysis was not performed as 1D riverine models would likely not yield practical results.

Many of the streams along the Adams Bayou mainstem are within a general shared floodplain. Significant effort was made to use information from the 2014 Effective study for Newton County and 2014 Preliminary study for Orange County, but updates in terrain data resulted in some differences. It is recommended that a more detailed study of the hydrology in this region be performed to account for the many flow diversions that occur, particularly that of the Relief Ditch that runs laterally through the watershed. A 2D hydraulic study is also recommended for this area, as many of the flow paths are not well defined enough for a 1D study methodology.

Additional analysis is suggested for this area as there are multiple elevated irrigation channels that run through Orange County, TX. While these levees are not technically accredited for flood control at this time, they do cause flow blockage in many areas. A more detailed analysis of the channels and any internal drainage features should be performed.

BAYOU ANACOCO

Minor overtopping exists for Unnamed Tributary to Sale Creek and Bayou Castor Tributary 8. There are also instances of flow interaction between streams, including Beason Creek and Beason Creek Tributary as well as Bayou Anacoco, UNT095, and UNT096 in Bayou Anacoco. Additionally, smooth tie in was not able to be achieved on Bayou Anacoco Tributary 6.

BAYOU TORO

Left overbank mapping of the 500 year floodplain from station 1963 to 3283 of Macelva Creek was trimmed to the subbasin boundary. Further analysis of the overflows from Macelva Creek towards Bayou Toro Tributary 1 and Bayou Toro Tributary 1_1 is recommended.

BIG COW CREEK

Overflows were common for the 500 year event particularly on the downstream end of the HUC10 near the Sabine River. Where containment was not possible, cross sections and mapping were clipped to subbasin extents. 2D analysis is more appropriate for areas closer to the Sabine River where flow paths are not well defined. Additional areas of minor 500 year overflow occurrences are indicated in the S_AOMI_Ar shapefile in the database.

COW BAYOU

Like Adams Bayou, a significant portion of tributaries were fully within the mainstem Cow Bayou floodplain, so this HUC-10 includes many instances of shared floodplain modeling. While much of the floodplain was able to be contained in the 1D cross sections, some streams still show overtopping, and further analysis is recommended. The tributaries along Cow Bayou between stations 96828 and 115097 should be evaluated further to obtain a better representation of the interactions with each other as well as the effect of the TX Highway 12 and Kansas City Southern

Railroad, which both pass through the area and cause obstructions. These tributaries include Cow Bayou Laterals 5, 4_B_1, 5E1, 5_E, 5_F_2, and 5_G. Flow from the shared Cow Bayou Lateral No. 6 and UNT008 floodplain overtops the HUC-8 boundary. Further investigation is warranted for the interaction between this area and Caney Creek in the Lower Neches HUC-8 watershed.

UNT018 shows overtopping for much of the reach. Cross sections were trimmed to the subbasin boundaries and further analysis is recommended. Additionally, multiple cross sections along Goode Branch and UNT026 were trimmed to the basin limit. BLE results indicate overflows from White Bay Branch going south towards Gum Slough and Dognash Gully. Based on effective mapping, White Bay Branch cross sections were trimmed to the basin limit rather than manually interpolating WSEL's between the reaches. Further analysis is suggested for this area.

The upstream ends of Cole Creek and Cole Creek Lateral No. 3 should also be evaluated along with Adams Bayou – Sabine River stream Adams Bayou Lateral 16A, as current LiDAR data indicates there may be significant interaction across the HUC-10 boundaries at this location.

Additional analysis is suggested for this area as there are multiple elevated irrigation channels that run through Orange County, TX. While these levees are not technically accredited for flood control at this time, they do cause flow blockage in many areas. A more detailed analysis of the channels and any internal drainage features should be performed.

DEMPSEY CREEK – SABINE RIVER

Similarly to other study areas, overflows were common in the downstream portion of many of the tributaries near the mainstem Sabine River. Church House Creek, Davis Creek, Dempsey Creek Donahoe Creek, and UNT 203 in Dempsey Creek Watershed are the primary streams with significant overflows for the 100 and 500 year events. In these areas where containment was not achievable, cross sections were clipped to subbasin boundaries. Based on the effective study data, there is significant interaction between the different tributaries and it is recommended that a more detailed hydrologic analysis as well as 2D hydraulics analysis be performed to more appropriately assess the area.

LITTLE COW CREEK

There were no challenges within the Little Cow Creek – Sabine River HUC-10.

LITTLE CYPRESS CREEK - CYPRESS CREEK

Many of the streams on the downstream end of the watershed were modeled using shared floodplain methods. Due to the flat nature of the terrain near the mainstem Sabine River, containment was not always achievable and cross sections and mapping were trimmed to basin extents when possible. Further analysis is recommended for these areas. Additionally, overflow from the Little Cypress Creek – Cypress Creek watershed to the Nichols Creek – Sabine River watershed were noted. Further analysis is recommended for this area as well.

NICHOLS CREEK – SABINE RIVER

In multiple streams near the mainstem Sabine River, flow containment was not always achievable and further detailed study is recommended for the complex areas near the Sabine River. On Nichols Creek from station 72359 to station 86240, cross sections were trimmed to the subbasin limit to better align with the effective floodplain extents. Additional areas of overtopping are called out in the AOMI shapefile along Nichols Creek. Detailed study is also recommended for the area between Nichols Creek and Slaydons Creek. Due to the alignment of the channels a shared floodplain modeling approach was not appropriate, and flow containment was not achievable. For much of the areas near the mainstem Sabine River, 2D modeling may be more appropriate. Additional streams with overtopping issues include Simms Branch, Bivens Branch, Black Marsh Slough, Brushy Creek, Bess Branch, UNT 001, UNT003, UNT004, and UNT076.

QUICKSAND CREEK – SABINE RIVER

Overflows from Little Quicksand Creek appear to flow into UNT 95. Additionally, significant overflows exist on many of the tributaries near their respective confluences with Sabine River. As stated, areas like this are better suited for 2D modeling rather than 1D. Smooth tie in could not be achieved for the confluence of Martin Branch and UNT 90.

SANDY CREEK – SABINE RIVER

There were no challenges within the Sandy Creek – Sabine River HUC-10.

Results and Recommendations

The BLE results for this study produced an SFHA that conforms to the existing topography and compares favorably with the effective SFHA. These boundaries provide an approximate SFHA in areas that have not been previously studied and therefore do not currently have an SFHA mapped. These results provide context for flood risk communication as part of the Discovery process, and should be verified through community work map meetings before being applied to a regulatory product.

A map showing the BLE results is included as Appendix A.

3.1 CNMS Validation of Effective Zone A SFHA

The inventory of Zone A studies (1864.1 miles) in the Lower Sabine Watershed were classified in CNMS with validation status of "UNVERIFIED" (960.1 miles) or "VALID" (904.0 miles), and with status type of "BEING STUDIED." The following is a summary of the results of the CNMS validation assessment for the effective Zone A studies in the study area. Initial Assessment checks A1-A3 were evaluated for the CNMS inventory of Zone A studies.

INITIAL ASSESSMENT A1 – SIGNIFICANT TOPOGRAPHY UPDATE CHECK

This check involves determining whether a topographic data source is available that is significantly better than what was used for the effective Zone A modeling and mapping. Jasper County, Orange County, and Sabine Parish did not utilize LiDAR data for effective studies and the LiDAR sources used in this BLE study are considered significant improvements from the effective zone A topographic sources. Therefore, these reaches fail this check. All other effective Zone A studies in the watershed utilized LiDAR and, therefore, pass this check.

INITIAL ASSESSMENT A2 – CHECK FOR SIGNIFICANT HYDROLOGY CHANGES

This check involves first determining if regression equations were used for the effective study. Next, it must be determined whether new regression equations have become available from the USGS since the date of the effective Zone A study. If newer regression equations exist for the area of interest, then an engineer must determine whether these regression equations would significantly affect the 1-percent annual chance flow.

Effective studies in Jasper County, Orange County, and Sabine Parish did not use regression analysis in their effective studies. Newton County effective approximate studies utilized the current regression equations (USGS SIR 2009-5087). Beauregard Parish, Calcasieu Parish, and Vernon Parish also utilized the current regression equations (USGS FS 099-01). Therefore, all effective approximate studies in the Lower Sabine HUC-8 watershed pass this check.

INITIAL ASSESSMENT A3 – CHECK FOR SIGNIFICANT DEVELOPMENT

This check involves using the National Urban Change Indicator (NUCI) dataset to assess increased urbanization in the watershed of the Zone A study. If the percentage of urban area within the HUC-12 watershed containing the effective Zone A study is 15% or more, and has increased by 50% or more since the effective analysis, the study would fail this check. Although the NUCI data provide year-to-year changes in urbanization, the NLCD also is needed to establish a baseline of urban land cover for this analysis. The check for significant development in this watershed was completed by evaluating percentage of urban change at the HUC-12 level.

The majority of this watershed does not meet the minimum percent impervious area to be classified as urban and pass this check as a result. There are areas in Jasper and Newton County that meet the urban classification requirements. The effective studies in Jasper County are much older than those in Newton County, therefore, experiencing a significant increase in urbanization since the effective studies and causing this check to fail in Jasper County and pass in Newton County.

All of the initial assessment results are shown in Table 8.

Table 8: Zone A Initial Assessment Results

Assessment Check	Pass / Fail	Notes
A1 – Topography	Pass/Fail	LiDAR used for effective study/ LiDAR sources available are considered significant improvements from the effective zone A topographic sources.
A2 – Hydrology	Pass	Regression equations are not used in effective study OR Current equations used in effective analysis
A3 – Development	Pass/Fail	Watershed does not meet urban threshold OR Urban watershed has not experienced significant increase in urban area/Urban watershed has had a significant increase in urbanization since effective study

VALIDATION CHECK A4 – CHECK OF STUDIES BACKED BY TECHNICAL DATA

Zone A studies that pass all initial assessment checks described above may be categorized as “Valid” in the CNMS Inventory only if the effective Zone A study is supported by modeling or sound engineering judgment and all regulatory products are in agreement. If the effective Zone A study passes all initial assessment checks, but is not supported by modeling, or if the original engineering method used is unsupported or undocumented, a comparison of the BLE results and effective Zone A’s is performed.

Newton County, Beauregard Parish, Calcasieu Parish, and Vernon Parish effective approximate studies are model-backed and, therefore, pass this check. All other effective Zone A studies in the Lower Sabine HUC-8 are not supported by technical data and fail this check.

VALIDATION CHECK A5 – COMPARISON OF BLE AND EFFECTIVE ZONE A

The BLE /effective Zone A comparison method leverages the existing Floodplain Boundary Standard (FBS) certification procedures described in FEMA SID 113, but with a slight modification. This modified FBS comparison approach uses the 1-percent plus and 1-percent minus flood profiles and horizontal and vertical tolerances described in FEMA’s Automated Engineering guidance document dated May 2016. For the comparison of BLE and effective Zone A in the Lower Sabine study area, the following vertical and horizontal tolerances were used to conduct the modified FBS procedure. One point was placed every 200 feet along the floodplain boundaries for comparison.

- Vertical Tolerance: +/- 10 feet (one-half contour interval of assumed effective topographic source).
- Horizontal Tolerance: +/- 75 feet (standard horizontal tolerance for BLE comparison testing).

Comparison results for these streams were grouped at the HUC-12 level and are summarized in Table 9 to better understand the general health of the HUC-12 watershed, but the validation check was performed at the stream level. Streams where the percentage of passing FBS sample points is greater than or equal to 85% are marked as "Pass", otherwise they are marked as "Fail".

Table 9: BLE Comparison Results

HUC-12 Watershed		Total FBS points	Fail	Pass	%Pass	BLE Comparison Pass? (>85%)	Priority Score
Watershed Name	Watershed Number						
Lower Sabine Watershed	All Streams	66,893	9,500	57,393	86%	PASS	
120100050203	Bear Branch-Little Cow Creek	1,602	213	1,389	87%	Pass	10.6
120100050106	Beaver Creek-Toro Bayou	1,081	134	947	88%	Pass	19.7
120100050904	Bess Branch-Long Slough	311	44	267	86%	Pass	8.6
120100050307	Big Branch-Castor Bayou	3,085	207	2,878	93%	Pass	5.5
120100050609	Big Cow Creek	919	101	818	89%	Pass	8.0
120100051100	Black Bayou-Sabine River	1,094	193	901	82%	Fail	5.7
120100050804	Blacks Prairie-Cypress Creek	424	66	358	84%	Fail	3.9
120100050501	Bridge Creek	1,233	28	1,205	98%	Pass	1.1
120100050903	Brushy Creek	2,561	221	2,340	91%	Pass	2.2
120100050504	Caney Creek	2,239	494	1,745	78%	Fail	11.9
120100050703	Cypress Creek	1,289	10	1,279	99%	Pass	0.2
120100050309	Cypress Creek-Anacoco Creek	2,137	83	2,054	96%	Pass	1.7
120100050405	Damrel Creek-Sabine River	1,125	56	1,069	95%	Pass	2.5
120100050701	Davis Creek	1,171	214	957	82%	Fail	9.1
120100050607	Davis Creek-Trout Creek	1,418	463	955	67%	Fail	21.5
120100050704	Dempsey Creek	875	155	720	82%	Fail	8.9
120100051001	Dognash Gully	623	241	382	61%	Fail	19.3
120100050706	Donahoe Creek-Sabine River	470	31	439	93%	Pass	5.0
120100050310	Dry Branch-Anacoco Creek	2,812	244	2,568	91%	Pass	3.7
120100050603	Dry Creek-Big Cow Creek	1,069	262	807	75%	Fail	19.9
120100050302	East Anacoco Creek	2,781	222	2,559	92%	Pass	5.8

Table 9 continued: BLE Comparison Results

120100050606	George Lewis Branch-Big Cow Creek	1,016	170	846	83%	Fail	8.4
120100051002	Gum Slough	1,715	549	1,166	68%	Fail	18.1
120100050902	Headwaters Nichols Creek	1,304	299	1,005	77%	Fail	12.9
120100050901	Headwaters Slaydons Creek	625	201	424	68%	Fail	16.1
120100050702	Hoosier Creek	1,606	16	1,590	99%	Pass	0.3
120100050601	Hunter Creek	669	213	456	68%	Fail	20.8
120100050403	Jones Creek-Sabine River	1,177	109	1,068	91%	Pass	7.4
120100050303	Liberty Creek-Castor Bayou	2,731	93	2,638	97%	Pass	2.4
120100050802	Little Cypress Creek	516	127	389	75%	Fail	15.0
120100050502	Little Quicksand Creek	1,632	552	1,080	66%	Fail	16.9
120100050305	Little Sandy Creek-Anacoco Bayou	3,461	118	3,343	97%	Pass	2.7
120100050801	Long Branch-Cypress Creek	1,290	285	1,005	78%	Fail	11.1
120100050201	McGraw Creek	1,551	455	1,096	71%	Fail	23.5
120100050602	Melhomes Creek	1,510	483	1,027	68%	Fail	16.0
120100050308	Mill Creek-Anacoco Bayou	1,156	20	1,136	98%	Pass	1.0
120100051003	Myrtle Prairie-Cow Bayou	243	94	149	61%	Fail	19.2
120100050104	Namby Creek	49	0	49	100%	Pass	0.0
120100050905	Nichols Creek-Sabine River	1,614	283	1,331	82%	Fail	11.8
120100050705	Old River-Sabine River	962	151	811	84%	Fail	4.4
120100050402	Pearl Creek	946	3	943	100%	Pass	0.3
120100050304	Prairie Creek	3,757	128	3,629	97%	Pass	2.3
120100050503	Quicksand Creek	1,609	386	1,223	76%	Fail	12.0
120100050803	Red Bank Creek-Cypress Creek	1,629	350	1,279	79%	Fail	9.4
120100050404	Red Bank Creek-Sabine River	1,968	131	1,837	93%	Pass	5.5
120100050401	Sandy Creek	1,933	12	1,921	99%	Pass	0.5

Table 9 continued: BLE Comparison Results

120100050204	Swindler Creek-Little Cow Creek	1,154	236	918	80%	Fail	15.7
120100050604	Thicketry Creek	1,743	473	1,270	73%	Fail	13.6
120100050505	Trout Creek-Sabine River	1,287	16	1,271	99%	Pass	0.4
120100050301	West Anacoco Creek	2,061	84	1,977	96%	Pass	3.3
120100050605	White Oak Creek	1,632	527	1,105	68%	Fail	16.1
120100050608	Whitman Branch-Trout	680	130	550	81%	Fail	10.3
120100050202	Yellow Bayou	1,743	257	1,486	85%	Pass	11.3
120100050306	Zourie Bayou	1,915	74	1,841	96%	Pass	2.4

VALIDATION RESULTS

Based on the validation assessments and BLE comparison results described above, the CNMS inventory of Zone A studies in the Lower Sabine Watershed has been updated as summarized in Table 10 and illustrated in Figure 6 below.

Table 10: Zone A Validation Results

Validation Status	Status Type	Total Miles
VALID	BEING STUDIED	904.0
UNVERIFIED	BEING STUDIED	960.1

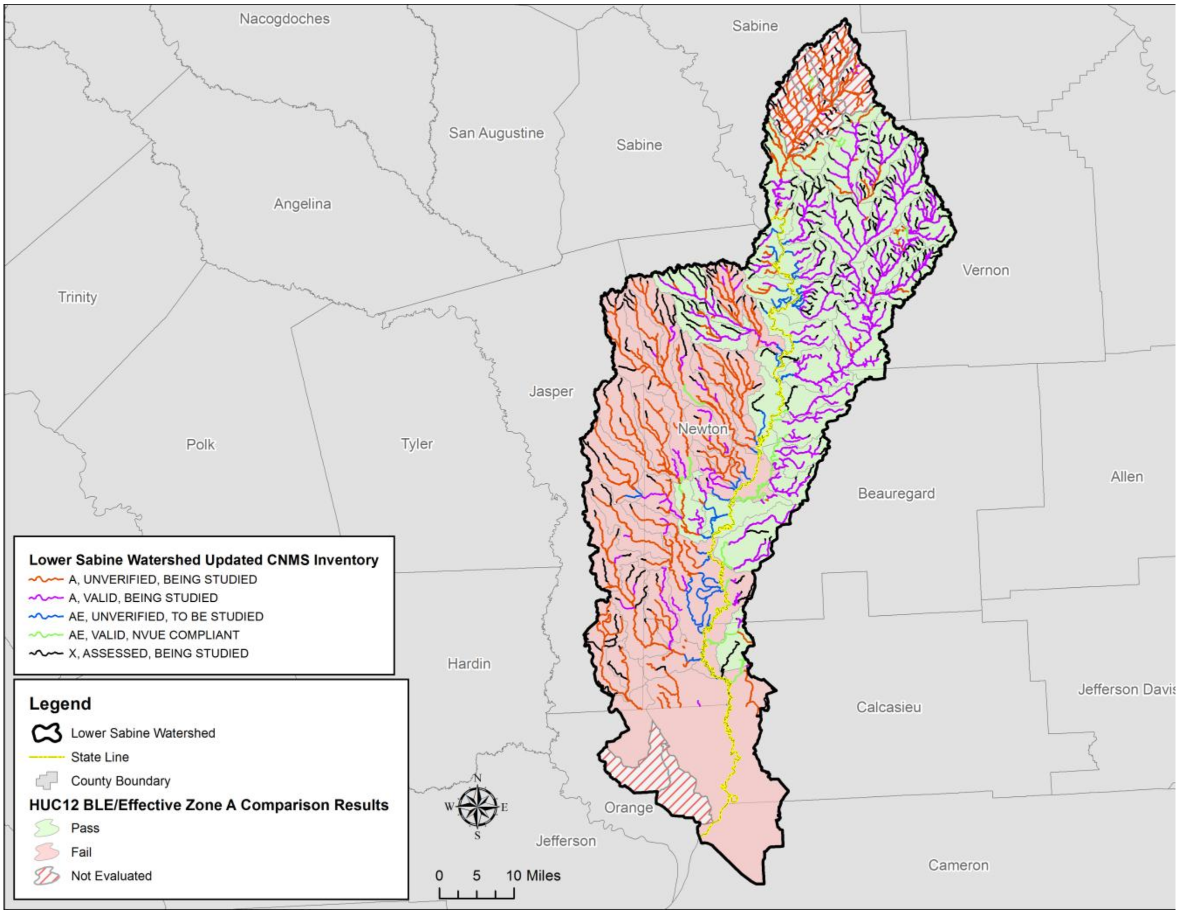

Figure 6: Lower Sabine Watershed CNMS Validation Results

An overall risk for each HUC-12 watershed was calculated using the National Flood Risk Percentages Dataset and its proportional area. The weighted risk was multiplied by the percentage of points in the watershed that failed the CNMS comparison to effective to determine the priority score. Figure 7 below shows the range of the HUC-12 priority scores which can be used to initiate discussions during the Discovery phase.

McGraw Creek HUC-12 was determined to have the highest priority score and the most need while Namby Creek HUC-12 had the lowest scores.

The A1-A5 evaluation was omitted for Orange County, TX. Orange County went LFD on 6/16/2021 and effective 12/16/2021. When a BFE overlaps a recent study, the CNMS database should not include those reaches.

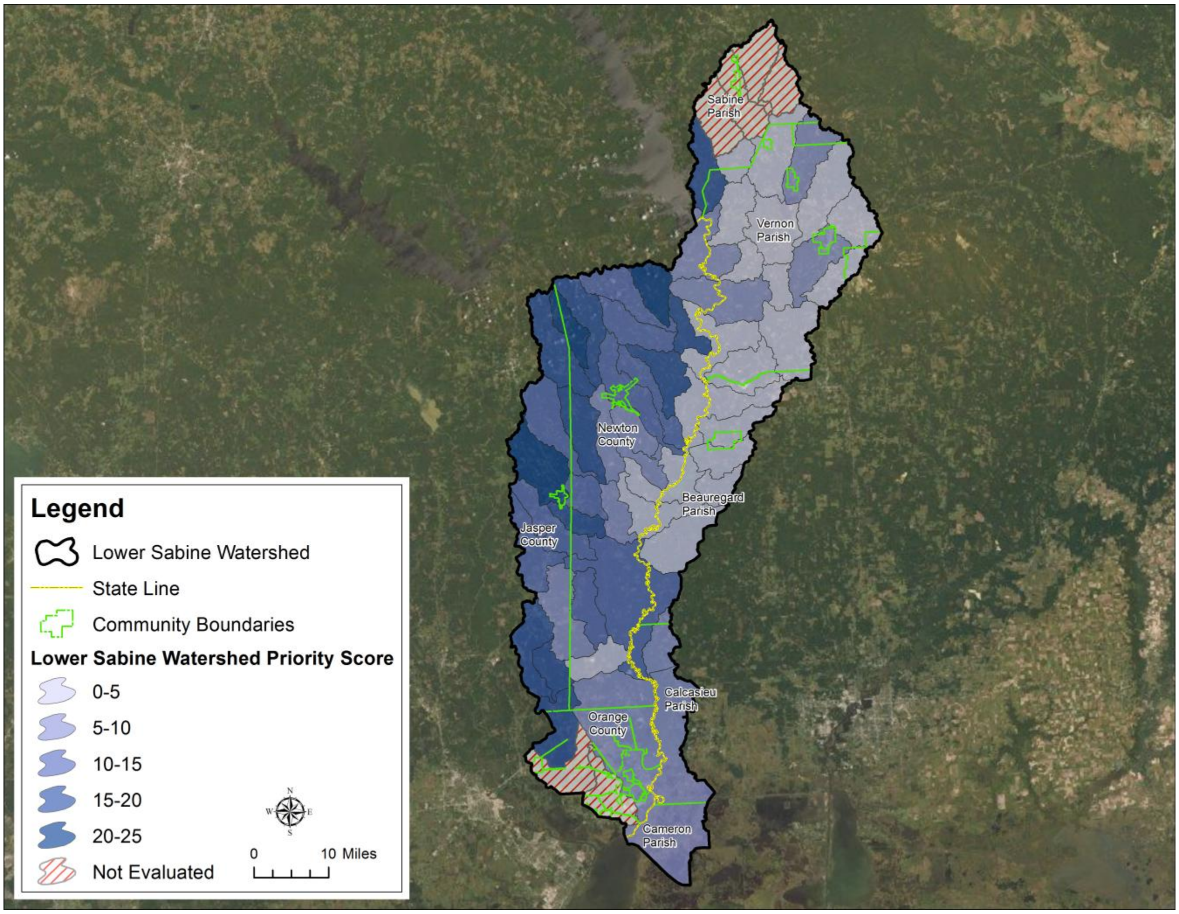

Figure 7: Ranking of Lower Sabine Watershed HUC-12s

3.2 Flood Risk Analysis

A flood risk analysis was performed for this project. The updated 1% annual chance and 0.2% annual chance depth grids were used to calculate the potential flood losses. The loss results are stored in the S_FRAC_AR spatial file within the FRD geodatabase. All results are reported in whole dollar values.

Hazus version 4.2 (SP03) was used for the basic and refined loss analysis.

The losses are reported via census blocks. It is important to note that Hazus version 4.2 (SP03) uses dasymetric census blocks. Dasymetric mapping removes undeveloped areas (such as areas covered by other bodies of water, wetlands, or forests) from the census blocks, changing their shape and reducing their size in these areas. For more information on dasymetric data visit FEMA's Media Library for the Hazus-MH Data Inventories: Dasymetric vs. Homogenous, or Hazus 3.0 Dasymetric Data Overview.

Hazus analysis was performed by county within the project watershed extents for each return period to ensure proper model processing. A summary of results for these counties for the 1-percent a.c.e. scenarios are shown in Table 11.

Table 11: Hazus 4.2 (SP03) Results for 1-Percent-Annual-Chance (100 year) Scenario

County	Full Replacement - Total Loss	Dollar Exposure (Replacement Value) - Buildings	Dollar Exposure (Replacement Value) - Contents
Beauregard	$21,630,000	$275,701,000	$159,340,000
Calcasieu	$60,590,000	$224,316,000	$132,287,000
Cameron	$1,003,000	$1,637,000	$1,746,000
Jasper	$32,088,000	$1,236,846,000	$698,401,000
Newton	$149,282,000	$1,091,431,000	$607,599,000
Orange	$701,451,000	$5,340,594,000	$3,275,234,000
Sabine	$10,236,000	$335,834,000	$206,030,000
Vernon	$98,455,000	$2,834,892,000	$1,716,252,000
Total	$1,074,735,000.00	$11,341,251,000.00	$6,796,889,000.00

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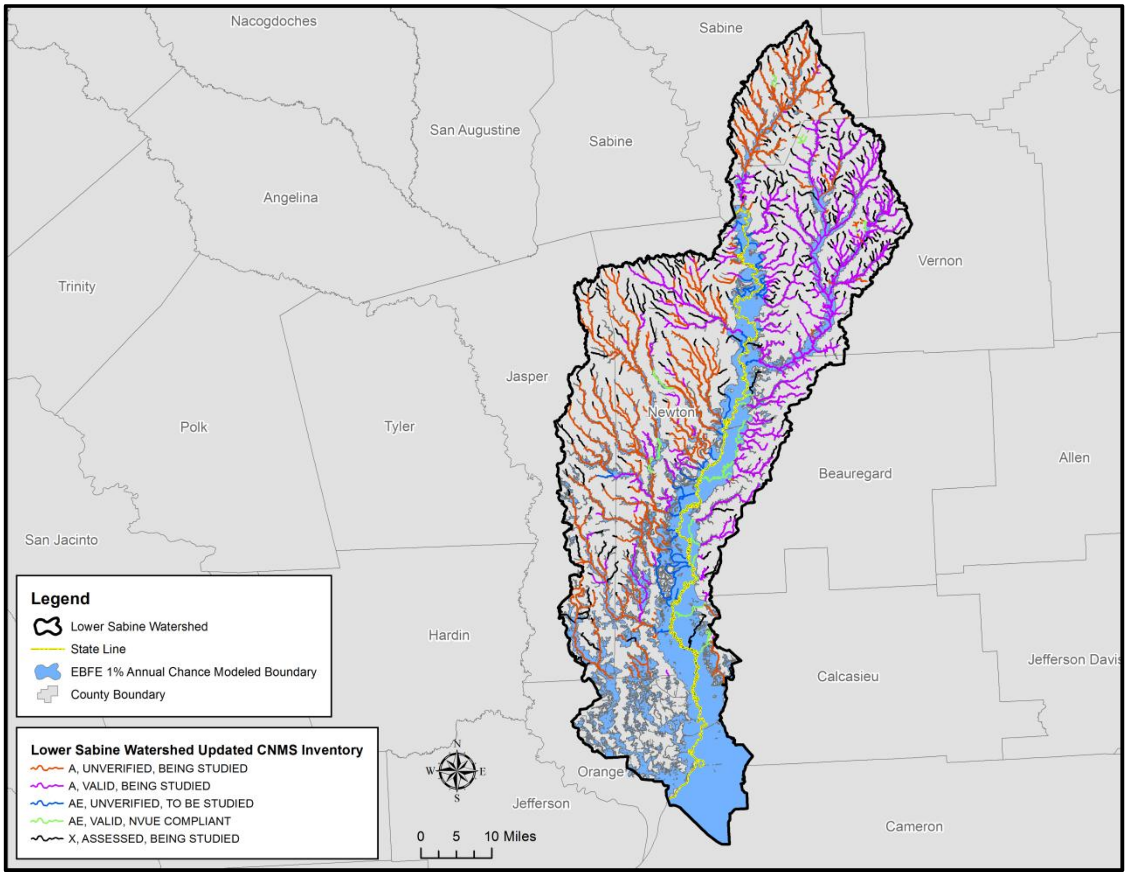
Appendix A BLE Map



Appendix IV: Resources

FEMA Points of Contact

Subject/Topic of Interest	Name	Contact Information
FEMA Region VI Risk MAP Lead *Project Outreach*	Ryan Carey Risk Analysis Branch FEMA Region VI	Email: Ryan.Carey@fema.dhs.gov
FEMA Technical Monitor	Dustin Busse Risk Analysis Branch FEMA Region VI	Phone: (940) 383 7214 Email: dustin.busse@fema.dhs.gov
• How to find and read FIRMs • Letters of Map Change and Elevation Certificates • Flood zone disputes • Mandatory insurance purchase guidelines • Map Service Center (MSC) and National Food Hazard Layer	FEMA Map Information eXchange (FMIX)	Phone: 877-FEMA-MAP (336-2627) Email: FEMAMapSpecialist@Risk MAPcds.com Live Chat: https://www.floodmaps.fema.gov/fhm/fmx_main.html

State Partners

Organization/Title	Name	Partner Location	Contact Information
Louisiana Water Resources Development Program *Deputy Assistant Secretary, OPW*	Ed Knight, P.E.	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379 3015 Email: edward.knight@la.gov Web Page: La DOTD - Floodplain Management Contacts
Louisiana State NFIP Coordinator	Susan Veillon, CFM	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379-3017 Email: Susan.Veillon@la.gov Web Page: La DOTD - Floodplain Management Contacts
DOTD CTP Project Manager	Pam Lightfoot, CFM	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379-3016 Email: Pam.Lightfoot@la.gov Web Page: La DOTD - Floodplain Management Contacts
State Hazard Mitigation Officer	Jeffrey Giering	7667 Independence Blvd. Baton Rouge, Louisiana 70806	Phone: (225) 932-6300 Email: jeffrey.giering@la.gov Web Page: Governor's Office of Homeland Security & Emergency Preparedness
LADOTD *Statewide Flood Control Program Manager*	Lucas T Johnson	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379 3027 Email: lucas.johnson@la.gov Web Page: Statewide Flood Control Program (la.gov)
Louisiana Department of Transportation and Development *Communications Director*	Rodney Mallett	P.O. Box 94245 Baton Rouge, LA 70804-9245	Phone: (225) 379-1275 Email: rodney.mallett@la.gov Web Page: Administration Contacts (la.gov)

Governor's Office of Homeland Security and Emergency Preparedness

GOHSEP (la.gov)

Louisiana is a high-risk state for emergency events and disasters. The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) is the agency responsible for coordinating the state's efforts throughout the emergency management cycle to prepare for, prevent where possible, respond to, recover from, and mitigate against hazards to lessen the effects of man-made or natural disasters that threaten the state. GOHSEP can save lives and reduce property damage by understanding risks and taking action to address those risks, as well as minimizing disaster impacts and increasing the resiliency in our communities, environment, and economy.

Louisiana Department of Transportation and Development (LADOTD)

Risk MAP / CTP (la.gov)

On March 11, 2015, the Louisiana Department of Transportation and Development (LADOTD) signed a partnership agreement with FEMA Region VI to become a Cooperating Technical Partner (CTP) in FEMA's Risk MAP Program. Since becoming a CTP, LADOTD has been diligently planning and working toward the release of updated flood risk information for Louisiana. The hope is that in the future, other stakeholders will become involved in the program to make good and efficient use of the data for floodplain management decisions and mitigation actions.

Louisiana Floodplain Management Association (LFMA)

The Louisiana Floodplain Management Association serves as a forum for parish and municipal employees, state and federal officials, and the private sector to meet and share experiences, ideas, and solutions to common flooding problems. As a grassroots effort, we assist and support each other when confronted by flooding. Flood damage reduction can best be achieved through floodplain management, that is, a balanced combination of structural and nonstructural measures. Structural measures include levees, pumps, dams, channelization, diversions, and detention/retention ponds. Of equal importance are nonstructural measures, which encompass flood insurance, federal and state legislation, voluntary relocation, local codes, emergency preparedness, floodproofing, and mitigation plans and activities.

Organization	**Website**
Louisiana Floodplain Management Association	Louisiana Floodplain Management Association - Home Page

Certified Floodplain Manager (CFM) Certification

The Association of State Floodplain Managers (ASFPM) established a national program for certifying floodplain managers. This program recognizes continuing education and professional development that enhances the knowledge and performance of local, state, federal, and private-sector floodplain management professionals.

The role of the nation's floodplain managers is expanding due to increases in disaster losses, the emphasis on mitigation to alleviate the cycle of damage-rebuild-damage, and a recognized need for professionals to adequately address these issues. This certification program will lay the foundation for ensuring that highly qualified individuals are available to meet the challenge of breaking the damage cycle and stopping its negative drain on the nation's human, financial, and natural resources.

CFM® is a registered trademark and available only to individuals certified and in good standing under the ASFPM Certified Floodplain Manager Program.
For more information, you may want to review these available CFM Awareness Videos:

- What is the CFM Program?
- Becoming a CFM
- What are the Benefits of a CFM?

Study materials for those interested in applying for the CFM certification can be found on the ASFPM Website at: Getting Certified (floods.org)
Check the Training & Education | Association of State Floodplain Management (floods.org) for in-person training sessions near you.
For information on becoming a member and the exam application process in the State of Louisiana visit Getting Certified (floods.org)

Interactive Preliminary Data Viewer

Risk Mapping, Assessment and Planning (Risk MAP) | FEMA.gov
To support community review of the study information and promote risk communication efforts, FEMA launched an interactive web tool accessible on-line at ArcGIS - Mapping Information Platform Studies Tracker for the project areas.
For more information on the Interactive Preliminary Data Viewer in the Region VI area:
Region VI | FEMA.gov
FEMA's Flood Map Changes Viewer
Flood Map Changes Viewer (arcgis.com)

Estimated Base Flood Elevation (BFE) Viewer

As a part of the Risk MAP process, FEMA is completing BLE to provide a complete picture of flood hazard throughout a watershed. The BLE analysis uses high resolution ground elevation data, flood flow calculations, and fundamental engineering modeling techniques to define flood extents for streams.

To provide a look at BLE data availability and relative engineering analysis, FEMA developed the Estimated BFE Viewer for community officials, property owners, and land developers to identify the flood risk (high, moderate, low), expected flood elevation, and estimated flood depth near any property or structure within watersheds where BLE has been prepared.

Visit the Estimated BFE Viewer FEMA's Estimated Base Flood Elevation (BFE) Viewer (usgs.gov) application to learn the status of BLE in your area of interest or surrounding communities, to view the flood hazard data developed, or to utilize the tool's flood risk reporting features for a location where BLE has been made available.

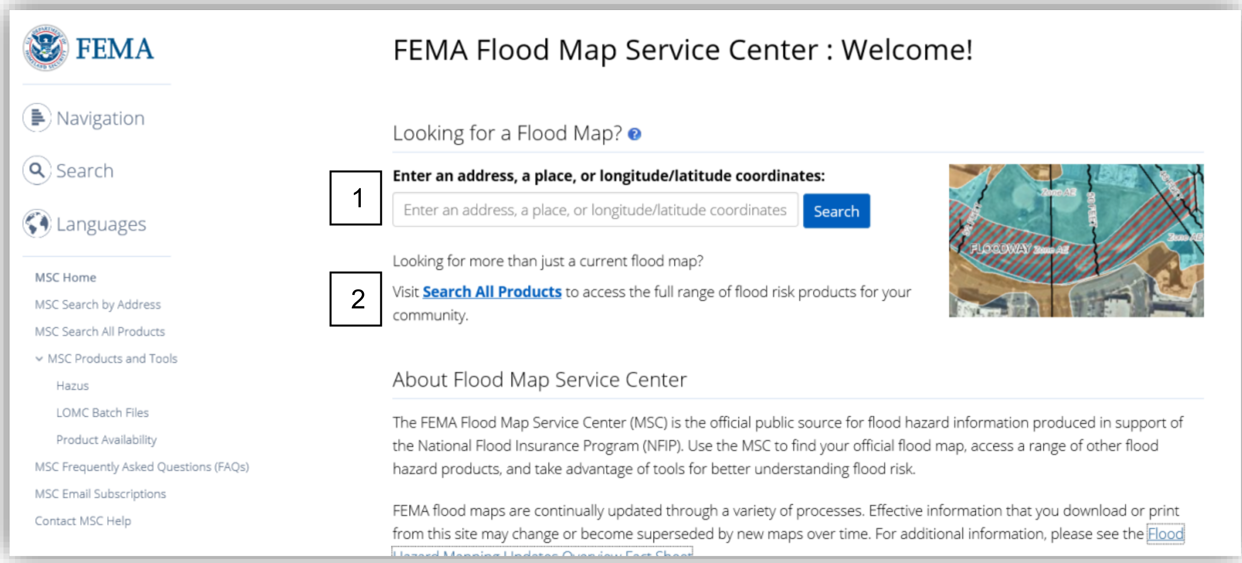
Map Service Center – Available Map Data

The FEMA Flood Map Service Center (MSC) is the official public source for flood hazard information produced in support of the NFIP. Use the MSC to find your official effective flood map, preliminary flood maps, and access a range of other flood hazard products.

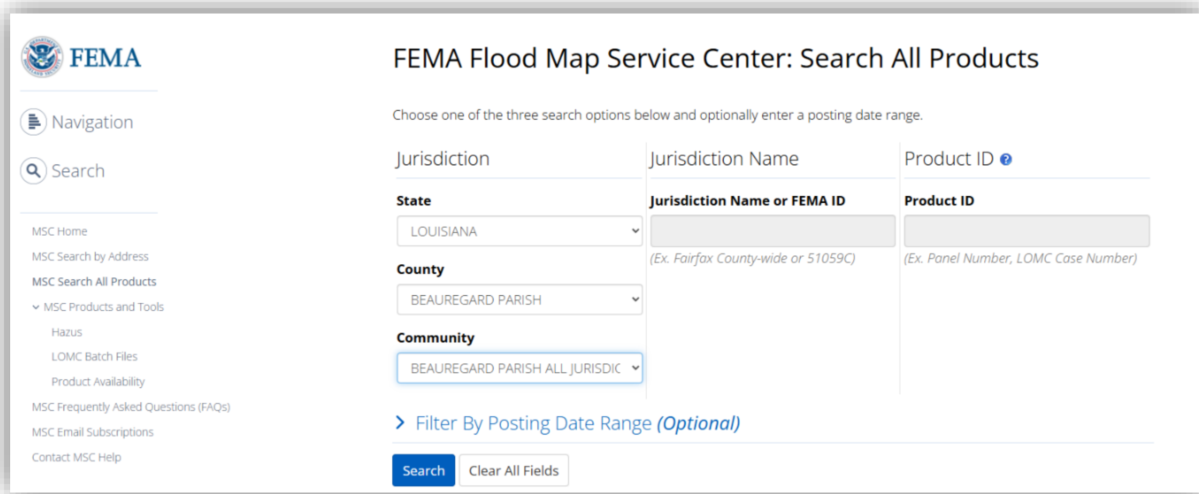
FEMA flood maps are continually updated through a variety of processes. Effective information that you download or print from this site may change or become superseded by new maps over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet.

At the MSC, there are two ways to locate flood maps in your vicinity.

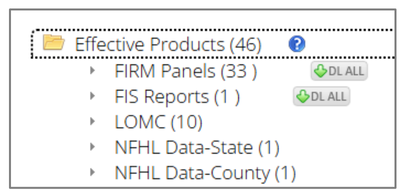
1. Enter an address, place name, or latitude/longitude coordinates and click search. This will provide the current effective FIRM panel where the location is shown.
2. Or Search All Products, which will provide access to the full range of flood risk information available.



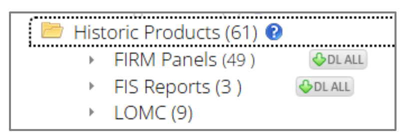
By using the more advanced search option, "Search All Products," users may access current, preliminary, pending, and historic flood maps. Additionally, GIS data and flood risk products may be accessed through the site with these few steps.



Using the pull down menus, select your state, county, and community of interest. For this example, we selected Beauregard Parish - All Jurisdictions. After the search button is selected, the MSC will return all items in the area. There are five types of data available.



Effective Products: The current effective FIS, FIRM, and DFIRM database (if available) is available through the MSC. If users click on the available effective products, they are presented a breakdown of the available products. FIRM panels, FIS reports, LOMRs, statewide National Flood Hazard Layer (NFHL) data, and parish wide NFHL data may be available, as indicated in the breakdown on the right of the page.



Historic Products: A range of historic flood hazard maps, FIS reports, and LOMCs are available through the MSC.

Flood Risk Products: The Flood Risk Report, Flood Risk Map, and Flood Risk Database will be made available through the MSC once they have been compiled and completed. These products are made available after the flood study analysis and mapping have been reviewed and community comments incorporated.

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