

# GREENBRIER COUNTY FLOOD IMPACT STUDY RESOURCES

Compiled by Kurt Donaldson 2/17/2023

**I. Greenbrier County Study Focus Group Materials.** Materials presented at focus group meetings in November 2022 at Rainelle and White Sulphur Springs, Greenbrier County, WV.

- 1) Flood Risk Indicators
  - a) [Hazard Risk Characteristics](#)
    - i) Frequency
    - ii) Depth
    - iii) Velocity
    - iv) Duration
    - v) Rise and Fall
  - b) Exposure Risk Indicators
    - i) [Human Exposure](#)
    - ii) [Physical Exposure](#)
  - c) Vulnerability Risk Indicators
    - i) Institutional Vulnerability
    - ii) [Social Vulnerability](#)
    - iii) [Physical Vulnerability](#)
  - d) Flood Loss Models Estimates
    - i) [Building Damage and Dollar Percent Estimates](#)
    - ii) [Substantial Damage Estimates](#)
    - iii) [Building Debris Removal Estimates](#)
    - iv) [Population Displacement and Short-Term Shelter Estimates](#)
    - v) [Transportation Inundation Models Estimates](#)
- 2) Mitigation Actions
  - a) [Mitigated Structures](#)
  - b) Building Adaptability (CTP)
  - c) [Open Space Preservation \(OSP\)](#)
  - d) [Higher Standards](#)
  - e) [Flood Insurance](#)
  - f) [Floodplain Management](#)
  - g) [Risk Communication](#)
  - h) Pre-Disaster Planning
  - i) Post-Disaster Findings and Planning
  - j) Training
- 3) Tools /Products
  - a) Community Risk Indicators and Rankings
    - i) [Indicator/Ranking Tables](#)
    - ii) Indicator Charts
    - iii) Flood Risk Maps
    - iv) Flood Risk/Loss Dashboards. [Rainelle](#) | [WSS](#)
    - v) [Updated FEMA Dashboard](#)
    - vi) [Display Posters of Risk Assessment \(Exposure/Vulnerability/Loss\)](#)

- b) Story Maps
- c) Mitigation Assessment Tools
  - i) [Mitigation Tables](#)
  - ii) Mitigation Maps. Rainelle [Streets Aerial](#) | WSS [Streets Aerial](#)
  - iii) Building-Level Mitigation Images. [Rainelle](#) | [WSS](#)
- d) [Flood Tool](#)
- e) Multimedia
  - i) [Community-Level 3D Movies](#)
  - ii) [Community-Level 3D Viewsheds](#)
  - iii) [Neighborhood-Level 3D Mitigation Maps](#)
  - iv) [Structure-Level 3D Views](#)
- f) Posters
  - i) Flood Hazard Characteristics [Rainelle](#) | [WSS](#)
  - ii) Flood Risk Indicators [Rainelle](#) | [WSS](#)
  - iii) Flood Mitigation Measures [Rainelle](#) | [WSS](#)
  - iv) Community Mitigation Maps
    - (1) Street Base Map. [Rainelle Streets](#) | [WSS Streets](#)
    - (2) Imagery Base Map. [Rainelle Imagery](#) | [WSS Imagery](#)

## II. Supporting Documents. Materials for focus group meetings in November 2022.

### 1) Inundation Maps

- a) RAINELLE inundation maps
  - i) FEMA Preliminary – 2022
    - (1) [10-Year](#) Return Period Estimate
    - (2) [25-Year](#) Return Period Estimate
    - (3) [50-Year](#) Return Period Estimate
    - (4) [100-Year](#) Return Period Estimate
    - (5) [100-Year Plus](#) Return Period Estimate (**Climate Change**)
    - (6) [500-Year](#) Return Period Estimate (similar to 100-yr Plus for NE Rainelle because of backwater modeling)
    - (7) [FSF All Flood Frequencies](#)
    - (8) [100-Year & 500-Year](#) Return Periods Combined
    - (9) [Floodplain Map & Floodway](#) (Preliminary FIRM)
    - (10) [3D Viewshed](#)
  - ii) First Street Foundation (FSF) - 2022
    - (1) [5-Year](#) Return Period Estimate
    - (2) [20-Year](#) Return Period Estimate
    - (3) [100-Year](#) Return Period Estimate
    - (4) [100-Year Climate](#) 2052 Return Period (30 years) (**Climate Change**)
    - (5) [500-Year](#) Return Period Estimate
    - (6) [500-Year Climate](#) 2052 Estimate (**Climate Change**)
    - (7) [100-Year & 500-Year](#) Return Periods Combined
    - (8) [FSF All Flood Frequencies](#)

- (9) Source: [Flood Factor Methodology](#)
- iii) Comparison between FSF and FEMA
  - (1) [100-Year](#) Comparison
  - (2) [500-Year](#) Comparison
  - (3) Combine exceedance probability with depth
- iv) USGS [High Water Marks](#) (2016 Flood)
- b) WHITE SULPHUR SPRINGS inundation maps**
  - i) FEMA Preliminary – 2022
    - (1) [10-Year](#) Return Period Estimate
    - (2) [25-Year](#) Return Period Estimate
    - (3) [50-Year](#) Return Period Estimate
    - (4) [100-Year](#) Return Period Estimate
    - (5) [100-Year Plus](#) Return Period Estimate (**Climate Change**)
    - (6) [500-Year](#) Return Period Estimate
    - (7) [100-Year & 500-Year](#) Return Periods Combined
    - (8) [Floodplain Map & Floodway](#) (Preliminary FIRM)
    - (9) [FEMA All Flood Frequencies](#)
    - (10) [3D Viewshed](#)
  - ii) First Street Foundation (FSF) - 2022
    - (1) [5-Year](#) Return Period Estimate
    - (2) [20-Year](#) Return Period Estimate
    - (3) [100-Year](#) Return Period Estimate
    - (4) [100-Year Climate](#) 2052 Return Period (30 years) (**Climate Change**)
    - (5) [500-Year](#) Return Period Estimate
    - (6) [500-Year Climate](#) 2052 Estimate (**Climate Change**)
    - (7) [100-Year & 500-Year](#) Return Periods Combined
    - (8) [FSF All Flood Frequencies](#)
  - iii) Comparison between FSF and FEMA
    - (1) [100-Year](#) Comparison
    - (2) [500-Year](#) Comparison
  - iv) USGS [High Water Marks](#) (2016 Flood)
- c) Future Building Map Conditions – SFHA Change Building In / Building Out**
  - i) Rainelle [Building Future Map Conditions](#) (100-yr) *preliminary*
  - ii) White Sulphur Springs [Building Future Map Conditions](#) (100-yr) *preliminary*

## 2) BUILDING EXPOSURE

- a) **Building Type** (Occupancy Class: Residential versus Non-Residential)
  - i) Communitywide Building Type by Parcels. Source 2022 tax assessments.
  - ii) Communitywide Building Type Parcels and 1% Floodplain BLRA Points. The BLRA (Building-Level Risk Assessment) is a detailed and verified inventory of building structures within the 1%-chance floodplain.
  - iii) AOI Building Type Parcels and 1% Floodplain BLRA Points.
  - iv) Graphics
    - (1) Rainelle Occupancy Class [Community](#) | [with BLRA](#) | [BLRA AoI](#)

- (2) WSS Occupancy Class [Community AOI](#) | [BLRA](#)
- b) **Owned versus Rented** for Residential Properties
  - i) Owner Occupied versus Rented graphic
  - ii) Selection Criteria
    - (1) Property Class = **Residential** or **Apartment**
    - (2) Land Use Codes <> Vacant Lands or Auxiliary Structures
    - (3) Hazus Occupancy Classes from RES1 to RES3B
    - (4) Building Value (tax assessment appraisal value) > \$5,000
  - iii) Tax Class
    - (1) Value 2 = Owner Occupied
    - (2) Value 4 = Renter Occupied
  - iv) Graphics
    - (1) Rainelle Owner-Occupied [Community](#) | [Floodplain](#)
    - (2) WSS Owner-Occupied [Community AOI](#) | [Floodplain AOI](#)
- c) **Subgrade Basements** (2022 Tax Assessment Foundation)
  - i) [Rainelle Basements](#) (FSF 500-yr depth)
  - ii) [WSS Basements](#) (FSF 500-yr depth)

### 3) **BUILDING DAMAGE LOSS**

- a) **2016 Flood Substantial Damage Estimates** (percentage damaged)
  - i) [WSS Substantial Damage Estimates](#)
  - ii) Rainelle Substantial Damage Estimates (no data)
- b) **Hazus Flood Loss Estimates**
  - i) FEMA 100-Yr SDE Percent Damage
    - (1) Rainelle [Building Damage Loss Estimates](#) (100-yr) *preliminary*
    - (2) WSS [Building Damage Loss Estimates](#) (100-yr) *preliminary*
  - ii) Hazus Building Damage Loss SDE (Elevated versus Non-Elevated); Building Counts; SDE (>50% Counts). Graphics show building footprints with red points for SDEs. Tabular summary data for dollar value estimates.
    - (1) FEMA
      - (a) FEMA 100-Yr 1ft. [Rainelle](#)
      - (b) FEMA 100-Yr Elevated [Rainelle](#)
      - (c) FEMA 100-Yr Plus 1ft. (Climate)
      - (d) FEMA 100-Yr Plus Elevated (Climate) [Rainelle](#)
      - (e) FEMA 500-Yr 1ft.
      - (f) FEMA 500-Yr Elevated
    - (2) First Street Foundation
      - (a) FSF 100-Yr 1ft.
      - (b) FSF 100-Yr Elevated
      - (c) FSF 100-Yr 2052 1ft. (Climate)
      - (d) FSF 100-Yr 2052 Elevated (Climate)
      - (e) FSF 500-Yr 1ft. [Rainelle](#) | [White Sulphur Springs](#)
      - (f) FSF 500-Yr Elevated

- c) **Repetitive Loss**
  - i) Rainelle RL (and tabular)
  - ii) WSS RL (and tabular) (few data points)
  
- 4) **TRANSPORTATION INUNDATION**
  - a) [Rainelle Inundated Transportation](#) (FEMA 100-yr)
  - b) [WSS Transportation Inundation](#) (FEMA 100-yr)
  
- 5) **MITIGATION**
  - a) **Mitigated Properties: Mitigated Structures and Acquisition Properties (Post Flood)**
    - i) **MITIGATED RECONSTRUCTION, ELEVATION, and ACQUISITION/BUYOUT** (Close or open foundations for mitigated structures). Mitigated properties are structures that have been removed, reconstructed, or elevated to protect them from a flood hazard.
      - (1) [Rainelle Mitigated Properties](#)
      - (2) [WSS Mitigated Properties](#)
      - (3) Mitigation Reconstruction by Sponsor
        - (a) ASP [Greenbrier County / Rainelle](#)
        - (b) VOAD
        - (c) WV RISE
    - ii) **RELOCATION.** New Residential Construction Post Flood – Relocated Communities. (2017-2021 Tax Assessment)
      - (1) [Rainelle New Residential Construction and Relocation Community](#) (Tax Assessment 2017-2021) (FSF 500-yr depth)
      - (2) [WSS New Residential Construction and Relocation Community](#) (Tax Assessment 2017-2021) (FSF 500-yr depth)
  - b) **Unmitigated Properties:**
    - i) **Unmitigated Low Value Structures.** Low-valued structures in which not mitigation measures have been taken.
      - (1) [Rainelle Unmitigated Low Value Structures](#)
      - (2) [WSS Unmitigated Low Value Structures](#)
    - ii) **Unmitigated Repaired/Rehabilitated Structures.** Structures damaged from a flood but the lowest floor was not mitigated or elevated above the base flood elevation to reduce or eliminate long-term flood risk to people and property. Structures were rehabilitated only to their previous building design.
      - (1) [Rainelle Unmitigated Rehabilitated / Repaired](#)
      - (2) [WSS Unmitigated Rehabilitated / Repaired](#)
  - c) **Community Mitigated Properties Map** (combined mitigated and unmitigated measures)
    - i) Mitigated Properties
      - (1) Structures
        - (a) Mitigation Reconstruction/Elevation to DFE (Green Tags)
        - (b) Relocation (only on community-wide graphic). Source data is from tax assessment records (building year 2017-2022).
      - (2) Open Space Preservation (Light green shaded parcels)
        - (a) Acquisition/Buyout Parcels (Deed Restricted)

- (b) Community Owned (parks, stormwater management, etc.)
- ii) Unmitigated Properties
  - (1) Low Value Structures (Red Tags)
  - (2) Repaired/Rehabilitated Structures (Orange Dots)
- iii) Partial Mitigation
  - (1) Elevated Structures not to DFE
  - (2) Elevated Structures with Improper flood vents (solid wall foundation)
- iv) *Reference and other Flood-Related Layers*: Incorporated place boundary, 1% floodplain and floodway, stream names, high water marks with depth values, elevation certificates with FFH values, 2016 SDE > 50%, mobile homes (RES2), 1% floodplain structures with subgrade basements. Also for consideration: Post-FIRM structures, future building condition structures, parcels, site addresses.
- d) **Mitigated Actions after 2016 Flood** using Pre-Flood Oblique Imagery (Google Earth). Shows removed structures, mitigation reconstruction, acquisition/buyout parcels, and 2016 SDE field surveys.
  - i) Rainelle
    - (1) 7<sup>th</sup> Street
    - (2) Greenbrier Ave
  - ii) White Sulphur Springs
    - (1) Central Ave
    - (2) Freeland Ave
- e) **Lowest Floor Elevation of Residential Buildings.** Building Lowest Floor or Design Flood Elevation above the Base Flood Elevation
  - i) Graphics:
    - (1) Rainelle Building DFE
    - (2) WSS Building DFE
  - ii) Criteria: First Floor Height (FFH) < Base Flood Elevation (BFE) + 2 ft.
    - (1) 100-year depth grid plus 2 feet freeboard (BFE + 2 ft.)
    - (2) Residential buildings
    - (3) Include “Mitigation Reconstruction to DFE” as map layer. Verify with “Rehabilitated/Repaired” to DFE layer
  - iii) Floodplain management compliance. The lowest floor must be above the BFE plus freeboard for all new construction or existing structures significantly improved.
- f) **Areas of Mitigation Interest**
  - i) Rainelle AoMI (AoMI)
  - ii) WSS AoMI (AoMI)
- g) **Loss Avoidance Study**
  - i) Avoided damages losses (Hazus computed)
  - ii) Open Space Preservation

## 6) FEMA FLOOD STUDIES AND REPORTS

- a) 2022 Flood Insurance Study (Preliminary) [Volume 1](#) | [Volume 2](#)
  - i) [Historical Stream Gage HWM](#) (page 36)
  - ii) [Channelization of Sewell Creek](#) (page 37). Refer to engineering notes from Matt Breen.
  - iii) Rainelle [FIRM Index and Panels](#)
  - iv) Flood Profiles
    - (1) [Howard Creek - WSS Garden Street Profiles](#) (page 43)
    - (2) [Sewell Creek Flood Profiles](#) (page 52)
  - v) Floodway Information
    - (1) [Floodway Description](#) (page 32)
    - (2) [Howard Creek Floodway Velocity data](#) (page 74)
    - (3) [Sewell Creek Floodway Velocity data](#) (page 77)
- b) 2016 Flood Report
  - i) FEMA [Lessons Learned from June 2016 Flood](#) | [Story Map](#)
    - (1) [Story Map WV Flooded Towns, June 2016. The Historic Flooding of Southern West Virginia on June 23, 2016](#)
  - ii) USGS [Characteristics of peak streamflows and extent of inundation in areas of West Virginia and southwestern Virginia affected by flooding, June 2016](#) | [Publication Download Site](#)
    - (1) HWM map of [White Sulphur Springs](#) (page 30)
    - (2) HWM map of [Sewell Creek](#) (page 31)
- c) 2012 Flood Study
  - i) Rainelle
    - (1) [Sewell Creek Flood Map](#)
    - (2) [FIS Report](#)
- d) 1987 Flood Study – [Rainelle’s 1987 Sewell Creek Flood Map](#)
- e) 1977 Flood Study – [HUD Rainelle’s 1977 Sewell Creek Flood Map](#)