Flood Risk Report

Flagler County, Florida

Flagler County (Unincorporated Areas)

Town of Beverly Beach

City of Bunnell

City of Flagler Beach

Town of Marineland

City of Palm Coast

Report Number 01 ***(Draft)***

1/17/2018

FEMA

RiskMAP

Increasing Resilience Together

Preface

The Department of Homeland Security (DHS), Federal Emergency Management Agency's (FEMAs) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states, tribes, and local communities with flood risk information and tools that they can use to increase their resilience to flooding. By using updated floodplain maps with risk assessment tools, planning, and outreach, Risk MAP has transformed traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks.

This Flood Risk Report (FRR) provides non-regulatory information to help state, tribal, or local officials, floodplain managers, planners, emergency managers, and others better understand their flood risk, take steps to mitigate those risks, and communicate those risks to their citizens and local businesses.

The FRR provides flood risk data for the entire Flood Risk Project as well as for each individual community. This emphasizes that flood risk reduction activities may impact areas beyond jurisdictional boundaries.

Flood risk is always changing, and there may be other studies, reports, or sources of information available that provide more comprehensive information. The FRR is not intended to be regulatory or a final authoritative source of all flood risk data in the project area. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the project area.

The FRR, Flood Risk Map (FRM) and Flood Risk Database (FRD) here described for Flagler County have been developed based on the coastal areas only to match the extent of the 2016 Flagler County Flood Insurance Study. While all jurisdictions are listed within the FRR, analysis for the City of Bunnell is not within the coastal extent, therefore, there will be limited information pertaining to these communities other than an overview of their established flood hazard information.

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FLOOD RISK REPORT

1 Introduction

1.1 About Flood Risk

Floods are naturally occurring phenomena that occur almost anywhere. Basically, a flood is an adverse accumulation of water over normally dry areas. Floods become hazardous when they threaten people or damage property. Mild flood losses may have less severe impacts on people or property, such as damage to landscaping or the generation of unwanted debris. Severe flooding can destroy buildings, ruin crops, and cause critical injuries or death.

Photo: flaglercounty.org
Flooding is a natural part of our world and our communities. Flooding becomes a significant hazard when it intersects with the built environment.

1.1.1 Calculating Flood Risk

Identifying where flooding may occur is not enough. Just because one knows where a flood occurs does not mean they know the actual **risk** of flooding. The most common method for determining flood risk is to identify the probability of flooding and the consequences of flooding as follows:

Flood Risk = Probability x Consequences, where:

- **Probability** = the likelihood of occurrence
- **Consequences** = the estimated impacts associated with the occurrence (e.g., estimated flood loss in dollars)

The probability of a flood is the likelihood that a flood will occur. The probability of flooding can change based on physical, environmental, and/or contributing engineering factors. Factors affecting the probability that a flood will impact 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 water body in question.

The consequences of a flood are the estimated impacts associated with the flood occurrence. Consequences relate to humans' activities within an area and how a flood impacts the natural and built environments.

Which picture below shows more flood risk?

Photos
Top: mynews12.com
Bottom: flaglercounty.org

Even if the flood in both pictures had the same probability—let's say a 10-percent-annual-chance flood—the consequences in terms of property damage and potential injury are much more severe in the top photo due to population density and property values in the area.

1.1.2 Flood Risk Products

Through Risk MAP, FEMA provides communities with updated Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study (FIS) Reports that focus on the probability of floods and that show where flooding may occur as well as the calculated 1-percent-annual-chance flood elevation. The 1-percent-annual-chance flood, also known as the Base Flood Elevation (BFE), has a 1% chance of being equaled or exceeded in any given year. FEMA understands that flood risk is dynamic—that flooding does not necessarily follow a line on a map. As a complimentary flood hazard source of information for communities, FEMA provides the Flood Risk Project consisting of the following flood risk products:

Photo:mynews13.com
The extent and depth of flooding are considerations equally as important as the probability of flooding.

- **Flood Risk Report (FRR)**: The FRR presents key risk analysis data for the Flood Risk Project.
- **Flood Risk Map (FRM)**: Like the example found in Section 3.1 of this document, the FRM shows a variety of flood risk information in the project area. More information about the data shown on the FRM may be found in Section 2 of this report.
- **Flood Risk Database (FRD)**: The FRD is formatted in a Geographic Information System (GIS) and stores the flood risk data developed during the course of the flood risk analysis that can be used and updated by the community. After the Flood Risk Project is complete, this data can be used to visualize and communicate flood risk within the Flood Risk Project.

These Flood Risk products provide flood risk information at both the Flood Risk Project (FRP) level and community level for those portions of each community within the FRP. Community-level information is useful for mitigation planning and emergency management activities.

The Flood Risk Database, Flood Risk Map, and Flood Risk Report are “non-regulatory” products. They are available and intended for community use but are neither mandatory nor tied to the regulatory development and insurance requirements of the National Flood Insurance Program (NFIP). They may be used as regulatory products by communities if authorized by state and local authorities.

1.2 Uses of this Report

The goal of this report is to help inform and enable communities and tribes to take action to reduce flood risk. Possible users of this report include:

Photo: flaglercounty.org
Vulnerability of infrastructure is another important consideration.

- Local elected officials
- Floodplain managers

- Community planners
- Emergency managers
- Public works officials
- Other special interests (e.g., watershed conservation groups, environmental organizations, etc.)

State, local, and tribal officials can use the summary information provided in this report, in conjunction with the data in the FRD, to:

- **Update local hazard mitigation plans:** As required by the 2000 Federal Stafford Act, local hazard mitigation plans must be updated at least every five (5) years. Summary information presented in Section 3 of this report and the FRM can be used to identify areas that may need additional focus when updating the risk assessment section of a local hazard mitigation plan. Information found in Section 4 pertains to the different mitigation techniques and programs and can be used to inform decisions related to the mitigation strategy of local plans.
- **Update community comprehensive plans:** Planners can use flood risk information in the development and/or update of comprehensive plans, future land use maps, and zoning regulations. For example, zoning codes may be changed to better provide for appropriate land uses in high-hazard areas.
- **Update emergency operations and response plans:** Emergency managers can identify low-risk areas for potential evacuation and sheltering and can help first responders avoid areas of high-depth flood water. Risk assessment results may reveal vulnerable areas, facilities, and infrastructure for which planning for continuity of operations plans (COOP), continuity of government (COG) plans, and emergency operations plans (EOP) would be essential.

Photo: news-journalonline.com
Flooding associated with Hurricane Charley in Flagler County, Florida, contributed to a federal disaster declaration on August 13, 2004.

- **Develop hazard mitigation projects:** Local officials can use flood risk information to re-evaluate and prioritize mitigation actions in local hazard mitigation plans.
- **Communicate flood risk:** Local officials can use the information in this report to communicate with property owners, business owners, and other citizens about flood risks, changes since the last FIRM, and areas of mitigation interest. The report layout allows community information to be extracted in a fact sheet format.
- **Inform the modification of development standards:** Floodplain managers, planners, and public works officials can use information in this report to support the adjustment of development standards for certain locations. For example, heavily developed areas tend to increase floodwater runoff because paved surfaces cannot absorb water, indicating a need to adopt or revise standards that provide for appropriate stormwater retention.

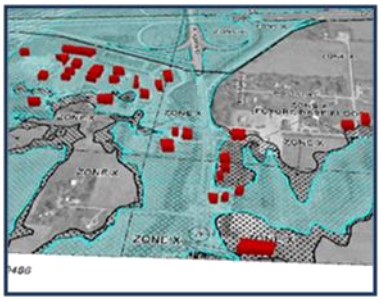
1.3 Sources of Flood Risk Assessment Data Used

To assess potential community losses, or the consequences portion of the "risk" equation, the following data is typically collected for analysis and inclusion in a Flood Risk Project:

- Information about local assets or resources at risk of flooding.
- Information about the physical features and human activities that contribute to that risk.
- Information about where the risk is most severe.

For most Flood Risk Projects, FEMA uses the following sources of flood risk information to develop this report:

- Hazus-estimated flood loss information.
- New engineering analyses (e.g. coastal, hydrologic, and/or hydraulic modeling) to develop new flood boundaries.
- Locally supplied data (see Section 7 for a description).
- Sources identified during the Discovery process.



FEMA data can be leveraged to identify and measure vulnerability by including local building information (i.e. building type). The examples above show various ways to display flooding intersecting with buildings.

1.4 Related Resources

For a more comprehensive picture of flood risk, FEMA recommends that state and local officials use the information provided in this report in conjunction with other sources of flood risk data, such as the following:

- **FIRMs and FIS Reports:** This information indicates areas with specific flood hazards by identifying the limit and extent of the 1-percent-annual-chance floodplain and the 0.2-percent-annual-chance floodplain. FIRMs and FIS Reports do not identify all floodplains in a Flood Risk Project. The FIS Report includes summary information regarding other frequencies of flooding, as well as flood profiles for riverine sources of flooding. In rural areas and areas for which flood hazard data are not available, the 1-percent-annual-chance floodplain may not be identified. In addition, the 1-percent-annual-chance floodplain may not be identified for flooding sources with very small drainage areas (less than 1 square mile).
- **Hazus Flood Loss Estimation Reports:** Hazus can be used to generate reports, maps and tables on potential flood damage that can occur based on new/proposed mitigation projects or future development patterns and practices. Hazus can also run specialized risk assessments, such as what happens when a dam or levee fails. Flood risk assessment tools are available through other agencies as well, including the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of

Engineers (USACE). Other existing watershed reports may have a different focus, such as water quality, but may also contain flood risk and risk assessment information. See Section 6 for additional resources.

- **Flood or multi-hazard mitigation plans:** Local hazard mitigation plans include risk assessments that contain flood risk information and mitigation strategies that identify community priorities and actions to reduce flood risk. This report was informed by any existing mitigation plans in the Flood Risk Project.
- **Hurricane Evacuation Studies:** Produced through a joint effort by FEMA, NOAA, and USACE, Hurricane Evacuation Studies provide tools and information to the state and county emergency management offices to help determine who should evacuate during hurricane threats, and when those evacuations should occur. The information can be used to supplement or update hurricane evacuation plans and operational procedures for responding to hurricane threats.
- **Climate Change and Sea Level Rise Data and Maps:** Data and maps showing potential impacts from sea level rise provide a valuable resource for planning and risk communication purposes. By identifying areas that are most susceptible to rising sea levels, short- and long-term strategies can be developed to support coastal communities in their mitigation efforts. Various organizations, including NOAA, state, and local agencies, provide viewers, maps, and/or reports that help highlight low-lying coastal areas that would be inundated based on sea level rise scenarios.
- **Emergency Action Plans:** These plans are formal documents that identify potential emergency conditions, such as a dam breaches, and specify preplanned actions to be followed to minimize property damage and loss of life.
- **FEMA Map Service Center (MSC):** The MSC has useful information, including fly sheets, phone numbers, data, etc. Letters of Map Change are also available through the MSC. The user can view FIRM databases and the National Flood Hazard Layer (NFHL) Database.

2 Flood Risk Analysis

2.1 Overview

Flood hazard identification uses FIRMs, and FIS reports to identify where flooding can occur along with the probability and depth of flooding. A flood risk assessment is the systematic approach to identifying how flooding impacts the environment. In hazard mitigation planning, flood risk assessments serve as the basis for mitigation strategies and actions by defining the hazard and enabling informed decision making. Fully assessing flood risk requires the following:

- Identifying the flooding source and determining the flood hazard occurrence probability.
- Developing a complete profile of the flood hazard including historical occurrence and previous impacts.
- Inventorying assets located in the identified flood hazard area.
- Estimating potential future flood losses caused by exposure to the flood hazard area.

Flooding impacts non-populated areas too, such as agricultural lands and wildlife habitats.

Flood risk analyses are different methods used in flood risk assessment to help quantify and communicate flood risk. Flood risk analyses can be performed on a large scale (state, community) level and on a very small scale (parcel, census block). Advantages of large-scale flood risk analyses, especially at the watershed level, include identifying how actions and development in one community can affect areas upstream and downstream. On the parcel or census block level, flood risk analysis can provide actionable data to individual property owners so they can take appropriate mitigation steps.

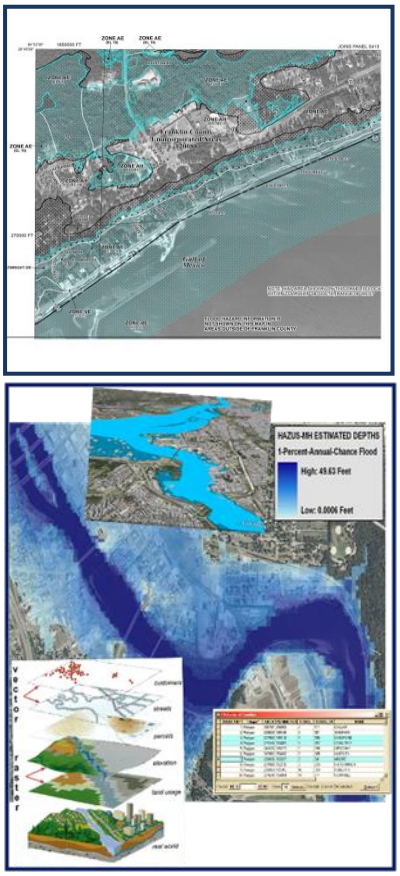
2.2 Analysis of Risk

The FRR, FRM, and FRD contain a variety of flood risk analysis information and data to help describe and visualize flood risk within the project area. Depending on the scope of the Flood Risk Project for this project area, this information may include some or all of the following elements which are described in additional detail below:

- Changes Since Last FIRM (S_CSLF_Ar)
- Coastal BFE Depth Grids (Cstdpth1pct)
- Coastal BFE Elevation Raster (WSE_01pct)

State and Local Hazard Mitigation Plans are required to have a comprehensive all-hazard risk assessment. The flood risk analyses in the FRR, FRM, and FRD can inform the flood hazard portion of a community's or state's risk assessment. Further, data in the FRD can be used to develop information that meets the requirements for risk assessments as it relates to the hazard of flood in hazard mitigation plans.

- Coastal SWEL Depth Grids (SWL_DG_xxpct)
- Coastal SWEL Modeling Elevations (SWL_WS_xxpct)
- Coastal Increased Inundation Areas (S_Cst_Inc_Inundation_Ar)
- Potential High Risk Asset Dataset (S_Pot_High_Risk_Pt)
- Coastal Wave Hazard Severity Areas (S_Simp_Cst_Zone_Ar)
- Coastal Flood Risk Assessments (all L_RA tables)
- Area of Mitigation Interest (S_AOMI_Pt)



Floodplain maps have evolved considerably from the older paper-based FIRMs to the latest digital products and datasets.

2.2.1 Changes Since Last FIRM

The Changes Since Last FIRM (CSLF) dataset, stored in the FRD and shown in Section 3 of this report, illustrates where changes to flood risk may have occurred since the last FIRM was published for the subject area. Communities can use this information to update their mitigation plans, specifically quantifying "what is at risk" and identifying possible mitigation activities.

The CSLF dataset identifies changes in the Special Flood Hazard Area (SFHA) and floodway boundary changes since the previous FIRM was developed. These datasets quantify land area increases and decreases to the SFHA and floodway, as well as areas where the flood zone designation has changed (e.g., Zone A to AE, AE to VE, etc.).

The CSLF dataset is created in areas that were previously mapped using digital FIRMs. The CSLF dataset for this project area includes:

- **Floodplain and/or Zone Break Boundary Changes**: Any changes to the existing floodplain or zone boundaries are depicted in this dataset.
- **Floodplain Designation Changes**: This includes changed floodplain designations (e.g., Zone AE to Zone VE).
- **CSLF Information**: Within this dataset additional information is provided to help explain the floodplain boundary changes shown on the FIRM. This information is stored as digital attributes within the CSLF polygons and may include some or all of the following:

CSLF data can be used to communicate changes in the physical flood hazard area (size, location) as part of the release of new FIRMs. It can also be used in the development or update of hazard mitigation plans to describe changes in hazard as part of the hazard profile.

CSLF data is shown in the FRR, and underlying data is stored in the FRD.

- Changes in 1% SWEL
- Changes in Base Flood Elevations

2.2.2 Flood Depth Grids

Grids are FEMA datasets provided in the FRD to enhance the visualization and use of flood hazard in the Flood Risk Project. Like the pixels in a digital photo or graphic, a grid is made up of square cells, which store a value representing the depth of flooding. The FIRM and FIS Report describe "what" is at risk by identifying the hazard areas and flood depth. The flood depth grids help define and quantify "how severe" the risk is within those identified areas. These grids are intended to be used by communities for additional analysis, enhanced visualization, and communication of flood risks for hazard mitigation planning and emergency management. The Flood Depth Grids provide an alternative way to visualize how flood depths vary within the floodplain. Since they are derived from the engineering modeling results, they are typically associated with a particular frequency-based flooding event (e.g., 1-percent-annual-chance flood). Grids provided in the FRD for this project area include the following:

- **Flood Depth Grid Rasters (Cstdpth1pct & WSE_01pct):** Flood Depth Grids are created for each flood frequency calculated during the course of a Flood Risk Project. These grids communicate flood depth as a function of the difference between the calculated water surface elevation and the ground. Coastal flood depth grids are created for areas where the dominant wave hazard is overland wave propagation.

  The 1-pecrent annual chance grid depicts the flood depth, which is the difference in elevation between the BFE and the ground. Coastal areas will typically only receive a depth grid for the 1-percent-annual-chance flood as represented in the *Cstdpth1pct* raster. The corresponding BFE elevation values are represented in the *WSE_01pct* raster.

  Depth grids enhance flood risk assessments (as presented in a table in Section 3 of this report) and are used to calculate potential flood losses for display on the FRM.

Grid data can make flood mapping more informative. The top image is a flood depth grid showing relative depths of water in a scenario flood event.

Grid data can be used to communicate the variability of floodplains, such as where floodplains are particularly deep or hazardous, where residual risks lie behind levees, and where losses may be great after a flood event. For mitigation planning, grid data can inform the hazard profile and vulnerability analysis (what is at risk for different frequencies) and can be used for preliminary benefit-cost analysis screening. For floodplain management, higher regulatory standards can be developed in higher hazard flood prone areas (i.e., 10-percent-annual-chance floodplains or deep floodplains).

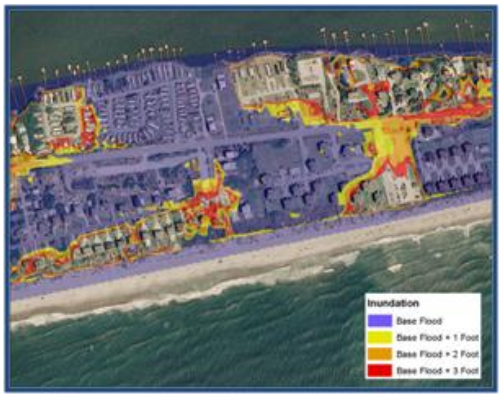
Grid data is stored in the FRD, and a list of available grid data is provided in the FRR.

- **Depth Grids and Elevation Rasters Based on SWEL Modeling and Additional Flood Frequencies (*SWL_DG_xxpct & SWL_WS_xxpct)*:** These datasets provide additional flood frequencies beyond what the 1-percent-annual-chance flood calculates. For St. Johns County, Florida, SWEL based depth grids were also developed for the 50-percent-annual-chance, 20-percent-annual-chance, 10-percent-annual-chance, 4-percent-annual-chance, 2-percent-annual-chance, 1-percent-annual-chance, and 0.2-percent-annual-chance floods.

2.2.3 Coastal-Specific Datasets

Unique hazards are present in communities along the coast. Because of low and mildly sloping topography, some coastal communities may be exposed to large increases in inundated areas from only minor increases in water levels. Certain areas along the coast may also be more vulnerable to storm-induced coastal erosion, depending on the size and condition of coastal dunes. The following datasets provide information that help communicate some of these coastal-specific risks.

- **Increased Flooding Scenarios:** The increased flooding scenarios dataset, stored in the FRD, helps identify the areas that would be exposed to flooding by hypothetical increases in coastal flood levels. The polygon dataset depicts areas that would be flooded by additional 1, 2, or 3 feet of flooding above the total water level elevation (stillwater plus waves) for a specified flood frequency. By highlighting the areas that would be inundated if flood levels increased, this product helps to communicate "what if" scenarios, such as "what if a flood event exceeds the 1-percent-annual-chance flood by 2-feet?", or, "what if sea level rise causes flood levels to increase for the 1-percent-annual-chance flood?"



Inundation scenarios allow the identification of areas exposed to higher flooding levels

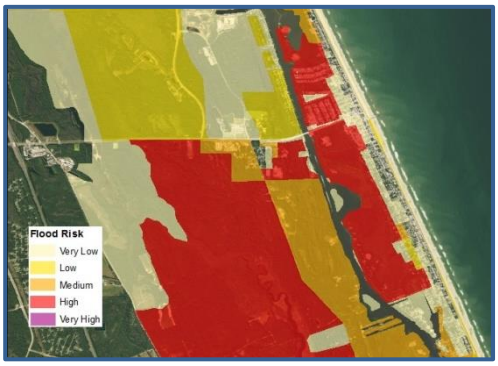
- **Potential High Risk Asset Dataset:** This point dataset was created to display AoMI's current risk to inundation relative to increased flooding. The AoMI points have additional information including the zone of greatest risk, inundation risk, wave hazard risk, and depths at each flood frequency depth. This can help community officials develop mitigation actions plans for future flooding scenarios.

AoMIs are intersected with the increased inundation scenarios to identify assets vulnerable to higher flooding levels.

- **Simplified Coastal Zones:** As its name implies, the Simplified Coastal Zones is a polygon dataset that depicts the wave hazards in simplified terms of High, Moderate, or Low Wave Action. It provides a way to visualize the areas where wave heights are greater than 3 ft (High), between 1.5 and 3 feet (Moderate), and less than 1.5 feet (Low). This dataset helps spatially identify the Coastal A Zone, where the implementation of higher building standards can be used as an effective mitigation strategy. This dataset is also known as Wave Severity Hazard Areas.

Parcels can be intersected with the Simplified Coastal Zone polygons for a quick identification of properties in need of higher building standards.

- **Coastal Flood Risk Assessment:** The creation of the Coastal Flood Risk Assessment occurs through a merging of two datasets. By combining the communities census block areas dataset with the risk analysis composite data table itentified through the Hazus flood loss estimation tool, a graphic result can be achieved and visualized by census block identifier. The result can be symbolized through natural breaks into five groups: Very High, High, Medium, Low, and Very Low.



Flood loss estimates by census block can facilitate mitigation decisions.

2.2.4 Estimated Flood Loss Information

Flood risk assessment results reported in the FRR were developed using FEMA's flood loss estimation tool, Hazus. Hazus (www.fema.gov/hazus) is a nationally-applicable and standardized risk assessment tool that estimates potential losses from earthquakes, floods, and hurricanes. It uses GIS technology to estimate physical, economic, and social impacts of disasters, Hazus can be used to help individuals and communities graphically visualize the areas where flood risk is highest. Some benefits of using Hazus include the following:

Hazus is a loss estimation methodology developed by FEMA for flood, wind, and earthquake hazards. The methodology and data established by Hazus can also be used to study other hazards.

- Outputs that can enhance state and local mitigation plans and help screen for cost-effectiveness in FEMA mitigation grant programs.

- Analysis refinement through updating inventory data and integrating data produced using other flood models.
- Widely available support documents and networks (Hazus Users Groups).

Files from the FRD can be imported into Hazus to develop other risk assessment information including:

- Debris generated after a flood event.
- Dollar loss of the agricultural products in a study region.
- Utility system damages in the region.
- Vehicle loss in the study region.
- Damages and functionality of lifelines such as highway and rail bridges, potable water, and wastewater facilities.

Flood risk assessment data can be used in many ways to support local decision making and explanation of flood risk. For mitigation planning, loss data can be used to develop loss information for the flood hazard of interest. Also, the FRM can show where flood risk varies by geographic location. For emergency management, risk assessment data can help forecast losses based on predicted events, and resources can be assigned accordingly. Loss information can support floodplain management efforts, including those to adopt higher regulatory standards. Awareness of at-risk essential facilities and infrastructure also encourages mitigation actions to protect citizens from service disruption should flooding occur.

Flood risk assessment loss data is summarized in the FRR and on the FRM and stored in the FRD.

2.2.4.1 Scenario-Based Flood Loss Estimates

Scenario-based flood losses have been calculated using Hazus for the 1-percent-annual-chance flood. These losses are expressed in dollar amounts and are provided for the Flood Risk Project area only, even though results are shown for the entire project area and at the local level.

Loss estimates are based on best available data, and the methodologies applied result in an approximation of risk. These estimates should be used to understand relative risk from flood and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, demographics, or economic parameters).

Flood loss estimates in this report are being provided at the project and community levels for multiple flood frequencies, and include the following:

- **Residential Asset Loss**: These include direct building losses (estimated costs to repair or replace the damage caused to the building) for all classes of residential structures including single family, multi-family, manufactured housing, group housing, and nursing homes. This value also includes content losses.
- **Commercial Asset Loss**: These include direct building losses for all classes of commercial buildings including retail, wholesale, repair, professional services, banks, hospitals, entertainment, and parking facilities. This value also includes content and inventory losses.

- **Other Asset Loss**: This includes losses for facilities categorized as industrial, agricultural, religious, government, and educational. This value also includes content and inventory losses.
- **Business Disruption**: This includes the losses associated with the inability to operate a business due to the damage sustained during the flood. Losses include inventory, income, rental income, wage, and direct output losses, as well as relocation costs.
- **Annualized Losses**: Annualized losses are calculated using Hazus by taking losses from multiple events over different frequencies and expressing the long-term average by year. This factors in historic patterns of frequent smaller floods with infrequent but larger events to provide a balanced presentation of flood damage.
- **Loss Ratio:** The loss ratio expresses the scenario losses divided by the total building value for a local jurisdiction and can be a gage to determine overall community resilience as a result of a scenario event. For example, a loss ratio of 5 percent for a given scenario would indicate that a local jurisdiction would be more resilient and recover more easily from a given event, versus a loss ratio of 75 percent which would indicate widespread losses. An annualized loss ratio uses the annualized loss data as a basis for computing the ratio. Loss ratios are not computed for business disruption. These data are presented in the FRR.

2.2.5 Areas of Mitigation Interest

Many natural and unnatural factors contribute to flooding and flood losses. Consequently, the Federal government, State agencies, and local jurisdictions responded with flood mitigation programs to prevent or reduce future losses and impacts. An area identified as an Area of Mitigation Interest (AoMI) is identifies target areas and potential projects for flood hazard mitigation, encouraging local collaboration, and communicating how various mitigation activities can successfully reduce flood risk.

This report and the FRM may include information that focuses on identifying AoMIs that may be contributing (positively or negatively) to flooding and flood losses in the Flood Risk Project. AoMIs are identified through coordination with local stakeholders leveraging the following:

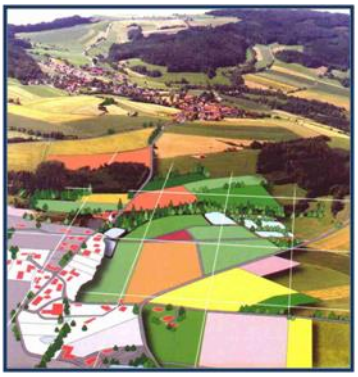
- revised hydrologic and hydraulic and/or coastal analyses,
- previous flood studies,
- community mitigation plans,
- floodplain management plans,
- local surveys, and
- data mining of federal government databases (e.g., flood claims, disaster grants, and data from other agencies).

AoMIs identified within the county, but present beyond the extent of the coastal floodplain, where retained within the FRD for potential future assessments. An additional dataset has been created to display AoMIs that could be vulnerable to potential high risk of flooding, with the hypothetical flooding conditions due to stronger intensity future storms or a future sea level rise scenarios. Below is a list of the types of Areas of Mitigation Interest that may be identified in this Flood Risk Report, shown on the Flood Risk Map, and stored in the Flood Risk Database:

- **Coastal Structures:** Coastal structures, such as seawalls and revetments, are typically used to stabilize the shoreline to mitigate or prevent flood and/or erosion losses. Structures, such as jetties, groins and breakwaters, are constructed along naturally dynamic shorelines to alter the physical processes (e.g. sediment transport) for purposes that include reduction of long-term erosion rates, improvements to safe navigation (e.g., into ports), and reduction of erosive wave forces impacting a coast. Coastal structures are considered AoMIs based on the following characteristics or obserations:

Coastal structures can reduce flooding and stabilize the shoreline

  - Coastal structures may provide flood or erosion protection for one site. However, they may also interrupt the sediment transport process, resulting in coastal erosion downdrift of the structure.
  - Coastal structures are typically designed to withstand the forces associated with extreme design conditions of waves and water levels. Adequate protection may not be provided if these conditions are exceeded.
  - As with other infrastucture such as roads, bridges, and utilities, regular maintenance of shoreline protection structures is essential to ensure that they continue to provide the intended protection from flooding and erosion.



Rooftops, pavements, patios, and driveways contribute to the impervious area in a watershed. This occurs in both urban areas and rural areas being developed.

- **At-Risk Essential Facilities:** Essential facilities, sometimes called “critical facilities,” are those whose impairment during a flood could cause significant problems to individuals or communities. For example, when a community’s wastewater treatment is flooded and shut down, not only do contaminants escape and flow into the floodwaters, but backflows of sewage can contaminate basements or other areas of the community. Similarly, when a facility such as a hospital is flooded, it can result in a significant hardship on the community not only during the

event but long afterwards as well. At-risk essential facilities are considered AoMIs based on the following characteristics or obserations:

- Costly and specialized equipment may be damaged and need to be replaced.
- Impairments to facilities such as fire stations may cause delays in responding to emergencies.
- Critical records and information stored at these facilities may be lost.

- **Areas of Significant Land Use Change:** Man-made modification and destruction of natural dune fields can results in the reduction and deterioration of the dune sediment reservoir, thereby increasing overland flood hazards landward of the dune field.

  Additionally, changes in land use in areas vulnerable to coastal flooding may affect the severity of wave hazards. Wave energy dissipates as waves propagate through forested areas or areas with dense development while wave energy can increase in open areas such as agricultural fields or parking lots. Changes in land use can affect wave hazards beyond the immediate area of land use change.

  Sometimes a major land use change may be for planning purposes only. For example, a land use change that rezones land from a classification such as floodplain that restricts development to a zone such as industrial or high density residential could result in significant new infrastructure and structures in high flood risk areas. Areas of Significant Land Use Change are considered AoMIs based on the following characteristics or obserations:

  - Deterioration of dune fields, which can increase inland flooding.
  - Open areas can allow wave energy to increase while dense vegetation cover often obstruct waves. These obstructions diminish the wave's potentially destructive forces in areas inland of the obstructions.
  - Rezoning flood-prone areas to high densities and/or higher intensity uses can result in more people and property at risk of flooding and flood damage.

- **Key Emergency Routes Overtopped During Frequent Flooding Events:** Roads are not always elevated above estimated flood levels, and present a significant flood risk to motorists during flooding events. When alternate routes are available, risks may be reduced, including risks to life and economic loss. Overtopped roads are considered AoMIs based on the following characteristics or obserations:

  - These features can be accounted for and incorporated into Emergency Action Plans.
  - Roads may be elevated or reinforced to reduce the risk of overtopping during flood

Photo: flaglercounty.org
When large highways close due to flooding, traffic is detoured causing inconvenience and economic loss.

events.

- **Areas of Mitigation Success:** Flood mitigation projects reduce losses and are useful to communicate the concepts of mitigation, which results in more resilient communities. Both structural measures and non-structural measures have been implemented in thousands of communities. An extensive list of mitigation actions can be found in Section 4. Areas of mitigation success are considered AoMIs based on the following characteristics or obserations:
  - Mitigation successes identify those areas within the community that have experienced a reduction or elimination of flood risk.
  - Such areas are essential in demonstrating successful loss reduction measures and in educating citizens and officials on available flood hazard mitigation techniques.
  - Avoided losses can be calculated and shown.
- **Areas of Significant Coastal Erosion:** Sandy beaches, barrier islands, and inlets are dynamic environments shaped by a number of factors, including: erosion, acretion, and lateral migration of sediments. Dunes play an important part in protecting from flood and wave impacts. During the Flood Risk Project process a number of areas were identified where dunes have a higher risk of erosion, overwash, and inundation than other areas. Areas of significant riverine or coastal erosion are considered AoMIs based on the following characteristics or obserations:

Sandy dunes are invaluable natural protection systems against flooding.

  - Erosion of coastal barrier islands can result in breaches of roadways and primary access routes.
  - Erosion often occurs along beaches during storms, especially severe storms that stay offshore for long durations and result in ongoing “battering” of the shoreline from high winds and waves. As the beach erodes, vulnerable properties are placed at even greater risk to coastal flooding from later storm surge, high tides, and wave action.
- **Non-Levee Embankments:** Areas that provide flood control through containment or diversion of the flow of water. These would include those used for highways or railroads that were not designed for protection but do have a flood alleviating influence on the flooding of the area. Non-levee embankments are considered AoMIs based on the following characteristics or obserations:
  - Constructed embankments or earthworks that, while not designed to prevent flooding behind them, do have a mitigating effect on flooding.

3 Flood Risk Analysis Results

The following sections provide summary flood risk results for the Flood Risk Project:

Flood Risk Map:
Within the Flood Risk Project, the FRM displays:

The FRM provides a graphical overview of the Flood Risk Project which highlights areas of risk that should be noted, based on potential losses, exposed facilities, etc., based on data found in the FRD. Refer to the data in the FRD to conduct additional analyses.

- Base data reflecting community boundaries (S_Carto_Ar),
- Major roads (S_Carto_Ln),
- Stream lines (S_Carto_Ln),
- Potential losses that include both the 2010 Average Annualized Loss (AAL) flood loss study supplemented with new Hazus runs for areas with new or updated flood modeling (L_RA_Composite joined to S_CenBlk_Ar),
- Areas of Mitigation Interest (S_AOMI_Pt),
- New Flood Risk Project areas (S_FRD_Proj_Ar), and
- Graphics and text that promote access and usage of additional data available through the FRD, FIRM, and National Flood Hazard Layer and viewers (desktop or FEMA website, etc.).

This information can be used to assist in Flood Risk Project-level planning as well as for developing mitigation actions within each jurisdiction located within the Flood Risk Project.

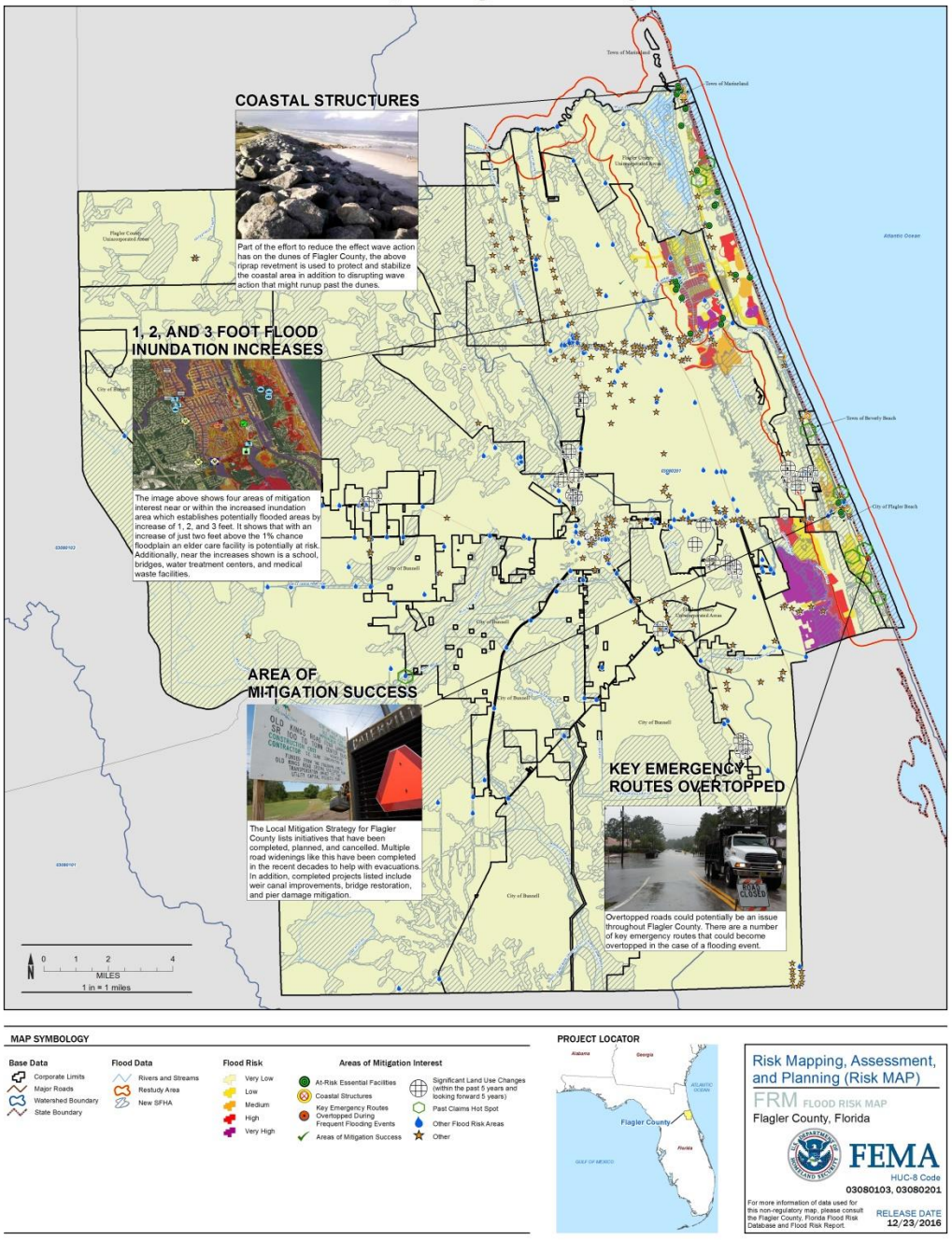
Flood Risk Project Summary: Within the Flood Risk Project area, summary data for some or all of the following datasets are provided for the project area and also on a jurisdiction by jurisdiction basis:

- **Changes Since Last FIRM:** This is a summary of where the floodplain and flood zones have increased or decreased (only analyzed for areas that were previously mapped using digital FIRMs).
- **Flood Depth Grids:** A general discussion of the data provided in the FRD, including coastal analysis surface water elevation grids if furnished as part of the coastal project.
- **Coastal-Specific Datasets:** A description of areas that may benefit from mitigation or additional risk analysis.
- **Flood Risk Assessments:** A loss estimation of potential flood damages using different flood scenarios.
- **Areas of Mitigation Interest:** A description of areas that may benefit from mitigation or additional risk analysis.

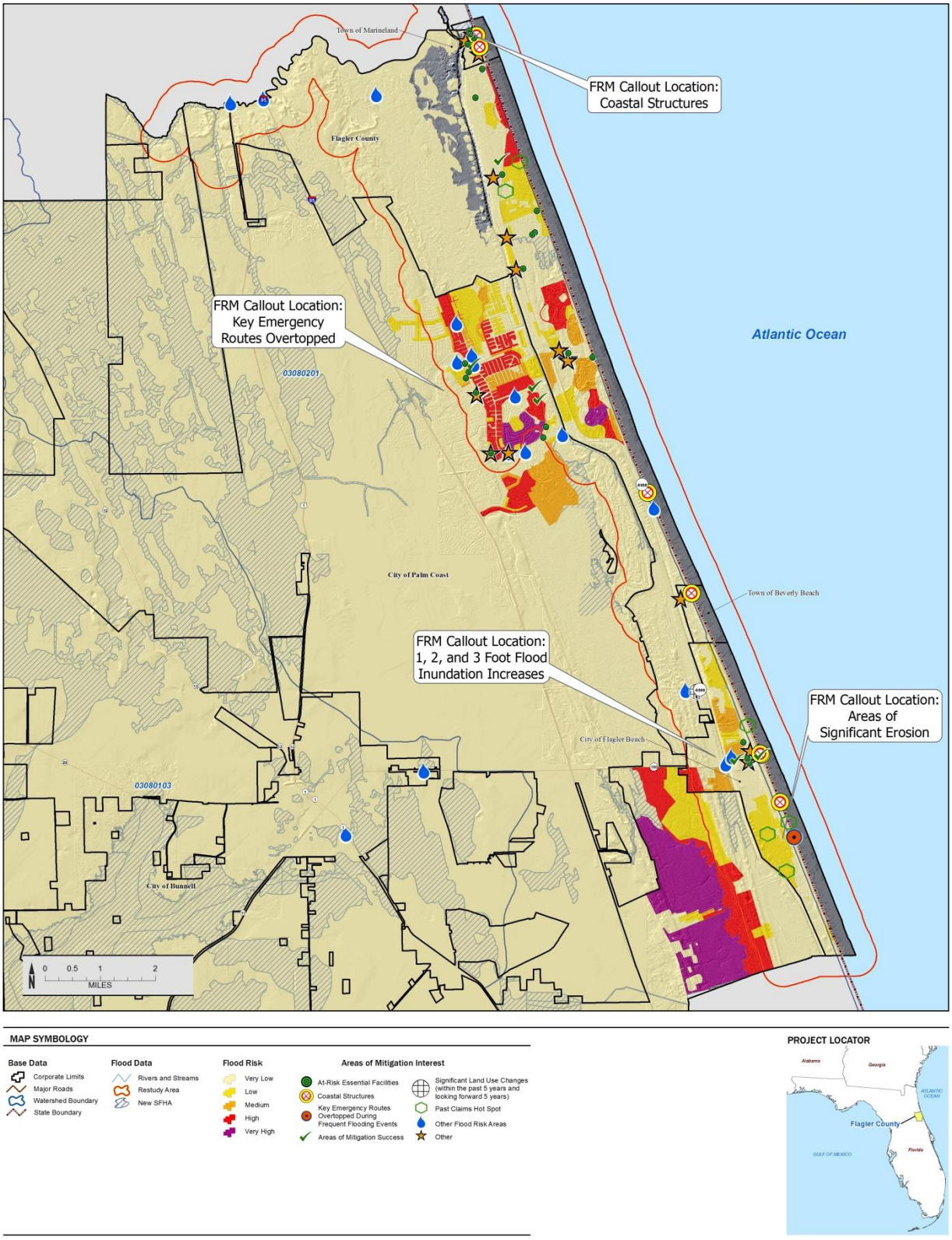
3.1 Flood Risk Map

An abridged version of the Flood Risk Map for this Flood Risk Project as follows. This Flood Risk Product has been produced using datasets within the FRD as well as key study-specific examples of AoMI points. Data overlaid on the map base data are the SFHA boundaries, and flood risk information output from Hazus. The generalized flood risk is displayed for the 1-percent-annual-chance within individual census block areas. The map can be used as a reference material for the areas of mitigation interest. A full size version of the map seen below is available within the FRP. In addition, on the next page the coastal area of this study has been scaled larger to better view the details displayed in the FRM when not printed at its full size.

Flood Risk Map: Flagler County, Florida



Flagler County: Detailed Coastal View of Flood Risk Map



MAP SYMBOLOGY

Base Data
- Corporate Limits
- Major Roads
- Watershed Boundary
- State Boundary

Flood Data
- Rivers and Streams
- Restudy Area
- New SFHA

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

Areas of Mitigation Interest
- At-Risk Essential Facilities
- Coastal Structures
- Key Emergency Routes Overtopped During Frequent Flooding Events
- Areas of Mitigation Success
- Significant Land Use Changes (within the past 5 years and looking forward 5 years)
- Past Claims Hot Spot
- Other Flood Risk Areas
- Other

PROJECT LOCATOR

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3.2 Flagler County, Florida Flood Risk Project Area Summary

Flagler County is located on the Atlantic Ocean in the northeast region of Florida. It borders the St. John's County, Florida to the north and Volusia County, Florida to the south. The dominant source of flooding in the coastal region of Flagler County is storm surge from tropical storms and hurricanes from the Atlantic Ocean.

3.2.1 Overview

Flagler County unincorporated and incorporated areas include the following NFIP communities:

Community Name	CID	Total Community Population	Percent of Population in Study Area	Total Community Land Area (sq mi)	Percent of Land Area in Study Area	NFIP	CRS Rating	Mitigation Plan
Town of Beverly Beach	120569	336	0.3	0.6	100	Y	10	Y
City of Bunnell	120086	2,741	3	138	100	Y	10	Y
City of Flagler Beach	120087	4,424	4	5.4	100	Y	6	Y
Town of Marineland	120570	16	0.0	0.6	100	Y	10	Y
City of Palm Coast	120684	78,740	79	95.8	100	Y	6	Y
Flagler County	120085	13,699	14	271.7	100	Y	10	Y

Community-specific results are provided on subsequent sections and only includes areas located within the Flagler County, Florida Flood Risk Project. Section 2 of the FRR provides more information regarding the source and methodology used to develop this information. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the FRD.

3.2.2 Community Analysis and Results

As a part of this Flood Risk Project, flood risk datasets were created for inclusion in the Flood Risk Database. Those datasets are summarized for this Flood Risk Project as follows:

Changes Since Last FIRM: Special Flood Hazard Area (SFHA) boundaries within Flagler County, Florida were updated by new coastal engineering analysis and flood hazard mapping performed within the Flood Risk Project area. This includes a datum conversion resulting in updated elevations across the entire county. The data in this section reflects a comparison between the effective FIRMs and the new analysis/mapping in this study. Section 2 of the FRR provides more information regarding the source and methodology used to develop thed data in this section. The Changes Since Last FIRM dataset in the FRD should be used to help identify specific areas where the flood hazard designation has changed. The table below summarizes the total increases, decreases, and net change of SFHAs within the Flood Risk Project.

Area of Study	Total Area (mi^2)	Increase (mi^2)	Decrease (mi^2)	Net Change (mi^2)
Within SFHA	198.7	4.9	9.5	-4.6
Within Floodway	9.0	0.1	0.5	-0.4
Within CHHA (Zone VE or V)	4.9	0.1	0.2	-0.1

The figures in this table only represent information within the Flagler County Incorporated and Unincorporated Areas.

The table below summarizes the increases, decreases, and net change of effected parcels for the project area

Area of Study	# Parcels: Increase	# Parcels: Decrease	# Parcels: Net Change
Within SFHA	3,616	4,045	-429
Within CHHA (Zone VE or V)	9	261	-252

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Flagler County, Florida, the figures in this table only represent information within the Flagler County, Florida.

Evidence of actual flood losses can be one of the most compelling factors for increasing a community's flood risk awareness. Specific areas within each jurisdiction are detailed within the individual community summaries.

Coastal Depth Grids: The FRD contains datasets in the form of depth grids for the entire Flood Risk Project that can be used for additional analysis, enhanced visualization, and communication of flood risks for hazard mitigation planning and emergency management. The data provided within the FRD should be used to further isolate areas where flood mitigation potential is high and may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

Increased Flooding Scenarios: This dataset helps identify the areas that would be exposed to flooding by hypothetical increases in coastal flood levels. The polygons depict areas that would be flooded by an additional 1, 2, or 3 feet of flooding above the total water level elevation (stillwater plus waves) for the specified flood frequency. The table below summarizes the total additional area that would be inundated for each of these scenarios.

Flood Event Frequency	Additional Area (mi^2) Inundated by a 1-ft Increase	Additional Area (mi^2) Inundated by a 2-ft Increase	Additional Area (mi^2) Inundated by a 3-ft Increase
1%-annual-chance	3.5	5.1	6.2

The table below represents inundation information stored within the FRD that helps identify current and future risk for AoMIs identified. The points in the dataset have additional information including the zone of greatest risk that it falls within, inundation risk, wave hazard risk, and depths at each flood frequency depth grid created within the study.

Flood Event Frequency	AoMI Inundated by the 1-percent-annual-chance flood event	Additional AoMI Inundated by a 1-ft Increase	Additional AoMI Inundated by a 2-ft Increase	Additional AoMI Inundated by a 3-ft Increase
1%-annual-chance	129	6	8	24

Simplified Coastal Zones: This dataset depicts the wave hazards in simplified terms of High, Moderate, or Low Wave Action. It provides a way to visualize the areas where wave heights are greater than 3 ft (High), between 1.5 and 3 feet (Moderate), and less than 1.5 feet (Low). The table below identifies the total area within each wave action category, along with the number of parcels affected. Parcel counts were estimated based on parcel centroids within each wave action zone.

Wave Action	Total Coastal Zone Area (mi^2)	Total Parcel Area (mi^2)	# of Parcel Centroids
High (V Zone)	4.8	0.5	530
Moderate (Coastal A Zone)	0	0	0
Low (A Zone)	40.5	24.8	3,284

Flood Risk Results: Flagler County, Florida flood risk analysis incorporates results from a Hazus analysis, which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were estimated as well as potential loss ratios for multiple scenarios. The 2010 Average Annual Loss (AAL) study data was re-analyzed within Hazus 3.1 using the more 2010 AAL study census block area data.

Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur. By joining the census block area dataset and the Hazus combined risk analysis output table by census block identifiers, users can easily visualize the projected risks at locations within the community.

Flagler County Unincorporated and Incorporated Areas: Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$15,295,400,000	84	$1,000,000	0.0	$1,153,100,000	8	*$683,200,000	*4	$2,342,100,000	15	$86,900,000	0.6
Commercial Building & Contents	$1,948,600,000	11	$200,000	0.0	$135,700,000	7	*$96,200,000	*5	$312,000,000	16	$10,800,000	0.6
Other Building & Contents	$933,700,000	5	$500,000	0.1	$46,000,000	5	*$26,400,000	*3	$116,400,000	12	$3,800,000	0.4
Total Building & Contents[3]	$18,177,900,000	100	$1,600,000	0.0	$1,334,900,000	7	*$805,700,000	*4	$2,770,100,000	15	$101,600,000	0.6
Business Disruption[4]	N/A	N/A	$30,000	N/A	$7,600,000	N/A	*$4,300,000	N/A	$14,000,000	N/A	$600,000	N/A
TOTAL[5]	**$18,177,900,000**	**N/A**	**$1,700,000**	**0.0**	**$1,342,500,000**	**7**	***$810,200,000**	***4**	**$2,783,600,000**	**15**	**$102,100,000**	**0.6**

Source: Hazus 3.1 AAL coastal analysis, based on the 2010 census, stored as the Flood Risk Assessment Datasets in the Flood Risk Database. (10%, 2%, and 0.2% flood events)
*Source: Hazus 3.1 refined coastal analysis, based on the 2010 census, resulting in less generalized results and stored in the Flood Risk Database. (1% flood event)

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios over 1 are rounded to the nearest integer percent. Loss ratios less than 1 are rounded to the nearest tenth of a percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within Flagler County (Unincorporated and Incorporated Areas), Florida

Areas of Mitigation Interest: Section 2.2.5 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type. The table below summarizes the number of areas of mitigation interest by type.

Type of Mitigation Interest	Number of Occurrences	Data Source from L_Source_Cit table
Coastal Structures	7	FDEP
Key Emergency Routes Overtopped	1	HazMit
Significant Land Use Change	25	ECFRPC
Past Claims Hot Spot	10	HazMit
At Risk Essential Facilities	80	Central Florida Regional Transportation Authority, FDEP, UFGC
Other Flood Risk Areas	438	Bureau of Archaeological Research, EPA, FDEP, FLDOR, UFGC, USDOT
Other	424	FCC, FDEP, FLDOH, USDOT
Areas of Mitigation Success	7	HazMit

Within the Flagler County Unincorporated and Incorporated areas, including areas not within the coastal study, there have been 988 Areas of Mitigation Interest (AoMI) identified. Within the coastal restudy area alone, there are 113 locations of mitigation, of which 45 fall within the Special Flood Hazard Area (SFHA). The remaining 988 AoMIs fall outside of the coastal area, which include 84 features within the SFHA that are not included in the coastal specific locations.

Of the total identified AoMIs there are 80 identified at-risk essential facilities, of which 3 fall within the SFHA. As noted in the Local Mitigation Strategy, the only key emergency routes identified as having water overtopping is within the SFHA and seven of the ten past claims identified were included in the modelled flooding. Because of their specificity to the area, all seven Coastal Structures are erosion located within the SFHA. Of the 10 Significant Land Use Changes, only one has been identified as being within the SFHA and is noted as industrial development. Within the 'Other' type of mitigation interest which includes 424 locations similar to water storage, fuel faculties, and biomedical waste sites, five of them are within the SFHA areas of the coastal restudy. Of the 438 Other Flood Risk Areas, 19 of these would be subject to flooding in the restudied boundaries. These areas include locations like care locations, bridges, and community centers.

Examples of mitigation success have been found within the Local Mitigation Strategy plan for Flagler County. These are notations of successful adjustments to the community based on needs determined at planning meetings. Three of the successes were improvements of the roadway infrastructure along various routes and all of which are key emergency evacuation routes which would allow for a greater density of cars to evacuate during evacuations. Two are bridge improvements, one is a group of weir canal projects, and finally Flagler pier strengthening against wind and wave action.

3.3 Communities

The following sections provide an overview of the community's floodplain management program and a summary of the flood risk analysis performed for each project area in Flagler County, Florida.

3.3.1 Town of Beverly Beach Summary (CID 120569)

The following pages include Flood Risk data for the Town of Beverly Beach.

3.3.1.1 Overview

The information that follows provides an overview of the Town of Beverly Beach's floodplain management program information.

Community Name	CID	Total Community Population	Percent of Population in Study Area	Total Community Land Area (sq mi)	Percent of Land Area in Study Area	NFIP	CRS Rating	Mitigation Plan
Town of Beverly Beach	120569	336	0.3	0.6	100	Y	10	Y

- Participating in the Flagler County Local Mitigation Strategy which expires 6/1/2021
- Past Federal Disaster Declarations for flooding = 20
- National Flood Insurance Program (NFIP) policy coverage = 133 policies totaling approximately $27,903,600
- NFIP-recognized repetitive loss properties = 2 (Residential); 0 (Commercial)
- NFIP-recognized severe repetitive loss properties = 0 (Residential)

Data provided below only includes areas in the Town of Beverly Beach that are located within Flagler County, Florida Flood Risk Project, and do not necessarily represent community-wide totals. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the FRD.

3.3.1.2 Community Analyses and Results

Changes Since Last FIRM: Special Flood Hazard Area (SFHA) boundaries for certain areas within the Town of Beverly Beach were updated due to new coastal engineering analysis performed. The data in this section reflects a comparison between the effective FIRMs and the new analysis in this study. The Changes Since Last FIRM dataset in the FRD should be used to help identify specific areas where the flood hazard designation has changed.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi^2)	Increase (mi^2)	Decrease (mi^2)	Net Change (mi^2)
Within SFHA	0.4	0.0	0.1	-0.1
Within Floodway	0.0	0.0	0.0	0.0
Within CHHA (Zone VE or V)	0.3	0.0	0.0	0.0

*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the Town of Beverly Beach, the figures in this table only represent information within the Town of Beverly Beach.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

The table below summarizes the increases, decreases, and net change of affected parcels.

Area of Study	# Parcels: Increase	# Parcels: Decrease	# Parcels: Net Change
Within SFHA	76	136	-60
Within Floodway	0	0	0
Within CHHA (Zone VE or V)	0	10	-10

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the Town of Beverly Beach, the figures in this table only represent information within the Town of Beverly Beach.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

- **Coastal Depth Grids**
  - See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
    - Water surface elevation grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
    - Multi-frequency flood depth grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Increase Flood Scenarios**
  - This dataset, stored in the FRD, helps identify the areas that would be exposed to flooding by hypothetical increases in coastal flood levels. The polygons depict areas that would be flooded by an additional 1, 2, or 3 feet of flooding above the total water level elevation (stillwater plus waves) for the specified flood frequency. The following table summarizes the total additional area that would be inundated and added to the floodplain for each of these scenarios.

Flood Event Frequency	Additional Area (mi^2) Inundated by a 1-ft Increase	Additional Area (mi^2) Inundated by a 2-ft Increase	Additional Area (mi^2) Inundated by a 3-ft Increase
1-annual-chance	0.04	0.03	0.02

- **Simplified Coastal Zones**
  - This dataset depicts the wave hazards in simplified terms of High, Moderate, or Low Wave Action. It provides a way to visualize the areas where wave heights are greater than 3 ft (High), between 1.5 and 3 feet (Moderate), and less than 1.5 feet (Low). The following table identifies the total area within each wave action category, along with the number of structures affected. Structure counts were estimated based on [explain – building footprints, building centroids, etc.]

Wave Action	Total Coastal Zone Area (mi^2)	Total Parcel Area (mi^2)	# of Parcel Centroids
High (V Zone)	0.30	0.02	33
Moderate (Coastal A Zone)	0	0	0
Low (A Zone)	0.11	0.10	110

- **Flood Risk Results**
  - The Town of Beverly Beach's flood risk analysis uses results from a FEMA-performed Hazus 3.1 analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

Town of Beverly Beach: Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$68,000,000	71	$100,000	0.2	$19,000,000	28	*$2,000,000	*3	$43,400,000	64	$1,500,000	2
Commercial Building & Contents	$19,900,000	21	$100,000	0.6	$1,600,000	8	*$500,000	*3	$6,300,000	32	$200,000	0.9
Other Building & Contents	$7,400,000	8	$0	0.0	$1,100,000	15	*$200,000	*2	$3,500,000	47	$100,000	1
Total Building & Contents[3]	$95,300,000	100	$200,000	0.3	$21,700,000	23	*$2,700,000	*3	$53,200,000	56	$1,800,000	2
Business Disruption[4]	N/A	N/A	$0	N/A	$80,000	N/A	*$10,000	N/A	$200,000	N/A	$10,000	N/A
TOTAL[5]	$95,300,000	N/A	**$300,000**	**0.3**	**$21,800,000**	**23**	***$2,700,000**	***3**	**$53,400,000**	**56**	**$1,800,000**	2

Source: Hazus 3.1 AAL coastal analysis, based on the 2010 census, stored as the Flood Risk Assessment Datasets in the Flood Risk Database. (10%, 2%, and 0.2% flood events)
* Source: Hazus 3.1 refined coastal analysis, based on the 2010 census, resulting in less generalized results and stored in the Flood Risk Database. (1% flood event)

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios over 1 are rounded to the nearest integer percent. Loss ratios less than 1 are rounded to the nearest tenth of a percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within the Town of Beverly Beach, Florida

- **Areas of Mitigation Interest**
  - Section 2.2.5 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type. The table below summarizes the number of areas of mitigation interest by type.

Type of Mitigation Interest	Number of Occurrences	Data Source from L_Source_Cit table
At Risk Essential Facilities	2	UFGC
Coastal Structures	1	FDEP
Other	1	FDEP

3.3.2 City of Bunnell Summary (CID 120086)

The following pages include Flood Risk data for the City of Bunnell.

3.3.2.1 Overview

The information below provides an overview of the City of Bunnell's floodplain management program information as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Study Area	Total Community Land Area (sq mi)	Percent of Land Area in Study Area	NFIP	CRS Rating	Mitigation Plan
City of Bunnell	120086	2,741	3	138	100	Y	10	Y

- Participating in the Flagler County Local Mitigation Strategy which expires 6/1/2021
- Past Federal Disaster Declarations for flooding = 20
- National Flood Insurance Program (NFIP) policy coverage (policies/value) = 35 policies totaling approximately $9,300,400
- NFIP-recognized repetitive loss properties = 5 (Residential); 0 (Commercial)
- NFIP-recognized severe repetitive loss properties = 0 (Residential)

Data provided below only includes areas in the City of Bunnell that are located within the Flagler County, Florida Flood Risk Project, and do not necessarily represent community-wide totals. Section 2 of the FRR provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the FRD.

3.3.2.2 Community Analyses and Results

The community is not located directly within the extent of the coastal analysis as a result the Town of Callahan is not affected by the completed analysis. There have been no updates to the Flood Risk Results. Some Areas of Mitigation Interest have been identified for future flood risk.

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries for certain areas within the City of Bunnell were updated due to new engineering analysis performed. The data in this section reflects a comparison between the effective FIRMs and the new analysis in this study. The Changes Since Last FIRM dataset in the FRD should be used to help identify specific areas where the flood hazard designation has changed.

    The table below summarizes the increases, decreases, and net change of SFHAs and Coastal High Hazard Areas (CHHAs) for the community.

Area of Study	Total Area (mi^2)	Increase (mi^2)	Decrease (mi^2)	Net Change (mi^2)
Within SFHA	47.4	0.5	0.8	-0.3
Within Floodway	6.1	0.0	0.0	0.0
Within CHHA (Zone VE or V)	0.0	0.0	0.0	0.0

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the City of Bunnell, the figures in this table only represent information within the City of Bunnell.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

The table below summarizes the increases, decreases, and net change of affected parcels for the community.

Area of Study	# Parcels: Increase	# Parcels: Decrease	# Parcels: Net Change
Within SFHA	7	10	-3
Within Floodway	0	0	0
Within CHHA (Zone VE or V)	0	0	0

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the City of Bunnell, the figures in this table only represent information within the City of Bunnell.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

- **Coastal Depth Grids**
  - See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
    - Water surface elevation grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
    - Multi-frequency flood depth grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Increase Flood Scenarios**
    - This dataset, stored in the FRD, helps identify the areas that would be exposed to flooding by hypothetical increases in coastal flood levels. The polygons depict areas that would be flooded by an additional 1, 2, or 3 feet of flooding above the total water level elevation (stillwater plus waves) for the specified flood frequency. The following table summarizes the total additional area that would be inundated and added to the floodplain for each of these scenarios.

Flood Event Frequency	Additional Area (mi^2) Inundated by a 1-ft Increase	Additional Area (mi^2) Inundated by a 2-ft Increase	Additional Area (mi^2) Inundated by a 3-ft Increase
1-annual-chance	0.07	0.06	0.17

- **Simplified Coastal Zones**
    - This dataset depicts the wave hazards in simplified terms of High, Moderate, or Low Wave Action. It provides a way to visualize the areas where wave heights are greater than 3 ft (High), between 1.5 and 3 feet (Moderate), and less than 1.5 feet (Low). The following table identifies the total area within each wave action category, along with the number of structures affected. Structure counts were estimated based on [explain – building footprints, building centroids, etc.]

Wave Action	Total Coastal Zone Area (mi^2)	Total Parcel Area (mi^2)	# of Parcel Centroids
High (V Zone)	0	0	0
Moderate (Coastal A Zone)	0	0	0
Low (A Zone)	0.07	0.07	0

- **Areas of Mitigation Interest**
    - Section 2.2.5 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type. The table below summarizes the number of areas of mitigation interest by type.

Type of Mitigation Interest	Number of Occurrences	Data Source from L_Source_Cit table
At Risk Essential Facilities	18	UFGC, Central Florida Regional Transportation Authority, FDEP
Other	56	FCC, FDEP, FLDOH, USDOT
Other Flood Risk Areas	89	EPA, FDEP, FLDOR, UFGC, USDOT
Significant Land Use Change	3	ECFRPC

3.3.3 City of Flagler Beach Summary (CID 120087)

The following pages include Flood Risk data for the City of Flagler Beach.

3.3.3.1 Overview

The information below provides an overview of the City of Flagler Beach's floodplain management program information as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Study Area	Total Community Land Area (sq mi)	Percent of Land Area in Study Area	NFIP	CRS Rating	Mitigation Plan
City of Flagler Beach	120087	4,424	4	4.43	100	Y	6	Y

- Participating in the Flagler County Local Mitigation Strategy which expires 6/1/2021
- Past Federal Disaster Declarations for flooding = 20
- National Flood Insurance Program (NFIP) policy coverage (policies/value) = 1943 policies totaling approximately $454,076,300
- NFIP-recognized repetitive loss properties = 0 (Residential); 0 (Commercial)
- NFIP-recognized severe repetitive loss properties = 0 (Residential)

Data provided below only includes areas in the City of Flagler Beach that are located within the Flagler County, Florida Flood Risk Project, and do not necessarily represent community-wide totals. Section 2 of the FRR provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the FRD.

3.3.3.2 Community Analyses and Results

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries for certain areas within the City of Flagler Beach were updated due to new engineering analysis performed. The data in this section reflects a comparison between the effective FIRMs and the new analysis in this study. The Changes Since Last FIRM dataset in the FRD should be used to help identify specific areas where the flood hazard designation has changed.

The table below summarizes the increases, decreases, and net change of SFHAs and Coastal High Hazard Areas (CHHAs) for the community.

Area of Study	Total Area (mi^2)	Increase (mi^2)	Decrease (mi^2)	Net Change (mi^2)
Within SFHA	3.9	0.2	0.4	-0.2
Within Floodway	0.0	0.0	0.0	0.0
Within CHHA (Zone VE or V)	1.5	0.0	0.1	-0.1

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the City of Flagler Beach, the figures in this table only represent information within the City of Flagler Beach.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

The table below summarizes the increases, decreases, and net change of affected parcels for the community.

Area of Study	# Parcels: Increase	# Parcels: Decrease	# Parcels: Net Change
Within SFHA	76	501	-425
Within Floodway	0	0	0
Within CHHA (Zone VE or V)	0	206	-206

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the City of Flagler Beach, the figures in this table only represent information within the City of Flagler Beach.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

- **Coastal Depth Grids**
  - See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
    - Water surface elevation grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
    - Multi-frequency flood depth grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Increase Flood Scenarios**
    - This dataset, stored in the FRD, helps identify the areas that would be exposed to flooding by hypothetical increases in coastal flood levels. The polygons depict areas that would be flooded by an additional 1, 2, or 3 feet of flooding above the total water level elevation (stillwater plus waves) for the specified flood frequency. The following table summarizes the total additional area that would be inundated and added to the floodplain for each of these scenarios.

Flood Event Frequency	Additional Area (mi^2) Inundated by a 1-ft Increase	Additional Area (mi^2) Inundated by a 2-ft Increase	Additional Area (mi^2) Inundated by a 3-ft Increase
1-annual-chance	0.25	0.13	0.08

- **Simplified Coastal Zones**
    - This dataset depicts the wave hazards in simplified terms of High, Moderate, or Low Wave Action. It provides a way to visualize the areas where wave heights are greater than 3 ft (High), between 1.5 and 3 feet (Moderate), and less than 1.5 feet (Low). The following table identifies the total area within each wave action category, along with the number of structures affected. Structure counts were estimated based on [explain – building footprints, building centroids, etc.]

Wave Action	Total Coastal Zone Area (mi^2)	Total Parcel Area (mi^2)	# of Parcel Centroids
High (V Zone)	1.51	0.05	267
Moderate (Coastal A Zone)	0	0	0
Low (A Zone)	2.29	1.97	1057

- **Flood Risk Results**
    - The City of Flagler Beach's flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

City of Flagler Beach: Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$981,600,000	79	$600,000	0.1	$166,500,000	17	*$70,900,000	*7	$399,300,000	41	$13,500,000	1
Commercial Building & Contents	$160,000,000	13	$60,000	0.0	$21,600,000	13	*$10,000,000	*6	$55,600,000	35	$1,800,000	1
Other Building & Contents	$97,100,000	8	$500,000	0.5	$10,400,000	11	*$6,200,000	*6	$29,000,000	30	$900,000	0.9
Total Building & Contents[3]	$1,238,800,000	100	$1,100,000	0.1	$198,500,000	16	*$87,000,000	*7	$483,800,000	39	$16,200,000	1
Business Disruption[4]	N/A	N/A	$30,000	N/A	$1,400,000	N/A	*$700,000	N/A	$3,000,000	N/A	$100,000	N/A
TOTAL[5]	$1,238,800,000	N/A	**$1,100,000**	**0.1**	**$199,900,000**	**16**	***$87,800,000**	***7**	**$486,400,000**	**39**	**$16,300,000**	1

Source: Hazus 3.1 AAL coastal analysis, based on the 2010 census, stored as the Flood Risk Assessment Datasets in the Flood Risk Database. (10%, 2%, and 0.2% flood events)
* Source: Hazus 3.1 refined coastal analysis, based on the 2010 census, resulting in less generalized results and stored in the Flood Risk Database. (1% flood event)

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios over 1 are rounded to the nearest integer percent. Loss ratios less than 1 are rounded to the nearest tenth of a percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within City of Fernandina, Florida

- **Areas of Mitigation Interest**
    - Section 2.2.5 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type. The table below summarizes the number of areas of mitigation interest by type.

Type of Mitigation Interest	Number of Occurrences	Data Source from L_Source_Cit table
At Risk Essential Facilities	5	UFGC, FDEP
Coastal Structures	3	FDEP
Key Emergency Routes Overtopped	1	HazMit
Other	13	FDEP, FLDOH
Other Flood Risk Areas	21	EPA, FDEP, FLDOR, UFGC, USDOT
Significant Land Use Change	1	ECFRPC
Areas of Mitigation Success	2	HazMit

3.3.4 Town of Marineland Summary (CID 120570)

The following pages include Flood Risk data for the Town of Marineland.

3.3.4.1 Overview

The information below provides an overview of the Town of Marineland's floodplain management program information as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Study Area	Total Community Land Area (sq mi)	Percent of Land Area in Study Area	NFIP	CRS Rating	Mitigation Plan
Town of Marineland	120570	16	0.0	0.6	100	Y	10	Y

- Participating in the Flagler County Local Mitigation Strategy which expires 6/1/2021
- Past Federal Disaster Declarations for flooding = 20
- National Flood Insurance Program (NFIP) policy coverage (policies/value) = 35 policies totaling approximately $3,516,600
- NFIP-recognized repetitive loss properties = 0 (Residential); 0 (Commercial)
- NFIP-recognized severe repetitive loss properties = 0 (Residential)

Data provided below only includes areas in the Town of Marineland that are located within the Flagler County, Florida Flood Risk Project, and do not necessarily represent community-wide totals. Section 2 of the FRR provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the FRD.

3.3.4.2 Community Analyses and Results

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries for certain areas within the Town of Marineland were updated due to new engineering analysis performed. The data in this section reflects a comparison between the effective FIRMs and the new analysis in this study. The Changes Since Last FIRM dataset in the FRD should be used to help identify specific areas where the flood hazard designation has changed.

The table below summarizes the increases, decreases, and net change of SFHAs and Coastal High Hazard Areas (CHHAs) for the community.

Area of Study	Total Area (mi^2)	Increase (mi^2)	Decrease (mi^2)	Net Change (mi^2)
Within SFHA	0.5	0.3	0.1	0.2
Within Floodway	0.0	0.0	0.0	0.0
Within CHHA (Zone VE or V)	0.2	0.1	0.0	0.1

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the Town of Marineland, the figures in this table only represent information within the Town of Marineland.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

The table below summarizes the increases, decreases, and net change of affected structures and population for the community.

Area of Study	# Parcels: Increase	# Parcels: Decrease	# Parcels: Net Change
Within SFHA	0	0	0
Within Floodway	0	0	0
Within CHHA (Zone VE or V)	0	0	0

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the Town of Marineland, the figures in this table only represent information within the Town of Marineland.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

- **Coastal Depth Grids**
  - See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
    - Water surface elevation grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
    - Multi-frequency flood depth grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Increase Flood Scenarios**
    - This dataset, stored in the FRD, helps identify the areas that would be exposed to flooding by hypothetical increases in coastal flood levels. The polygons depict areas that would be flooded by an additional 1, 2, or 3 feet of flooding above the total water level elevation (stillwater plus waves) for the specified flood frequency. The following table summarizes the total additional area that would be inundated and added to the floodplain for each of these scenarios.

Flood Event Frequency	Additional Area (mi^2) Inundated by a 1-ft Increase	Additional Area (mi^2) Inundated by a 2-ft Increase	Additional Area (mi^2) Inundated by a 3-ft Increase
1-annual-chance	0.03	0.02	0.00

- **Simplified Coastal Zones**
    - This dataset depicts the wave hazards in simplified terms of High, Moderate, or Low Wave Action. It provides a way to visualize the areas where wave heights are greater than 3 ft (High), between 1.5 and 3 feet (Moderate), and less than 1.5 feet (Low). The following table identifies the total area within each wave action category, along with the number of structures affected. Structure counts were estimated based on [explain – building footprints, building centroids, etc.]

Wave Action	Total Coastal Zone Area (mi^2)	Total Parcel Area (mi^2)	# of Parcel Centroids
High (V Zone)	0.17	0.02	3
Moderate (Coastal A Zone)	0	0	0
Low (A Zone)	0.12	0.12	11

- **Flood Risk Results**
    - The Town of Marineland's flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

Town of Marineland: Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$3,700,000	93	$0	0.0	$800,000	22	*$200,000	*6	$3,100,000	83	$80,000	2
Commercial Building & Contents	$200,000	5	$0	0.3	$0	2	*$10,000	*3	$40,000	18	$0	0.4
Other Building & Contents	$0	0.0	$0	0.0	$0	0.0	*$0	*0.0	$0	0.0	$0	0.0
Total Building & Contents[3]	$4,000,000	100	$0	0.0	$800,000	21	*$200,000	*5	$3,100,000	79	$80,000	2
Business Disruption[4]	N/A	N/A	$0	N/A	$0	N/A	*$0	N/A	$0	N/A	$0	N/A
TOTAL[5]	$4,000,000	N/A	**$0**	**0.0**	**$800,000**	**21**	***$200,000**	***5**	**$3,100,000**	**79**	**$80,000**	2

Source: Hazus 3.1 AAL coastal analysis, based on the 2010 census, stored as the Flood Risk Assessment Datasets in the Flood Risk Database. (10%, 2%, and 0.2% flood events)
* Source: Hazus 3.1 refined coastal analysis, based on the 2010 census, resulting in less generalized results and stored in the Flood Risk Database. (1% flood event)

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios over 1 are rounded to the nearest integer percent. Loss ratios less than 1 are rounded to the nearest tenth of a percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within Town of Marineland, Florida

- **Areas of Mitigation Interest**
  - Section 2.2.5 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type. The table below summarizes the number of areas of mitigation interest by type.

Type of Mitigation Interest	Number of Occurrences	Data Source from L_Source_Cit table
Coastal Structures	2	FDEP
Other	3	FLDOH
Other Flood Risk Areas	5	EPA, FDEP

3.3.5 City of Palm Coast Summary (CID 120684)

The following pages include Flood Risk data for the City of Palm Coast.

3.3.5.1 Overview

The information below provides an overview of the City of Palm Coast's floodplain management program information as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Study Area	Total Community Land Area (sq mi)	Percent of Land Area in Study Area	NFIP	CRS Rating	Mitigation Plan
City of Palm Coast	120684	78,740	79	95.8	100	Y	6	Y

- Participating in the Flagler County Local Mitigation Strategy which expires 6/1/2021
- Past Federal Disaster Declarations for flooding = 20
- National Flood Insurance Program (NFIP) policy coverage (policies/value) = 4368 policies totaling approximately $1,242,109,400
- NFIP-recognized repetitive loss properties = 0 (Residential); 0 (Commercial)
- NFIP-recognized severe repetitive loss properties = 0 (Residential)

Data provided below only includes areas in the City of Palm Coast that are located within the Flagler County, Florida Flood Risk Project, and do not necessarily represent community-wide totals. Section 2 of the FRR provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the FRD.

3.3.5.2 Community Analyses and Results

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries for certain areas within the City of Palm Coast were updated due to new engineering analysis performed. The data in this section reflects a comparison between the effective FIRMs and the new analysis in this study. The Changes Since Last FIRM dataset in the FRD should be used to help identify specific areas where the flood hazard designation has changed.

The table below summarizes the increases, decreases, and net change of SFHAs and Coastal High Hazard Areas (CHHAs) for the community.

Area of Study	Total Area (mi^2)	Increase (mi^2)	Decrease (mi^2)	Net Change (mi^2)
Within SFHA	28.1	1.0	3.1	-2.1
Within Floodway	0.2	0.0	0.0	0.0
Within CHHA (Zone VE or V)	0.0	0.0	0.0	0.0

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the City of Palm Coast, the figures in this table only represent information within the City of Palm Coast.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

The table below summarizes the increases, decreases, and net change of affected structures and population for the community.

Area of Study	# Parcels: Increase	# Parcels: Decrease	# Parcels: Net Change
Within SFHA	2,913	698	+2,215
Within Floodway	0	0	0
Within CHHA (Zone VE or V)	0	0	0

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of the City of Palm Coast, the figures in this table only represent information within the City of Palm Coast.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

- **Coastal Depth Grids**
  - See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
    - Water surface elevation grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
    - Multi-frequency flood depth grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Increase Flood Scenarios**
  - This dataset, stored in the FRD, helps identify the areas that would be exposed to flooding by hypothetical increases in coastal flood levels. The polygons depict areas that would be flooded by an additional 1, 2, or 3 feet of flooding above the total water level elevation (stillwater plus waves) for the specified flood frequency. The following table summarizes the total additional area that would be inundated and added to the floodplain for each of these scenarios.

Flood Event Frequency	Additional Area (mi^2) Inundated by a 1-ft Increase	Additional Area (mi^2) Inundated by a 2-ft Increase	Additional Area (mi^2) Inundated by a 3-ft Increase
1-annual-chance	0.32	0.99	2.34

- **Simplified Coastal Zones**
  - This dataset depicts the wave hazards in simplified terms of High, Moderate, or Low Wave Action. It provides a way to visualize the areas where wave heights are greater than 3 ft (High), between 1.5 and 3 feet (Moderate), and less than 1.5 feet (Low). The following table identifies the total area within each wave action category, along with the number of structures affected. Structure counts were estimated based on [explain – building footprints, building centroids, etc.]

Wave Action	Total Coastal Zone Area (mi^2)	Total Parcel Area (mi^2)	# of Parcel Centroids
High (V Zone)	0	0	0
Moderate (Coastal A Zone)	0	0	0
Low (A Zone)	2.09	1.86	344

- **Flood Risk Results**
  - The City of Palm Coast's flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

City of Palm Coast: Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	$11,251,800,000	86	$0	0.0	$784,800,000	7	*$358,100,000	*3	$1,159,500,000	10	$52,600,000	0.5
Commercial Building & Contents	$1,253,800,000	10	$0	0.0	$98,000,000	8	*$57,600,000	*5	$185,800,000	15	$7,200,000	0.6
Other Building & Contents	$523,700,000	4	$0	0.0	$25,400,000	5	*$12,900,000	*2	$50,900,000	10	$1,900,000	0.4
Total Building & Contents[3]	$13,029,400,000	100	$0	0.0	$908,300,000	7	*$428,600,000	*3	$1,395,900,000	11	$61,700,000	0.5
Business Disruption[4]	N/A	N/A	$0	N/A	$4,100,000	N/A	*$2,300,000	N/A	$6,500,000	N/A	$300,000	N/A
TOTAL[5]	$13,029,400,000	N/A	**$0**	**0.0**	**$912,400,000**	**7**	***$430,900,000**	***3**	**$1,402,300,000**	**11**	**$62,000,000**	0.5

Source: Hazus 3.1 AAL coastal analysis, based on the 2010 census, stored as the Flood Risk Assessment Datasets in the Flood Risk Database. (10%, 2%, and 0.2% flood events)
* Source: Hazus 3.1 refined coastal analysis, based on the 2010 census, resulting in less generalized results and stored in the Flood Risk Database. (1% flood event)

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios over 1 are rounded to the nearest integer percent. Loss ratios less than 1 are rounded to the nearest tenth of a percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within Flagler County, Florida

- **Areas of Mitigation Interest**
  - Section 2.2.5 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type. The table below summarizes the number of areas of mitigation interest by type.

Type of Mitigation Interest	Number of Occurrences	Data Source from L_Source_Cit table
At Risk Essential Facilities	43	UFGC
Other	239	FCC, FDEP, FLDOH, USDOT
Other Flood Risk Areas	189	EPA, FDEP, FLDOR, UFGC, USDOT
Significant Land Use Change	3	ECFRPC
At Risk Essential Facilities	43	UFGC
Other	239	FCC, FDEP, FLDOH, USDOT
Areas of Mitigation Success	4	HazMit

3.3.6 Flagler County Unincorporated Areas Summary (CID 120085)

The following pages include Flood Risk data for Flagler County Unincorporated Areas.

3.3.6.1 Overview

The information below provides an overview of Flagler County's floodplain management program information as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Study Area	Total Community Land Area (sq mi)	Percent of Land Area in Study Area	NFIP	CRS Rating	Mitigation Plan
Flagler County Unincorporated	120085	13,699	14	271.7	100	Y	10	Y

- Participating in the Flagler County Local Mitigation Strategy which expires 6/1/2021
- Past Federal Disaster Declarations for flooding = 20
- National Flood Insurance Program (NFIP) policy coverage (policies/value) = 4652 policies totaling approximately $1,249,337,900
- NFIP-recognized repetitive loss properties = 12 (Residential); 0 (Commercial)
- NFIP-recognized severe repetitive loss properties = 0 (Residential)

Data provided below only includes areas in Flagler County that are located within the Flagler County, Florida Flood Risk Project, and do not necessarily represent community-wide totals. Section 2 of the FRR provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the FRD.

3.3.6.2 Community Analyses and Results

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries for certain areas within Flagler County were updated due to new engineering analysis performed. The data in this section reflects a comparison between the effective FIRMs and the new analysis in this study. The Changes Since Last FIRM dataset in the FRD should be used to help identify specific areas where the flood hazard designation has changed.

The table below summarizes the increases, decreases, and net change of SFHAs and Coastal High Hazard Areas (CHHAs) for the community.

Area of Study	Total Area (mi^2)	Increase (mi^2)	Decrease (mi^2)	Net Change (mi^2)
Within SFHA	118.5	3.0	5.1	-2.1
Within Floodway	2.8	0.1	0.5	-0.4
Within CHHA (Zone VE or V)	2.9	0.0	0.1	-0.1

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Flagler County Unincorporated Areas, the figures in this table only represent information within Flagler County Unincorporated Areas.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

The table below summarizes the increases, decreases, and net change of affected structures and population for the community.

Area of Study	# Parcels: Increase	# Parcels: Decrease	# Parcels: Net Change
Within SFHA	558	2,744	-2,186
Within Floodway	0	0	0
Within CHHA (Zone VE or V)	9	48	-39

Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Flagler County Unincorporated Area, the figures in this table only represent information within Flagler County Unincorporated Areas.

Section 2 of the FRR provides more information regarding the source and methodology used to develop this table.

- **Coastal Depth Grids**
  - See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
    - Water surface elevation grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
    - Multi-frequency flood depth grids (50-, 20- 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water

should seriously consider mitigation options for implementation.

- **Increase Flood Scenarios**
  - This dataset, stored in the FRD, helps identify the areas that would be exposed to flooding by hypothetical increases in coastal flood levels. The polygons depict areas that would be flooded by an additional 1, 2, or 3 feet of flooding above the total water level elevation (stillwater plus waves) for the specified flood frequency. The following table summarizes the total additional area that would be inundated and added to the floodplain for each of these scenarios.

Flood Event Frequency	Additional Area (mi^2) Inundated by a 1-ft Increase	Additional Area (mi^2) Inundated by a 2-ft Increase	Additional Area (mi^2) Inundated by a 3-ft Increase
1-annual-chance	2.75	3.89	3.58

- **Simplified Coastal Zones**
  - This dataset depicts the wave hazards in simplified terms of High, Moderate, or Low Wave Action. It provides a way to visualize the areas where wave heights are greater than 3 ft (High), between 1.5 and 3 feet (Moderate), and less than 1.5 feet (Low). The following table identifies the total area within each wave action category, along with the number of structures affected. Structure counts were estimated based on [explain – building footprints, building centroids, etc.]

Wave Action	Total Coastal Zone Area (mi^2)	Total Parcel Area (mi^2)	# of Parcel Centroids
High (V Zone)	2.83	0.41	227
Moderate (Coastal A Zone)	0	0	0
Low (A Zone)	35.84	20.68	1762

- **Flood Risk Results**
  - Flagler County's flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

Flagler County Unincorporated Areas: Estimated Potential Losses for Flood Event Scenarios

Type	Inventory Estimated Value	% of Total	10% (10-yr) Dollar Losses[1]	10% Loss Ratio[2]	2% (50-yr) Dollar Losses[1]	2% Loss Ratio[2]	1% (100-yr) Dollar Losses[1]	1% Loss Ratio[2]	0.2% (500-yr) Dollar Losses[1]	0.2% Loss Ratio[2]	Annualized Losses[1] ($/yr)	Ann. Loss Ratio[2]
Residential Building & Contents	**$2,579,600,000**	**83**	**$300,000**	**0.0**	**$182,000,000**	**7**	***$252,000,000**	***10**	**$736,800,000**	**29**	**$19,200,000**	**0.7**
Commercial Building & Contents	$322,700,000	10	$0	0.0	$14,500,000	4	*$28,100,000	*9	$64,300,000	20	$1,600,000	0.5
Other Building & Contents	$196,800,000	6	$0	0.0	$9,100,000	5	*$7,100,000	*4	$33,000,000	17	$900,000	0.5
Total Building & Contents[3]	$3,099,100,000	100	**$300,000**	**0.0**	**$205,600,000**	**7**	***$287,200,000**	***9**	**$834,100,000**	**27**	**$21,800,000**	0.7
Business Disruption[4]	N/A	N/A	**$0**	**N/A**	**$2,000,000**	**N/A**	***$1,300,000**	**N/A**	**$4,300,000**	**N/A**	**$200,000**	N/A
TOTAL[5]	$3,099,100,000	N/A	**$300,000**	**0.0**	**$207,600,000**	**7**	***$288,600,000**	***9**	**$838,400,000**	**27**	**$21,900,000**	0.7

Source: Hazus 3.1 AAL coastal analysis, based on the 2010 census, stored as the Flood Risk Assessment Datasets in the Flood Risk Database. (10%, 2%, and 0.2% flood events)
* Source: Hazus 3.1 refined coastal analysis, based on the 2010 census, resulting in less generalized results and stored in the Flood Risk Database. (1% flood event)

[1]Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.
[2]Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios over 1 are rounded to the nearest integer percent. Loss ratios less than 1 are rounded to the nearest tenth of a percent.
[3]Total Building and Contents = Residential Building and Contents + Commercial Building and Contents + Other Building and Contents.
[4]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.
[5]Total = Total Building and Contents + Business Disruption

The figures in this table only represent information within Flagler County Unincorporated Areas, Florida

- **Areas of Mitigation Interest**
  - Section 2.2.5 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type. The table below summarizes the number of areas of mitigation interest by type.

Type of Mitigation Interest	Number of Occurrences	Data Source from L_Source_Cit table
At Risk Essential Facilities	12	UFGC
Coastal Structures	1	FDEP
Other	112	FCC, FDEP, FLDOH, USDOT
Other Flood Risk Areas	134	Bureau of Archaeological Research, EPA, FDEP, FLDOR, UFGC, USDOT
Past Claims Hot Spot	10	HazMit
Significant Land Use Change	18	ECFRPC
Areas of Mitigation Success	1	HazMit

4 Actions to Reduce Flood Risk

To benefit from the flood risk datasets and products created for this Flood Risk Project, local stakeholders should consider many different flood risk mitigation tactics, including, but not limited the items shown in the sub-sections below.

Before Mitigation and After Mitigation

Seasonal nor'easters have destroyed natural dunes and threatened buildings. This process of riprap revetment is meant to restore and enhance the dune system.

4.1 Types of Mitigation Actions

Mitigation provides a critical foundation on which to reduce loss of life and property by avoiding or lessening the impact of hazard events. This creates safer communities and facilitates resiliency by enabling communities to return to normal function as quickly as possible after a hazard event. The mitigation plan requirements in 44 CFR Part 201 encourage communities to understand their vulnerability to hazards and take actions to minimize vulnerability and promote resilience. Flood mitigation actions generally fall into the following categories:

4.1.1 Preventative Measures

Preventative measures are intended to keep flood hazards from getting worse. They can reduce future vulnerability to flooding, especially in areas where development has not yet occurred or where capital improvements have not been substantial. Examples include:

- Comprehensive land use planning,
- Zoning regulations,
- Subdivision regulations,
- Open space preservation,
- Building codes,
- Floodplain development regulations,
- Stormwater management,
- Purchase development rights or conservation easements, and
- Participation in the NFIP Community Rating System (CRS).

NFIP's CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from community actions meeting the three goals of the CRS: to reduce flood losses, to facilitate accurate insurance rating, and to promote the awareness of flood insurance.

For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount. (A Class 10 is not participating in the CRS and receives no discount.)

4.1.2 Property Protection Measures

Property protection measures protect existing buildings by modifying the building to withstand floods, erosion, and waves or by removing buildings from hazardous locations. Various grants (Table 4.3.1-1. FEMA Hazard Mitigation Assistance Programs) may be available to support property protection, but community floodplain managers should be consulted to determine their use. Property protection examples include:

- Building relocation,
- Acquisition and clearance,
- Building elevation,
- Barrier installation, and
- Building retrofit.

4.1.3 Natural Resource Protection Activities

Natural resource protection activities reduce the impact of floods by preserving or restoring natural areas such as floodplains, wetlands, and dunes and their natural functions. While more in depth information on natural resource protection can be acquired from the Florida Department of Environmental Protection and the U.S. EPA, examples include:

- Wetland protection,
- Habitat protection,
- Erosion and sedimentation control,
- Best management practices (BMP),
- Prevention of stream dumping activities (anti-litter campaigns),
- Improved forestry practices such as reforesting or selective timbering (extraction),
- Beach nourishment,
- Dune construction, and
- Dune protection measures such as walkovers, sand fencing, and vegetation.

4.1.4 Structural Mitigation Projects

Structural mitigation projects lessen the impact of floods by modifying the environmental natural progression of the flooding event. Structural protection such as upgrading dams/levees for already existing development and critical facilities may be a realistic alternative. However, citizens should be made aware of their residual risk through sources such as FIRM maps. Examples include:

- Reservoirs, retention, and detention basins,

- Levees and floodwalls,
- Seawalls, reventments, and bulkheads, and
- Groins, offshore breakwaters, and jetties.

4.1.5 Public Education and Awareness Activities

Public education and awareness activities advise residents, business owners, potential property buyers, and visitors about floods, hazardous areas, and mitigation techniques they can use to reduce the flood risk to themselves and their property. Examples include:

- Readily available and readable updated maps,
- Outreach projects (meetings or brochures),
- Libraries,
- Technical assistance (flood map lookup station),
- Real estate disclosure,
- Environmental education, and
- Risk information via the nightly news.

For more information regarding hazard mitigation techniques, best practices, and potential grant funding sources, visit www.fema.gov or contact your local floodplain manager, emergency manager, or State Hazard Mitigation Officer.

4.1.6 Emergency Service Measures

Although not typically considered a mitigation technique, emergency service measures minimize the impact of flooding on people and property. These are actions commonly taken immediately prior to, during, or in response to a hazard event. Examples include:

- Hazard warning system,
- Emergency response plan,
- COOP and COG planning,
- Critical facilities protection,
- Health and safety maintenance, and
- Post flood recovery planning.

In Section 3, specific Areas of Mitigation Interest were identified. Table 4.1 below identifies possible mitigation actions for each AoMI to consider.

Table 4.1.6-1. Mitigation Actions for Areas of Mitigation Interest

AoMI	Possible Actions to Reduce Flood Risk
Coastal Structures Jetties Groins Seawalls Other structures/living shoreline	Increase coastal setbacks for construction Habitat restoration programs Wetland restoration and mitigation banking programs Engineering assessment Structure upgrades and strengthening Emergency Action Plan Structure removal
Significant Land Use Changes	Higher regulatory standard Transfer of Development rights
Key Emergency Routes Overtopped During Frequent Flooding Events	Elevation Creation of alternate routes
Areas of Significant Coastal Erosion	Relocation of buildings and infrastructure Regulations and planning Natural vegetation Erosion Control Structures Building Setbacks Beach Nourishment Dune Construction Dune Protection Activities
At Risk Essential Facilities	Relocation of buildings and infrastructure Elevation
Areas of Mitigation Success	Promoting success to encourage future actions

4.2 Identifying Specific Actions for Your Community

As many mitigation actions are possible to lessen the impact of floods, how can a community decide which ones are appropriate to implement? There are many ways to identify specific actions most appropriate for a community. Some factors to consider may include the following:

Refer to FEMA Mitigation Planning How To Guide #3 (FEMA 386-3) "Developing the Mitigation Plan - Identifying Mitigation Actions and Implementation Strategies" for more information on how to identify specific mitigation actions to address hazard risk in your community.

- **Site characteristics:** Does the site present unique challenges (e.g., significant slopes or erosion potential)? Review the Increase Flooding Scenarios data in the Flood Risk Database to see view what Areas of Mitigation Interest would be affected by an increase of 1, 2, or 3 feet.
- **Flood characteristics:** Are the flood waters affecting the site fast or slow moving? Are there wave hazards? Is there debris associated with the flow? How deep is the flooding? Review the 1-annual-chance depth grid in the Flood Risk Database to see the depth of

flooding. Review the Coastal Wave Hazard Severity Areas to see which areas in Flagler County are likely to experience wave hazards. Structural retrofits or elevation may be potential mitigation solutions for areas with high wave hazard risks.

- **Social acceptance:** Will the mitigation action be acceptable to the public? Does it cause social or cultural problems? Talk to FEMA's outreach specialists for a tailored outreach plan for Franklin County. Use the Flood Risk Database to "show" the public the potential risks for a particular area.
- **Technical feasibility:** Is the mitigation action technically feasible (e.g., making a building watertight to a reasonable depth)? Work with engineers or other certified professionals when designing mitigation activities.
- **Administrative feasibility:** Is there administrative capability to implement the mitigation action? Review the local jurisdiction hazard mitigation plan to see which specific mitigation projects already receive administrative support. Use the Flood Risk Database to match planned mitigation projects with the highest risk areas to help prioritize future projects.
- **Legal:** Does the mitigation action meet all applicable codes, regulations, and laws? Public officials may have a legal responsibility to act and inform citizens if a known hazard has been identified.
- **Economic:** Is the mitigation action affordable? Is it eligible under grant or other funding programs? Can it be completed within existing budgets?
- **Environmental:** Does the mitigation action cause adverse impacts on the environment or can they be mitigated? Is it the most appropriate action among the possible alternatives?

FEMA in collaboration with the American Planning Association has released the publication, "Integrating Hazard Mitigation into Local Planning." This guide explains how hazard mitigation can be incorporated into several different types of local planning programs. For more information, go to www.planning.org or http://www.fema.gov/library.

The local Hazard Mitigation Plan is a valuable tool to identify and prioritize possible mitigation actions. The plan includes a mitigation strategy with mitigation actions that were developed through a stakeholder involvement process. You can then add to or modify those actions based on what is learned during the course of the Risk MAP project and the information provided within this FRR.

4.3 Mitigation Programs and Assistance

Not all mitigation activities require funding (e.g., local policy actions such as strengthening a flood damage prevention ordinance), and those that do, are not limited to outside funding sources (e.g., inclusion in local capital improvements plan, etc.). For those mitigation actions that require assistance through funding or technical expertise, several State and Federal agencies have flood hazard mitigation grant programs and offer technical assistance. These

Communities can link hazard mitigation plans and actions to the right FEMA grant programs to fund flood risk reduction. More information about FEMA HMA programs can be found at http://www.fema.gov/government/grant/hma/index.shtm.

programs may be funded at different levels or may be activated under special circumstances such as after a presidential disaster declaration.

4.3.1 FEMA Mitigation Programs and Assistance

FEMA awards many mitigation grants each year to states and communities to undertake mitigation projects to prevent future loss of life and property resulting from hazard impacts, including flooding. The FEMA Hazard Mitigation Assistance (HMA) programs provide grants for mitigation through the programs listed in Table 4.2 below.

Table 4.3.1-1. FEMA Hazard Mitigation Assistance Programs

Mitigation Grant Program	Authorization	Purpose
Hazard Mitigation Grant Program (HMGP)	Robert T. Stafford Disaster Relief and Emergency Assistance Act	Activated after a presidential disaster declaration; provides funds on a sliding scale formula based on a percentage of the total federal assistance for a disaster for long-term mitigation measures to reduce vulnerability to natural hazards
Flood Mitigation Assistance (FMA)	National Flood Insurance Reform Act	Reduce or eliminate claims against the NFIP
Pre-Disaster Mitigation (PDM)	Disaster Mitigation Act	National competitive program focused on mitigation project and planning activities that address multiple natural hazards
Repetitive Flood Claims (RFC)	Bunning-Bereuter-Blumenauer Flood Insurance Reform Act	Reduce flood claims against the NFIP through flood mitigation; properties must be currently NFIP insured and have had at least one NFIP claim
Severe Repetitive Loss (SRL)	Bunning-Bereuter-Blumenauer Flood Insurance Reform Act	Reduce or eliminate the long-term risk of flood damage to SRL residential structures currently insured under the NFIP

The HMGP and PDM programs offer funding for mitigation planning and project activities that address multiple natural hazard events. The FMA, RFC, and SRL programs focus funding efforts on reducing claims against the NFIP. Funding under the HMA programs is subject to availability of annual appropriations, and HMGP funding is also subject to the amount of FEMA disaster recovery assistance provided under a presidential major disaster declaration.

FEMA's HMA grants are awarded to eligible states, tribes, and territories (applicant) that, in turn, provide sub-grants to local governments and communities (sub-applicant). The applicant selects and prioritizes sub-applications developed and submitted to them by sub-applicants and submits them to FEMA for funding consideration. Prospective sub-applicants should consult the office designated as their applicant for further information regarding specific program and application requirements. Contact information for the FEMA Regional Offices and State Hazard Mitigation Officers (SHMO) is available on the FEMA website (www.fema.gov).

4.3.2 Additional Mitigation Programs and Assistance

Several additional agencies including USACE, Natural Resource Conservation Service (NRCS), U.S. Geological Survey (USGS), NOAA, and others have specialists on staff and can offer further information on flood hazard mitigation. The State NFIP Coordinator and SHMO are state-level sources of information and assistance, which vary among different states.

The Silver Jackets program, active in several states, is a partnership of USACE, FEMA, and state agencies. The Silver Jackets program provides a state-based strategy for an interagency approach to planning and implementing measures for risk reduction.

5 Acronyms and Definitions

5.1 Acronyms

A

AAL	Average Annualized Loss
ALR	Annualized Loss Ratio
AoMI	Areas of Mitigation Interest

B

BCA	Benefit-Cost Analysis
BFE	Base Flood Elevation
BMP	Best Management Practices

C

CFR	Code of Federal Regulations
CID	Community Identification Number
COG	Continuity of Government Plan
COOP	Continuity of Operations Plan
CRS	Community Rating System
CSLF	Changes Since Last FIRM

D

DHS	Department of Homeland Security
DMA 2000	Disaster Mitigation Act of 2000

E

EOP	Emergency Operations Plan

F

FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FRD	Flood Risk Database
FRM	Flood Risk Map
FRP	Flood Risk Project
FRR	Flood Risk Report
FY	Fiscal Year

G

GIS	Geographic Information System

H

HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program

I

IA	Individual Assistance

N

NFIA	National Flood Insurance Act
NFIP	National Flood Insurance Program
NRCS	Natural Resource Conservation Service

P

PA	Public Assistance
PDM	Pre-Disaster Mitigation

R

RFC	Repetitive Flood Claims
Risk MAP	Mapping, Assessment, and Planning

S

SFHA	Special Flood Hazard Area
SHMO	State Hazard Mitigation Officer
SRL	Severe Repetitive Loss

U

USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

5.2 Definitions

0.2-percent-annual-chance flood – The flood elevation that has a 0.2-percent chance of being equaled or exceeded each year. Sometimes referred to as the 500-year flood.

1-percent-annual-chance flood – The flood elevation that has a 1-percent chance of being equaled or exceeded each year. Sometimes referred to as the 100-year flood.

Accredited Levee System – A levee system that FEMA has shown on a FIRM that is recognized as reducing the flood hazards posed by a 1-percent-annual-chance or greater flood. This determination is based on the submittal of data and documentation as required by 44CFR65.10 of the NFIP regulations. The area landward of an accredited levee system is shown as Zone X (shaded) on the FIRM except for areas of residual flooding, such as ponding areas, which are shown as Special Flood Hazard Area (SFHA).

Annualized Loss Ratio (ALR) – Expresses the annualized loss as a fraction of the value of the local inventory (total value/annualized loss).

Average Annualized Loss (AAL) – The estimated long-term weighted average value of losses to property in any single year in a specified geographic area.

Base Flood Elevation (BFE) – Elevation of the 1-percent-annual-chance flood. This elevation is the basis of the insurance and floodplain management requirements of the NFIP.

Berm – A small levee, typically built from earth.

Cfs – Cubic feet per second, the unit by which discharges are measured (a cubic foot of water is about 7.5 gallons).

Coastal High Hazard Area (CHHA) – Portion of the SFHA extending from offshore to the inland limit of a primary frontal dune along an open coast or any other area subject to high velocity wave action from storms or seismic sources.

Consequence (of flood) – The estimated damages associated with a given flood occurrence.

Crest – The peak stage or elevation reached or expected to be reached by the floodwaters of a specific flood at a given location.

Dam – An artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water.

Design flood event – The greater of the following two flood events: (1) the base flood, affecting those areas identified as SFHAs on a community's FIRM; or (2) the flood corresponding to the area designated as a flood hazard area on a community's flood hazard map or otherwise legally designated.

Erosion – Process by which floodwaters lower the ground surface in an area by removing upper layers of soil.

Essential facilities – Facilities that, if damaged, would present an immediate threat to life, public health, and safety. As categorized in Hazus, essential facilities include hospitals, emergency operations centers, police stations, fire stations, and schools.

Flood – A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters or (2) the unusual and rapid accumulation or runoff of surface waters from any source.

Flood Insurance Rate Map (FIRM) – An official map of a community, on which FEMA has delineated both the SFHAs and the risk premium zones applicable to the community. See also Digital Flood Insurance Rate Map.

Flood Insurance Study (FIS) Report – Contains an examination, evaluation, and determination of the flood hazards of a community, and if appropriate, the corresponding water-surface elevations.

Flood risk – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of flooding. This is sometimes referred to as flood vulnerability.

Flood vulnerability – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of flooding. This is sometimes referred to as flood risk.

Flood-borne debris impact – Floodwater moving at a moderate or high velocity can carry flood-borne debris that can impact buildings and damage walls and foundations.

Floodwall – A long, narrow concrete or masonry wall built to protect land from flooding.

Floodway (regulatory) – The channel of a river or other watercourse and that portion of the adjacent floodplain that must remain unobstructed to permit passage of the base flood without cumulatively increasing the water surface elevation more than a designated height (usually 1 foot).

Floodway fringe – The portion of the SFHA that is outside of the floodway.

Freeboard – A factor of safety usually expressed in feet above a flood level for purposes of flood plain management. "Freeboard" tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed (44CFR§59.1).

Hazus – A GIS-based risk assessment methodology and software application created by FEMA and the National Institute of Building Sciences for analyzing potential losses from floods, hurricane winds and storm surge, and earthquakes.

High velocity flow – Typically comprised of floodwaters moving faster than 5 feet per second.

Levee – A human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding. (44CFR§59.1)

Loss ratio – Expresses loss as a fraction of the value of the local inventory (total value/loss).

Mudflow – Mudslide (i.e., mudflow) describes a condition where there is a river, flow or inundation of liquid mud down a hillside usually as a result of a dual condition of loss of brush cover, and the subsequent accumulation of water on the ground preceded by a period of unusually heavy or sustained rain. A mudslide (i.e., mudflow) may occur as a distinct phenomenon while a landslide is in progress, and will be recognized as such by the Administrator only if the mudflow, and not the landslide, is the proximate cause of damage that occurs. (44CFR§59.1)

Non-Accredited Levee System – A levee system that does not meet the requirements spelled out in the NFIP regulations at Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44CFR65.10), Mapping of Areas Protected by Levee Systems, and is not shown on a FIRM as reducing the flood hazard posed by a 1-percent-annual-chance flood.

Primary frontal dune (PFD) – A continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

Probability (of flood) – The likelihood that a flood will occur in a given area.

Provisionally Accredited Levee (PAL) – A designation for a levee system that FEMA has previously accredited with reducing the flood hazards associated with a 1-percent-annual-chance or greater flood on an effective FIRM, and for which FEMA is awaiting data and/or documentation that will demonstrate the levee system's compliance with the NFIP regulatory criteria cited at 44CFR65.10.

Risk MAP – Risk Mapping, Assessment, and Planning, a FEMA strategy to work collaboratively with state, local, and tribal entities to deliver quality flood data that increases public awareness and leads to action that reduces risk to life and property.

Riverine – Of, or produced by, a river. Riverine floodplains have readily identifiable channels.

Special Flood Hazard Area (SFHA) – Portion of the floodplain subject to inundation by the 1-percent-annual or base flood.

Stafford Act – Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988; amended the Disaster Relief Act of 1974, PL 93-288. This Act constitutes the statutory authority for most federal disaster response activities especially as they pertain to FEMA and FEMA programs.

Stillwater – Projected elevation that flood waters would assume, referenced to National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or other datum, in the absence of waves resulting from wind or seismic effects.

Stream Flow Constrictions – A point where a human-made structure constricts the flow of a river or stream.

6 Additional Resources

ASCE 7 – National design standard issued by the American Society of Civil Engineers (ASCE), *Minimum Design Loads for Buildings and Other Structures*, which gives current requirements for dead, live, soil, flood, wind, snow, rain, ice, and earthquake loads, and their combinations, suitable for inclusion in building codes and other documents.

ASCE 24-05 – National design standard issued by the ASCE, *Flood Resistant Design and Construction*, which outlines the requirements for flood resistant design and construction of structures in flood hazard areas.

National Flood Insurance Program (NFIP), Federal Emergency Management Agency (FEMA), www.floodsmart.gov

FEMA, www.fema.gov

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7 Data Used to Develop Flood Risk Products

GIS base map information was acquired from the following sources:

- United States of America Army Corps of Engineers
- Preliminary Flagler County Flood Insurance Study
- National Inventory of Dams
- State of Florida Enhanced Hazard Mitigation Plan
- Flagler County Local Mitigation Strategy
- US Environmental Protection Agency
- US Department of Transportation
- East Central Florida Regional Planning Council
- Florida Department of Health
- Federal Communications Commision
- Flagler County GIS Department