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WV GIS TEchnical Center

In support of FEMA HMGP Project

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Flood Risk Assessment Report

**JEFFERSON COUNTY, WEST VIRGINIA**

D-R-A-F-T

# Project Area Community List

|  |  |  |
| --- | --- | --- |
| **Community Name** |  | **Community ID** |
| Jefferson Unincorporated |  | 540065 |
| Town of Bolivar |  | 540030 |
| City of Charles Town |  | 540066 |
| Town of Harpers Ferry |  | 540067 |
| City of Ranson |  | 540068 |
| Town of Shepherdstown |  | 540069 |

# Preface

Funded by a FEMA Hazard Mitigation Grant Program (HMGP) and the West Virginia State Hazard Mitigation Office (WVSHMO), building-level flood risk assessments are being completed statewide for a 1-percent annual chance flood (100-year) event in support of local and state hazard mitigation plans. The building-level flood risk assessments utilize FEMA’s Flood Assessment Structure Tool (FAST), a GIS-based, open-source utility designed by FEMA’s Hazus Program for estimating potential building losses from flood disasters.

Using the FEMA Flood Risk Report (FRR) template as a guide, a West Virginia centric flood risk

report has been produced for Jefferson County, West Virginia.

The development and publication of this new enhanced FAST data was a prioritized mitigation

strategy for West Virginia and will assist in risk ranking and decision-making. West Virginia’s commitment to the completion of enhanced HAZUS analysis has resulted in additional data and

redelineated AE flood zone mapping. This level of analysis will further assist in the determination of vulnerability and risk by indicating which area(s) contain the highest number of at-risk essential facilities and the highest potential estimated losses, as well as those areas of the state with the highest state asset loss estimations. Finally, this FRR includes the information contained within the geodatabase, as well as new data tables and mapping products developed for the West Virginia centric FRR project culminating in a robust analysis for improved decision-making and information sharing at both the State and local level.

The Department of Homeland Security (DHS) and Federal Emergency Management Agency’s (FEMA) Risk Mapping, Assessment, and Planning provides states, tribes, and local communities with flood risk information and tools that they can use to increase their resilience to flooding and better protect their citizens. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, communities can transform 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 flood risk information to help 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.

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 the ultimate authoritative source of all flood risk data in the project area. Instead, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the study area.

# Guidance on Using This Report

These flood risk products are intended to be used to assess the impacts of flooding in Jefferson County, West Virginia. The analysis was performed using FEMA’s FAST Tool, a GIS-based, open-source utility designed by FEMA’s Hazus Program for estimating potential building losses from flood disasters and incorporates User Defined Facilities (UDFs) to improve the loss estimates for the 1-percent

annual chance flood event. The UDFs were developed using local parcels, assessors, and building footprint data. The analysis also incorporated the impacts on critical facilities and expected debris and sheltering needs for the 1-percent annual chance flood event.

Sections 1 and 2 of this FRR provide an introduction and overview of the data, methodology,

and potential uses for this flood risk assessment.

Section 3 provides the results of this analysis for individual communities within the county, with

flood risk results, community exposure to hazard, high risk flood zones, critical facilities, most vulnerable building list (Top 10), repetitive loss properties, dams and levees, undeveloped areas, reducing flood losses to existing development, paid claims and flood insurance, flood information data, and public outreach information. Commonly, users of this report are encouraged to begin with Section 1 to familiarize themselves with the data and methodology for this flood risk assessment. Experienced users with a strong background in local hazard mitigation planning and emergency preparedness may wish to skip to Section 3 of this FRR.

Section 4 of the report provides an approach for community engagement and field verification as part of the flood risk assessment.

The building level risk assessment tabular and spatial data presented in this FRR are stored in an accompanying Flood Risk Database (FRD), which can be accessed using Microsoft Excel and standard Geographic Information Systems (GIS) software. The FRD contains information about the depth of flooding and water surface elevations, flood loss, debris loss, and other estimations for individual buildings within the county. Collectively, these products can be used to improve emergency and hazard mitigation planning in the county.

Please note that these products were developed by West Virginia GIS Technical Center (WVGISTC) for the State of West Virginia and funded by FEMA through HMGP grant to the West Virginia Division of Emergency Management (WVDEM).

# EXECUTIVE SUMMARY

FEMA’s Hazard Mitigation Grant Program (HMGP) and the State Hazard Mitigation Office funded statewide building-level flood risk assessments that are being completed for a 1-percent annual chance flood (100-year) event in support of local and state hazard mitigation plans. The building-level flood risk assessments utilize FEMA’s Flood Assessment Structure Tool (FAST), a GIS-based, open-source utility designed by FEMA’s Hazus Program for estimating potential building losses from flood disasters. FAST was built from the ArcGIS Python script developed by Oregon’s Department of Geology and Mineral Industries (DOGAMI). A Hazus Level 2 advanced analysis increases the accuracy and precision of an analysis by incorporating user-supplied data relevant to the hazard. The flood model results support local hazard mitigation plans and other flood reduction efforts.

This Flood Risk Report (FRR) provides non-regulatory flood risk information to help 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.

**About Jefferson County**: Jefferson County is located in the Eastern panhandle of West Virginia. It is located in Blue Ridge and Appalachian mountains. The county has an area of 135,566 acres and a population of 55,673 according to 2017 American Community Survey (ACS) 5-year estimates. The county includes Jefferson unincorporated (CID-540065) community and five incorporated communities, namely Town of Bolivar (CID-540030), City of Charles Town (CID-540066), Town of Harpers Ferry (CID-540067), City of Ranson (CID-540068) and Town of Shepherdstown (CID-540069). There are 650 primary structures in SFHA (special flood hazard area) and 84 primary structures in High Risk Advisory flood zones. Nine repetitive loss areas have been identified in the county. These areas, along with properties with a substantial damage estimate of more than 50 percent, should be reviewed for mitigation efforts. Jefferson County is a CRS community and has a CRS rating of 6, which is the highest in West Virginia.

**Jefferson Unincorporated** has a population of 41,907 and a total community area of 125,719 acres. Dividing line date between Pre-FIRM and Post-FIRM structures is 10/15/1980. There are 485 structures in highrisk regulatory A zones with total building value exposure of $60,897,100. There are 37 structures in regulatory floodway with total building value exposure of $3,145,070. The high risk advisory zone has 44 structures, with an estimated value of $9,720,330. Potomac River has the highest number of structures (173) in flood zones, as well as the highest building value ($16,002,480) exposed in the flood zone. There are no essential facilities in the 0.2 % (500 year) annual chance flood zone, and there are 28 historical structures in SFHA.

Based on the water depth models, there are 83 structures that will be **substantially damaged** (>=50% damage). These structures can be reviewed for future mitigation efforts.

There are 529 structures in high-risk advisory zones that represent **future map conditions**. The status of these households will potentially change when FEMA performs a re-study of flood zones. 45 structures will potentially be mapped-in SFHA. These households should be encouraged to buy flood insurance so they can get preferred flood insurance rates. 233 structures can get potentially mapped-out. These structures may qualify for LOMA. Owners of these properties should be contacted to review their status and potentially apply for LOMA. For 251 structures, there will be no status change, and they will remain in SFHA after re-mapping.

There are 21 **repetitive loss structures** and 4 severe repetitive loss structures. There are eight repetitive loss areas containing 138 structures with a value of $40,443,300. Properties in these repetitive loss areas, along with structures with high substantial damage estimates in the accompanying BLRA table, should be reviewed for potential mitigation activities.

5.3% of the total community area is within the SFHA and the modified SFHA area is 6241 acres. The percentage of open space preservation (rOSP%) is 1.47 and 92 acres of parcels within the SFHA are preserved as open space (aOSP). One acre is deed-restricted in SFHA, and there are 92 acres allocated for natural functions (aNFOS). *This information is part of CRS activities 420 and 520 and can be included in the CRS review for* **potential CRS credits**.

**Town of Bolivar** has a population of 1,246 and a total community area of 278 acres. Dividing line date between Pre-FIRM and Post-FIRM structures is 12/18/2009. There are no structures in high-risk regulatory A zones and regulatory floodway. The high-risk advisory zone has 3 structures with an estimated value of $255,600. Shenandoah River has the highest number of structures (3) in flood zones, with a building value of $255,600 exposed in the flood zone . There are no essential facilities in the 0.2 % (500 year) annual chance flood zone, and there are three historical structures in SFHA.

Based on the water depth models, there is one structure that will be **substantially damaged** (>=50% damage). This structure can be reviewed for future mitigation efforts.

There are 3 structures in the high-risk advisory zone representing **future map conditions**. Status of these households will potentially change when FEMA performs a re-study of flood zones. All three structures will potentially be mapped-in SFHA. *These households should be encouraged to buy flood insurance so they can get preferred flood insurance rates*.

There are no repetitive loss structures or severe repetitive loss structures. The town also does not contain any repetitive loss areas.

4% of the total community area is within the SFHA and the modified SFHA area is 1 acre. The percentage of open space preservation (rOSP%) is zero and no parcels are preserved as open space. There are no deed-restricted acres in the SFHA, and there are zero acres allocated for natural functions (aNFOS). *This information is part of CRS activities 420 and 520 and can be included in the CRS review for* **potential CRS credits**.

**City of Charles Town** has a population of 5,766 and a total community area of 3,744 acres. Dividing line date between Pre-FIRM and Post-FIRM structures is 12/4/1979. There are 22 structures in high-risk regulatory A zones with total building value exposure of $2,768,900. There are 3 structures in regulatory floodway with total building value exposure of $153,900. The high-risk advisory zone has 4 structures with an estimated value of $423,900. Evitts Run has the highest number of structures (24) in flood zones, with a building value of $2,741,100 exposed in the flood zone. There are no essential facilities in 0.2 % (500 year) annual chance flood zone, and there are 17 historical structures in SFHA.

Based on the water depth models, there are no structures that will be **substantially damaged** (>=50% damage).

There are 29 structures in the high-risk advisory zone representing **future map conditions**. Status of these households will potentially change when FEMA performs a re-study of flood zones. Four structures will potentially be mapped-in SFHA. These households should be encouraged to buy flood insurance so they can get preferred flood insurance rates. 10 structures can get potentially mapped-out. These structures may qualify for LOMA. Owners of these properties should be contacted to review their status and potentially apply for LOMA. For 15 structures, there will be no status change, and they will remain in SFHA after re-mapping.

There are no **repetitive loss structures** or severe repetitive loss structures. There are no repetitive loss areas.

5% of the total community area is within the SFHA and the modified SFHA area is 184 acres. The percentage of open space preservation (rOSP%) is 13 and 24 acres of parcels within the SFHA are preserved as open space (aOSP). No acre is deed-restricted in SFHA, and there are 24 acres allocated for natural functions (aNFOS). *This information is part of CRS activities 420 and 520 and can be included in the CRS review for* **potential CRS credits**.

**Town of Harpers Ferry** has a population of 236 and a total community area of 400 acres. Dividing line date between Pre-FIRM and Post-FIRM structures is 8/24/1984. There is one structure in high-risk regulatory A zones with total building value exposure of $91,200 and no structure in the regulatory floodway. The high-risk advisory zone has 30 structures, with an estimated value of $6,881,599. Shenandoah River has the highest number of structures (31) in flood zones with a building value of $6,972,799 exposed in the flood zone. There are no essential facilities in the 0.2 % (500 year) annual chance flood zone, and there are 31 historical structures in SFHA.

Based on the water depth models there are 25 structures that will be **substantially damaged** (>=50% damage). These structures can be reviewed for future mitigation efforts.

There are 31 structures in high-risk advisory zones that represent **future map conditions**. Status of these households will potentially change when FEMA performs a re-study of flood zones. 30 structures will potentially be mapped-in SFHA. These households should be encouraged to buy flood insurance so they can get preferred flood insurance rates. No structures can get potentially mapped-out. For 1 structure, there will be no status change and they will remain in SFHA after re-mapping.

There are no **repetitive loss structures** and no severe repetitive loss structures. There are no repetitive loss areas

39.8% of the total community area is within the SFHA and the modified SFHA area is 24 acres. The percentage of open space preservation (rOSP%) is 4 and one acre of parcels within the SFHA is preserved as open space (aOSP). No acres are deed-restricted in SFHA and there is 1 acre allocated for natural functions (aNFOS). *This information is part of CRS activities 420 and 520 and can be included in the CRS review for* **potential CRS credits**.

**City of Ranson** has a population of 4,945 and a total community area of 5,185 acres. Dividing line date between Pre-FIRM and Post-FIRM structures is 6/15/1979. There are 77 structures in high-risk regulatory A zones with total building value exposure of $4,990,640. There are no structures in the regulatory floodway. The high-risk advisory zone has 3 structures with an estimated value of $204,600. Evitts Run Tributary 1 has the highest number of structures (78) in flood zones with a building value of $5,071,940 exposed in the flood zone. There are no essential facilities in the 0.2 % (500 year) annual chance flood zone, and there are no historical structures in SFHA.

Based on the water depth models, there are no structures that will be **substantially damaged** (>=50% damage).

There are 80 structures in high-risk advisory zones representing **future map conditions**. Status of these households will potentially change when FEMA performs a re-study of flood zones. Two structures will potentially be mapped-in SFHA. These households should be encouraged to buy flood insurance so they can get preferred flood insurance rates. 32 structures can get potentially mapped-out. These structures may qualify for LOMA. Owners of these properties should be contacted to review their status and potentially apply for LOMA. For 46 structures, there will be no status change, and they will remain in SFHA after re-mapping.

There are 2 **repetitive loss structures** and no severe repetitive loss structures. There is one repetitive loss area containing 75 structures with a value of $7,374,200. Properties in these repetitive loss areas, along with structures with high substantial damage estimates in the accompanying BLRA table, should be reviewed for potential mitigation activities.

3.4% of the total community area is within the SFHA and the modified SFHA area is 176 acres. The percentage of open space preservation (rOSP%) is 8 and 14 acres of parcels within the SFHA are preserved as open space (aOSP). No acre is deed-restricted in the SFHA and there are 14 acres allocated for natural functions (aNFOS). *This information is part of CRS activities 420 and 520 and can be included in the CRS review for* **potential CRS credits**.

**Town of Shepherdstown** has a population of 1,573 and a total community area of 240 acres. Dividing line date between Pre-FIRM and Post-FIRM structures is 3/18/1980. There are 65 structures in high-risk regulatory A zones with total building value exposure of $18,442,5900. There are no structures in the regulatory floodway. The high-risk advisory zone has 1 structure with an estimated value of $278,100. Town Run has the highest number of structures (65) in flood zones with a building value of $18,564,390 exposed in the flood zone. There are no essential facilities in the 0.2 % (500 year) annual chance flood zone, and there are 65 historical structures in SFHA.

Based on the water depth models, there is one structure that will be **substantially damaged** (>=50% damage). This structure can be reviewed for future mitigation efforts.

There are 66 structures in high-risk advisory zones representing **future map conditions**. Status of these households will potentially change when FEMA performs a re-study of flood zones. One structure will potentially be mapped-in SFHA. This household should be encouraged to buy flood insurance so they can get a preferred flood insurance rate. 4 structures can get potentially mapped-out. These structures may qualify for LOMA. Owners of these properties should be contacted to review their status and potentially apply for LOMA. For 61 structures, there will be no status change, and they will remain in SFHA after re-mapping.

There are no **repetitive loss structures** or severe repetitive loss structures. There are no repetitive loss areas.

8.8% of the total community area is within the SFHA and the modified SFHA area is 21 acres. The percentage of open space preservation (rOSP%) is zero and zero acres of parcels are preserved as open space (aOSP). No acre is deed-restricted in the SFHA and there are no acres allocated for natural functions (aNFOS). *This information is part of CRS activities 420 and 520 and can be included in the CRS review for* **potential CRS credits**.

Table of Contents

[Project Area Community List i](#_Toc51229026)

[Preface ii](#_Toc51229027)

[Guidance on Using This Report iii](#_Toc51229028)

[EXECUTIVE SUMMARY iv](#_Toc51229029)

[1 Introduction 1](#_Toc51229030)

[1.1 About Flood Risk 1](#_Toc51229031)

[1.1.1 Calculating Flood Risk 1](#_Toc51229032)

[1.1.2 Flood Risk Products 2](#_Toc51229033)

[1.2 Uses of this Report 2](#_Toc51229034)

[1.3 Sources of Flood Risk Assessment Data Used 4](#_Toc51229035)

[1.4 Related Resources 4](#_Toc51229036)

[2 Flood Risk Analysis 6](#_Toc51229037)

[2.1 Overview 6](#_Toc51229038)

[2.2 Analysis of Risk 6](#_Toc51229039)

[2.2.1 Flood Depth and Analysis Grids 7](#_Toc51229040)

[2.2.2 Building Inventory 8](#_Toc51229041)

[2.2.3 Flood Risk Assessment Products 8](#_Toc51229042)

[2.2.4 Flood Risk Assessments 12](#_Toc51229043)

[2.2.5 Areas of Mitigation Interest 13](#_Toc51229044)

[2.2.6 Flood Risk Map 20](#_Toc51229045)

[3 Jefferson County Flood Risk Analysis Result 21](#_Toc51229046)

[3.1 Overview 21](#_Toc51229047)

[3.1.1 Community’s Exposure to Hazards 22](#_Toc51229048)

[3.1.2 High Risk Flood Zones 30](#_Toc51229049)

[3.1.3 Critical Facilities 40](#_Toc51229050)

[3.1.4 Most Vulnerable Building Lists (Top 10 Lists) 41](#_Toc51229051)

[3.1.5 Repetitive Loss Properties 55](#_Toc51229052)

[3.1.6 Dams and Levees 57](#_Toc51229053)

[3.1.7 Transportation Infrastructure 58](#_Toc51229054)

[3.1.8 Undeveloped Areas 61](#_Toc51229055)

[3.1.8 Reducing Flood Losses to Existing Development 64](#_Toc51229056)

[3.1.9 Paid Claims and Flood Insurance 65](#_Toc51229057)

[3.1.10 Flood Information Data 66](#_Toc51229058)

[3.1.11 Public Outreach 69](#_Toc51229059)

[Floods 70](#_Toc51229060)

[Landslides 70](#_Toc51229061)

[3.2 Flood Risk Maps 71](#_Toc51229062)

[3.3 Flood Risk Database 71](#_Toc51229063)

[4 Community Engagement & Field Verification 72](#_Toc51229064)

[5 Actions to Reduce Flood Risk 73](#_Toc51229065)

[5.1 Types of Mitigation Actions 73](#_Toc51229066)

[5.1.1 Local Plans and Regulations 73](#_Toc51229067)

[5.1.2 Structure and Infrastructure Projects 74](#_Toc51229068)

[5.1.3 Natural Systems Protection Activities 74](#_Toc51229069)

[5.1.4 Education and Awareness Activities 74](#_Toc51229070)

[5.2 Identifying Specific Actions for Your Community 76](#_Toc51229071)

[5.3 Mitigation Programs and Assistance 77](#_Toc51229072)

[5.3.1 FEMA Mitigation Programs and Assistance 77](#_Toc51229073)

[5.3.2 Additional Mitigation Programs and Assistance 78](#_Toc51229074)

[6 Acronyms and Definitions 79](#_Toc51229075)

[6.1 Acronyms 79](#_Toc51229076)

[6.2 Definitions 82](#_Toc51229077)

[7 Additional Resources 101](#_Toc51229078)

[8 Contact Information 104](#_Toc51229079)

LIST OF TABLES

[Table 1: Jefferson County community profile. The table also summarizes exposure to hazard, including the number of buildings and total building exposure. 22](#_Toc51229080)

[Table 2: FIRM information for communities and number of structures by Pre and Post-FIRM 24](#_Toc51229081)

[Table 3: Demographic details for each community showing details about the area, income, residential housing, spending on housing, and age. 25](#_Toc51229082)

[Table 4: Percentage of Detailed and Approximate zones in Jefferson County 26](#_Toc51229083)

[Table 5: Percentage of Detailed and Approximate zones in each community 26](#_Toc51229084)

[Table 6: Acreage of different types of flood zones in each community 26](#_Toc51229085)

[Table 7: Flood related Presidential disaster declaration. Disaster declarations are at county level. 27](#_Toc51229086)

[Table 8: Details of building exposure in each community 27](#_Toc51229087)

[Table 9: Total structures and exposure in flood fringe and floodway for each community 28](#_Toc51229088)

[Table 10: Structures and exposure cost in high risk advisory zones for each community 28](#_Toc51229089)

[Table 11: Essential facilities count and exposure in each community 29](#_Toc51229090)

[Table 12: Building exposure characteristics in high risk regulatory and advisory flood zones for each community 30](#_Toc51229091)

[Table 13: Ownership and population distribution in high risk flood zones for each community 32](#_Toc51229092)

[Table 14: Building Count and Exposure cost by streams in Jefferson County Unincorporated 32](#_Toc51229093)

[Table 15: Building Count and Exposure cost by streams in Town of Bolivar 33](#_Toc51229094)

[Table 16: Building Count and Exposure cost by streams in City of Charles Town 33](#_Toc51229095)

[Table 17: Building Count and Exposure cost by streams in Town of Harpers Ferry 33](#_Toc51229096)

[Table 18: Building Count and Exposure cost by streams in City of Ranson 34](#_Toc51229097)

[Table 19: Building Count and Exposure cost by streams in Town of Shepherdstown 34](#_Toc51229098)

[Table 20: Damage estimate and building impact model summary by community 35](#_Toc51229099)

[Table 21: Displaced population and short term shelter needs for each community 37](#_Toc51229100)

[Table 22: Future Map condition for each community in Jefferson County 39](#_Toc51229101)

[Table 23: Critical facilities in each community in Jefferson County 40](#_Toc51229102)

[Table 24: Buildings with the highest exposure in Jefferson County Unincorporated 41](#_Toc51229103)

[Table 25: Buildings with the highest exposure in Town of Bolivar 41](#_Toc51229104)

[Table 26: Buildings with the highest exposure in the City of Charles Town 42](#_Toc51229105)

[Table 27: Buildings with the highest exposure in Town of Harpers Ferry 42](#_Toc51229106)

[Table 28: Buildings with the highest exposure in City of Ranson 43](#_Toc51229107)

[Table 29: Buildings with the highest exposure in Town of Shepherdstown 44](#_Toc51229108)

[Table 30: Buildings with the highest impact in Jefferson County Unincorporated 45](#_Toc51229109)

[Table 31: Buildings with the highest impact in Town of Bolivar 46](#_Toc51229110)

[Table 32: Buildings with the highest impact in the City of Charles Town 47](#_Toc51229111)

[Table 33: Buildings with the highest impact in Town of Harpers Ferry 48](#_Toc51229112)

[Table 34: Buildings with the highest impact in City of Ranson 49](#_Toc51229113)

[Table 35: Buildings with the highest impact in Town of Shepherdstown 50](#_Toc51229114)

[Table 36: New Buildings in Jefferson County Unincorporated 51](#_Toc51229115)

[Table 37: New Buildings in Town of Bolivar 51](#_Toc51229116)

[Table 38: New Buildings in City of Charles Town 52](#_Toc51229117)

[Table 39: New Buildings in Town of Harpers Ferry 52](#_Toc51229118)

[Table 40: New Buildings in City of Ranson 53](#_Toc51229119)

[Table 41: New Buildings in Town of Shepherdstown 54](#_Toc51229120)

[Table 42: RL, SRL building count and RL Areas for each community in Jefferson County 55](#_Toc51229121)

[Table 43: Repetitive loss areas in Jefferson County 56](#_Toc51229122)

[Table 44: Dam and Levee status for each community 57](#_Toc51229123)

[Table 45: Road mileage and water depth 58](#_Toc51229124)

[Table 46: Types of Road and flooded mileage 59](#_Toc51229125)

[Table 47: Railroad mileage and water depth 59](#_Toc51229126)

[Table 48: Inundated bridges 60](#_Toc51229127)

[Table 49: Transportation infrastructure in the special flood hazard area 60](#_Toc51229128)

[Table 50: Details of Open Space Preservation for each community in Jefferson County 62](#_Toc51229129)

[Table 51: Wetland, Riparian area and number of Threatened and endangered species in each community 63](#_Toc51229130)

[Table 52: Acquisition and relocation details for each community 64](#_Toc51229131)

[Table 53: Paid claims and flood insurance for each community in Jefferson County 65](#_Toc51229132)

[Table 54: Flood Height and depth grid availability for each community in Jefferson County 66](#_Toc51229133)

[Table 55: Number of verified LOMC in study area 67](#_Toc51229134)

[Table 56: Assessment of reference layers in study area 67](#_Toc51229135)

[Table 57: Base flood height, first floor elevation, lowest floor below BFE and source data limitations in the study area 68](#_Toc51229136)

[Table 58: Public outreach information for flood protection 69](#_Toc51229137)

[Table 59: Mitigation Actions for Areas of Mitigation Interest 75](#_Toc51229138)

[Table 61: FEMA Hazard Mitigation Assistance Program 77](#_Toc51229139)

FLOOD RISK REPORT

# 1 Introduction

Flooding is a natural part of our world and our communities. Flooding becomes a significant hazard, however, when it intersects with the built environment.



## 1.1 About Flood Risk

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

***Which picture below shows more flood risk?***

*Even if you assume that the flood in both pictures was the same probability- let’s say a 10%-percent- annual-chance flood -- the consequences in terms of property damage and potential injury as a result of the flood in the bottom picture are much more severe. Therefore the flood risk in the area shown on the bottom picture is higher.*

***Which picture below shows more flood risk?***

*Even if you assume that the flood in both pictures was the same probability- let’s say a 10%-percent- annual-chance flood -- the consequences in terms of property damage and potential injury as a result of the flood in the bottom picture are much more severe. Therefore the flood risk in the area shown on the bottom picture is higher.*

### 1.1.1 Calculating Flood Risk

It is not enough to simply identify where flooding may occur. Just because one knows where a flood occurs does not mean they know the **risk** of flooding. The most common method for determining flood risk, also referred to as vulnerability, is to identify the probability of flooding and the consequences of flooding. In other words:

**Which picture below shows**

**more flood risk?**

Even if you assume that the flood in both pictures was the same probability—let’s say a 10-percent-annual-chance flood—the consequences in terms of property damage and potential injury as a result of the flood in the bottom picture are much more severe. Therefore, the flood risk in the area shown in the bottom picture is higher.



**Flood Risk = Probability x Consequences**; where

**Probability** = the likelihood of occurrence

**Consequences** = the estimated impacts associated with the occurrence

**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 human activities within an area and how a flood impacts the natural and built environments.

### 1.1.2 Flood Risk Products

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, has a 1% chance of being equaled or exceeded in any given year. FEMA understands that flood risk is dynamic—that flooding does not stop at a line on a map. This flood risk project provides the following flood products:

**Flood Risk Report (FRR)**: The FRR presents key risk analysis data for the Flood Risk Project.



Whether or not an area might flood is one consideration. The extent to which it might flood adds a necessary dimension to that understanding**.**

**Flood Risk Map (FRM)**: Like the example found in Section 3.2 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 contains building-level risk assessment and is in Microsoft Excel and Geographic Information System (GIS) format. The FRD houses 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 in various ways to visualize and communicate flood risk within the county.

These Flood Risk Products provide flood risk information at flood risk county level, community level (for those portions of each community within the Flood Risk Project), and building level. They demonstrate how decisions made within a flood risk project can impact properties downstream, upstream, or both. Community-level information is particularly useful for mitigation planning and emergency management activities, which often occur at a local jurisdiction level.

## 1.2 Uses of this Report

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



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 awareness organizations, etc.)

State and local 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 Disaster Mitigation 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.

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](http://www.planning.org) or http://www.fema.gov/library.

**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.

**Develop hazard mitigation projects.** Local officials (e.g., planners and public works 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 flood water runoff because paved surfaces cannot absorb water, indicating a need to adopt or revise standards that provide for appropriate stormwater retention.

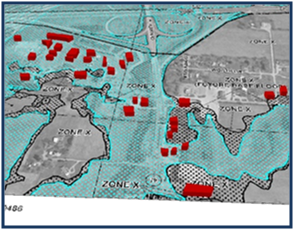
**Assess potential CRS credits.** Floodplain managers, planners, and public works officials can use information in this report to access potential CRS credits. This information can then be further used to assess participation in the CRS program or add additional CRS cedit points if it is already a CRS community.

The Flood Risk Database, Flood Risk Map, and Flood Risk Report are “non-regulatory” flood risk 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 enabling authorities.

## 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



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.



For this Flood Risk Project, we have used the following sources of flood risk information to develop this report:

* FAST-estimated flood loss information
* Building inventory
* Parcel Assessment (2019)
* Flood zones (SFHA, Advisory A, Updated AE)
* Imagery
* Sources identified during the analysis process

## 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 those listed below.

**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).

**FAST Flood Loss Estimation Reports.** The FAST tool can be used to generate a table on potential flood damage that can occur based on new/proposed mitigation projects or future development patterns and practices. Instead of the FAST tool, 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.

**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.

**WV Flood Tool.** The West Virginia Flood Tool ([www.mapwv.gov/flood](http://www.mapwv.gov/flood) ) is an interactive web map application developed by the West Virginia GIS Technical Center (WVGISTC) with funding from the West Virginia Division of Emergency Management (DHSEM), and the Federal Emergency Management Agency (FEMA). This application depicts 1-percent annual chance floodplain boundaries in an online map environment. Map features are connected to geospatial databases that may be queried by users in order to obtain pertinent information that may otherwise be difficult to obtain or relate to specific geographic locations. West Virginia Flood Tool has information regarding flood risk and assessment. Flood risk data can be viewed on the flood risk tab.

# 2 Flood Risk Analysis

## 2.1 Overview

Flood hazard identification uses FIRMs, and FIS Reports identify where flooding can occur along with the probability and depth of that flooding. Flood risk assessment is a 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:



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

* 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

Flood risk analyses are different methods used in flood risk assessment to help quantify and communicate flood risk. Flood risk analysis can be performed on a large scale (state, community) level and on a very small scale (parcel, census block). The advantages of large-scale flood risk analysis include identifying how actions and development in one community can affect areas up- 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

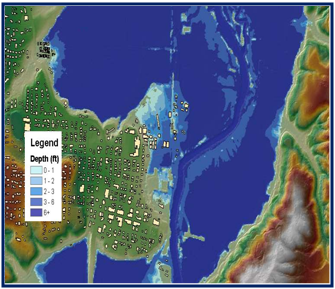
State and Local Hazard Mitigation Plans are required to have a comprehensive all-hazard risk assessment. The flood risk analyses in the FRR, FRM, and FRD can inform the flood hazard portion of a community’s or state’s risk assessment. Further, data in the FRD can be used to develop information that meets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

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. Flood Risk Project for Jefferson county includes the following elements:

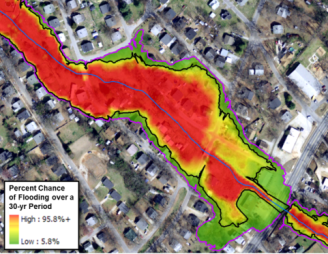
* Flood Depth and Analysis Grids
* Flood Risk Assessments
* Building Inventory
* Flood Risk Assessment Products
* Areas of Mitigation Interest

### 2.2.1 Flood Depth and Analysis Grids

Grids are datasets provided in the FRD to better describe the risk of the flood hazard. Much like the pixels in a photo or graphic, a grid is made up of square cells, where each grid cell stores a value representing a particular flood characteristic (elevation, depth, velocity, etc.) While the FIRM and FIS Report describe “what” is at risk by identifying the hazard areas, water surface, flood depth, and other analysis grids can help define “how bad” 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 and Analysis Grids provide an alternative way to visualize how a particular flood characteristic (depth, velocity, etc.) varies within the floodplain. Since they are mostly derived from the engineering modeling results, they are typically associated with a particular frequency-based flooding event (e.g., 1-percent-annual-chance event). Grids provided in the FRD for this project area include the following:



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. The bottom image is a percent annual chance of flooding grid, which shows inundation areas of various frequency floods.



* **Water Surface Elevation Grid:** This dataset represents the flood elevation calculated for a 1-percent-annual-chance event modeled flood frequency.
* **Flood Depth Grid:** The Water Depth Grid communicates information about the flood depth for a 1-percent (100-year) annual chance flood. Flood Depth Grids illustrate the flood depth, in feet above the ground surface, to demonstrate the variability of flood depths in flood-prone areas. Officials can use depth grids to help individuals visualize the depth of flooding their home might experience; an easier concept than understanding a base flood elevation. The depth grid, combined with an inventory of the built environment, is used by the FAST Flood Model to determine flood loss potential, by applying the appropriate depth-damage curves. For the Flood Model Analysis, Model-Backed Depth Grids created from engineering software like HEC-RAS are preferred over updated AE and the less-accurate Hazus Depth Grids. In the WV Flood Tool, the Water Depth is displayed in the (1) Flood Results Query Panel, (2) Flood Risk Layers Menu, and (3) 3D Flood Visualization.

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 form the basis for flood risk and are used to calculate potential flood losses for display on the FRM and for tabular presentation in this report. Depth grids may also be used for a variety of ad-hoc risk visualization and mitigation initiatives.

### 2.2.2 Building Inventory

Detailed building inventories have been developed by pinpointing all primary structures in the Special Flood Hazard Area or 100-year floodplain. Historical and community assets (government buildings, churches) are also inventoried. Essential facilities are inventoried to the 0.2-percent (500-year) annual chance flood event. Required building characteristics are Occupancy Class, Foundation Type, First Floor Height, Number of Stories, Area, and Replacement Cost. Default values are populated from the most current State Parcel Assessment Database, which is updated annually, and then where necessary, modified with user-defined values that override the Assessment Database values. User-defined values can be entered for the building address, parcel geometry and assessment identifiers, essential building characteristics, and base flood water depth. Building pictures can be linked to the risk assessment using the unique building identifier.

GIS Specialists use desktop mapping software to pinpoint the building location to the most restrictive flood zone, identify insurable primary structures, match building points to the correct building assessment records, complete missing building attributes, and modify default assessment building values with user-supplied values. The following GIS Reference Layers are used to improve the location accuracy and building attributes: E-911 Addresses, Parcels/Attributes, Aerial Imagery, Building Footprints, Street View Pictures, Elevation Certificates, and other building reference databases. All the building points in the Special Flood Hazard Area and High-risk Advisory Zones are manually captured, processed, and then quality checked using nine square mile grids. Data error flags are recorded for missing assessment values, parcel misalignments, missing E-911 address numbers, etc. User-supplied values that override the default assessment values are recorded as red text in the building inventory tables. A unique building identifier is formed from concatenating the Parcel ID and Building Address Number***.***

### 2.2.3 Flood Risk Assessment Products

Flood Risk Products are presented at the building and community levels for each county. Primary products include a Flood Risk Report, Flood Risk Map, Flood Risk Database, Flood Risk Tables, Flood Risk Grids (Water Depth, Water Surface Elevation), Flood Zone Changes resulting from active or future flood map studies, and Building-Level Flood Risk Assessments. Building Exposure information like structure values, occupancy type, owner occupancy, and household population are tabulated per structure. The FAST (Hazus) Flood Model calculates per structure Building Damage Loss Estimates, Debris Removal, and Restoration Time for a 1-percent annual chance flood event. The Population Displacement is computed per residential structure from the building inventory and census average household size, which provides inputs for Short-Term Shelter Models. Other data layers and products which support floodplain management and risk assessments include dams, levees, landslides, high-water marks, LOMA verified points, elevation certificates, assessment reports, CRS program variables, and 3D flood visualizations. Building Flood Risk Products are viewable in both tabular or graphical formats. Building-level risk assessments are aggregated to the community-level, which in turn can be summarized at the regional and state levels. Risk assessment reports can also be generated at the stream and watershed levels.

Although the Flood Risk Reports and data are organized primarily at the community and building levels, users can access the detailed risk assessments of each structure by viewing the Flood Risk Tables or WV Flood Tool. Mitigation layers (e.g., buyout properties, open space preservation) provide information for communities to identify flood reduction activities. FEMA’s Community Engagement Prioritization Tool (CEP-Tool) will be used to rank communities by risk indicators and prioritize for engagement.

#### Community Exposure and Risk

There are 287 communities (232 municipalities and 55 unincorporated counties), 11 planning regions, and 55 counties in the project area. The data variables below identify flood exposure to communities and have been calculated in for this study.

* Demographic / Social Vulnerability
  + Population Growth
  + Population in SFHA
  + Social Vulnerability (SOVI)
  + Ownership
  + Income
  + Age
* Land Use / Impervious Surfaces
* Historical Flooding
  + Presidential-Declared Disasters
  + Date of Last Disaster
  + High Water Marks
* Insurance Claims
* Insurance Policies
* Flood Zones
  + Stream Miles
  + Regulatory Floodway
  + High-risk Advisory Zones (Advisory A, Updated AE, Preliminary NFHL)
  + Area in SFHA (aSFHA)
* Structures Summary
  + Buildings in SFHA (counts, values, occupancy class, etc.)
  + Facilities (Essential, Community, Government)
  + Historical
  + Repetitive Loss Structures
  + Dams and Levees
  + Transportation Infrastructure (Roads / Bridges)
* Flood Risk Assessment Summary
  + Building Damage
  + Debris Removal
  + Population Displaced
    - Short-Term Sheltering
    - Companion Pets

#### Building-Level Exposure

The data variables below identify flood exposure to buildings and communities:

Flood Zones

* Regulatory / Non-Regulatory / Floodway
* High risk Advisory Zones / Future Map Conditions
  + Mapped-In SFHA
  + Mapped-Out SFHA
  + No Change SFHA
  + Floodway
* LOMA (Positional Accuracy Verified)
  + Structure Removal
  + Structure Non-Removal
  + Structure Out as Shown
* Flooding Source by Stream Name / Watershed
* Population in SFHA

Water Depth

* Water Depth
* Water Depth-in-Structure
* Water Surface Elevation

Structures

* Building Exposure
* Building Exposure Cost
* Building Occupancy Class (Residential/Commercial/Other)
* Building Owner Occupied / Rental
* Basement / Foundation Type
* First-Floor Height / Lowest Floor
* Building Year / Construction / New Development (Pre-FRIM, Post-FIRM)
* Essential Facilities / Community Assets
* Historical Structure
* Riparian Zone Structure

#### Building-Level Flood Risk Assessment

Site-specific flood assessments are conducted for a 1-percent annual chance flood (100-year flood) event. FEMA’s OpenHazus FAST (Flood Assessment Structure Tool) is employed for the Flood Analysis Model.

* Building Damage Percent (Hazus)
* Building Damage Loss U.S. Dollars (Hazus)
* Content and Inventory Loss (Hazus)
* Debris Removal (Hazus)
* Restoration Time (Hazus)
* Population Displacement

#### Potential CRS Credits for Community

The National Flood Insurance Program Community Rating System (CRS), published by FEMA in 2017, is intended to reward communities for flood mitigation activities that are beyond the minimum national requirements regulating the construction of new buildings. A study has been conducted to assess potential CRS credits for each community. This information can be used by communities as a starting point to assess potential CRS credits. Some of the prerequisites to participate in CRS include:

* In the regular phase of NFIP ≥ 1 year
* In full compliance with NFIP minimum criteria
* Agree to maintain Elevation certificates
* Assess and address repetitive loss properties
* Maintain all flood insurance policies required for community-owned buildings

The following table shows the basic scenario for all communities

|  |  |  |  |
| --- | --- | --- | --- |
| **CRS Series** | **CRS Activity** | **CRS Element** | **CRS Credit** |
| Public Information Activities | 310 | Elevation Certificates | 38 |
| Public Information Activities | 320 | Map Information Services | 90 |
| Mapping and Regulations | 430 | Freeboard 2 Ft. (Higher Regulatory Standards) | 225 |
| Mapping and Regulations | 440 | Additional Map Data (Flood Data Maintenance) | 154 |
| Flood Damage Reduction Activities | 510 | Floodplain Management Planning (Hazard Mitigation Plan) | 100 |
|  |  | *Basic Scenario Points* | *607* |

The following table shows potential additional CRS points

|  |  |  |  |
| --- | --- | --- | --- |
| **CRS Series** | **CRS Activity** | **CRS Element** | **CRS Credit Points** |
| Public Information Activities | 350 | Flood Protection Information on Website | 77 |
| Mapping and Regulations | 410 | Advisory BFE (New Study) | 130 |
| Mapping and Regulations | 420 | Open Space Preservation | 1,950 |
| Flood Damage Reduction Activities | 520 | Acquisition & Relocation of Buildings | 2,250 |
| Warning and Response | 630 | High Hazard Dams | 160 |
|  |  | *Potential Maximum Points* | *4,567* |

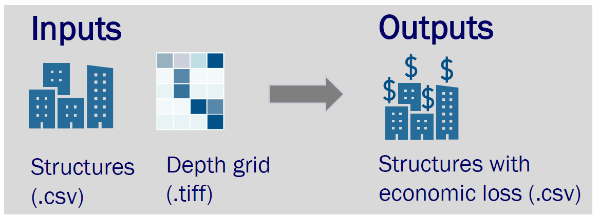
Some benefits of participating in CRS include the following:

* Reduced flood insurance rates for residents
* CRS activities provide:
  + enhanced public safety
  + a reduction in damage to property and public infrastructure
  + avoidance of economic disruption and losses
  + reduction of human suffering
  + protection of the environment.
* Can evaluate the effectiveness of its flood program against a nationally recognized benchmark
* Technical assistance in designing and implementing some activities is available through CRS at no charge
* A community’s flood program benefits from having an added incentive to maintain its flood programs over the years. The elimination of a flood-related activity or a weakening of the regulatory requirements for new development could affect a community’s CRS status
* The implementation of some CRS activities can help a community qualify for certain federal assistance programs

CRS credits that have been calculated as part of this study are discussed in Section 3.

### 2.2.4 Flood Risk Assessments

The building-level flood risk assessments utilize FEMA’s Flood Assessment Structure Tool (FAST), a GIS-based, open-source utility designed by FEMA’s Hazus Program for estimating potential building losses from flood disasters. FAST was built from the ArcGIS Python script developed by Oregon’s Department of Geology and Mineral Industries (DOGAMI). A Hazus Level 2 advanced analysis increases the accuracy and precision of an analysis by incorporating user-supplied data relevant to the hazard. The flood model results support local hazard mitigation plans and other flood reduction efforts.

The Hazus utility employs a standardized methodology in which building and water depth inputs utilize Depth Damage Functions (DDFs) to calculate economic damage loss estimates. The proper Depth Damage Function (DDF) is assigned based on the Occupancy Type, Foundation Type, and Number of Stories of each structure. The First Floor Height for each structure point is subtracted from the Water Depth to calculate the Depth-in-Structure flood depth, in feet above ground level.

The FAST performs a Hazus Flood Model analysis, using the most accurate 100-year depth grid available. It generates damage loss estimates for building, content, and inventory, building debris, and building repair/replacement times. Population displacement estimates are computed from the Residential Occupancy Types and census average household size. All building-level risk assessments are output to tabular reports, geodatabase, and the RiskMAP View of the WV Flood Tool.

The Hazus Program designed FAST to make flood risk assessments quicker, simpler, and more cost-effective. FAST provides planners, analysts, and policymakers with a free and user-friendly tool to characterize flood risk in their communities using completely open methods and technology.

Some benefits of using FAST include the following:

* 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) of lifelines such as highway and rail bridges, potable water, and wastewater facilities

### 2.2.5 Areas of Mitigation Interest

Many factors contribute to flooding and flood losses. Some are natural, and some are not. In response to these risks, there has been a focus by the Federal government, State agencies, and local jurisdictions to mitigate properties against the impacts of flood hazards so that future losses and impacts can be reduced. An area identified as an Area of Mitigation Interest (AoMI) is an important element of defining a more comprehensive picture of flood risk and mitigation activity in a watershed, identifying target areas and potential projects for flood hazard mitigation, encouraging local collaboration, and communicating how various mitigation activities can successfully reduce flood risk.

AoMIs are identified through coordination with local stakeholders; through revised hydrologic and hydraulic analyses; by leveraging other studies or previous flood studies; from community mitigation plans, floodplain management plans, and local surveys; and from the mining of federal government databases (e.g., flood claims, disaster grants, and data from other agencies). ***This study identifies repetitive loss areas as well as primary structures that have the potential to sustain substantial damage during a 1-percent annual chance flood. Both of these should be taken into account by communities to identify final Areas of Mitigation Interest.*** Below is a list of the types of Areas of Mitigation Interest that may be identified:

#### Dams

A dam is a barrier built across a waterway for impounding water. Dams vary from impoundments that are hundreds of feet tall and contain thousands of acre-feet of water (e.g., Hoover Dam) to small dams that are a few feet high and contain only a few acre-feet of water (e.g., small residential pond). “Dry dams,” which are designed to contain water only during floods and do not impound water except for the purposes of flood control, include otherwise dry land behind the dam.



Dams vary in size and shape, the amount of water they impound, and their assigned hazard classification.

While most modern, large dams are highly engineered structures with components such as impervious cores and emergency spillways, most smaller and older dams are not. State dam safety programs emerged in the 1960s, and the first Federal Guidelines for Dam Safety were not prepared until 1979. By this time, the vast majority of dams in the United States had already been constructed.

##### Reasons dams are considered AoMIs:

Many older dams were not built to any particular standard and thus may not withstand extreme rainfall events. Older dams in some parts of the country are made out of an assortment of materials. These structures may not have any capacity to release water and could be overtopped, which could result in catastrophic failure.

Dams may not always be regulated, given that the downstream risk may have changed since the dam was constructed or since the hazard classification was determined. Years after a dam is built, a house, subdivision, or other development may be constructed in the dam failure inundation zone downstream of the dam. Thus, a subsequent dam failure could result in downstream consequences, including property damage and the potential loss of life. Since these dams are not regulated, it is impossible to predict how safe they are.



This dam failure caused flooding that damaged several homes and vehicles.

A significant dam failure risk is structural deficiencies associated with older dams that are not being adequately addressed today through needed inspection/maintenance practices.

For larger dams, a flood easement may have been obtained on a property upstream or downstream of the dam. However, there may have been buildings constructed in violation of the flood easement.

When a new dam is constructed, the placement of such a large volume of material in a floodplain area (if that is the dam location) will displace flood waters and can alter how the watercourse flows. This can result in flooding upstream, downstream or both.

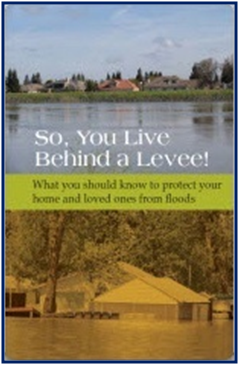
For many dams, the dam failure inundation zone is not known. Not having knowledge of these risk areas could lead to unprotected development in these zones.

#### Levees

FEMA defines a levee as “a man-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.” Levees are sometimes referred to as dikes. The soil used to construct a levee is compacted to make the levee as strong and stable as possible. Levees can be covered with everything from grass and gravel to harder surfaces like stone (riprap), asphalt, or concrete to protect against erosion and scouring.

Similar to dams, levees have not been regulated in terms of safety and design standards until relatively recently. Many older levees were constructed in a variety of ways, from a farmer piling dirt along a stream to prevent nuisance flooding to levees made out of old mining spoil material. As engineered structures, levees are designed to a certain height and can fail if a flood event is greater than anticipated.

A floodwall is a vertical wall that is built to reduce the flood hazard in a similar manner as a levee. Typically made of concrete or steel, floodwalls often are erected in urban locations where there is not enough room for a levee. Floodwalls are sometimes constructed on a levee crown to increase its height.



For more information about the risks associated with living behind levees, consult the publication “So, You Live Behind a Levee!” published by the American Society of Civil Engineers at http://content.asce.org/ASCELeveeGuide.html

Most new dams and levees are engineered to a certain design standard. If that design is exceeded, they could be overtopped and fail catastrophically, causing more damage than if the levee was not there in the first place. Few levees anywhere in the nation are built to more than a 1-percent-annual-chance flood, and the areas behind them are still at some risk for flooding. In some states, the flooding threat can extend up to 15 miles from a riverbank. Although the probability of flooding may be lower because a levee exists, the risk is nonetheless still present. The American Society of Civil Engineers’ publication “So, You Live Behind a Levee!” provides an in-depth explanation of levees and residual risk.

##### Reasons levees are considered AoMIs:

Like dams, many levees in the United States were constructed using unknown techniques and materials. These levees have a higher failure rate than those that have been designed to today’s standards.



Canal levee breaches as a result of Hurricane Katrina in New Orleans in 2005. Note damages can be more extensive due to high velocity flood flows than if the levee was not there.

A levee might not provide the flood risk reduction it once did as a result of flood risk changes over time. Flood risk can change due to a number of factors, including increased flood levels due to climate change or better estimates of flooding, development in the watershed increasing flood levels and settlement of the levee or floodwall, and sedimentation in the leveed channel. Increased flood levels reduce the effectiveness of levees. The lack of adequate maintenance over time will also reduce the capability of a levee to contain the flood levels for which it was originally designed.

Given enough time, any levee will eventually be overtopped or damaged by a flood that exceeds the levee’s capacity. Still, a widespread public perception of levees is that they will always provide protection. This perception may lead to not taking mitigation actions such as purchasing flood insurance.

A levee is a system that can fail due to its weakest point, and therefore maintenance is critical. Many levees in the United States are poorly maintained or not maintained at all. Maintenance also includes maintaining the drainage systems behind the levees so they can keep the protected area dry.

#### Stream Flow Constrictions

A stream flow constriction occurs when a human-made structure, such as a culvert or bridge, constricts the flow of a river or stream. Constriction can cause increased damage to the man-made structure, an increase in velocity of flow through the structure, and the creation of significant ponding or backwater upstream of the structure. Regulatory standards regarding the proper opening size for a structure spanning a river or stream are not consistent and may be non-existent. Some local regulations require structures to pass a volume of water that corresponds to a certain size rain event; however, if under-sized, these openings can result in flood damage to the structure itself. After a large flood event, it is not uncommon to have numerous bridges and culverts “washed out.”

##### Reasons stream flow constrictions are considered AoMIs:

Stream flow constrictions can back water up on property located upstream of the structure if not designed properly. These structures can also accelerate the flow of water, causing downstream erosion if not properly mitigated. This erosion can affect the structure itself, causing undermining and failure. If the constriction is a bridge or culvert, it can get washed out, causing an area to become isolated and potentially more difficult to evacuate. Washed-out culverts and associated debris can wash downstream and cause additional constrictions.

#### 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 contaminants escape and flow into the flood waters, 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 afterward as well.

##### Reasons at-risk essential facilities are considered AoMIs:

Costly and specialized equipment may be damaged and need to be replaced.

Impairments to facilities such as fire stations may result in lengthy delays in emergency response and a focus on evacuating the facility itself. Critical records and information stored at these facilities may be lost.

#### Past Flood Insurance Claims and Individual Assistance/Public Assistance Hotspots

Assistance provided after flood events (flood insurance in any event and Individual Assistance [IA] or Public Assistance [PA] after declared disasters) occurs in flood-affected areas. Understanding geographically where this assistance is being provided may indicate unique flood problems.



Clusters of past flood insurance claims can show where there is a repetitive flood problem.

Flood insurance claims are not always equally distributed in a community. Although estimates indicate that only 20 to 50 percent of structures in identified flood hazard areas have flood insurance, clusters of past claims and/or areas where there are high payments under FEMA’s IA or PA Programs may indicate areas of significant flood hazard.

##### Reasons past claim hotspots are considered AoMIs:

A past claim hotspot may reflect an area of recent construction (large numbers of flood insurance policies as a result of a large number of mortgages) and an area where the as-built construction is not in accordance with local floodplain management regulations.

Sometimes clusters of past claims occur in subdivisions that were constructed before flood protection standards were in place, places with inadequate stormwater management systems, or in areas that may not have been identified as SFHAs.

Clusters of IA or PA claims may indicate areas where high flood insurance coverage or other mitigation actions are needed.

#### Areas of Significant Land Use Change

Development, whether it is a 100-lot subdivision or a single lot big-box commercial outlet, can result in large amounts of fill and other material being deposited in flood storage areas, thereby increasing flood hazards downstream.

Additionally, when development occurs, hard surfaces such as parking lots, buildings, and driveways do not allow water to absorb into the ground and more of the rainwater becomes runoff flowing directly into streams. As a result, the “peak flow” in a stream after a storm event will be higher and will occur faster. Without careful planning, major land-use changes can affect the impervious area of a site and result in a significant increase in flood risk caused by streams that cannot handle the extra stormwater runoff.

##### Reasons Areas of Significant Land Use Change are considered AoMIs:

Development in areas mapped as SFHA reduces the amount of flood storage area, which can make flooding worse at the development site and downstream of it.



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

Impervious surfaces speed up the water flowing in the streams, which can increase erosion and the danger that fast-flowing flood waters pose to people and buildings.

Open areas can allow wave energy to increase while densely developed areas and 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



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

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.

##### Reasons overtopped roads are considered AoMIs:

Such areas, when identified, can be accounted for and incorporated into Emergency Action Plans.

Roads may be elevated or reinforced to reduce the risk of overtopping during flood events.

#### Drainage or Stormwater-Based Flood Hazard Areas, or Areas Not Identified as Floodprone on the FIRM But Known to Be Inundated

Flood hazard areas exist everywhere. While FEMA maps many of these, others are not identified. Many of these areas may be located in communities with existing, older, and often inadequate stormwater management systems or in very rural areas. Other similar areas could be a result of complex or unique drainage characteristics. Even though they are not mapped, awareness of these areas is important, so adequate planning and mitigation actions can be performed.

##### Reasons drainage or stormwater-based flood hazard areas or unidentified flood-prone locations are considered AoMIs:

So further investigation of such areas can occur and, based on scientific data, appropriate mitigation actions can be taken (i.e., land use and building standards).

To create viable mitigation project applications in order to reduce flood losses.

#### Areas of Mitigation Success

Flood mitigation projects are powerful tools to communicate the concepts of hazard mitigation and create more resilient communities. Multiple agencies have undertaken flood hazard mitigation actions for decades. Both structural measures (those that result in flood control structures) and non-structural measures have been implemented in thousands of communities. An extensive list of mitigation actions can be found in Section 4.

##### Reasons areas of mitigation success are considered AoMIs:

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 Riverine Erosion

Stream channels are shaped by a number of factors, including degradation, aggradation, general scour, local scour, deposition, and lateral migration. Streams are constantly progressing towards a state of dynamic equilibrium involving water and sediment.

##### Reasons why areas of significant riverine erosion are considered AoMIs:

Riverine flood damage assessments generally consider inundation alone.

Bank erosion caused by within channel flows is not recognized as a significant hazard in Federal floodplain management regulations.

Riverine erosion can undercut structures and roads, causing instability and possible collapse.

Landslides and mudslides are a result of erosion.

Approximately one-third of the nation’s streams experience severe erosion problems ([National Research Council, 1999](https://www.nap.edu/read/6385/chapter/1#iv)).

#### Other

Other types of flood risk areas include drainage or stormwater-based flood hazard areas, or areas known to be inundated during storm events. In addition to the above discussed AOMI’s, this risk study includes lists of the most vulnerable buildings (Top 10 structures) grouped by high building exposure in the floodplain, building impact FAST flood loss model, new development in the floodplain, and critical facilities. These tables are discussed in Section 3. Structures at risk of substantial damage mentioned in the tables can be used to identify high-risk areas for floodplain managers and planners.

### 2.2.6 Flood Risk Map

The Flood Risk Maps for this Flood Risk Project are available in Appendix A

# 3 Jefferson County Flood Risk Analysis Result

The following sub-sections provide summary flood risk results for Jefferson County.

## 3.1 Overview

*Jefferson County* is located in the easternmost part of the Eastern panhandle of West Virginia. The Potomac River and Washington County, MD border the county on the north, the Potomac and Shenandoah Rivers and Loudoun County, VA on the east, Clarke County, VA on the south, and Opequon Creek and Berkeley County, WV on the west. It includes unincorporated Jefferson County and incorporated areas of Town of Bolivar, City of Charles Town, Town of Harpers Ferry, City of Ranson, and Town of Shepherdstown. *The Town of Bolivar* is the smallest incorporated community in Jefferson County. It is surrounded by Town of Harpers Ferry on the east side and unincorporated areas of the county on all other sides. *The Town of Charles Town* is located in the center of Jefferson County and is the county seat. It is surrounded by the City of Ranson in the north and by unincorporated portions of the county on all other sides. *The Town of Harpers Ferry*, a historic town, is located in floodplains of the Potomac and Shenandoah rivers. The town is surrounded by Harpers Ferry National Historical Park. *The City of Ranson* is surrounded by the Town of Charles Town on the south side and unincorporated areas of the county on all other sides. It is drained by two major drainages, Evitts Run and Flowing Spring Run, that drain into the Shenandoah River. *The Town of Shepherdstown* is surrounded by unincorporated areas of the county on all sides except the Potomac River in the north. Town Run and Potomac River flood plains affect the town.

Jefferson County is contained within HUC 8 watersheds of Shenandoah (2070007) and Conococheague-Opequon (2070004). The following subsections discuss the flood risk study results for each community within Jefferson County. All of the areas participate in CRS with a rating of 6.

### 3.1.1 Community’s Exposure to Hazards

The following table summarizes community profiles for each community in Jefferson County.

#### Community Profile

Table : Jefferson County community profile. The table also summarizes exposure to hazard, including the number of buildings and total building exposure.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson unincorporated** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **County** | Jefferson | Jefferson | Jefferson | Jefferson | Jefferson | Jefferson |
| **Incorporated / Unincorporated** | Unincorporated | Incorporated | Incorporated | Incorporated | Incorporated | Incorporated |
| **WV RPDC Region** | 9 | 9 | 9 | 9 | 9 | 9 |
| **Freeboard Amount** | 3 feet | 3 feet | 3 feet | 3 feet | 3 feet | 3 feet |
| **Building Code Standard** | - | - | - | - | - | - |
| **Community Rating System Class** | 6 | 6 | 6 | 6 | 6 | 6 |
| **Total Population** | 41,907 | 1,246 | 5,766 | 236 | 4,945 | 1,573 |
| **Total Community Area (acres)** | 125,719 | 278 | 3,744 | 400 | 5,185 | 240 |
| **Area of SFHA (aSFHA); NSFHA community** | 6,696 | 11 | 187 | 159 | 178 | 21 |
| **Buildings in SFHA (bSF)** | 485 | 0 | 22 | 1 | 77 | 65 |
| **Building in High Risk Advisory Zones** | 44 | 3 | 4 | 30 | 3 | 1 |
| **Essential Facilities (high and moderate risk zones)** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Building Exposure in Dollars ($) in High Risk Flood Zones** | $70,617,430 | $255,600 | $3,192,800 | $6,972,799 | $5,195,240 | $18,720,690 |
| **NFIP Status (Participating/Not Participating/No Status)** | Participating | Participating | Participating | Participating | Participating | Participating |

**Jefferson County** unincorporated has a population of 41,907. It has a total community area of 125,719 acres with 6,696 acres within SFHA (special flood hazard area). It has 3 feet of freeboard. There are 485 buildings in SFHA and 43 in high risk advisory areas. There are no essential facilities in SFHA or high and moderate risk advisory flood areas. Total building exposure in SFHA is $70,617,430.

**Town of Bolivar** incorporated has a population of 1,246. It has a total community area of 278 acres with 11 acres within SFHA (special flood hazard area). It has 3 feet of freeboard. There are zero buildings in SFHA and 3 in high risk advisory areas. There are no essential facilities in SFHA or high and moderate risk advisory flood areas. Total building exposure in SFHA is $255,600.

**City of Charles Town** incorporated has a population of 5,766. It has a total community area of 3,744 acres with 199 acres within SFHA (special flood hazard area). It has 3 feet of freeboard. There are 22 buildings in SFHA and 4 in high risk advisory areas. There are no essential facilities in SFHA or high and moderate risk advisory flood areas. Total building exposure in SFHA is $3,192,800.

**Town of Harpers Ferry** incorporated has a population of 236. It has a total community area of 400 acres with 159 acres within SFHA (special flood hazard area). It has 3 feet of freeboard. There is 1 building in SFHA and 30 in high risk advisory areas. There are no essential facilities in SFHA or high and moderate risk advisory flood areas. Total building exposure in SFHA is $6,972,799.

**City of Ranson** incorporated has a population of 4,945. It has a total community area of 5,185 acres with 179 acres within SFHA (special flood hazard area). It has 3 feet of freeboard. There are 77 buildings in SFHA and 3 in high risk advisory areas. There are no essential facilities in SFHA or high and moderate risk advisory flood areas. Total building exposure in SFHA is $5,195,240.

**Town of Shephardstown** incorporated has a population of 1,573. It has a total community area of 240 acres with 21 acres within SFHA (special flood hazard area). It has 3 feet of freeboard. There are 65 buildings in SFHA and 1 in high risk advisory areas. There are no essential facilities in SFHA or high and moderate risk advisory flood areas. Total building exposure in SFHA is $18,720,690.

#### FIRM Dates and Maps

Table 2 shows information about Flood Insurance Rate Maps (FIRM) for each community in the study area. The date of the first FIRM represents the community’s first Flood Insurance Rate Map and it is important because it represents the dividing line between two building categories called Pre-FIRM and Post-FIRM. Structures constructed after the FIRM date are considered Post-FIRM structures. A Pre-FIRM building is a building for which construction or substantial improvement occurred on or before December 31, 1974, or before the effective date of an initial Flood Insurance Rate Map (FIRM). A Post-FIRM building is a building for which construction or substantial improvement occurred after December 31, 1974, or on, or after the effective date of an initial Flood Insurance Rate Map (FIRM), whichever is later.

Table : FIRM information for communities and number of structures by Pre and Post-FIRM

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Date of first FIRM** | **Dividing Line Date between the Pre-FIRM and Post-FIRM** | **Date of Current FIRM Map** | **Number of structures in High risk Flood Zones are Pre-FIRM** | **Number of structures in High risk Flood Zones are Post-Firm** | **Number of structures in High risk Flood Zones are Unknown** |
| **540065** | **Jefferson Unicorporated** | 10/15/1980 | 10/15/1980 | 12/18/2009 | 298 | 176 | 55 |
| **540030** | **Town Of Bolivar** | 12/18/2009 | 12/18/2009 | 12/18/09(M) | 3 | 0 | 0 |
| **540066** | **City Of Charles Town** | 12/4/1979 | 12/4/1979 | 12/18/2009 | 20 | 6 | 0 |
| **540067** | **Town Of Harpers Ferry** | 8/24/1984 | 8/24/1984 | 12/18/09(M) | 31 | 0 | 0 |
| **540068** | **City Of Ranson** | 6/15/1979 | 6/15/1979 | 12/18/2009 | 52 | 18 | 10 |
| **540069** | **Town Of Shepherdstown** | 3/18/1980 | 3/18/1980 | 12/18/2009 | 56 | 5 | 5 |

Jefferson County unincorporated has the highest number of structures (298) in Pre-FIRM, whereas the Town of Bolivar has the lowest number of structures (3). Jefferson County unincorporated also has the highest number of Post-FIRM structures (176), while the Town Of Bolivar and Town of Harpers Ferry have no Post-FIRM structures.

#### Demographics

Table 3 provides details on population, households, income, residential housing, spending on housing, and age for each community.

Table : Demographic details for each community showing details about the area, income, residential housing, spending on housing, and age.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Area** |  | | | | | |
| * Area of Community | 125,719 | 278 | 3,744 | 400 | 5,185 | 240 |
| **Population** |  |  |  |  |  |  |
| * Population Total | 41,907 | 1,246 | 5,766 | 236 | 4,945 | 1,573 |
| * Population Density (persons/sq mile) | 213.3 | 2,873.3 | 985.8 | 378.2 | 610.5 | 4,197.6 |
| **Households** |  |  |  |  |  |  |
| * Households Total | 15,700 | 526 | 2,279 | 113 | 1,859 | 331 |
| * Average Household Size | 2.65 | 2.37 | 2.49 | 2.09 | 2.66 | 1.70 |
| **Income** |  | | | | | |
| * Per Capita Income | 33,241 | 33,264 | 30,604 | 49,642 | 22,008 | 17,660 |
| * Median Household Income | 72,526 | 59,722 | 70,708 | 88,393 | 44,769 | 40,417 |
| * Percent below State Median Income | 25.8 | 33.1 | 39.0 | 19.5 | 50.4 | 61.0 |
| **Residential Housing** |  | | | | | |
| * Occupied Residential Units | 15,700 | 526 | 2,279 | 113 | 1,859 | 331 |
| * Owner Occupied Residential | 12,477 | 400 | 1,296 | 92 | 1,024 | 131 |
| * Renter Occupied Residential | 3,223 | 126 | 983 | 21 | 835 | 200 |
| * Vacant Residential Units | 1,478 | 94 | 142 | 52 | 163 | 76 |
| **Spending on Housing** |  | | | | | |
| * % of households spend 30% or more of their income on housing | 22.4 | 19.6 | 29.8 | 22.1 | 44.3 | 44.4 |
| **Age** |  | | | | | |
| * Age\_pct\_Under\_15 | 18.8 | 18.1 | 24.4 | 13.1 | 22.5 | 1.3 |
| * Age\_pct\_15\_64 | 66.6 | 63.2 | 62.2 | 61.8 | 67.8 | 91.2 |
| * Age\_pct\_65\_over | 14.6 | 18.7 | 13.5 | 25.0 | 9.8 | 7.4 |

#### Total Stream Miles

Reports were generated for the total number of stream miles (approximate) detailed and approximate A zones. Jefferson County has approximately 129 miles of stream length with 36% in detailed zones and 64% in the approximate zone.

Table : Percentage of Detailed and Approximate zones in Jefferson County

|  |  |  |  |
| --- | --- | --- | --- |
| **County Name** | **Total Stream Miles** | **Percentage of detailed zones (AE, AO, AH)?** | **Percentage of Approximate A Zones?** |
| **Jefferson County** | 128.59 | 36.0% | 64.0% |

*Community Breakup*

Table : Percentage of Detailed and Approximate zones in each community

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Total Stream Miles** | **Percentage of detailed zones (AE, AO, AH)?** | **Percentage of Approximate A Zones?** |
| **540065** | **Jefferson County** | 119.47 | 34.7% | 65.3% |
| **540030** | **Town Of Bolivar** | 0.3 | 0.0% | 100.0% |
| **540066** | **City Of Charles Town** | 4.64 | 60.4% | 39.6% |
| **540067** | **Town Of Harpers Ferry** | 1.93 | 0.0% | 100.0% |
| **540068** | **City Of Ranson** | 1.88 | 90.4% | 9.6% |
| **540069** | **Town Of Shepherdstown** | 0.38 | 98.9% | 1.1% |

The city of Charles Town has the highest percentage of the streams with detailed zones (60%), whereas the Town of Bolivar and Town of Harpers Ferry have no streams with detailed flood zones. The Town of Bolivar and Town of Harpers Ferry have 100% Approximate A zones, whereas the Town of Shepherdstown has at least 1.1%.

#### Total Acreage of Flood Zones

The assessment was done for total acreage in 1-percent detailed and approximate, non-regulatory and X-Zone floodplains.

Table : Acreage of different types of flood zones in each community

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **SFHA Acreage: Percent Detailed and Approximate A** | **Non-Regulatory Layers: Preliminary, Updated AE, Advisory A** | **X Zone: 500-year (Shaded X) and Protected Levee Zone (X)** |
| **540065** | **Jefferson County** | 479 | 43 | 0 |
| **540030** | **Town Of Bolivar** | 0 | 3 | 0 |
| **540066** | **City Of Charles Town** | 22 | 4 | 0 |
| **540067** | **Town Of Harpers Ferry** | 1 | 30 | 0 |
| **540068** | **City Of Ranson** | 77 | 3 | 0 |
| **540069** | **Town Of Shepherdstown** | 65 | 1 | 0 |

#### Historical Flooding

Historical flooding data leading to presidential disaster declarations was obtained from FEMA Region III. Table 7 shows historic flooding related to the presidential declarations. Data is at the county level.

Table : Flood related Presidential disaster declaration. Disaster declarations are at county level.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Number of Flood-related Presidential Disaster Declarations (County Level)** | **USGS High-Water Marks** | **Other past flooding or storm water problem areas** |
| **540065** | **Jefferson County** | 8 |  |  |
| **540030** | **Town Of Bolivar** | 8 |  |  |
| **540066** | **City Of Charles Town** | 8 |  |  |
| **540067** | **Town Of Harpers Ferry** | 8 |  |  |
| **540068** | **City Of Ranson** | 8 |  |  |
| **540069** | **Town Of Shepherdstown** | 8 |  |  |

#### Building Exposure Community-Wide

The assessment was done for community-wide building exposure for each community. Detailed analysis for building exposure was also performed based on land-use code.

Table : Details of building exposure in each community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| * Total estimated number of structures in the community | 19,526 | 508 | 2,465 | 246 | 2,154 | 542 |
| * Total estimated value of structures in the community (Total Exposure) | $70,617,430 | $255,600 | $3,192,800 | $6,972,799 | $5,195,240 | $18,720,690 |
| * What is the breakdown of these structures? |  | | | | | |
| * Residential | 15,900 | 511 | 2,284 | 225 | 1,934 | 385 |
| * Farm | 1,046 | - | 14 | - | 21 | - |
| * Commercial | 2,355 | 97 | 668 | 45 | 694 | 213 |
| * Industrial | 32 | - | - | - | - | - |
| * Utility | 20 | - | 4 | - | - | 2 |
| * Exempt | - | - | - | - | - | - |
| * Percentage of these that are commercial or non-residential | 12.3% | 19.1% | 27.3% | 18.3% | 32.2% | 39.7% |

Jefferson County unincorporated has the highest total exposure and the Town of Bolivar has the least exposure to flood. The Town of Shepherdstown has the highest percentage of commercial structure exposure, whereas Jefferson County unincorporated has the least exposure.

#### Flood-Risk Structures

##### High-risk Regulatory SFHA and Floodway (Red Colored Warning Zones)

The analysis was performed to assess the number of structures in high-risk regulatory A zone flood fringe and floodway

Table : Total structures and exposure in flood fringe and floodway for each community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| * Total number of structures in your **high risk regulatory** A zones of SFHA | 485 | 0 | 22 | 1 | 77 | 65 |
| * Total building value exposure in A Zone? | $60,897,100 | $0 | $2,768,900 | $91,200 | $4,990,640 | $18,442,590 |
| * Total number of structures in r**egulatory floodway**? | 37 | 0 | 3 | 0 | 0 | 0 |
| * Total building value exposure in regulatory floodway? | $3,145,070 | $0 | $153,900 | $0 | $0 | $0 |

Jefferson County unincorporated has the highest building count of 485 and the highest exposure of $60,897,100 in flood fringe, whereas the Town of Bolivar has no structures in flood fringe. Jefferson County unincorporated also has the highest number of structures in the floodway at 37, with a total exposure of $3,145,070.

##### High-risk Advisory Zones (Orange Colored Warning Zones)

The assessment was performed for the total number of structures and building value exposure in non-regulatory Preliminary, High-risk Advisory, and updated AE floodplains. These orange-colored zones on the WV Flood Tool indicate Preliminary Studies, Advisory A, and Updated AE.

Table : Structures and exposure cost in high risk advisory zones for each community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| Total number of additional structures mapped in **high risk advisory zones** | 44 | 3 | 4 | 30 | 3 | 1 |
| Total Building Value Exposure | $9,720,330 | $255,600 | $423,900 | $6,881,599 | $204,600 | $278,100 |

Jefferson County unincorporated has the highest number of structures in high risk advisory zones at 44, with an estimated building value exposure of $9,720,330. The Town of Shepherdstown has only 1 structure in this zone.

##### Moderate-Risk Zones (Yellow Colored Warning Zones)

The assessment was performed for essential facilities in 1-percent (100 year) and 0.2-percent-annual chance (500 year) floodplain for each community. These yellow-colored zones on the WV Flood Tool include the 0.2 Percent Annual Chance Zone (Shaded X, 500-year) and Area with Reduced Flood Risk due to Levee (X Zone, Levee-Protected).

Table : Essential facilities count and exposure in each community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| Total number of structures mapped in **moderate risk zones** | 0 | 0 | 0 | 0 | 0 | 0 |

There are no essential facilities in Jefferson County in 1-percent-annual chance or 0.2-percent-annual chance flood zones.

### 3.1.2 High Risk Flood Zones

This section discusses in detail the summary assessment performed in high risk flood zones in previous sections.

#### Building Exposure Characteristics

The assessment was performed for detailed building exposure characteristics in high-risk regulatory and advisory flood zones. Table 12 shows the detailed result of the assessment by each community. Detailed assessment was performed by occupancy type, by residential vs. non-residential type, by different residential types, and foundation types. This level of detailed analysis is necessary to perform site-level assessment. It should be noted that there can be discrepancies in foundation type and other attributes of the assessment data.

Table : Building exposure characteristics in high risk regulatory and advisory flood zones for each community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Structures in High risk Regulatory & Advisory Flood Zones (Total Exposure in Floodplain)** |  | | | | | |
| * Total number of structures in high risk A Zones | 529 | 3 | 26 | 31 | 80 | 66 |
| * Total value of structures exposed in high risk A zones | $70,617,430 | $255,600 | $3,192,800 | $6,972,799 | $5,195,240 | $18,720,690 |
| **Occupancy Class** |  | | | | | |
| * Residential | 470 | 3 | 23 | 6 | 77 | 38 |
| * Agriculture (Farm) | 36 | 0 | 1 | 0 | 2 | 0 |
| * Commercial | 11 | 0 | 1 | 25 | 0 | 24 |
| * Industrial | 3 | 0 | 1 | 0 | 0 | 0 |
| * Education | 1 | 0 | 0 | 0 | 0 | 4 |
| * Government | 5 | 0 | 0 | 0 | 0 | 0 |
| * Religious | 3 | 0 | 0 | 0 | 1 | 0 |
| **Residential versus Non-Residential** |  | | | | | |
| * Number of Residential | 506 | 3 | 24 | 6 | 79 | 38 |
| * Percentage of Residential | 95.7% | 100.0% | 92.3% | 19.4% | 98.8% | 57.6% |
| * Number of Non-Residential | 23 | 0 | 2 | 25 | 1 | 28 |
| * Percentage of Non-Residential | 4.3% | 0.0% | 7.7% | 80.6% | 1.3% | 42.4% |
| **Residential Unit Types** |  | | | | | |
| Percentage of these that are 1-4 family residential structures |  | | | | | |
| * Single Family Dwelling | 76.5% | 100.0% | 87.5% | 100.0% | 81.0% | 89.5% |
| * Mobile Home | 15.2% | 0.0% | 0.0% | 0.0% | 11.4% | 0.0% |
| * Multi Family Dwelling – Duplex | 1.2% | 0.0% | 8.3% | 0.0% | 5.1% | 2.6% |
| * Multi Family Dwelling – 3-4 Units | 0 | 0 | 0 | 0 | 0 | 0 |
| Percentage of these structures that are multifamily (5 or more families) |  | | | | | |
| * Multi Family Dwelling – 5-9 Units | 0 | 0 | 0 | 0 | 0 | 0 |
| * Multi Family Dwelling – 10-19 Units | 0 | 0 | 0 | 0 | 0 | 0 |
| * Multi Family Dwelling – 20-49 Units | 0 | 0 | 0 | 0 | 0 | 0 |
| * Multi Family Dwelling – 50+ Units | 0 | 0 | 0 | 0 | 0 | 0 |
| * Temporary Lodging | 0 | 0 | 0 | 0 | 0 | 0 |
| * Institutional Dormitory | 0 | 0 | 0 | 0 | 0 | 0 |
| * Depository Institutions | 0 | 0 | 0 | 0 | 0 | 0 |
| **Foundation Types in Floodplain** |  | | | | | |
| * Full | 252 | 0 | 17 | 6 | 30 | 43 |
| * Crawl | 191 | 1 | 3 | 22 | 46 | 6 |
| * Slab | 73 | 2 | 6 | 3 | 4 | 17 |
| * Pile or Pier | 4 | 0 | 0 | 0 | 0 | 0 |
| * Other | 9 | 0 | 0 | 0 | 0 | 0 |
| * Unknown | 0 | 0 | 0 | 0 | 0 | 0 |

#### Population and Ownership

Detailed assessment was performed for population and ownership distribution in high-risk flood zones. Table 13 shows details for the residing population and percentage of owner-occupied homes in each community.

Table : Ownership and population distribution in high risk flood zones for each community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Residing Population** |  | | | | | |
| * Total Community Population | 41,907 | 1,246 | 5,766 | 236 | 4,945 | 1,573 |
| * Average Residential Household Size | 2.65 | 2.37 | 2.49 | 2.09 | 2.66 | 1.70 |
| * Population residing in High risk Flood Zone | 1339 | 7 | 60 | 13 | 210 | 65 |
| * Percentage of Community Population residing in high risk Flood Zone | 3.2% | 0.6% | 1.0% | 5.3% | 4.2% | 4.1% |
| **Owner Occupied** |  | | | | | |
| * Percentage of Owner-Occupied Homes | 69.6% | 66.7% | 41.7% | 0.0% | 65.8% | 84.2% |

#### Stream Names, Building Counts, and Values

The assessment was performed for each community for buildings affected and the exposure value by streams in that community. Jefferson County unincorporated has the maximum number of streams affecting structures. The highest number of structures (173) are affected by the Potomac River, with a total exposure of $16,002,480.

Table : Building Count and Exposure cost by streams in Jefferson County Unincorporated

|  |  |  |
| --- | --- | --- |
| **Community Identifier** | **Community Name** |  |
| **540065** | **Jefferson Unincorporated** |
| **Steam Names** | **Building Count** | **Building Value** |
| **Bullskin Run** | **35** | **$3,735,020** |
| Cattail Run | 2 | $461,500 |
| Dry Run | 2 | $233,500 |
| Elks Branch | 12 | $1,229,600 |
| Elks Run | 8 | $1,231,700 |
| Evitts Run | 27 | $6,330,700 |
| Evitts Run Tributary No.1 | 3 | $593,300 |
| Flowing Springs Run | 16 | $5,166,310 |
| Furnace Run | 4 | $323,300 |
| Hopewell Run | 13 | $6,069,510 |
| Hopewell Run Tributary No.1 | 11 | $1,729,910 |
| Long Marsh Run | 3 | $168,200 |
| North Fork Bullskin Run | 9 | $1,386,700 |
| Opequon Creek | 34 | $3,308,900 |
| **Potomac River** | **173** | **$16,002,480** |
| Potomac River Tributary No.1 | 7 | $2,503,600 |
| Rattlesnake Run | 9 | $1,591,100 |
| Rockymarsh Run | 16 | $2,365,700 |
| Rockymarsh Run Tributary No.2 | 6 | $1,230,000 |
| Shaw Run | 3 | $182,100 |
| Shenandoah River | 91 | $8,526,300 |
| Town Run | 15 | $3,356,900 |
| Tributary to Rockymarsh Run | 2 | $321,100 |
| Turkey Run | 14 | $2,430,000 |
| Turkey Run Tributary No. 2 | 14 | $140,000 |

Table : Building Count and Exposure cost by streams in Town of Bolivar

|  |  |  |
| --- | --- | --- |
| **Community Identifier** | **Community Name** |  |
| **540030** | **Town Of Bolivar** |
| **Steam Names** | **Building Count** | **Building Value** |
| Shenandoah River | 3 | $255,600 |

Table : Building Count and Exposure cost by streams in City of Charles Town

|  |  |  |
| --- | --- | --- |
| **Community Identifier** | **Community Name** |  |
| **540066** | **City Of Charles Town** |
| **Steam Names** | **Building Count** | **Building Value** |
| **Evitts Run** | **24** | **$2,741,100** |
| North Fork Bullskin Run | 2 | $451,700 |

Table : Building Count and Exposure cost by streams in Town of Harpers Ferry

|  |  |  |
| --- | --- | --- |
| **Community Identifier** | **Community Name** |  |
| **540067** | **Town Of Harpers Ferry** |
| **Steam Names** | **Building Count** | **Building Value** |
| Shenandoah River | 31 | $6,972,799 |

Table : Building Count and Exposure cost by streams in City of Ranson

|  |  |  |
| --- | --- | --- |
| **Community Identifier** | **Community Name** |  |
| **540068** | **City Of Ranson** |
| **Steam Names** | **Building Count** | **Building Value** |
| **Tributary 1** | **78** | **$5,071,940** |
| Evitts Run Tributary No. 2 | 2 | $123,300 |

Table : Building Count and Exposure cost by streams in Town of Shepherdstown

|  |  |  |
| --- | --- | --- |
| **Community Identifier** | **Community Name** |  |
| **540069** | **Town Of Shepherdstown** |
| **Steam Names** | **Building Count** | **Building Value** |
| Town Run | 65 | $18,564,390 |
| Potomac River | 1 | $156,300 |

#### Water Depth Models

This section discusses the details of building-level risk assessment results from FAST (Open HAZUS) output.

#### Physical Damage Building Impact

The physical damage estimate for each primary structure has been calculated using FAST. The results for each structure are in separate building level risk assessment spreadsheets. Please see the detailed report in the attached spreadsheet for building level risk assessment.

##### Substantial Damage Estimate

The term “substantial damage” applies to a structure in a Special Flood Hazard Area – or floodplain – for which the total cost of repairs is 50 percent or more of the structure’s market value before the disaster occurred, regardless of the cause of damage. This percentage rule can vary among jurisdictions. The decision about a structure being substantially damaged is made at the local government level, generally by a building-department official or floodplain manager. For communities that participate in the National Flood Insurance Program (NFIP), substantial damage determinations generally are required by local floodplain-management ordinances. These rules must be in place for residents of a community to purchase flood insurance. Table 20 shows substantial damage estimates and building impact summary by each community.

Table : Damage estimate and building impact model summary by community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| ***Substantial Damage Estimates*** |  | | | | | |
| * 0 – 25% | 408 | 0 | 26 | 1 | 80 | 64 |
| * 25 – 50% | 38 | 2 | 0 | 5 | 0 | 1 |
| * >= 50% | 83 | 1 | 0 | 25 | 0 | 1 |
| Model Input Issues (Depth grid sources, verification of first-floor heights) | Model backed depth grid | Model backed depth grid | Model backed depth grid | Model backed depth grid | Model backed depth grid | Model backed depth grid |
| **Building Impact Model Summary** |  | | | | | |
| * Building Count | 269 | 3 | 15 | 31 | 47 | 63 |
| * Total Building Loss ($) | $4,698,254 | $118,470 | $35,179 | $4,892,129 | $17,897 | $1,556,274 |
| * Total Building Exposure ($) | $32,720,150 | $255,600 | $926,800 | $6,972,799 | $2,992,750 | $18,060,790 |
| * Percent of Total | 50.9% | 100.0% | 57.7% | 100.0% | 58.8% | 95.5% |
| * Loss Ratio | 14% | 46% | 4% | 70% | 1% | 9% |
| * Total Debris (tons) | 3,318 | 136 | 7 | 3,552 | 3 | 274 |
| * **MInus Rated Structures (Disclaimer)** | 152 | 3 | 2 | 31 | 1 | 16 |

The loss ratio has also been calculated for the communities. The loss ratio is loss as a fraction of the value of local inventory (loss/total value). The loss ratio represents the percent of the building value that likely would be incurred to repair or restore the facility to its original, pre-hazard state. This can be a gage to determine overall community resilience as a result of a scenario event. For example, a loss ratio of 1% in City of Ranson would indicate that a local jurisdiction would be more resilient and recover easier from a given event versus a loss ratio of 70% in Town of Harpers Ferry which would indicate widespread losses.

#### Population Displacement & Short Term Shelter

This section discusses the displaced population due to flooding and short-term shelter needs. FEMA defines Short-Term Shelter as an existing facility (or facilities), such as a school, community center, convention center, or church temporarily converted to provide safe, accessible, and secure short-term housing for disaster survivors.

Short-Term Shelter:

1. Provides for the short-term needs of disaster survivors, typically for up to two weeks

2. Provides a safe and accessible location for life-sustaining support, such as:

a. Feeding

b. Hydration

c. Basic medical care

d. Sanitation 3. Provides a range of essential resident services, depending on the needs of disaster survivors and the resources available to the Authority Having Jurisdiction (AHJ):

a. Support for people with access and functional needs

b. Health and mental behavioral health services

c. Family reunification assistance

d. Childcare

e. Service animal and household pet care

f. Distribution of life-sustaining, comfort, and other essential supplies

g. Laundry

h. Access to transportation

i. Disaster recovery related information and services

Table 21 shows the model results for population displacement and short term shelter needs for each community. Jefferson County unincorporated has the highest estimated population in need of short-term shelter, with 56 people, and Town of Bolivar and Harpers Ferry each have at least 1 person that will be needing short term shelter.

Table : Displaced population and short term shelter needs for each community

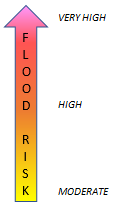
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Population** |  | | | | | |
| * Population in High risk Effective and Advisory Flood Zones | 1375 | 7 | 65 | 65 | 216 | 112 |
| ***Population Displacement*** | 559 | 7.2 | 15 | 12.6 | 45.9 | 108.8 |
| * Estimated Displaced Population (Inundation >-= 1 Foot) | 346 | 7 | 0 | 13 | 0 | 15 |
| * Percentage of Population in Flood Zones Displaced | 40.6% | 100.0% | 23.1% | 19.4% | 21.3% | 97.0% |
| * Number of households with inundation water depth >= 1 foot | 202 | 3 | 5 | 31 | 12 | 63 |
| * Estimated People per household | 2.6 | 2.4 | 2.5 | 2.1 | 2.7 | 1.7 |
| ***Short-Term Shelter Needs*** |  | | | | | |
| * Estimated Population in Need of Short-Term Shelter (10% of total population displacement) | 56 | 1 | 2 | 1 | 5 | 11 |
| * Percentage of Population in Flood Zones in Need of Shelter | 4.1% | 10.0% | 2.3% | 1.9% | 2.1% | 9.7% |
| Companion Pets Shelter Needs |  | | | | | |
| * Number of households with Depth Grid > 1 foot | 202 | 3 | 5 | 31 | 12 | 63 |
| * Dogs? (38% of households) | 77 | 1 | 2 | 12 | 5 | 24 |
| * Cats? (25% of households) | 51 | 1 | 1 | 8 | 3 | 16 |
| **Model Input Issues** | None | None | None | None | None | None |

#### Future Map Conditions

Future map condition shows the future status of structures when FEMA does remapping of the community. Future map condition has been interpreted based on model backed depth grids, including 1-percent chance flood zones of Effective A, Advisory A, and redelineated AE. The table shows the future map condition for each community. **Mapped in** structures show the number of structures that will be mapped in 1-percent-annual chance flood plain when future remapping is done. **Mapped Out** structures show the number of properties that will get mapped out when future mapping is done. These structures are also a potential candidate for LOMA. No change and regulatory floodway indicate the structures whose status will remain in 1-percent-annual chance floodplain when new mapping is done. Table 22 shows potential mapped in, mapped out, and no change in status structures when the re-study is performed by FEMA.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |  |
| **Community Name** | **Jefferson County Uninc.** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** | **County Total** |
|  Regulatory Floodway | **32** | **0** | **0** | **0** | **0** | **0** | **32** |
|  No Change SFHA | **220** | **0** | **12** | **1** | **45** | **61** | **339** |
|  Structures **Mapped In** SFHA (potential high flood risk structure) | **45** | **3** | **4** | **30** | **2** | **1** | **85** |
| * Preliminary NFHL | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| * Advisory A | 21 | 3 | 0 | 30 | 0 | 1 | 55 |
| * Updated AE | 24 | 0 | 4 | 0 | 2 | 0 | 30 |
|  Structures **Mapped Out** SFHA (structure may qualify for LOMA) | **233** | **0** | **10** | **0** | **32** | **4** | **279** |
| * Advisory A | 175 | 0 | 2 | 0 | 30 | 0 | 207 |
| * Updated AE | 58 | 0 | 8 | 0 | 2 | 4 | 72 |
| **Total Buildings in High Risk Zones (Effective and Advisory)** | **530** | **3** | **26** | **31** | **79** | **66** | **735** |
|  | | | | | | | |
| Future Map Conditions: Summary Building Breakdown for High Risk Effective and Advisory Zones | | | | | | | |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |  |
| **Community Name** | **Jefferson County Uninc.** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** | **County Total** |
| Buildings in High Risk Effective Zones - SFHA (bSF) | **485** | **0** | **22** | **1** | **77** | **65** | **650** |
| Buildings in High Risk Advisory Zones (Mapped in SFHA) | 45 | 3 | 4 | 30 | 2 | 1 | 85 |
| **Total Buildings in High Risk Zones (Effective and Advisory)** | **530** | **3** | **26** | **31** | **79** | **66** | **735** |

Table : Future Map condition for each community in Jefferson County



### 3.1.3 Critical Facilities

Critical facilities consist of essential facilities and community assets. Essential facilities have been evaluated in both 1-percent and 0.2-percent-annual chance floodplain. Community assets were evaluated only for 1-percent-annual chance floodplain. None of the communities in Jefferson County have any essential facilities in the floodplain. Table 23 shows the number of essential facilities and community assets in each community.

Table : Critical facilities in each community in Jefferson County

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| Total number of **critical facilities** located in high and moderate risk flood zones |  | | | | | |
| **Essential facilities** |  |  |  |  |  |  |
| * 911 Centers | 0 | 0 | 0 | 0 | 0 | 0 |
| * Fire Stations | 0 | 0 | 0 | 0 | 0 | 0 |
| * Hospitals | 0 | 0 | 0 | 0 | 0 | 0 |
| * Nursing Homes | 0 | 0 | 0 | 0 | 0 | 0 |
| * Police Departments | 0 | 0 | 0 | 0 | 0 | 0 |
| * Schools (university buildings) | 0 | 0 | 0 | 0 | 0 | 0 |
| * List other essential or critical facilities? | 0 | 0 | 0 | 0 | 0 | 0 |
| **Community Assets** |  | | | | | |
| * Historical structures | 28 | 3 | 17 | 31 | 0 | 65 |
| * Government facilities (Federal, State, Local) | 0 | 0 | 0 | 0 | 0 | 0 |
| * Religious organizations | 0 | 0 | 0 | 0 | 0 | 0 |
| * List other essential or critical facilities? | 0 | 0 | 0 | 0 | 0 | 0 |

### 3.1.4 Most Vulnerable Building Lists (Top 10 Lists)

This section discusses the top 10 most vulnerable buildings in the floodplain for each community. These structures can be part of the potential high-risk area and, in conjunction with already identified repetitive loss areas, can be used to create final Areas of Mitigation Interest for mitigation. Red text in building appraisal value indicates that appraisal values were modified by WVGISTC during the building level review process.

#### High Building Exposure in Floodplain

The following tables present results for top 10 buildings with the highest exposure in each community.

Table : Buildings with the highest exposure in Jefferson County Unincorporated

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Appraisal Value** | **Occupancy Class (residential versus non-residential)** | **Floodway (buildings may be subject to high velocities)** | **Building Year / Pre-FIRM / Post-FIRM** | **Basement Type** |
| 540065 | Jefferson County | 19-07-0011-0009-0000\_407 | $3,141,500 | Government | No | Post-FIRM | Basement |
| 540065 | Jefferson County | 19-04-0009-0009-0000\_52 | $2,688,200 | Industrial | No | Post-FIRM | Basement |
| 540065 | Jefferson County | 19-09-008B-0084-0000\_662 | $1,428,200 | Education | No | Unknown | Slab-on-Grade |
| 540065 | Jefferson County | 19-07-0011-0009-0000\_11649 | $1,238,600 | Government | No | Post-FIRM | Basement |
| 540065 | Jefferson County | 19-04-0014-0003-0000\_57 | $1,000,300 | Industrial | No | Post-FIRM | Slab-on-Grade |
| 540065 | Jefferson County | 19-09-0015-0011-0000\_2097 | $740,400 | Agriculture | No | Pre-FIRM | Basement |
| 540065 | Jefferson County | 19-04-010A-0002-0000\_33 | $555,100 | Residential | No | Post-FIRM | Basement |
| 540065 | Jefferson County | 19-02-0013-0007-0000\_223 | $537,000 | Industrial | No | Post-FIRM | Slab-on-Grade |
| 540065 | Jefferson County | 19-09-005B-0028-0000\_267 | $510,800 | Residential | No | Post-FIRM | Crawlspace |
| 540065 | Jefferson County | 19-02-0016-0017-0002\_656 | $496,500 | Residential | No | Pre-FIRM | Basement |

Table : Buildings with the highest exposure in Town of Bolivar

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Appraisal Value** | **Occupancy Class (residential versus non-residential)** | **Floodway (buildings may be subject to high velocities)** | **Building Year / Pre-FIRM / Post-FIRM** | **Basement Type** |
| 540030 | Town of Bolivar | 19-01-0003-0023-0000\_86 | 105700 | Residential | No | Pre-FIRM | None |
| 540030 | Town of Bolivar | 19-01-0003-0021-0001\_100 | 87600 | Residential | No | Pre-FIRM | Crawl |
| 540030 | Town of Bolivar | 19-01-0003-0022-0000\_112 | 62300 | Residential | No | Pre-FIRM | None |

Table : Buildings with the highest exposure in the City of Charles Town

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Appraisal Value** | **Occupancy Class (residential versus non-residential)** | **Floodway (buildings may be subject to high velocities)** | **Building Year / Pre-FIRM / Post-FIRM** | **Basement Type** |
| 540066 | City Of Charles Town | 19-03-0008-0002-0000\_1034 | 651300 | Commercial | No | Post-FIRM | None |
| 540066 | City Of Charles Town | 19-03-0005-0041-0003\_191 | 387800 | Agriculture | No | Post-FIRM | None |
| 540066 | City Of Charles Town | 19-03-011D-0074-0000\_3 | 231000 | Residential | No | Post-FIRM | Full |
| 540066 | City Of Charles Town | 19-03-011D-0073-0000\_7 | 220700 | Residential | No | Post-FIRM | Full |
| 540066 | City Of Charles Town | 19-03-0009-0005-0000\_806 | 174700 | Residential | No | Pre-FIRM | Part |
| 540066 | City Of Charles Town | 19-03-0009-0009-0000\_937 | 165700 | Residential | No | Pre-FIRM | Full |
| 540066 | City Of Charles Town | 19-03-0001-0218-0000\_503 | 157100 | Residential | No | Pre-FIRM | Full |
| 540066 | City Of Charles Town | 19-03-0009-0012-0000\_939 | 155400 | Residential | No | Post-FIRM | Full |
| 540066 | City Of Charles Town | 19-03-0009-0010-0000\_941 | 135300 | Residential | No | Pre-FIRM | Crawl |
| 540066 | City Of Charles Town | 19-03-0001-0185-0000\_416 | 117400 | Residential | No | Pre-FIRM | Full |

Table : Buildings with the highest exposure in Town of Harpers Ferry

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Appraisal Value** | **Occupancy Class (residential versus non-residential)** | **Floodway (buildings may be subject to high velocities)** | **Building Year / Pre-FIRM / Post-FIRM** | **Basement Type** |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_744 | 532300 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_780 | 482800 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_9999S | 461800 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_723 | 450600 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_754 | 434400 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_735 | 329400 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_743 | 314100 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_31H | 291200 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_759 | 290800 | Commercial | No | Pre-FIRM | None |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000\_801 | 278800 | Commercial | No | Pre-FIRM | None |

Table : Buildings with the highest exposure in City of Ranson

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Appraisal Value** | **Occupancy Class (residential versus non-residential)** | **Floodway (buildings may be subject to high velocities)** | **Building Year / Pre-FIRM / Post-FIRM** | **Basement Type** |
| 540068 | City Of Ranson | 19-08-0006-0008-0000\_408 | 173300 | Residential | No | Post-FIRM | Crawlspace |
| 540068 | City Of Ranson | 19-08-0006-0077-0000\_311 | 142000 | Residential | No | Post-FIRM | Basement |
| 540068 | City Of Ranson | 19-08-0006-0020-0000\_405 | 109200 | Residential | No | Pre-FIRM | Basement |
| 540068 | City Of Ranson | 19-08-0006-0196-0000\_108 | 107800 | Residential | No | Pre-FIRM | Basement |
| 540068 | City Of Ranson | 19-08-0006-0031-0000\_513 | 99570 | Religious | No | Unknown | Slab-on-Grade |
| 540068 | City Of Ranson | 19-08-0004-0011-0000\_307 | 98500 | Residential | No | Pre-FIRM | Basement |
| 540068 | City Of Ranson | 19-08-0009-0003-0000\_218 | 98100 | Agriculture | No | Pre-FIRM | Slab-on-Grade |
| 540068 | City Of Ranson | 19-08-0006-0191-0000\_501 | 97000 | Residential | No | Pre-FIRM | Basement |
| 540068 | City Of Ranson | 19-08-0004-0004-0000\_308 | 94700 | Residential | No | Pre-FIRM | Crawlspace |
| 540068 | City Of Ranson | 19-08-0006-0203-0000\_104 | 93400 | Residential | No | Pre-FIRM | Basement |

Table : Buildings with the highest exposure in Town of Shepherdstown

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Appraisal Value** | **Occupancy Class (residential versus non-residential)** | **Floodway (buildings may be subject to high velocities)** | **Building Year / Pre-FIRM / Post-FIRM** | **Basement Type** |
| 540069 | Town Of Shepherdstown | 19-10-0003-0010-0000\_110 | 2464100 | Education | No | Unknown | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-003A-0024-0000\_129 | 1296570 | Education | No | Unknown | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-003A-0017-0000\_101 | 812750 | Education | No | Unknown | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-0003-0027-0000\_201 | 794500 | Commercial | No | Post-FIRM | Basement |
| 540069 | Town Of Shepherdstown | 19-10-003A-0043-0000\_126 | 565300 | Commercial | No | Pre-FIRM | Basement |
| 540069 | Town Of Shepherdstown | 19-10-0003-0034-0000\_206 | 544600 | Residential | No | Pre-FIRM | Basement |
| 540069 | Town Of Shepherdstown | 19-10-003A-0019-0000\_115 | 540500 | Commercial | No | Pre-FIRM | Basement |
| 540069 | Town Of Shepherdstown | 19-10-0003-0048-0000\_111 | 505400 | Commercial | No | Pre-FIRM | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-0003-0021-0000\_207 | 362600 | Residential | No | Pre-FIRM | Basement |
| 540069 | Town Of Shepherdstown | 19-10-0003-0033-0000\_204 | 358700 | Residential | No | Pre-FIRM | Basement |

#### Building Impact Hazus (FAST) Flood Loss Models

Tables in this section show top 10 buildings with high impact. Results have been derived from FAST flood loss models for each community. If a building is damaged by more than 50 percent, it has been classified as substantially damaged.

Table : Buildings with the highest impact in Jefferson County Unincorporated

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Damage Percent ($)** | **Substantial Damage Classification** | **Building Appraisal Value** | **Building Damage Loss ($)** | **Occupancy Class** | **Building Year / Pre-FIRM / Post-FIRM** | **Floodway** | **Basement Type** |
| 540065 | Jefferson County | 19-02-019A-0028-0001\_355 | 84.6 | Substantially Damaged | $16,480 | $13,949.4 | Residential | Unknown | No | Crawlspace |
| 540065 | Jefferson County | 19-04-0003-0025-0000\_298 | 84.0 | Substantially Damaged | $10,000 | $8,395.4 | Residential | Post-FIRM | No | Crawlspace |
| 540065 | Jefferson County | 19-02-0020-0031-0000\_9999 | 83.7 | Substantially Damaged | $10,000 | $8,370.6 | Residential | Unknown | Yes | Crawlspace |
| 540065 | Jefferson County | 19-04-0003-0025-0000\_386 | 83.6 | Substantially Damaged | $10,000 | $8,360.4 | Residential | Post-FIRM | No | Crawlspace |
| 540065 | Jefferson County | 19-04-0003-0025-0000\_484 | 83.6 | Substantially Damaged | $10,000 | $8,355.1 | Residential | Post-FIRM | No | Crawlspace |
| 540065 | Jefferson County | 19-04-0003-0025-0000\_356 | 83.5 | Substantially Damaged | $10,000 | $8,345.6 | Residential | Post-FIRM | No | Crawlspace |
| 540065 | Jefferson County | 19-04-0003-0025-0000\_510 | 83.4 | Substantially Damaged | $10,000 | $8,344.8 | Residential | Post-FIRM | No | Crawlspace |
| 540065 | Jefferson County | 19-04-0003-0025-0000\_439 | 82.9 | Substantially Damaged | $10,000 | $8,294.1 | Residential | Post-FIRM | No | Crawlspace |
| 540065 | Jefferson County | 19-04-0003-0025-0000\_506 | 82.8 | Substantially Damaged | $10,000 | $8,282.8 | Residential | Post-FIRM | No | Crawlspace |
| 540065 | Jefferson County | 19-02-0019-0034-0000\_246 | 81.7 | Substantially Damaged | $10,000 | $8,173.2 | Residential | Unknown | Yes | Crawlspace |

Table : Buildings with the highest impact in Town of Bolivar

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Damage Percent ($)** | **Substantial Damage Classification** | **Building Appraisal Value** | **Building Damage Loss ($)** | **Occupancy Class** | **Building Year / Pre-FIRM / Post-FIRM** | **Floodway** | **Basement Type** |
| 540030 | Town of Bolivar | 19-01-0003-0022-0000\_112 | 52.0 | Substantially Damaged | 62300 | 32399 | Residential | Pre-FIRM | No | Slab-on-Grade |
| 540030 | Town of Bolivar | 19-01-0003-0023-0000\_86 | 47.6 |  | 105700 | 50276 | Residential | Pre-FIRM | No | Slab-on-Grade |
| 540030 | Town of Bolivar | 19-01-0003-0021-0001\_100 | 40.9 |  | 87600 | 35796 | Residential | Pre-FIRM | No | Crawlspace |

Table : Buildings with the highest impact in the City of Charles Town

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Damage Percent ($)** | **Substantial Damage Classification** | **Building Appraisal Value** | **Building Damage Loss ($)** | **Occupancy Class** | **Building Year / Pre-FIRM / Post-FIRM** | **Floodway** | **Basement Type** |
| 540066 | City Of Charles Town | 19-03-0001-0211-0000\_520 | 11.4 | No | 28300 | 3217 | Residential | Pre-FIRM | Yes | Slab-on-Grade |
| 540066 | City Of Charles Town | 19-03-0001-0184-0000\_414 | 7.3 | No | 107400 | 7880 | Residential | Pre-FIRM | No | Basement |
| 540066 | City Of Charles Town | 19-03-0001-0126-0000\_414 | 4.0 | No | 39400 | 1576 | Residential | Pre-FIRM | No | Basement |
| 540066 | City Of Charles Town | 19-03-0001-0127-0000\_412 | 4.0 | No | 31200 | 1248 | Residential | Pre-FIRM | No | Basement |
| 540066 | City Of Charles Town | 19-03-0001-0186-0000\_418 | 4.0 | No | 31600 | 1264 | Residential | Pre-FIRM | No | Basement |
| 540066 | City Of Charles Town | 19-03-0001-0187-0000\_420 | 4.0 | No | 36300 | 1452 | Residential | Pre-FIRM | No | Basement |
| 540066 | City Of Charles Town | 19-03-0001-0209-0000\_519 | 4.0 | No | 56100 | 2244 | Residential | Pre-FIRM | Yes | Basement |
| 540066 | City Of Charles Town | 19-03-0001-0217-0001\_106 | 4.0 | No | 42000 | 1680 | Residential | Pre-FIRM | No | Basement |
| 540066 | City Of Charles Town | 19-03-0001-0218-0000\_503 | 4.0 | No | 157100 | 6284 | Residential | Pre-FIRM | No | Basement |
| 540066 | City Of Charles Town | 19-03-0001-0179-0000\_415 | 3.7 | No | 69500 | 2600 | Industrial | Pre-FIRM | Yes | Slab-on-Grade |

Table : Buildings with the highest impact in Town of Harpers Ferry

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Damage Percent ($)** | **Substantial Damage Classification** | **Building Appraisal Value** | **Building Damage Loss ($)** | **Occupancy Class** | **Building Year / Pre-FIRM / Post-FIRM** | **Floodway** | **Basement Type** |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 532300 | 415194 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 482800 | 376584 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 461800 | 360204 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 450600 | 351468 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 434400 | 338832 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 329400 | 256932 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 314100 | 244998 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 278800 | 217464 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 257500 | 200850 | Commercial | Pre-FIRM | No | Crawlspace |
| 540067 | Town Of Harpers Ferry | 19-05-0004-0025-0000 | 78 | Substantially Damaged | 255500 | 199290 | Commercial | Pre-FIRM | No | Crawlspace |

Table : Buildings with the highest impact in City of Ranson

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Damage Percent ($)** | **Substantial Damage Classification** | **Building Appraisal Value** | **Building Damage Loss ($)** | **Occupancy Class** | **Building Year / Pre-FIRM / Post-FIRM** | **Floodway** | **Basement Type** |
| 540068 | City Of Ranson | 19-08-0006-0002-0000\_421 | 20.5 | No | 19700 | 4035 | Residential | Pre-FIRM | No | Slab-on-Grade |
| 540068 | City Of Ranson | 19-08-0006-0016-0000\_412 | 6.5 | No | 10000 | 649 | Residential | Unknown | No | Crawlspace |
| 540068 | City Of Ranson | 19-08-0006-0077-0000\_311 | 4.0 | No | 142000 | 5680 | Residential | Post-FIRM | No | Basement |
| 540068 | City Of Ranson | 19-08-0004-0011-0000\_307 | 4.0 | No | 98500 | 3940 | Residential | Pre-FIRM | No | Basement |
| 540068 | City Of Ranson | 19-08-0004-0006-0000\_306 | 4.0 | No | 65800 | 2632 | Residential | Pre-FIRM | No | Basement |
| 540068 | City Of Ranson | 19-08-0006-0026-0000\_508 | 4.0 | No | 8800 | 352 | Residential | Pre-FIRM | No | Basement |
| 540068 | City Of Ranson | 19-08-0006-0015-0000\_410 | 2.7 | No | 20900 | 557 | Residential | Unknown | No | Crawlspace |
| 540068 | City Of Ranson | 19-08-0006-0023-0000\_403 | 0.1 | No | 44300 | 53 | Residential | Pre-FIRM | No | Crawlspace |
| 540068 | City Of Ranson | 19-08-0006-0008-0000\_408 | 0.0 | No | 173300 | 0 | Residential | Post-FIRM | No | Crawlspace |
| 540068 | City Of Ranson | 19-08-0006-0020-0000\_405 | 0.0 | No | 109200 | 0 | Residential | Pre-FIRM | No | Basement |

Table : Buildings with the highest impact in Town of Shepherdstown

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Building Damage Percent ($)** | **Substantial Damage Classification** | **Building Appraisal Value** | **Building Damage Loss ($)** | **Occupancy Class** | **Building Year / Pre-FIRM / Post-FIRM** | **Floodway** | **Basement Type** |
| 540069 | Town Of Shepherdstown | 19-10-0001-0051-0001\_315 | 54.5 | Substantially Damaged | Commercial | 16615 | Commercial | Pre-FIRM | No | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-0001-0049-0001\_314 | 40.8 | No | Residential | 63710 | Residential | Pre-FIRM | No | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-0003-0015-0000\_208 | 19.0 | No | Residential | 15960 | Residential | Pre-FIRM | No | Basement |
| 540069 | Town Of Shepherdstown | 19-10-003A-0039-0000\_102 | 16.0 | No | Commercial | 50043 | Commercial | Unknown | No | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-0003-0034-0000\_206 | 14.0 | No | Residential | 76244 | Residential | Pre-FIRM | No | Basement |
| 540069 | Town Of Shepherdstown | 19-10-0003-0048-0000\_111 | 14.0 | No | Commercial | 70756 | Commercial | Pre-FIRM | No | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-0003-0021-0000\_207 | 14.0 | No | Residential | 50764 | Residential | Pre-FIRM | No | Basement |
| 540069 | Town Of Shepherdstown | 19-10-0003-0033-0000\_204 | 14.0 | No | Residential | 50218 | Residential | Pre-FIRM | No | Basement |
| 540069 | Town Of Shepherdstown | 19-10-0003-0026-0000\_101 | 14.0 | No | Residential | 42420 | Residential | Pre-FIRM | No | Basement |
| 540069 | Town Of Shepherdstown | 19-10-003A-0040-0000\_105 | 14.0 | No | Residential | 40544 | Residential | Pre-FIRM | No | Basement |

#### New Development in Floodplain

This section lists the top 10 (by building appraisal value) new development structures in the floodplain for each community. *All of these structures are Post-FIRM*.

Table : New Buildings in Jefferson County Unincorporated

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Post-FIRM / Building Year** | **Building Appraisal Value** | **Floodway** | **BldgDmgPct** | **BldgLossUSD** | **Basement Type** |
| 540065 | Jefferson County | 19-04-003B-0044-0000\_156 | 2017 | $224,400 | No | 1.7 | $3,825 | Pile |
| 540065 | Jefferson County | 19-04-0011-0041-0000\_226 | 2013 | $149,350 | No | 13.1 | $19,535 | Slab-on-Grade |
| 540065 | Jefferson County | 19-04-0011-0041-0000\_9999 | 2013 | $68,300 | No | 12.0 | $8,196 | Crawlspace |
| 540065 | Jefferson County | 19-06-0006-0004-0003\_9999 | 2012 | $39,600 | No | 76.4 | $30,273 | Crawlspace |
| 540065 | Jefferson County | 19-06-009G-0002-0000\_917 | 2012 | $174,200 | Yes | 4.0 | $6,968 | Basement |
| 540065 | Jefferson County | 19-02-0013-0007-0000\_223 | 2012 | $537,000 | No | 0.0 | $0 | Slab-on-Grade |
| 540065 | Jefferson County | 19-09-008B-0036-0000\_412 | 2012 | $273,500 | No | 0.0 | $0 | Crawlspace |
| 540065 | Jefferson County | 19-06-009H-0019-0000\_781 | 2011 | $176,400 | Yes | 9.1 | $16,021 | Pile |
| 540065 | Jefferson County | 19-09-009A-0075-0000\_3645 | 2011 | $212,200 | No | 2.6 | $5,578 | Pile |
| 540065 | Jefferson County | 19-04-003C-0092-0000\_80 | 2010 | $183,200 | No | 11.1 | $20,246 | Slab-on-Grade |

Table : New Buildings in Town of Bolivar

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Post-FIRM / Building Year** | **Building Appraisal Value** | **Floodway** | **BldgDmgPct** | **BldgLossUSD** | **Basement Type** |
| 540030 | Town of Bolivar | No new Post-FIRM structure in the floodplain | | | | | | |

Table : New Buildings in City of Charles Town

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Post-FIRM / Building Year** | **Building Appraisal Value** | **Floodway** | **BldgDmgPct** | **BldgLossUSD** | **Basement Type** |
| 540066 | City Of Charles Town | 19-03-011D-0073-0000\_7 | 2013 | 220700 | No | 0.0 | 0 | Basement |
| 540066 | City Of Charles Town | 19-03-011D-0074-0000\_3 | 2013 | 231000 | No | 0.0 | 0 | Basement |
| 540066 | City Of Charles Town | 19-03-0009-0012-0000\_939 | 2002 | 155400 | No | 0.0 | 0 | Basement |
| 540066 | City Of Charles Town | 19-03-0005-0041-0003\_191 | 1993 | 387800 | No | 0.0 | 0 | Slab-on-Grade |
| 540066 | City Of Charles Town | 19-03-0008-0002-0000\_1034 | 1988 | 651300 | No | 0.0 | 0 | Slab-on-Grade |
| 540066 | City Of Charles Town | 19-03-0009-0014-0000\_1101 | 1987 | 100700 | No | 0.0 | 0 | Slab-on-Grade |

Table : New Buildings in Town of Harpers Ferry

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Post-FIRM / Building Year** | **Building Appraisal Value** | **Floodway** | **BldgDmgPct** | **BldgLossUSD** | **Basement Type** |
| 540067 | Town Of Harpers Ferry | No new Post-FIRM structure in the floodplain | | | | | | |

Table : New Buildings in City of Ranson

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Post-FIRM / Building Year** | **Building Appraisal Value** | **Floodway** | **BldgDmgPct** | **BldgLossUSD** | **Basement Type** |
| 540068 | City Of Ranson | 19-08-0006-0008-0000\_408 | 2008 | $173,300 | No | 0 | 0 | Crawl |
| 540068 | City Of Ranson | 19-08-0006-0077-0000\_311 | 1988 | $142,000 | No | 4 | 5680 | Part |
| 540068 | City Of Ranson | 19-08-0004-0002-0006\_205 | 1984 | $91,500 | No | 0 | 0 | Crawl |
| 540068 | City Of Ranson | 19-08-0006-0009-0000\_402 | 1991 | $89,300 | No | 0 | 0 | Crawl |
| 540068 | City Of Ranson | 19-08-0004-0002-0004\_201 | 1984 | $88,900 | No | 0 | 0 | Crawl |
| 540068 | City Of Ranson | 19-08-0006-0201-0000\_108 | 1980 | $87,800 | No | 0 | 0 | Crawl |
| 540068 | City Of Ranson | 19-08-0004-0002-0007\_207 | 1984 | $87,400 | No | 0 | 0 | Crawl |
| 540068 | City Of Ranson | 19-08-0004-0002-0005\_203 | 1984 | $87,000 | No | 0 | 0 | Crawl |
| 540068 | City Of Ranson | 19-08-0004-0009-0001\_303 | 1992 | $85,900 | No | 0 | 0 | Crawl |
| 540068 | City Of Ranson | 19-08-0004-0010-0000\_305 | 1979 | $85,800 | No | 0 | 0 | Crawl |

Table : New Buildings in Town of Shepherdstown

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Building ID** | **Post-FIRM / Building Year** | **Building Appraisal Value** | **Floodway** | **BldgDmgPct** | **BldgLossUSD** | **Basement Type** |
| 540069 | Town Of Shepherdstown | 19-10-0001-0054-0002\_204 | 2012 | $311,500 | No | 0.0 | 0 | Basement |
| 540069 | Town Of Shepherdstown | 19-10-003A-0041-0000\_104 | 2005 | $217,100 | No | 14.0 | 30394 | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-003A-0041-0000\_105 | 2005 | $160,00 | No | 14.0 | 2240 | Slab-on-Grade |
| 540069 | Town Of Shepherdstown | 19-10-0003-0027-0000\_201 | 1997 | $794,500 | No | 0.0 | 0 | Basement |
| 540069 | Town Of Shepherdstown | 19-10-003A-0042-0001\_114 | 1992 | $194,100 | No | 0.0 | 0 | Basement |

### 3.1.5 Repetitive Loss Properties

A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period since 1978. A RL property may or may not be currently insured by the NFIP. A severe repetitive loss (SRL) property is a single-family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Repetitive loss and Severe Repetitive loss data were acquired from WVDSEM through FEMA Region III. This dataset was validated for location accuracy and Repetitive Loss areas were identified. These areas (1-9) are shown on the County Map in Appendix 1.

Table : RL, SRL building count and RL Areas for each community in Jefferson County

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | 540065 | 540030 | 540066 | 540067 | 540068 | 540069 |
| **Community Name** | Jefferson County | Town Of Bolivar | City Of Charles Town | Town Of Harpers Ferry | City Of Ranson | Town Of Shepherdstown |
| **Repetitive Loss BUILDINGS** |  | | | | | |
| **Do you have repetitive loss BUILDINGS in your community?** | Yes | No | No | No | Yes | No |
| **How many repetitive loss buildings are in the SFHA? (Source-FEMA Region III, WVDEM)** | 21 | 0 | 0 | 0 | 2 | 0 |
| **How many repetitive loss buildings are outside the SFHA?** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Repetitive Loss AREAS** |  | | | | | |
| How many repetitive loss AREAS do you have in your A zones? | 8 | 0 | 0 | 0 | 1 | 0 |
| What is the total number of buildings in these areas? |  |  |  |  |  |  |
| How many repetitive loss AREAS do you have in your B, C, and X zones? What is the total number of buildings in these areas? | 0 | 0 | 0 | 0 | 0 | 0 |
| **Severe Repetitive Loss Properties** |  | | | | | |
| How many severe repetitive loss properties do you have in your A zones? How many severe repetitive loss properties do you have in your B, C, and X zones? | 4 | 0 | 0 | 0 | 0 | 0 |

#### Repetitive loss areas

Areas in the county that have a repetitive loss and severe repetitive loss structure have been used to create repetitive loss areas. Please note that significant flood damage can occur outside of the identified repetitive loss areas. In addition to the repetitive loss areas, the study also identified the top 10 structures which have the highest potential for damage. Users can review the substantial damage assessment of each building in the accompanying Building Level Risk Assessment spreadsheet table. Finally, repetitive loss areas in conjunction with areas showing substantial damage can be used to create Areas of Mitigation Interest.

In Jefferson County, 9 Repetitive Loss areas have been identified. Eight areas are in Jefferson County unincorporated and one is in the Town of Ranson. Area 5 in Jefferson County has the highest number of structures (82), with an appraisal value of $31,131,800. Although the Town of Ranson has only one repetitive loss Area, it contains 75 structures worth $7,374,200.

Table : Repetitive loss areas in Jefferson County

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Community Identifier** | **Community Name** | **Repetitive Loss Area** | **Building Count** | **Building Appraisal Value** |
| 540065 | Jefferson County | Area 1 | 4 | $654,500 |
| 540065 | Jefferson County | Area 2 | 18 | $3,583,100 |
| 540065 | Jefferson County | Area 3 | 10 | $1,241,500 |
| 540065 | Jefferson County | Area 4 | 5 | $401,200 |
| 540065 | Jefferson County | Area 5 | 82 | $31,131,800 |
| 540065 | Jefferson County | Area 6 | 15 | $2,486,700 |
| 540065 | Jefferson County | Area 7 | 2 | $527,900 |
| 540065 | Jefferson County | Area 8 | 2 | $416,600 |
| 540068 | Town of Ranson | Area 9 | 75 | $7,374,200 |

### 3.1.6 Dams and Levees

Table 43 shows the dam and levee information for each community. Jefferson County unincorporated is the only community that contains dams. It has 6 dams which are owned by both public and private utilities. One dam is under significant hazard, and 2 dams are low hazard.

Table : Dam and Levee status for each community

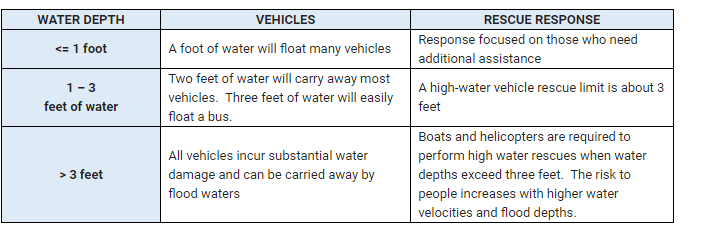
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Dams** |  | | | | | |
| * **Could your community be impacted by the failure of a high hazard potential dam\* (in or outside of your community)?** | Yes (6) | No | No | No | No | No |
| * **Who owns and maintains the dam?** | Public Utility/Private | - | - | - | - | - |
| * **What is the hazard category of the dam?** | Significant/Low | - | - | - | - | - |
| **Levees** |  | | | | | |
| * **Does your community have levees,\* a levee system,\*\* or could it be impacted by a levee failure?** | No | No | No | No | No | No |
| * **What is the levee certification status?** | - | - | - | - | - | - |
| * **Do you have dam/levee failure inundation maps that include water arrival times, peak water depths, and building inventories affected by a breach?** | - | - | - | - | - | - |

According to the U.S. Army Corps of Engineers – Baltimore District, a catastrophic failure of the Jennings Randolph Lake Dam on the border of Garrett County, Maryland and Mineral County, West Virginia which impounds a 952-acre lake, could create a hazard to life and property and could cause significant downstream flooding along the Potomac River in small portions of the Corporation of Shepherdstown, and the lower Town of Harpers Ferry.

### 3.1.7 Transportation Infrastructure

**Water Depth Categories:**

The following water depth categories were created around emergency vehicle response ability.

With water levels below one foot, rescue response is focused on those who need additional assistance, such as the elderly or disabled. However, a foot of water can float many vehicles, so driving may be very risky.

When water levels are between one foot and three feet, high profile vehicles can be used to rescue individuals. However, three feet is reaching the upper limit for using these vehicles. Two feet of water will carry away most vehicles, and three feet can easily float a bus. Driving in these conditions can be **EXTREMELY** dangerous.

When water levels are above three feet, boats and helicopters are required to perform high-water rescues. Risks people may incur will increase with higher water velocities and flood depths. All vehicles will sustain substantial water damage and can be carried away by flood waters.

Table : Road mileage and water depth

|  |  |  |
| --- | --- | --- |
| **Roads by Water Depth** | **Miles** | **%** |
| below 1 ft | 2.8 | 8% |
| 1 to 3 ft | 4.5 | 13% |
| above 3 ft | 25.9 | 78% |
| *Total* | **33.1** |  |

**Routes Affected:**

The following major routes will be affected by the 1-percent annual chance flood: WV Routes 9, 45, 51, 115, 230, and 480. The only US Route that runs through Jefferson County is US 340, but it most likely will not be inundated by water due to its higher deck elevation.

Table : Types of Road and flooded mileage

|  |  |  |  |
| --- | --- | --- | --- |
| **Flooded Roads by Type** | **Miles** | **% Miles to Total** | **Notes** |
| US Route | 1.0 | 3% | 340 (elevated structure) |
| WV Route | 1.2 | 3% | 9, 45, 51, 115, 230, 480 |
| Other Road | 32.1 | 94% |  |
| *Total* | **34.3** |  |  |

County and local routes along the Shenandoah and Potomac Rivers will likely be flooded during a 1-percent annual chance flood. Data shows that these roadways will represent the majority of flooded routes.

No roads within Bolivar will be flooded, but sections of the Baltimore and Ohio Railroad along the outskirts of the town following the Potomac and Shenandoah Rivers will be flooded.

In Shepherdstown, a section of WV Route 230 will be flooded near the middle of the town. A small section of WV Route 480 leading into Maryland will also be flooded. Very small sections of a railroad may be flooded, leading out of Shepherdstown towards the southern portion of the county. All three of these flooding events follow Town Run.

In Harpers Ferry, a section of alternate US Route 340 leading into Maryland may be flooded near the Potomac River. The Baltimore and Ohio Railroad comes to a junction point where the Potomac and Shenandoah rivers meet and is likely to be flooded there.

No roads within Charles Town city borders will be flooded, but three WV Routes leading into and out of Charles Town will be flooded. This includes WV 9 and 115, where they cross the Shenandoah and WV 51, where it crosses Evitts Run in the northern part of the city. No railroads are flooded within or near Charles Town.

No roads within Ranson will be flooded, but a significant portion of the Baltimore and Ohio Railroad will be flooded near Evitts Run and Flowing Springs Run. A small section of the Norfolk and Western Railroad will also be flooded as it crosses the B&O Railroad near Evitts Run.

**Mileage Affected:**

Approximately 75 miles of roads and railroads are within the flood plain formed from the 1-percent annual chance flood data. Of those 75 miles, about 43 miles will be inundated by flood waters, which will present some obstacles to smooth traveling across the county. The vast majority of roads and railroads will be covered with flood waters above three feet, so these will need to be closed.

Table : Railroad mileage and water depth

|  |  |  |
| --- | --- | --- |
| **Railroads by Water Depth** | **Miles** | **%** |
| below 1 ft | 1.2 | 16% |
| 1 to 3 ft | 1.0 | 14% |
| above 3 ft | 4.9 | 69% |
| *Total* | **7.1** |  |

However, only 8.2% of the total county road and railroad mileage will be flooded, so the majority of roads will be safe to travel. But nevertheless, a 1-percent annual chance flood can still cause transportation problems.

**Bridges Affected:**

Eleven bridges will be inundated with water—Avon Bend Bridge, Bakerton Road Bridge, Dailey Bridge, Kabletown Bridge, King Lear Bridge, Knott Island Bridge, Moler Crossroads Bridge, Scrabble Bridge, Shannondale Bridge, Sulphur Springs Bridge, and Wheatland Road Bridge.

The majority of these bridges fall along Opequon Creek near the western border of the county, the Shenandoah River, and the Potomac River along the northern border of the county. Other affected bridges are concentrated around smaller streams and rivers.

Three major bridges on WV 115 will be closed where the route crosses the Shenandoah. This may present some trouble for those wanting to drive out to Maryland or drive into Charles Town or Ranson.

Table : Inundated bridges

|  |  |  |
| --- | --- | --- |
| **Bridges** | **Count** | **%** |
| Inundated | 11 | 27% |
| Not Inundated | 30 | 73% |
| *Total* | **41** |  |

**Most-at-risk Areas by Community:**

The areas most at risk for flooding include Lower Town in Harpers Ferry, areas in Bolivar along the Shenandoah River, the middle of Shepherdstown surrounding Town Run, and areas of Ranson and Charles Town bordering Evitts Run.

Table : Transportation infrastructure in the special flood hazard area

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Transportation Infrastructure | Total County Mileage | Miles (in flood plain) | Miles (flooded) | % Miles flooded to miles in flood plain | % Miles flooded to total county mileage |
| Roads | 449.7 | 50.9 | 34.3 | 67% | 8% |
| Railroads | 72.0 | 24.0 | 8.5 | 35% | 12% |
| *Total Mileage* | **521.7** | **75.0** | **42.8** | **57%** | **8%** |
|  |  |  |  |  |  |
|  | Total County Count | Number (in flood plain) | Total (flooded) | % Total flooded to number in flood plain | % Total flooded to total county count |
| Bridges | 41 | 22 | 11 | 50% | 27% |
| *Total Structure Count* | **41** | **22** | **11** | **50%** | **27%** |

### 3.1.8 Undeveloped Areas

The project analyzed a selection of the activities described in the coordinator’s manual of the National Flood Insurance Program Community Rating System (CRS), published by FEMA in 2017, to investigate the achievable credits in communities of Jefferson County. The main goal of the CRS is to reward communities for flood mitigation activities that are beyond the minimum national requirements regulating the construction of new buildings.

With the purpose of supporting the National Flood Insurance Program (NFIP), the CRS provides communities with reductions in the flood insurance premium rate for implementing such activities. Benefiting from the CRS activities, communities can collect credit points that are applicable to the NFIP. Every 500 credit points can change a class in the NFIP that will reward the community with a discount equal to 5% of the flood insurance premium rate.

This study investigated two types of activities, Open Space Preservation (OSP) coded as 420 and building Acquisition and Relocation (AR) under class 520 in the manual.

#### Open Space Preservation

Open Space Preservation (OSP) is coded as 420 in the CRS manual. The objective of such activities is to reduce flood damages in areas that are prone to inundation by keeping them free of development, including buildings and infrastructure. Consequently, the lands located in those areas will continue or resume their natural functions for flood and erosion control while protecting biological resources.

Table 50 shows details of preserved open spaces in each community. This information can be used by communities for their CRS credits.

Table : Details of Open Space Preservation for each community in Jefferson County

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| * What is the area of your total SFHA? | 6696 | 11 | 187 | 159 | 178 | 21 |
| o What is the area of your SFHA minus large water bodies and federal lands? | 6,241 | 1 | 184 | 24 | 176 | 21 |
| o Area of open space preservation (aOSP) | 92 | 0 | 24 | 1 | 14 | 0 |
| o Percentage of community area in SFHA | 5.3% | 4.0% | 5.0% | 39.8% | 3.4% | 8.8% |
| * Land Use Community-wide? Developed versus undeveloped? |  | | | | | |
| o Developed - Impervious surfaces | 15,716 | 226 | 1,354 | 196 | 1,490 | 201 |
| o Undeveloped – Pervious surfaces | 110,003 | 52 | 2,390 | 204 | 3,695 | 39 |
| * Land Use in SFHA? Developed versus undeveloped? |  | | | | | |
| o Developed - Impervious surfaces | 703 | 7 | 35 | 50 | 44 | 17 |
| o Undeveloped – Pervious surfaces | 5,993 | 4 | 152 | 109 | 134 | 4 |
| * Open space preservation (OSP)? What open space lands protected from future development? Is your community's floodplain used for hunting, fishing, or recreational uses such as golf courses or summer camps? CRS 420 (OSP) | Yes |  | Yes | Yes | Yes |  |
|
|
| o Deed Restricted (DR) in SFHA (aDR) | 1 | 0 | 0 | 0 | 0 | 0 |
| o Natural Functions(aNFOS) | 92 | 0 | 24 | 1 | 14 | 0 |

#### Natural Floodplain Functions

Floodplains in riverine areas perform natural functions that cannot be replicated elsewhere. The CRS provides special credit for community activities that protect and/or restore natural floodplain functions, even though some of the activities may not directly reduce flood losses to insurable buildings. There are many reasons to protect floodplains in their natural state.

When kept open and free of development, floodplains provide the necessary flood water conveyance and flood water storage needed by a river or coastal system. When the floodplain is allowed to perform its natural function, flood velocities and peak flows are reduced downstream. Natural floodplains reduce wind and wave impacts, and their vegetation stabilizes soils during flooding.

Floodplains, in their natural state, provide many beneficial functions beyond flood reduction. Water quality is improved in areas where natural cover acts as a filter for runoff and overbank flows; sediment loads and impurities are also minimized. Natural floodplains moderate water temperature, reducing the possibility of adverse impacts on aquatic plants and animals.

Floodplains can act as recharge areas for groundwater and reduce the frequency and duration of low flows of surface water. They provide habitat for diverse species of flora and fauna, some of which cannot live anywhere else. They are particularly important as breeding and feeding areas.

The CRS encourages state, local, and private programs and projects that preserve or restore the natural state of floodplains and protect these functions. The CRS also encourages communities to coordinate their flood loss reduction programs with other public and private activities that preserve and protect natural and beneficial floodplain functions.

Table 51 shows details of natural floodplain functions in each community. This information can be used by communities for their CRS credits.

Table : Wetland, Riparian area and number of Threatened and endangered species in each community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| Does your community have wetlands, threatened and/or endangered species habitat, and/or other areas deserving protection for their natural floodplain functions? Is your community's floodplain used for hunting, fishing, or recreational uses? | Yes | Yes | Yes | Yes | Yes | Yes |
| * Wetlands (acreage) in SFHA? | 650 | 1 | 37 | 9 | 21 | 1 |
| * Riparian areas in SFHA? | 6224 | 1 | 184 | 23 | 176 | 21 |
| * Number of threatened and/or endangered species in SFHA? | 7 | 2 | 3 | 2 | 5 | 2 |

### 3.1.8 Reducing Flood Losses to Existing Development

This is relevant to building Acquisition and Relocation (AR) under class 520 in the CRS manual with the objective of encouraging communities to clear the existing structures from the floodplains. Acquiring, relocating, or demolishing the buildings can remove the population and assets from the floodplains and mitigate the potential flood losses and damages. It will have effects on the reduction of flood response and recovery costs for communities.

Table 52 shows details of mitigated properties for each community. This information can be used by communities for their CRS credits.

Table : Acquisition and relocation details for each community

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Repetitive Loss Properties** |  | | | | | |
| **Mitigated Buyout Properties** |  | | | | | |
| * How many property parcels have been acquired or relocated? | 0 | 0 | 0 | 0 | 0 | 0 |
| * What percentage in the SFHA? | 0 | 0 | 0 | 0 | 0 | 0 |
| **Primary Buildings Acquired or Relocated** |  | | | | | |
| * How many flood-prone buildings have been acquired or relocated out of harm’s way? | 0 | 0 | 0 | 0 | 0 | 0 |
| * Total properties removed from the SFHA? How many of these properties were Repetitive Loss (bRL) or Severe Repetitive Loss (bSRL)? | 0 | 0 | 0 | 0 | 0 | 0 |
| * What is ratio of building acquired or relocated in SFHA to bSF? | 0 | 0 | 0 | 0 | 0 | 0 |
| * Total number of Repetitive Loss (bRL) or Severe Repetitive Loss (bSRL) buildings removed from anywhere in the community, including outside the regulatory floodplain? | 0 | 0 | 0 | 0 | 0 | 0 |
| * How many critical facilities removed from the SFHA or 500-yer flood zones? | 0 | 0 | 0 | 0 | 0 | 0 |

### 3.1.9 Paid Claims and Flood Insurance

Data for paid claims and flood insurance was obtained from WVDEM through FEMA Region III. Table 53 shows details for flood insurance and paid claims for each community

Table : Paid claims and flood insurance for each community in Jefferson County

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Paid Claims** |  | | | | | |
| * Total Number of Paid Losses (Total Paid Claims) | 126 | 0 | 3 | 11 | 20 | 2 |
| * Total Paid Losses Dollar Amt. Previous Claims | $1,617,488 | $0 | $30,848 | $703,419 | $56,128 | $0 |
| * Paid Claims Outside the Effective Flood High Hazard Area (SFHA) | 16 | No Available Data | 0 | 0 | 0 | 0 |
| **Flood Insurance** |  |  |  |  |  |  |
| * Number of flood insurance policies in force | 175 | 3 | 13 | 3 | 28 | 22 |
| * Number of Pre-FIRM Policies | 64 | 0 | 1 | 1 | 14 | 12 |
| * Percent of SFHA Structures Without Flood Insurance (County Level) | 82% | 82% | 82% | 82% | 82% | 82% |
| * Community-Owned Buildings Requiring Flood Insurance. |  |  |  |  |  |  |

### 3.1.10 Flood Information Data

**Flood Height Grids.** The Base Flood Elevation, or BFE, is the height of the base (1-percent-annual-chance) flood, also known as the 100-year flood. Available base flood height information is displayed in the flood results query panel on the WV Flood Tool. Base Flood Elevations (BFEs) are the regulatory elevation requirement for floodproofing structures and for determining flood insurance premiums. Ongoing statewide mapping initiatives are creating gridded water surface elevation for both detailed AE and Approximate A zones.

**Depth Grids.** The Flood Depth Grid on the WV Flood Tool helps your community better understand the severity of flooding at a given location through 3D flood visualizations and building impact damage models for a 1-percent-annual-chance flood event (also known as the 100-year flood). Flood depth grids generated using engineering modeling software like HEC-RAS are more accurate than Hazus-software-generated grids.

Table 54 shows the percentage of available flood information data that has been used in this study.

#### Quality of Flood Information

Table : Flood Height and depth grid availability for each community in Jefferson County

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Flood Height Grids** |  | | | | | |
| * What percentage of your detailed AE zones have gridded Base Flood Elevations displayed on the WV Flood Tool? | 100% | 100% | 100% | 100% | 100% | 100% |
| * What percentage of your Approximate A zones have base flood elevations known as Advisory Flood Heights displayed on the WV Flood Tool? | 100% | 100% | 100% | 100% | 100% | 100% |
| **Depth Grids** |  | | | | | |
| * What percentage of your high risk flood zones have model-backed depth grids? | 100% | 100% | 100% | 100% | 100% | 100% |

#### Map Revisions

WVGISTC has reviewed and edited the database and verified addresses for LOMC locations. This includes revisions for new subdivisions, annexations, and letters of map change (LOMAs and LOMRs). LOMAs that exclude buildings from the regulatory floodplain should be dropped from your buildings count (bSF). It is important for communities to submit annexation changes through the Census Boundary Annexation Survey (BAS) program. Table 55 shows the number of LOMC in the study area

Table : Number of verified LOMC in study area

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Map Revisions?** |  | | | | | |
| Are you keeping your FIRM up to date? Keep track of LOMCs? | - | - | - | - | - | - |
| LOMCs FEMA Database | 140 | 0 | 16 | 6 | 13 | 15 |

#### Quality of Reference Layers for Identifying Flood Structures

Table 56 shows information about the quality of reference layers that have been used for the risk study of Jefferson County.

Table : Assessment of reference layers in study area

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| What is the quality of your GIS reference layers? |  | | | | | |
| * Leaf-off aerial imagery date | 2018 | 2018 | 2018 | 2018 | 2018 | 2018 |
| * Parcels and assessment attributes | Good | Good | Good | Good | Good | Good |
| * E-911 Addresses | Good | Good | Good | Good | Good | Good |

#### Flood Risk Values

Table 57 shows the information for base flood height, first floor elevation, the lowest floor below BFE, and source data limitations for each community. If the structure is below the BFE, particularly if it has a below-grade (below ground) crawl space or basement, the risk of flooding for that structure is high, and flood insurance rates will be accordingly high.

Table : Base flood height, first floor elevation, lowest floor below BFE and source data limitations in the study area

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** |
| **Base Flood Heights** |  | | | | | |
| * Detailed AE / AO / AH Zones (BFE grid values) | Present | Present | Present | Present | Present | Present |
| * Approximate A Zones (Advisory Flood Heights) | Present | Present | Present | Present | Present | Present |
| **Depth Grid** |  | | | | | |
| * HEC-RAS model-backed (more accurate). | Present | Present | Present | Present | Present | Present |
| * Hazus software generated (less accurate) | Not used in analysis | Not used in analysis | Not used in analysis | Not used in analysis | Not used in analysis | Not used in analysis |
| **First Floor Elevation** |  | | | | | |
| * Ground Elevation | verification needed | verification needed | verification needed | verification needed | verification needed | verification needed |
| * First Floor Height | verification needed | verification needed | verification needed | verification needed | verification needed | verification needed |
| **Lowest Floor Elevation Below BFE** |  | | | | | |
| * Base Flood Elevation | No issues | No issues | No issues | No issues | No issues | No issues |
| * First Floor Height | verification needed | verification needed | verification needed | verification needed | verification needed | verification needed |
| * Basement Information (below-grade or below ground) | verification needed | verification needed | verification needed | verification needed | verification needed | verification needed |
| **Source Data Limitations** | See above | See above | See above | See above | See above | See above |

### 3.1.11 Public Outreach

The following tables show public outreach information for each community

#### Flood Protection Information

Table : Public outreach information for flood protection

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Community Identifier** | **540065** | **540030** | **540066** | **540067** | **540068** | **540069** | |
| **Community Name** | **Jefferson County** | **Town Of Bolivar** | **City Of Charles Town** | **Town Of Harpers Ferry** | **City Of Ranson** | **Town Of Shepherdstown** | |
| Are you posting Elevation Certificates, real-time gage information, and flood protection messages conveyed under Activity 330 (Outreach Projects) on your community website? | No | No | No | No | No | NO | |
| **Elevation Certificates** |  | | | | | | |
| How many Elevation Certificates have been published to WV Flood Tool? | 0 | 0 | 0 | 0 | 0 | 0 | |
| Story Maps | | | | | | |
| Floods **Flood Risk in West Virginia: What We Learned from the June 2016 Flood**  <https://wvu.maps.arcgis.com/apps/Cascade/index.html?appid=32292859b21b44e99c0be706f6da8aa3>  **2016 Flood: WV Flooded Towns, June 2016.** The Historic Flooding of Southern West Virginia on June 23, 2016  <https://wvu.maps.arcgis.com/apps/Cascade/index.html?appid=7b98379452094cd6827dc8f09c8293bd>  **1985 Flood: The Historic WV Flooding of November 4-5 1985**  <https://wvu.maps.arcgis.com/apps/Cascade/index.html?appid=8c8fd107215443b98dbd61252a9c6c40> | | | | | | |
| Landslides **Causes of Landslides in Mountain State, West Virginia**  <https://arcg.is/1SW0Sn>  **West Virginia Landslides and Slide Prone Areas, WVGES 1976**. An online Story Map of the landslide risk assessment published in 1976 by the WV Geological and Economic Survey that was funded by the Appalachian Regional Commission. <https://arcg.is/1KDnvq> | | | | | | |

## 3.2 Flood Risk Maps

Please see appendix A for flood risk maps

## 3.3 Flood Risk Database

The following data layers provided within the FRD were developed for this Flood Risk Project and should be used to further analyze potential losses and areas where they are likely to occur.

* **S\_BLRA\_Pt** – *Flood risk assessment at the structure level*

This is a point feature class and contains primary structure location and results of site-specific flood risk assessment. State and local data were leveraged for this feature class, including site address points, Microsoft building footprints, and parcel assessments that include structure values and land use classification, among other attributes. WVGISTC staff have verified each of the primary structure. The data was evaluated against riverine 1-percent annual chance floodplain boundaries (effective, advisory, and updated AE). Essential facilities points were evaluated against 0.2-percent annual chance floodplain boundaries. Loss calculations were performed using FEMA’s FAST tool.

* **L\_BLRA\_Table**- *Building level risk assessment user-defined facilities table*

This is a MS Excel spreadsheet table. This table contains information that has been used in S\_FRAS\_Pt feature class. Data from this table are being used to display risk assessment results on the risk tab in the WV Flood Tool. Communities may use the spreadsheet table for validation of study results to provide feedback.

* **L\_BIF\_Table** – *Building level FAST input table*

This table contains the original UDF information that was imported into the FAST script to calculate flood losses. The table is saved as an MS Excel spreadsheet. This table can be used to run the FAST tool for assessment.

* **S\_DepthGrid\_01pct** – *01-percent-chance depth grid*

01-percent-chance depth grid was used as input in the FAST script to calculate flood losses. The depth grid is a composite of engineering backed studies as well as WVGISTC redelineated Updated AE and Advisory A flood zone depth grids.

* **S\_Pol\_Ar** – *Political Area polygon feature class*

Political area feature class has been used in maps for cartography and for summarization of results. County boundaries have been updated based on 24k resolution WVDEP polygon and USGS topographic maps. Community boundaries have been updated based on feedback by communities. This feature class can be used for cartography purposes.

* **S\_Fld\_Hzd\_Ar** – *01-percent and 0.2-percent annual chance flood zone feature class*

01-percent and 0.2-percent annual chance flood zones used for analysis. Feature class contains SFHA, Advisory A, and Updated AE flood zone polygons. This feature class can be used for visualization as well as cartography purposes.

# 4 Community Engagement & Field Verification

Field verification and outreach are an important component of the flood risk assessments in support of local hazard mitigation plans. Local officials, planners, emergency managers, or floodplain managers are the primary target audience for community engagement. The Flood Risk Products (Report, Map, Tables, Database) discussed in the previous section will be provided to each community to verify the risk assessment findings and identify potential mitigation actions. Reports will also be provided to the Regional Planning and Development Councils, which are responsible for coordinating local hazard mitigation plans. The Flood Risk Report will provide links to FEMA and State Resource Guides that may include:

* *Reducing Damage from Localized Flooding: A Guide for Communities*
* *Community Rating System Coordinators Manual*
* *WV Floodplain Management Quick Guide*

Communities will be provided with a form or survey to provide feedback on the Flood Risk Report, Maps, and Tables. Important variables for the communities to validate include structure type (e.g., primary, accessory, seasonal, dilapidated) and the foundation type / first floor height of elevated structures. It would be beneficial if communities can provide Finished Construction Elevation Certificates, especially of elevated structures, to verify the first-floor heights, lowest floor elevation, and water depth-in-structure. The Building Inventory follows a cyclic workflow in that new structure-level flood risk assessments can be generated fairly quickly from edits to the building stock or flood depth grids, and then published to the RiskMAP View of the WV Flood Tool. Communities do not need mapping software since the Building-Level Flood-Risk Assessments can be viewed in a Spreadsheet Table with web links to the WV Flood Tool. Areas of Mitigation Interest should be identified by the communities and submitted to the State via the form or survey. The identified repetitive loss areas along with severe repetitive loss areas should help finalize Areas of Mitigation Interest (AoMI). This combined dataset should capture the mitigation interests of the community and provide targets for future mitigation action.

# 5 Actions to Reduce Flood Risk

Before Mitigation and After Mitigation



Communities will need to prioritize projects as part of the planning process. FEMA can then help route federal mitigation dollars to fund these projects.

In order to fully leverage 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 to the items shown in the sub-sections below.

## 5.1 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. Once a community understands its flood risk, it is in a better position to identify potential mitigation actions that can reduce the risk to its people and property.

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:

* local plans and regulations
* structure and infrastructure projects

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.)

* natural systems protection
* education and awareness activities

### 5.1.1 Local Plans and Regulations

Preventative measures integrated into local plans and regulations 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
* Participation in the NFIP Community Rating System (CRS)
* Open space preservation
* Building codes
* Floodplain development regulations
* Stormwater management
* Purchase development rights or conservation easements

### 5.1.2 Structure and Infrastructure Projects

Structure protection measures protect existing buildings by modifying the building to withstand floods, erosion, and waves or by removing buildings from hazardous locations. Examples include:

* Building relocation
* Acquisition and clearance
* Building elevation
* Barrier installation
* Building retrofit

Infrastructure projects 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. Examples include:

* Reservoirs, retention, and detention basins
* Levees and floodwalls
* Channel modifications
* Channel maintenance
* Seawalls, revetments, and bulkheads
* Groins, offshore breakwaters, and jetties

### 5.1.3 Natural Systems Protection Activities

Natural systems protection activities reduce the impact of floods by preserving or restoring natural areas such as floodplains, wetlands, and dunes and their natural functions. Examples include:

* Wetland protection
* Habitat protection
* Erosion and sedimentation control
* Best management practices (BMP)
* Prevention of stream dumping activities (anti-litter campaigns)
* Dune protection measures such as walkovers, sand fencing, and vegetation

### 5.1.4 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 hazard maps
* Outreach projects

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

* Technical assistance
* Real estate disclosure
* Environmental education
* Risk information via the nightly news and social media

In Section 2, we discussed Areas of Mitigation Interest. Table 59 below identifies possible mitigation actions for each AoMI to consider.

Table : Mitigation Actions for Areas of Mitigation Interest

| **AoMI** | **Possible Actions to Reduce Flood Risk** |
| --- | --- |
| ***Dams*** | ***Engineering assessment***  ***Dam upgrades and strengthening***  ***Emergency Action Plan***  ***Dam removal***  ***Easement creation in impoundment and downstream inundation areas*** |
| ***Levees (accredited and non-accredited) and significant levee-like structures*** | ***Generally same as dams above***  ***Purchase of flood insurance for at-risk structures*** |
| ***Stream Flow Constrictions***  ***(Undersized culverts or bridge openings)*** | ***Engineering analysis***  ***Replacement of structure pre- and post-disaster*** |
| ***Past Flood Insurance Claims and IA/PA Hot Spots*** | ***Acquisition***  ***Elevation***  ***Relocation***  ***Floodproofing*** |
| ***Significant Land Use Changes*** | ***Higher regulatory standards***  ***Stormwater BMPs***  ***Transfer of development rights***  ***Compensatory storage and equal conveyance standards*** |
| ***Key Emergency Routes Overtopped During Frequent Flooding Events*** | ***Elevation***  ***Creation of alternate routes***  ***Design as low water crossing*** |
| ***Areas of Significant Erosion*** | ***Relocation of buildings and infrastructure***  ***Regulations and planning***  ***Natural vegetation***  ***Erosion control structures***  ***Building setbacks***  ***Beach nourishment***  ***Dune construction***  ***Dune protection activities*** |
| ***Drainage or Stormwater-Based Flood Hazard Areas, or Areas Not Identified as Floodprone on the FIRM but Known to be Inundated*** | ***Identification of all flood hazard areas*** |
| ***Areas of Mitigation Success*** | ***N/A*** |

## 

## 5.2 Identifying Specific Actions for Your Community

Many different mitigation actions are possible to lessen the impact of floods, so 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’s “Local Mitigation Planning Handbook” for more information on practical approaches, tools, worksheets and local mitigation planning examples for how communities can engage in effective planning to reduce risk from natural hazards and disasters.

**Site characteristics.** Does the site present unique challenges (e.g., significant slopes or erosion potential)?

**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?

**Social acceptance.** Will the mitigation action be acceptable to the public? Does it cause social or cultural problems?

“Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards” provides a FEMA resource that communities can use to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters.

**Technical feasibility.** Is the mitigation action technically feasible (e.g., making a building watertight to a reasonable depth)?

**Administrative feasibility.** Is there administrative capability to implement the mitigation action?

**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 mitigation action affordable? Is it eligible under the grant or other funding programs? Can it be completed within existing budgets?

**Environmental.** Does the mitigation action cause adverse impacts to the environment and can they be mitigated? Is it the most appropriate action among the possible alternatives?

Your local Hazard Mitigation Plan is a valuable place to identify and prioritize possible mitigation actions. The plan includes a mitigation strategy with mitigation actions that were developed through a public and open process. You can then add to or modify those actions based on what is learned in the information provided within this FRR.

## 5.3 Mitigation Programs and Assistance

Graphic showing 3 icons, each of which represents different types of hazard mitigation grants and programs that are availableCommunities 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 https://www.fema.gov/hazard-mitigation-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 programs may be funded at different levels over time or may be activated under special circumstances such as after a presidential disaster declaration.

### 5.3.1 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 61 below.

Table : FEMA Hazard Mitigation Assistance Program

| **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 |
| Building Resilient Infrastructure and Communities (BRIC) | Disaster Mitigation Act | National competitive program focused on mitigation project and planning activities that address multiple natural hazards |

The HMGP and BRIC programs offer funding for mitigation planning and project activities that address multiple natural hazard events. The FMA program focuses 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, federally-recognized 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](http://www.fema.gov/about/contact/regions.shtm) and [State Hazard Mitigation Officers](http://www.fema.gov/about/contact/shmo.shtm) (SHMO) is available on the FEMA website ([www.fema.gov](file:///C:\Users\wrig5717\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.IE5\0TBQF2GL\www.fema.gov)).

### 5.3.2 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.

# 6 Acronyms and Definitions

## 6.1 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

BRIC Building Resilient Infrastructure and Communities

**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

**E**

EC Elevation Certificate

EOP Emergency Operations Plan

**F**

FAST FEMA’s Flood Assessment Structure Tool

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

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

**L**

LOMA Letter of Map Amendment

LOMC Letter of Map Change

**M**

MSC Map Service Center

**N**

NFHL National Flood Hazard Layer

NFIA National Flood Insurance Act

NFIP National Flood Insurance Program

NHD National Hydrography Dataset

NOAA National Oceanic and Atmospheric Administration

NRCS Natural Resource Conservation Service

NSFHA Non-Special Flood Hazard Area

**P**

PA Public Assistance

**R**

Risk MAP Mapping, Assessment, and Planning

**S**

SFHA Special Flood Hazard Area

SHMO State Hazard Mitigation Officer

**U**

UDF User-Defined Facilities

USACE U.S. Army Corps of Engineers

USGS U.S. Geological Survey

**W**

WVDEM West Virginia Division of Emergency Management

WVGISTC West Virginia GIS Technical Center

## 6.2 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).

**Advisory Flood Height** - The water surface elevation (WSEL), in feet, of the 1-percent annual chance (100-year) flood at a given location, as determined using hydrology and hydraulics (H&H) analysis and the best available elevation data. This information is currently available for 35 of the 55 West Virginia counties on the WV Flood Tool. The Advisory Flood Height (or Advisory BFE) should be used with caution in the proximity of a culvert, bridge, flood control structure or other impoundment since stream crossings were not included in the hydraulic analyses for approximate floodplains. Also, if the site is close to the confluence with a larger stream, compare the advisory flood height at the location of interest to the advisory flood height or Base Flood Elevation on the larger stream to determine whether the site is within the backwater influence of the larger stream. Refer to the [AFH Handout](https://www.mapwv.gov/flood/content/documents/AFHhandout.pdf) for more information.

**Areas of Mitigation Interest (AoMI)** - The Areas of Mitigation Interest (AoMI) dataset assists communities in determining specific actions to increase their resilience from floods. AoMI identifies currently planned mitigation activities as well as areas of potential future action. It encourages collaboration among communities within the project area by providing them with the basis to assess how various mitigation action scenarios can successfully reduce their collective flood risk. AoMIs are identified by communities as part of the State's Flood Risk Assessment and may be published to the WV Flood Tool.

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

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

**Basement** - Any area of the building, including any sunken room or sunken portion of a room, having its floor below ground level (subgrade) on all sides. A walkout basement is not a subgrade basement. The NFIP definition of the basement does not include what is typically referred to as a “walkout” basement, whose floor would be at or above grade on at least one side.

**Base Flood Elevation (BFE)** – The computed elevation to which flood water is anticipated to rise during the base (1-percent-annual-chance) flood event. Base Flood Elevations (BFEs) are shown on Flood Insurance Rate Maps (FIRMs) and on the flood profiles. On the FIRM and WV Flood Tool, the BFE is represented as a black wavy line that intersects the floodplain; BFE values displayed are rounded to the nearest foot. The BFE is the regulatory requirement for the elevation or flood proofing of structures. BFE values from flood height grids (Restudy or Non-Restudy sources) are displayed in the Flood Query Results Panel. The BFE, along with Water-in-Depth of a structure, are important for identifying minus rated structures.

**Berm** – A small levee, typically built from earth.

**Building Identifier -** The 20-character parcel identifier (e.g., 19-02-019A-0022-0000) combined with a building address number (e.g., 257 Main Street) forms the unique building identifier (e.g., 19-02-019A-0022-0000\_257) of various flood hazard data products (flood risk assessments, building pictures, LOMAs, Elevation Certificates, etc.) shown on the WV Flood Tool. As another example, a building located in parcel identifier of 01-08-0011-0069-0000 at the address of 604 Main St, Philippi, WV, would have a unique Building Identifier of 01-08-0011-0069-0000\_604. The Building Identifier is the unique primary identifier for building-level flood risk assessments.

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

**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 flood waters of a specific flood at a given location.

**Community Identified Regulatory Floodplain** -The community-identified regulatory floodplain is the flood-prone land area that is subject to a community’s floodplain development or floodplain management regulations. The regulatory floodplain includes, at a minimum, the Special Flood Hazard Area (SFHA), but may also incorporate other areas outside the SFHA that are high risk advisory floodplain areas subject to a community’s floodplain development or floodplain management regulations.

A building or parcel located in the community’s regulatory floodplain means that it is located in either:

* The SFHA as shown on the community’s Flood Insurance Rate Map (FIRM), or
* A high risk advisory floodplain outside the SFHA where the community enforces development regulations similar to those enforced for new development in the SFHA. The community must map the area and document its floodplain management regulations. High risk advisory floodplains on the WV Flood Tool may be referenced by communities in their local floodplain ordinance.

**Community Rating System (CRS)** - The National Flood Insurance Program's (NFIP) Community Rating System (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 the community actions meeting the three goals of the CRS: (1) Reduce flood damage to insurable property; (2) Strengthen and support the insurance aspects of the NFIP; and (3) Encourage a comprehensive approach to floodplain management. The community’s CRS class is displayed in the Flood Query Results Panel of the WV Flood Tool. State-based CRS credits are provided by the WV Flood Tool to support CRS activities for its communities. For flooding and flood-related hazards (e.g., dams, landslides), CRS communities should execute a more comprehensive Floodplain Management Plan (CRS Activity 510) to integrate with its Local Hazard Mitigation Plan. While both the Local Mitigation Plan and CRS Floodplain Management Plan have similar objectives, each is administered by a different office in FEMA.

RESOURCES

* [CRS Rating System Fact Sheet (2017)](https://www.fema.gov/media-library/assets/documents/9998)
* [CRS Coordinator’s Manual (2017)](https://www.fema.gov/media-library-data/1493905477815-d794671adeed5beab6a6304d8ba0b207/633300_2017_CRS_Coordinators_Manual_508.pdf)
* [Mitigation Planning and the Community Rating System Key Topics Bulletin (2018)](https://www.fema.gov/media-library-data/1560365486495-6e5bdaa89de4bf2363596e615f4c7575/MitigationPlanningandtheCommunityRatingSystemKeyTopicsBulletin.pdf)
* [Small Communities in the CRS (2018)](https://crsresources.org/files/guides/small-communities-in-the-crs.pdf)
* [Local Hazard Mitigation Planning](https://www.fema.gov/hazard-mitigation-planning)

**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.

**Elevated Building** -A building that has no basement and that has its lowest elevated floor raised above ground level by foundation walls, shear walls, posts, piers, pilings, or columns. Foundation walls are masonry walls, poured concrete walls, or precast concrete walls, regardless of height, that extend above grade and support the weight of a building.

**Enclosure** - That portion of an elevated building below the lowest elevated floor that is either partially or fully shut in by rigid walls. For an elevated building located in any A Zone that has an enclosure below the elevated floor, including a crawlspace or an attached garage, the enclosure or garage floor becomes the lowest floor for rating if any of the following conditions exist:

* The enclosed space is finished (having more than 20 linear feet of interior finished wall [paneling, etc.]); or
* The unfinished enclosed space is used for things other than building access (stairwells, elevators, etc.), parking, or storage; or
* There is an elevator below the BFE; or
* The unfinished enclosed space (either the enclosure or garage) has no proper openings

**Elevation Certificate** - Elevation Certificates are useful for determining the lowest floor elevations for BFE regulatory compliance (minus rated structures), for determining first-floor heights for building-level risk assessments, and for submitting elevation data for Letters of Map Change (LOMCs). Elevation Certificates are maintained by the local floodplain manager and may be published to the WV Flood Tool. Floodplain Managers are encouraged to publish their Elevation Certificates to the WV Flood Tool. Scan “Finished Construction” Elevation Certificates, preferably in color if pictures included, and email to WV GIS Technical Center. Name Elevation Certificate files with the Building Identifier naming convention: Full Parcel ID + Building Number (e.g., 39-04-0020-0038-0000\_14466).

**Erosion** – Process by which flood waters 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 Depth Grid** - The base flood water depths are important for communicating flood risk. Flood depths are published in the Flood Query Results Panel and used for computing the Water Depth-in-Structure for the building-level flood risk assessments. The Water Depth is the principal input for the 3D flood visualizations. The statewide Hazus depth grid created in 2010 is not very accurate, and thus a priority is to attain model-backed depth grids for full statewide coverage. Two statewide, composite Depth Grids are organized and published separately by the source software utilized: HEC-RAS engineering software and Hazus software.

**Flood Hazard Zone/Area** - Area on a Flood Insurance Rate Map (FIRM) categorized according to the likelihood of flooding occurrence. The Flood Zone designation is denoted in the Flood Query Results Panel and labeled in the map frame of the WV Flood Tool. A corresponding warning color denotes the degree of flood hazard risk: (1) HIGH RISK 100-YR Effective A Zones (RED Warning Color); (2) HIGH RISK Advisory Non-Regulatory Zones (ORANGE Warning Color) for Preliminary NFHL, Advisory A, Updated AE; (3) MODERATE RISK 500-YR Shaded X Zones, Levee-Protected X Zones, and Areas in Close Proximity to Flood Zones (YELLOW Warning Color); and LOW RISK for no identified flood risks (GREEN Color).

**Flood Height Grid** - Gridded base flood heights are important for floodplain management and flood risk assessment activities. Presently, in the Flood Query Results Panel, model-backed flood height values are displayed for Approximate A Zones and AE Zones for 35 and 10 counties, respectively. FEMA now accepts the Advisory Flood Heights (or Advisory BFE) displayed on the WV Flood Tool for LOMA determinations and for Elevation Certificates. Gridded base flood elevations for AE Zones (from Restudies/Non-Restudies) displayed in the Flood Query Results Panel of the WV Flood Tool should be confirmed with the Flood Profile in the Flood Insurance Study. Composite Water Surface Elevation Grids are organized and published separately by source methodology: Risk MAP Restudy, Non-Restudy (AE Zone Redelineation), and Advisory Flood Height (Approximate A Zone) studies.

**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 Map Revision** - A major driver for flood map revisions in West Virginia is new Light Detection and Ranging (LiDAR) elevation data that allows for a dramatic increase in the accuracy of flood hazard mapping. This new high-resolution topography supports 1-foot contours and 1-meter digital elevation models. Ongoing flood studies in West Virginia are categorized as FEMA-Initiated or State-Initiated Studies.

* **FEMA-Initiated Studies:** A change in the Flood Insurance Rate Map (FIRM) for a community which reflects revised zone, base flood or other information. A FEMA-initiated study or restudy revises some or all of a community's effective flood map, resulting in both regulatory and flood risk products. FEMA’s Risk Mapping, Assessment, and Planning (Risk MAP) program provide communities with flood risk information that is used for developing regulatory and flood risk products. Once the new regulatory flood maps are finalized, a community has six months to adopt the map revisions in their local floodplain ordinance. For example, the 2016 Flood Study used new topography and high-water marks to create detailed flood studies with regulatory products for eight stream reaches in Greenbrier, Kanawha, Monroe, Nicholas, Summers, and Webster counties.
* **State-Initiated Studies:** State-initiated map revisions, typically through the FEMA's CTP Initiative, are smaller-scale studies limited in size and scope. State flood mapping initiatives incorporate new topography with hydrology and hydraulics (H&H) models to generate high risk advisory flood zone data. This includes the statewide map initiative of Approximate A Zones using engineering analyses to produce new floodplain boundaries, Advisory Flood Heights (Advisory BFEs), and flood depth grids for streams draining a minimum two-square mile watershed area. The advisory flood height values should be used with caution for sites in proximity to hydraulic structures (bridges/culverts/dams) or near the confluence of a larger stream. Another statewide map initiative involves the redelineation of AE Zones to produce high risk advisory flood zones, non-restudy BFE, and water depth grids. Redelineation is the method of updating effective flood hazard boundaries to match updated topographic data based on the computed water surface elevations from effective models; no new engineering analyses are performed as part of the redelineation methodology. Importantly, state-initiated studies produce high-risk advisory flood hazard information that will likely be incorporated into future effective regulatory or community identified floodplains.

**Flood Profile** - A graph of the flood elevations along the centerline of a stream. The profile displays elevations for a 100-year flood event and often includes 10-, 50-, and 500-year flood event data. Other data on the profiles include cross-sections, streambed elevation, base flood elevation (BFE), streets/bridges that cross the streams, culverts, dams, and confluences of other streams. Flood profiles for detailed streams can be viewed on the Flood Query Results Panel of the WV Flood Tool.

**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 Risk Community Engagement Questionnaire** - Communities are provided with instructions on how to validate and provide feedback on Flood Risk Report, Maps, or Tables. Communities also identify Areas of Mitigation Interest (AoMI) for the State and FEMA to review. The Areas of Mitigation Interest (AoMI) dataset should capture the mitigation interests of the community and provide targets for future mitigation actions.

**Flood Risk Database** - Provides communities with geospatial information collected during the risk assessment process and offers effective ways to visualize and communicate flood risk. The Flood Risk Assessment GIS (FRAGIS) is the name for West Virginia’s flood risk geodatabase.

**Flood Risk Map** - A map that illustrates the overall flood risk for a community. The map can be used as an outreach tool to communicate risk more clearly and to support mitigation planning. The Flood Risk Map is viewable as an interactive map on the WV Flood Tool or as a PDF print-ready static map.

**Flood Risk Report** - A narrative or a community’s flood risk assessment study to support floodplain management and flood reduction activities. A Flood Risk Report is published for each county to supplement its Local Hazard Mitigation Plan.

**Flood Risk Table** - Excel tables that list per structure the primary building exposure and flood risk assessment attributes for communities to verify. Specific tables for Essential Facilities, Buyout Properties, etc. are also provided to communities for verification. These tables can be used by communities to enhance floodplain management and risk reduction efforts. Share links are included in tables to link records to RiskMAP View of WV Flood Tool.

**Flood Risk Building: 3D Visualization** - 3D Flood Visualizations are rendered from the base flood water depth and building type (residential one- or two-story homes, mobile home, commercial/industrial) to effectively communicate flood risk. By describing the depth-in-structure damage according to varying flood depths, visualizations are easier for non-technical users to understand flood risks to their property in feet of water rather than comprehending the base flood elevation (BFE).

**Flood Risk Building: Assessment Datasets** - Various Flood Risk Assessment datasets are developed by pinpointing all primary insurable structures in the Special Flood Hazard Area or 100-year floodplain. Historical and community assets (government buildings, churches) are also inventoried. Essential facilities are inventoried to the 0.2-percent (500-year) annual chance flood event. Required building characteristics are Occupancy Class, Foundation Type, First Floor Height, Number of Stories, Area, and Replacement Cost. Default values are populated from the State Parcel Assessment Database and modified with user-defined values. Building pictures can be linked to the risk assessment using the unique building identifier.

**Flood Risk Building: Damage Loss Estimates** - Building Damage Loss Estimates (Hazus): The Flood Risk Assessment dataset is generated from FEMA’s OpenHazus Flood Assessment Structure Tool (FAST) and presents loss estimates in dollar values and damage percent. The depth grid, combined with an inventory of the built environment, is used by the Hazus Flood Model to determine flood loss potential, by applying the appropriate depth-damage curves, for a 100-year flood event. Besides the Building Damage Percent/Dollars Loss, other model outputs of the FAST Utility site-specific risk assessment include the Contents Damage, Inventory Damage, Debris Removal, and Maximum Restoration Time. Population per building is derived from the assessment Occupancy Type Class (e.g., Residential Single Family, Residential Multi Family) and census average residential household size. Owner-occupied homes are determined from assessment fields Tax Class and Occupancy Class.

**Flood Risk Building: Future Map Condition** - State-Initiated Studies produce high risk advisory flood hazard information that will likely be incorporated into future effective regulatory or community identified floodplains. Inputs for future map conditions are high risk advisory flood zones and LOMA’s verified for positional accuracy. Communities should consider any non-regulatory zones as becoming effective and regulatory when future FEMA-initiated Flood Studies are conducted. For Future Building Map Conditions, categories are Mapped out SFHA (yellow), Mapped in SFHA (orange), No Change (red), and Regulatory Floodway (magenta star). The color symbols have land use category letters for Residential, Commercial, and Other. Buildings “Mapped Out SFHA” should be considered for a LOMA Structure Removed status while Buildings “Mapped In SFHA” should be regulated to the 100-year floodplain standard until new effective maps are published. For buildings in the “Floodway” there should be no development unless a No-Rise Certificate is issued.

**Flood Risk Building: New Development** - New Development and Basements (Building-Level Risk Assessment): The Building Year from Assessment Database is symbolized by FIRM (Pre-FIRM/Post-FIRM/Unknown) and Basement (Basement/No Basement) status. Note: A basement in the assessment database may not be a subgrade basement but a walkout basement. Hence, basement designations from the assessment records should be field verified. There should be no minus rated structures for Post-FIRM structures new development.

**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** – Flood water 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 the land from flooding.

**Floodway (regulatory)** – The "Regulatory Floodway" is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. The “floodway” is denoted in the Flood Query Results Panel of the WV Flood Tool, and a risk indicator analyzed in building-level flood risk assessments.

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

**Freeboard** – An additional amount of height above the Base Flood Elevation used as a factor of safety (e.g., 2 feet above the Base Flood) in determining the level at which a structure's lowest floor must be elevated or floodproofed to be in accordance with state or community floodplain management regulations. Most communities in West Virginia have stipulated in their local floodplain ordinance a freeboard of two feet.

**Hazus (OpenHazus Flood Assessment Structure Tool)** – FEMA’s Hazus is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods, and hurricanes. The building-level flood risk assessments for a 1-percent annual chance flood (100-year) event utilize FEMA’s Flood Assessment Structure Tool (FAST), a GIS-based, open-source utility designed by FEMA’s Hazus Program for estimating potential building losses from flood disasters. FAST was built from the ArcGIS Python script developed by Oregon’s Department of Geology and Mineral Industries (DOGAMI). A Hazus Level 2 advanced analysis increases the accuracy and precision of an analysis by incorporating user-supplied data relevant to the hazard. The flood model results support local hazard mitigation plans and other flood reduction efforts funded by FEMA’s Hazard Mitigation Grant Program (HMGP) and the State Hazard Mitigation Office.

**HEC-RAS Model** - The US Army Corp of Engineers' Hydrologic Engineering Centers' River Analysis System (HEC-RAS), allows users to model water features, perform multiple flooding scenarios, volumetric calculation and analysis, and more, by incorporating structures, bridges, dams, and other features of the built environment to the analysis. HEC-RAS models of flood studies can be downloaded from the Flood Query Results Panel of the Flood Tool. See the [HEC-RAS User’s Manual](https://www.hec.usace.army.mil/software/hec-ras/documentation/HEC-RAS_4.1_Users_Manual.pdf) for more information.

**High-risk Advisory Zones: Future Flood Zone Changes** - High-risk advisory zones – Preliminary NFHL, Advisory A, or Updated AE – are non-regulatory 1-percent-annual-chance flood zones represented as orange-colored flood zones in the WV Flood Tool. These advisory flood zones are generated from new model-backed flood studies or from redelineation mapping. Redelineation is the method of updating effective flood hazard boundaries to match updated topographic data based on the computed water surface elevations from effective models. The public should be informed that these non-regulatory zones will most likely become effective when new Flood Insurance Rate Maps (FIRM) are published, and thus any development in these zones should be regulated to the same standards as effective high-risk flood zones. In local floodplain ordinances, communities may choose to adopt high-risk advisory zones as "community-identified floodplains" and regulated the same as the Special Flood Hazard Area of the official Flood Insurance Rate Map (FIRM). Besides showing flood prone areas that are likely to be “mapped into the SFHA” in a future FEMA Flood Restudy, the high-risk advisory zones are also beneficial in identifying Letters of Map Amendment (LOMAs) for structures or property that should be “removed from the SFHA.”

* **Preliminary (Draft) NFHL:** Preliminary FEMA National Flood Hazard Layers (NFHL) are pending to become effective on new Flood Insurance Rate Maps (FIRMs). A Preliminary Flood Zone for a 1-percent-annual-chance-flood (100-year flood) event is displayed on the WV Flood Tool as a high-risk advisory zone until it becomes effective on the official FIRM. Preliminary NFHL is also known as Preliminary DFIRM.
* **Advisory A Flood Zone:** A model-backed Approximate A Zone is determined by using hydrology and hydraulics (H&H) analysis and the best available elevation data. Water Depth and Water Surface Elevation Grids are also companion products of Advisory A Zones. The Advisory Flood Heights or Advisory Base Flood Elevations are displayed in the Flood Query Results Panel of the WV Flood Tool. Although these high-risk advisory zones are non-regulatory flood zones, future FEMA Flood Studies most likely will incorporate these advisory zones on the official FIRM. In local floodplain ordinances, communities may choose to adopt high-risk advisory zones as "community-identified floodplains" and regulated the same as the Special Flood Hazard Area of the official FIRM.
* **Updated AE Boundary**: A Non-Restudy where AE Zones undergo redelineation, a method of updating effective flood hazard boundaries to match updated topographic data based on the computed water surface elevations from effective models. Advisory AE Zones outside the SFHA are high-risk, non-regulatory flood zones. Future FEMA Flood Studies most likely will incorporate these Advisory AE Zones on the official FIRM. In local floodplain ordinances, communities may choose to adopt high-risk advisory zones as "community-identified floodplains" and regulated the same as the Special Flood Hazard Area of the official FIRM. Along with the Updated AE Floodplain Boundaries, the Depth and Water Surface Elevation Grids are products of the redelineation. Gridded Base Flood Elevations are displayed in the Flood Query Results Panel of the WV Flood Tool. Flood Heights in effective AE Zones should be confirmed with the Flood Profiles and Flood Elevation Tables, whereas flood heights or base flood elevations delineated outside the effective AE Zones of the FIRM are advisory; communities may choose to regulate Advisory Flood Heights (or Advisory Base Flood Elevations) in high risk advisory zones the same as Base Flood Elevations in the SFHA.

**Adoption of High risk Advisory Zones in Local Floodplain Ordinance:**  The local floodplain ordinance outlines the flood zone areas where the regulations apply. To be compliant with the NFIP, these areas, at a minimum, must include the current effective FIS and FIRM (including any revisions). Should a community want to regulate beyond these areas, such as within an “advisory floodplain,” then that community would need to formally recognize these additional areas. These areas must be formally adopted or “officially recognized” as such by the community for the regulations of the local ordinance to apply. WV Floodplain Ordinances may include language for what is commonly referred to as a “community identified floodplain” – areas of flood risk not included on the FEMA FIRM. A community-identified floodplain is outside the SFHA, where the community enforces development regulations similar to those enforced for new development in the SFHA. The community must map the area and document its floodplain management regulations. Refer to the [State Model Floodplain Ordinance](https://data.wvgis.wvu.edu/pub/temp/FEMA/FRA/Ordinance/WV_State_Model_Ordinance_2019.pdf) for more guidance.

**High risk Advisory Zones:** **Flood Risk Outreach Materials** - Flood Insurance Outreach Information to Property Owners for pending Flood Zone Changes or Future Map Conditions.

1. **Preliminary National Flood Hazard Layer (NFHL)**. A FEMA-Initiated Flood Study that results in detailed, digital flood hazard maps known as Flood Insurance Rate Maps (FIRM). These preliminary draft maps include updated, high-risk Special Flood Hazard Area (SFHA). These preliminary maps are pending and in the final review process to become effective.
   1. Property Mapped into SFHA Future Map Conditions
      1. If you have a mortgage from a federally regulated lender and the building(s) on this parcel are within the SFHA, then by federal law, your lender must require you to carry flood insurance when these flood maps become effective.
      2. Flood insurance is available through the National Flood Insurance Program (NFIP), a federally underwritten program provided by nearly 100 insurance companies and written through licensed insurance agents.
      3. Contact your insurance agent to learn about lower-cost “Preferred Risk Policy” options offered by the NFIP for properties being mapped into higher-risk areas for the first time.
      4. If you do not have a mortgage, it is still recommended that you purchase flood insurance. Over the life of a 30-year loan, there is about a three times greater chance of having a flood in your home than having a fire.Most homeowner’s insurance policies do not provide coverage for damage due to flooding.
      5. For more information on flood insurance, visit the National Flood Insurance Program’s website, [www.floodsmart.gov](http://www.floodsmart.gov).
   2. Property Mapped out of SFHA
      1. The risk for flooding changes over time due to erosion, land use, weather events and other factors. The risk for flooding can vary within the same neighborhood and even property to property.
      2. The floods of June 23 and 24, 2016, devastated communities in Central West Virginia, whereby repeated rounds of torrential thunderstorms dumped more than 9 inches of rain in the hardest hit areas, and media reports referred to the storm as a “1 in 1,000-year event.” However, research published in a 2018 FEMA Report suggests this type of event could happen more frequently than previously thought. Of the nearly 1,000 flood insurance claims in the declared counties, 77% were in the 1-percent annual-chance floodplain and approximately 23% of the insurance claims were outside. On average, in floods across the country, about 25% of claims are outside the Special Flood Hazard Area, so this is consistent with the national trend.
      3. Since your parcel has been building(s) on this parcel are within the SFHAthe new flood study has resulted in your parcel or building(s) on this parcel to be mapped outside the Special Flood Hazard Area (SFHA) and into a lower risk zone, shown on the FIRM as “X”. If you have a mortgage from a federally regulated lender, you will no longer be required by federal law to maintain flood insurance when the flood maps become effective
      4. While flood insurance becomes optional, maintaining coverage is recommended as the flood risk has only been reduced, not removed. Lower cost flood insurance from the National Flood Insurance Program (NFIP) is available in low- to moderate-risk areas and you may also qualify for the even lower cost Preferred Risk Policy (PRP). Contact your insurance agent to learn more about how to convert to the PRP. For more information on flood insurance, visit [www.floodsmart.gov](http://www.floodsmart.gov).
2. **High-risk Advisory A or AE Zones.** High-risk advisory flood hazard information from State-Initiated Studies that will likely be incorporated into future effective regulatory or community identified floodplains.
   1. Property Mapped into Future SFHA or Community Identified Floodplain
      1. A state-based flood map study indicates that this parcel or building(s) within the parcel has been mapped into a High-risk Advisory Zone. This property is at high risk of a 1-percent annual (100-Year) chance flood event
      2. A mapped High-risk Advisory Zone (orange color on WV Flood Tool) denotes a flood hazard area that will likely be incorporated into future effective FIRM maps. New development should not occur in updated floodplains without a detailed study to show the development is reasonably safe from flooding.
      3. The local floodplain management regulations required by the NFIP apply only in SFHAs. However, communities may regulate development in areas of high-risk outside the SFHA. Should a community want to regulate development beyond the FIRM, then a community may formally adopt High-risk Advisory Zones as a “community identified floodplain” in its local floodplain ordinance.
      4. Most homeowner’s insurance policies do not provide coverage for damage due to flooding. Contact your insurance agent to learn about lower-cost “Preferred Risk Policy (PRP)” options offered by the NFIP for properties being mapped into higher-risk flood hazard areas. When a property’s flood zone changes from a Non–Special Flood Hazard Zone (NSFHA) to an SFHA as a result of a FIRM update, then the property owner will have to follow the guidelines of a Standard Flood Insurance Policy (SFIP). Mortgage-backed loans for properties within regulatory SFHA are required by federal law to carry flood insurance. For more information on flood insurance, visit the National Flood Insurance Program’s website, [www.floodsmart.gov](http://www.floodsmart.gov).
   2. Property Owners Mapped out of Future SFHA or Community Identified Floodplain
      1. A state-based flood map study indicates that this parcel or building(s) within the parcel has been mapped out of a High-risk Advisory Zone and may qualify for a Letter of Map Amendment (LOMA).
      2. The Online LOMC web application allows homeowners or their designated representatives to easily request a Letter of Map Change (LOMC). Use this site if your property was inadvertently included in a flood zone, or if the addition of fill elevated your property so that it is above the flood zone. Use the WV Flood Tool to provide supporting documents, including LiDAR-based elevation information, if a field survey (Elevation Certificate) is not required.
      3. A LOMA with a REMOVAL determination status will map the parcel or building out of the Special Flood Hazard Area (SFHA) and into a lower risk zone, shown on the FIRM as “X”. If you have a mortgage from a federally regulated lender, you will no longer be required by federal law to maintain flood insurance.
      4. It is important to know that many flood claims are made by property owners located outside the high-risk flood zone and that the issuance of a LOMC does not mean the structure or property is safe from all flooding. Floods greater than the 1-percent-annual-chance event (100-year flood) can, and do, occur. Therefore, because flooding also occurs in areas of moderate or minimal flood risk, FEMA recommends flood insurance coverage, even if it is not required by law or a lender.
      5. While flood insurance becomes optional, maintaining coverage is recommended as the flood risk has only been reduced, not removed. Lower cost flood insurance from the National Flood Insurance Program (NFIP) is available in low- to moderate-risk areas, and you may also qualify for the even lower cost Preferred Risk Policy (PRP). Contact your insurance agent to learn more about how to convert to the PRP. For more information on flood insurance, visit [www.floodsmart.gov](http://www.floodsmart.gov).

**High velocity flow** – Typically comprised of flood waters moving faster than 5 feet per second.

**Initial FIRM Date Identified** - This date represents the community’s first Flood Insurance Rate Map, and it is important because it represents the dividing line between two building categories called Pre-FIRM and Post-FIRM. The Initial FIRM Date for each community is published on FEMA’s [Community Status Book](https://www.fema.gov/national-flood-insurance-program-community-status-book). See related terms Pre-FIRM and Post-FIRM buildings.

**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).

**LOMC (Letter of Map Change)** - A LOMC is a letter that reflects an official revision and/or an amendment to an effective FIRM, which as various uses. If a property owner thinks their property has been inadvertently mapped in a SFHA, property owners or their representatives may submit a request to FEMA for a LOMC. In another use, FEMA issues LOMCs in place of physically revising an effective FIRM. Three of the most common LOMCs that are displayed on the EXPERT and RISK MAP Views of the WV Flood Tool are:

* **Letters of Map Amendment (LOMAs).** An amendment to the currently effective FEMA map which establishes that a property is not located in a Special Flood Hazard Area (SFHA). A LOMA is issued only by FEMA. Typically, a LOMA is issued when the scale of the FIRM does not allow for small areas of natural high ground to be shown outside the SFHA
* **Letters of Map Revision based on Fill (LOMR-F).** An official amendment to the currently effective FEMA map. It is issued by FEMA and changes flood zones, delineations and elevations. A LOMR-F is like a LOMA, but instead of being based on natural ground elevations, the property or structure has been elevated by fill in order to elevate it above the flood elevation
* **Letters of Map Revision (LOMRs).** A LOMR is an official revision to an effective FIRM map that may change flood insurance risk zones, floodplain and/or floodway boundary delineations, plain metric features, and/or BFE. Unlike LOMAs and LOMR-Fs, a LOMR usually results in reprinting a portion of a FIRM.

The [Online LOMC](https://www.fema.gov/online-lomc) web application allows homeowners or their designated representatives to easily request a Letter of Map Change (LOMC). Use this site if your property was inadvertently included in a flood zone, or if the addition of fill elevated your property so that it is above the flood zone. The Online LOMC tool is an alternative to the MT-1 and MT-2 paper forms and/or MT-EZ paper form.

RESOURCES

* [How to Request a Map Amendment (Nov. 2018](https://www.fema.gov/media-library-data/1539806249718-eddafcd1b06c3a480339091a04bd665d/MT-1_Process_Graphic_October2018FINAL.pdf))
* [LOMA and LOMR-F Factsheet (2017)](https://www.fema.gov/media-library/assets/documents/19871)

**LOMC /LOMA Verified** - LOMA locations, as shown in the NFHL Viewer, are approximate. According to FEMA, the official exact location of the LOMA is in the legal property description of the LOMA Determination Document.

A state-based GIS mapping initiative is improving the positional accuracy of the LOMAs and published as the “LOMA Verified” map layer on the EXPERT and RISK MAP Views of the WV Flood Tool. For the Verified LOMAs, the positional accuracy of the x-y coordinates has been verified by legal descriptions, deed book/page number, parcel identifier, E-911 address, or other reference layers.

FEMA NFHL View LOMAs and the State Verified LOMAs are displayed in both the EXPERT and RISK MAP Views of the WV Flood Tool. The NFHL Viewer LOMAs are symbolized on the Revalidation Status attribute field whereas the State Verified LOMAs are symbolized on the LOMA Outcome field.

* **NFHL LOMAs** – Symbolized on the Revalidation Status data field. The Revalidation status is important for flood map revisions.
* **State Verified LOMAs** – Symbolized on the Outcome data field. The Outcome field is categorized as Structure Non-Removal, Removal, or Out as Shown. This outcome information is beneficial for identifying if a structure is in the SFHA and for calculating the bSF (buildings in the SFHA) for CRS communities.

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

**Lowest Floor (also terms Bottom Floor and First Floor Height)**- The lowest floor of the lowest enclosed area (including a basement). An unfinished or flood-resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area, is not considered a building's lowest floor provided that such enclosure is not built to render the structure in violation of requirements. Refer to the [Lowest Floor Guide](https://www.fema.gov/media-library-data/1523307311381-4cf9726b2eb04c3471a3e9d37a58fa6a/07_lowest_floor_guide_508_apr2018.pdf).

BOTTOM FLOOR VERSUS LOWEST FLOOR

* Bottom Floor: The Bottom Floor is measured by the surveyor. The floor with the lowest elevation is assumed to be level; if sloped, the lowest point of the floor is used. The Bottom Floor is C2.a on the Elevation Certificate.
* Lowest Floor: Interpreted by the community floodplain administrator based on multiple factors. The Lowest Floor is used for rating insurance and determines whether a structure is compliant with local floodplain ordinance.

FIRST FLOOR HEIGHT VERSUS LOWEST FLOOR

* First Floor Height: The First Floor Height is the depth in feet above the ground level and an important input for Hazus Flood Loss Estimates. The First Floor Height is subtracted from the Flood Depth to compute the Depth-in-Structure for a base flood.
* Lowest Floor: The Lowest Floor is measured in elevation in feet above sea level and used for rating flood insurance policies.

**Manufactured (Mobile) Home -** A structure built on a permanent chassis, transported to its site in 1 or more sections, and affixed to a permanent foundation. "Manufactured (mobile) home" does not include recreational vehicles. Manufacture homes occupancy class types are usually identified by the Land Use Code of assessment records or by aerial imagery. Mobile homes are considered personal property when the mobile homeowner does not own the land, and thus real estate values are not shown in the assessment records. When mobile home values are missing in the assessment records, then county mean or median mobile home replacement cost values are substituted.

**Mitigation: (AoMI) -** The Areas of Mitigation Interest (AoMI) dataset assists communities in determining specific actions to increase their resilience from floods. AoMI identifies currently planned mitigation activities as well as areas of potential future action. It encourages collaboration among communities within the project area by providing with them the basis to assess how various mitigation action scenarios can successfully reduce their collective flood risk. AoMIs are identified by communities as part of the State's Flood Risk Assessment and may be published to the WV Flood Tool.

**Mitigation: Buyout Properties** - Buyout land parcels located within floodplains that experience frequent flooding and damage due to flood events, may be altered, purchased, or have deed restrictions placed upon them by FEMA or other agencies to prevent loss of life and property damage. Property owners/communities with public lands in floodplains are compensated for their land, and the land usually becomes public green space or restored to its natural floodplain function. Mitigated buyout properties are displayed in the EXPERT and RISK MAP Views of the WV Flood Tool.

**Mitigation: Hazard Mitigation Plan** - Hazard mitigation planning is the process used by state and local leaders to understand risks from natural hazards and develop long-term strategies to reduce the impacts of disasters on people, property, and the environment. FEMA has two major hazard mitigation planning programs: local multi-hazard mitigation planning associated with the [Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act)](https://www.fema.gov/media-library/assets/documents/15271) hazard mitigation provisions and floodplain management planning under the Community Rating System (CRS). The [CRS Floodplain Management Planning](https://www.fema.gov/media-library-data/1560365486495-6e5bdaa89de4bf2363596e615f4c7575/MitigationPlanningandtheCommunityRatingSystemKeyTopicsBulletin.pdf) focuses on flood risks and allows CRS-participating communities to improve their CRS class and increase their flood insurance discount under the National Flood Insurance Program (NFIP).

**Mitigation: Open Space Preservation** - Open Space Preservation layers restore the floodplain to its natural function and provides opportunities for credits from FEMA’s Community Rating System (CRS). Open Space Preservation layers include Deed Restricted Buyout Properties, Private Lands (Nature Preserves, Land Trust) and Public Lands (state and local lands).

**NFHL Viewer** - FEMA's web application that contains current effective flood hazard data from the National Flood Hazard Layer (NFHL) geodatabase. In the Flood Query Results Panel of the WV Flood Tool, users can link to the [NFHL Viewer](https://msc.fema.gov/nfhl) at the same map extent and zoom level. Additional external links are also provided in the Flood Query Results Panel for viewing and downloading the FEMA FIRM.

**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.

**Parcel Identifier** - The Parcel ID is a unique number that is the basis for identifying all parcels in the WV Flood Tool and WV Property Viewer. The Parcel ID consists of six elements: County code, District code, Map number, Parcel Prefix, Parcel Suffix, and Special ID. All the elements are alpha-numeric characters except for the county and district codes, which are numeric. The Root Parcel ID (e.g., 31-05-0007-0031-0015-0000) consists of all six elements separated by hyphens. The 20-character GIS Parcel ID is the principal identifier for identifying flood hazard information (buyout property parcels, LOMA property parcels, etc.)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 31 | - | 05 | - | 0007 | - | 0031 | - | 0015 |
| County |  | District |  | Map |  | Parcel |  | Suffix |

Example:

GIS Parcel ID: 31-05-0007-0031-0015  
County: 31 (Monongalia County)  
District: 05 (Clinton District)  
Map: 7  
Parcel Number: 31  
Parcel Suffix: 15

The Viewer displays various formats of the Parcel ID. The GIS Parcel ID consists of all elements minus the Special ID (e.g., 31-05-0007-0031-0015) while the CAMA/IAS Parcel ID consists of all elements minus the county code (e.g., 05 7003100150000). The Viewer also displays abbreviated Parcel IDs in which leading zeros or spaces are removed. Examples include the parcel number search results that consist of the District-Map-Parcel (e.g., 05-7-31.15) or the parcel map labels denoted by Map-Parcel (e.g., 7-31.15).

**Post-FIRM Building** - For insurance rating purposes, a post-FIRM building is one that was constructed or substantially improved after December 31, 1974, or after the effective date of the initial Flood Insurance Rate Map of a community, whichever is later. A post-FIRM building is required to meet the National Flood Insurance Program’s minimum Regular Program flood protection standards. For building-level Flood Risk Assessments, the Post-FIRM building is computed from the Building Year of the assessment records. If there is no Building Year listed in the property records, then the FIRM category status is unknown. The Pre-FIRM or Post-FIRM category is displayed in the Flood Risk Assessment Tab of the WV Flood Tool.

**Pre-FIRM Building** - For insurance rating purposes, a pre-FIRM building is one that was constructed or substantially improved on or before December 31, 1974, or before the effective date of the initial Flood Insurance Rate Map of the community, whichever is later. Most pre-FIRM buildings were constructed without taking the flood hazard into account. For building-level Flood Risk Assessments, the Pre-FIRM building is computed from the Building Year of the assessment records. If there is no Building Year listed in the property records, then the FIRM category status is unknown. The Pre-FIRM or Post-FIRM category is displayed in the Flood Risk Assessment Tab of the WV Flood Tool.

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

**Property Assessment Search Tool** - The WV Property Search Tool (<https://www.mapwv.gov/property>) is a companion application of the WV Flood Tool that allows users to perform advanced search and filter queries on all property assessment records. The “Prior Ownership” search option allows users to search the parcel history back to the year 2005. This option is useful for verifying the positional accuracies of LOMAs and Mitigated Buyout Properties when prior owner and deed book information is recorded. The “Advanced” search option allows users to search for new structures in the floodplain; for example, the following filter parameters (County of Interest, Flood Hazard = High, Minimum Building Appraisal = $50,000, Building Year Minimum = 2018) will result in a record listing of all parcels that intersect high risk flood zones for 2018-19 Tax Years, and building values exceed $50,000.

**Property Assessment Report** - Online Detailed Property Assessment Reports are available for each property in West Virginia. The assessment reports provide information for every structure (main buildings and outbuildings) on a single parcel to include: Owner Name, Mailing Address, Property Location, Tax Class (Owner Occupied), Deed Book/Page Number, Deed, and Calculated Acreage, Legal Description, Land Use, Building and Land Values, Building Characteristics, Building Year, Secondary Structures, Sales History, Parcel History, Building Sketch Diagrams, and Flood Zone Hazard Risk. Building sketches with dimensions and additions are displayed for residential and farm properties. These sketch diagrams are beneficial in distinguishing among multiple structures located in a single parcel. Detailed Property Assessment Reports can be accessed in the Flood Query Results Panel or Parcel Tab of the WV Flood Tool.

**Preliminary (draft) DFIRM** - A community flood mapping database (DFIRM) that has been completed by the mapping partner/contractor, submitted to FEMA for validation, validated, and released to the community for review by local stakeholders. Preliminary (draft) DFIRM data may be used for planning purposes in regulating development in 1-percent annual chance floodplain areas but does not replace the current FIRM or DFIRM until the Preliminary becomes Effective. Where applicable, Preliminary 1-percent chance flood zones are viewable in the EXPERT and RISK MAP Views of the WV Flood Tool.

**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.

**Redelineation Mapping Method** - Redelineation of riverine floodplains is a useful technique for updating flood hazard information for an effective riverine analysis that is considered valid. Redelineation is often used when effective discharges and Base Flood Elevations (BFEs) appear accurate, but the SFHA seems inaccurate (e.g., flooding losses in Zones B, C, or X; numerous Letters of Map Amendment; comparison with accurate topographic data). The flood boundaries are delineated by finding the intersection of the ground surface defined by the underlying digital terrain model and the flood surface. Redelineation involves using more detailed topographic data than what was used to prepare the effective FIRM, in order to remap the floodplain boundaries based on the flood elevations used in preparing the effective FIRM. Redelineation is to be limited to floodplains studied by detailed methods where BFEs or flood depths are designated on the effective FIRM. No new engineering analyses are performed as part of the redelineation methodology; however, redelineation can be paired with new engineering studies as part of a larger update. For riverine studies, effective flood profiles and data tables from the Flood Insurance Study (FIS) report, Base Flood Elevations (BFEs) from the Flood Insurance Rate Maps (FIRMs) and supporting hydrologic and hydraulic analyses are used in conjunction with the updated topographic data to formulate new floodplain boundaries. Redelineation is part of a statewide flood mapping initiative to create Updated AE Boundaries and Non-Restudy BFE and Depth Grids. More Information: [FEMA Guidance for Flood Risk Analysis and Mapping - Redelineation Guidance (November 2019)](https://www.fema.gov/media-library-data/1578328270359-16dcbc4903ff36c1a1e946caeae35c29/Redelineation_Guidance_Nov_2019.pdf) and [FEMA Riverine Mapping and Floodplain Boundaries Guidance (November 2019)](https://www.fema.gov/media-library-data/1578497773910-a9ed418fb9a118634c3a22a63df6a1ad/Riverine_Mapping_and_Floodplain_Guidance_Nov_2019.pdf).

**Risk MAP** – The FEMA vision for identifying, assessing, communicating, and mitigating the risk associated with hazards such as flooding. MAP = (M)apping, (A)ssessment and (P)lanning. The RISK MAP View of the WV Flood Tool shows building-level risk assessments for a 1-percent annual chance (100-year) flood event.

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

**Special Flood Hazard Area (SFHA)** – Special Flood Hazard Areas are high risk areas subject to inundation by the base (1-percent-annual-chance) flood. They are also known as 1-percent-annual-chance floodplains, base floodplains, or 100-year floodplains. The Special Flood Hazard Areas are depicted in all three Views of the WV Flood Tool and by three different cartographic representations.

**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** – A 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.

**Structure or Building** - For floodplain management and flood risk assessment purposes, a structure is a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home. The terms "structure" and "building" are interchangeable in the National Flood Insurance Program (NFIP). Residential and non-residential structures are treated differently. A residential building built in a floodplain must be elevated above the Base Flood Elevation (BFE). Non-residential buildings may be elevated or floodproofed.

A “Building” is

* A structure with two or more outside rigid walls and a fully secured roof and that is affixed to a permanent site; or
* A manufactured home (also known as a mobile home) is a structure built on a permanent chassis, transported to its site in one or more sections, and affixed to a permanent foundation; or
* A travel trailer without wheels, built on a chassis and affixed to a permanent foundation, that is regulated under the community’s floodplain management and building ordinances or laws.

“Building” does not mean

* A gas or liquid storage tank, a recreational vehicle, a park trailer, or other similar vehicles, except as described above; or
* Outbuildings, garages, carports, [accessory structures](https://www.fema.gov/accessory-structures), or other secondary structures that are typically less than $10,000 in value or small than 300 square feet.
* Appurtenant structures less than 300 square feet in size and valued at less than $7,000. See the State Model Floodplain Ordinance.

As part of the State Flood Risk Assessment, all primary insurable structures in high-risk floodplains are inventoried and published to the RISK MAP View of the WV Flood Tool.

**Zone Designation** - Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area. [FEMA Flood Zone Designations](https://snmapmod.snco.us/fmm/document/fema-flood-zone-definitions.pdf) are regulatory zones A, AE, AO, AH, and X. High-risk advisory flood zone designations are Advisory A and Updated AE. All flood zone designations are displayed in the map frame and Flood Query Results Panel of the WV Flood Tool.

***Zone A* (High-Risk) Approximate A** - Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Areas with a 1-percent annual chance of flooding and a 26% chance of flooding over the life of a 30‐year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones. In stream miles, Approximate A Zones cover 70% of the 1-percent percent flood zones in West Virginia. In the Results Panel, Zone A (or Approximate A Zone) is indicated by a red warning color in the WV Flood Tool. The zone designation, advisory base flood height, and flood depth are displayed in the Flood Query Results Panel of the WV Flood Tool. State-Initiated Map Revisions (Advisory A): State-initiated map revisions have resulted in model-backed [Advisory Flood Heights](https://www.mapwv.gov/flood/content/documents/AFHhandout.pdf) and flood depth grids for 35 counties in West Virginia. See glossary terms High-Risk Advisory Zones and Zone Advisory A.

**Zone AE (High-Risk)** - Areas subject to inundation by the 1-percent-annual-chance flood event with base flood elevations determined by a “detailed” engineering flood study. In stream miles, AE Zones cover 30% of the 1-percent percent flood zones in West Virginia. In the Results Panel, Zone AE is indicated by a red warning color in the WV Flood Tool. The zone designation, base elevation, FIS flood profile, and flood depth are displayed in the Flood Query Results Panel of the WV Flood Tool.

State-Initiated Map Revisions and WV Flood Tool: State-initiated map revisions have resulted in Updated AE Zones for select counties in West Virginia using the redelineation methodology. Refer to glossary terms Redelineation, High-risk Advisory Zones, and Zone Updated AE.

***Zone AH* (High-Risk)** - Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone. The only Zone AH in West Virginia is in Petersburg in Grant County. Zone AH is a high risk flood zone indicated by a red warning color in the WV Flood Tool.

***Zone AO* (High-Risk) -** Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. The only Zone AO in West Virginia is in Shepherdstown in Jefferson County with a sheet flow of 3 feet. Zone AO is a high-risk flood zone indicated by a red warning color in the WV Flood Tool.

**Zone** **Advisory A (High-Risk)** - A High-risk Advisory A Flood Zone indicated by an orange warning color in the WV Flood Tool. High-risk advisory zones include corresponding flood height and depth grids. See High-Risk Advisory Flood Zone.

**Zone Updated AE (High-Risk)** - A High-risk Advisory AE Flood Zone indicated by an orange warning color in the WV Flood Tool. High-risk advisory zones include corresponding flood height and depth grids. See High-Risk Advisory Flood Zone.

**Zone X Shaded (Moderate-Risk)** - Moderate-risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. Zone X shaded is used on new and revised maps in place of Zone B. Moderate Risk Flood Zones are denoted by a yellow warning color in the WV Flood Tool.

**Zone X (unshaded) (Low-Risk)** - Minimal risk areas outside the 1-percent and 0.2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. Zone X (unshaded) is used on new and revised maps in place of Zone C. Minimal or low risk areas are denoted by a green warning color in the WV Flood Tool.

# 7 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](http://www.floodsmart.gov)

FEMA, [www.fema.gov](http://www.fema.gov)

FEMA, *Guidelines, and Standards for Flood Risk Analysis and Mapping*, [www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping](http://www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping)

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FEMA, 1998. *Homeowner’s Guide to Retrofitting*, FEMA 312. Washington, DC, June 1998.

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FEMA, 2007b. *Property Acquisition Handbook for Local Communities*, FEMA 317. Washington, DC, September 2007.

FEMA, 2007c. *Public Assistance Guide*, FEMA 322. Washington, DC, June 2007.

FEMA, 2007d. *Using Benefit-Cost Review in Mitigation Planning*, FEMA 386-5. Washington, DC, May 2007.

FEMA, 2007e. *Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings*, FEMA 543. Washington, DC, January 2007.

FEMA, 2007f. *Selecting Appropriate Mitigation Measures for Floodprone Structures*, FEMA 551. Washington, DC, March 2007.

FEMA, 2007g. *Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds: Providing Protection to People and Buildings,* FEMA 577. Washington, DC, June 2007.

FEMA, 2008a. *Reducing Flood Losses Through the International Codes: Meeting the Requirements of the National Flood Insurance Program,* FEMA 9-0372, Third Edition. Washington, DC, December 2007.

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FEMA, 2009d. *Recommended Residential Construction for Coastal Areas: Building on Strong and Safe Foundations,* FEMA P-550, Second Edition. Washington, DC, December 2009.

FEMA, 2010b. *Home Builder’s Guide to Coastal Construction,* FEMA P-499. Washington, DC, December 2010.

FEMA, 2011. *Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas*, Fourth Edition, FEMA P-55. Washington, DC, August 2011.

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