

Hazard Mitigation Loss Avoidance Study Henry County, Virginia

Localized Flood Control Project
Utilities and Infrastructure Protection

DR-VA-4042 - Earthquake August 23, 2011 - Declared November 4, 2011



2024

Developed and published by the Virginia Department of Emergency Management and the Virginia Modeling, Analysis and Simulation Center of Old Dominion University.



Contents

Introduction	3
Study Summary	5
Project Summary	8
Pre-Mitigation Problem Description	8
Post-Mitigation Event(s)	10
Study Methodology	10
Assumptions.....	11
Loss Avoidance Calculations	11
Losses Avoided.....	12

List of Figures

Figure 1: Approximate location of mitigation activity	6
Figure 2: Lower Smith River floodway and wastewater treatment plant.....	7
Figure 3: Lower smith river proposed berm & wastewater treatment plant	7
Figure 4: 1996 Hurricane Fran high water mark (approximately 3.5 feet above grade).	8
Figure 5: Stormwater fallout maintenance.....	9
Figure 6: Pretreatment and pumping facility	9
Figure 7: 2010 flood event (peak flood depth approximately 18 inches above grade).....	9
Figure 8: Earthen berm	10
Figure 9: Valve check.....	11

List of Tables

Table 1: Federally Declared Disaster Declarations in Virginia and Henry County	3
Table 2: Hazard Mitigation Assistance (HMA) grants 1990 – 2024 Virginia.....	4
Table 3: Hazard Mitigation Assistance (HMA) grants 1990 – 2024 Henry County.....	4

Introduction

The Commonwealth of Virginia has a history and exposure to a wide array of natural hazards as demonstrated by 73 federal disaster declarations occurring since 1953 (Table 1).¹ As such, the Commonwealth has a long-established commitment to hazard mitigation in the encouragement, promotion, assistance with, and funding of the implementation of measures to reduce or eliminate long-term risk to people and property from natural hazards and their effects.

Table 1: Federally Declared Disaster Declarations in Virginia and Henry County

Incident Type	Virginia (#)	Henry County (#)
Severe Storm	19	4
Flood	16	1
Hurricane	16	5
Fire	8	
Snowstorm	6	2
Biological	2	2
Drought	2	1
Earthquake	1	
Freezing	1	
Severe Ice Storm	1	
Terrorist	1	
Total	73	15

Since 1990, nearly \$334 million of Hazard Mitigation Assistance (HMA) funding has been allocated to Virginia communities and agencies funding more than 580 projects and mitigating nearly 1,300 properties.² Of those dollars \$4.7M has been spent on various projects in Henry County, including \$59,941 on Utility//Infrastructure Protection (Table 3).

To document and evaluate the impact of this funding, and update the *Commonwealth of Virginia Hazard Mitigation Plan*, VDEM determined that it is appropriate to examine a selection of completed mitigation projects and estimate the real-world losses avoided through those projects.

¹ FEMA Open Data: <https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2>. Includes major disaster, emergency, and fire management assistance.

² FEMA Hazard Mitigation Assistance: <https://www.fema.gov/data-visualizations/hazard-mitigation-assistance-obligations>. Includes total project costs for closed, obligated, and approved projects.

Table 2: Hazard Mitigation Assistance (HMA) grants 1990 – 2024 Virginia

HMA Project Type - Virginia	\$ Amount	# Projects
Acquisition/Elevation Mix	\$13,524,736	12
Acquisitions	\$63,491,520	128
Advanced Assistance	\$842,083	5
Codes/Standards	\$118,712	1
Education/Awareness	\$924,359	21
Elevations	\$67,711,174	90
Feas./Engrg./Design Studies	\$461,076	6
Flood Control	\$23,180,115	14
Floodproofing	\$622,036	5
Generators	\$13,004,784	32
Landslide Stabilization	\$52,200	1
Management & Tech. Assistance	\$18,068,195	46
Miscellaneous	\$1,680,427	18
Mitigation Planning	\$16,836,737	120
Mitigation Reconstruction	\$801,081	4
Not Specified	\$335,335	10
Other	\$905,367	9
Other Equipment	\$1,833,474	15
Relocation	\$141,819	3
Shoreline Stabilization	\$3,737,771	3
Utility/Infrastructure Protection	\$102,877,165	13
Warning Systems	\$1,946,912	20
Wind Retrofit	\$1,023,036	5
Grand Total	\$334,120,112	581

Table 3: Hazard Mitigation Assistance (HMA) grants 1990 – 2024 Henry County

HMA Project Type – Henry County	\$ Amount	# Projects
Acquisitions	\$400,000	2
Flood Control	\$704,200	1
Generators	\$3,547,355	4
Utility/Infrastructure Protection	\$59,941	1
Grand Total	\$4,711,496	8

This report presents the study in the following sections: 1) Study Summary, 2) Project Summary, 3) Study Methodology, and 4) Loss Avoidance Calculations.

Study Summary

The study area is located in Henry County, which is part of the West Piedmont Planning District Commission (WPPDC). The WPPDC has identified, through a Hazard Identification and Risk Assessment (HIRA) process, 14 natural hazards most likely to impact the district's communities.³ Flooding was assessed as the highest risk to mitigate. The project selected for the study includes the construction of an earthen berm around the Lower Smith River wastewater treatment facility and installation of a check valve for backflow. This area has an extensive history of riverine flooding. It has also experienced post-mitigation flooding necessary for a study such as this one, to determine what losses would have occurred had the facility remained unmitigated to future flooding.

Study Area – Henry County

Hazard Type – Riverine Flooding

Project Type – Utility and Infrastructure Protection

Total Project Cost – \$59,941(original) \$80,140 (with maintenance costs)

Total Losses Avoided – \$248,923

Return on Investment (ROI) | Benefit-Cost Ratio – 3.11

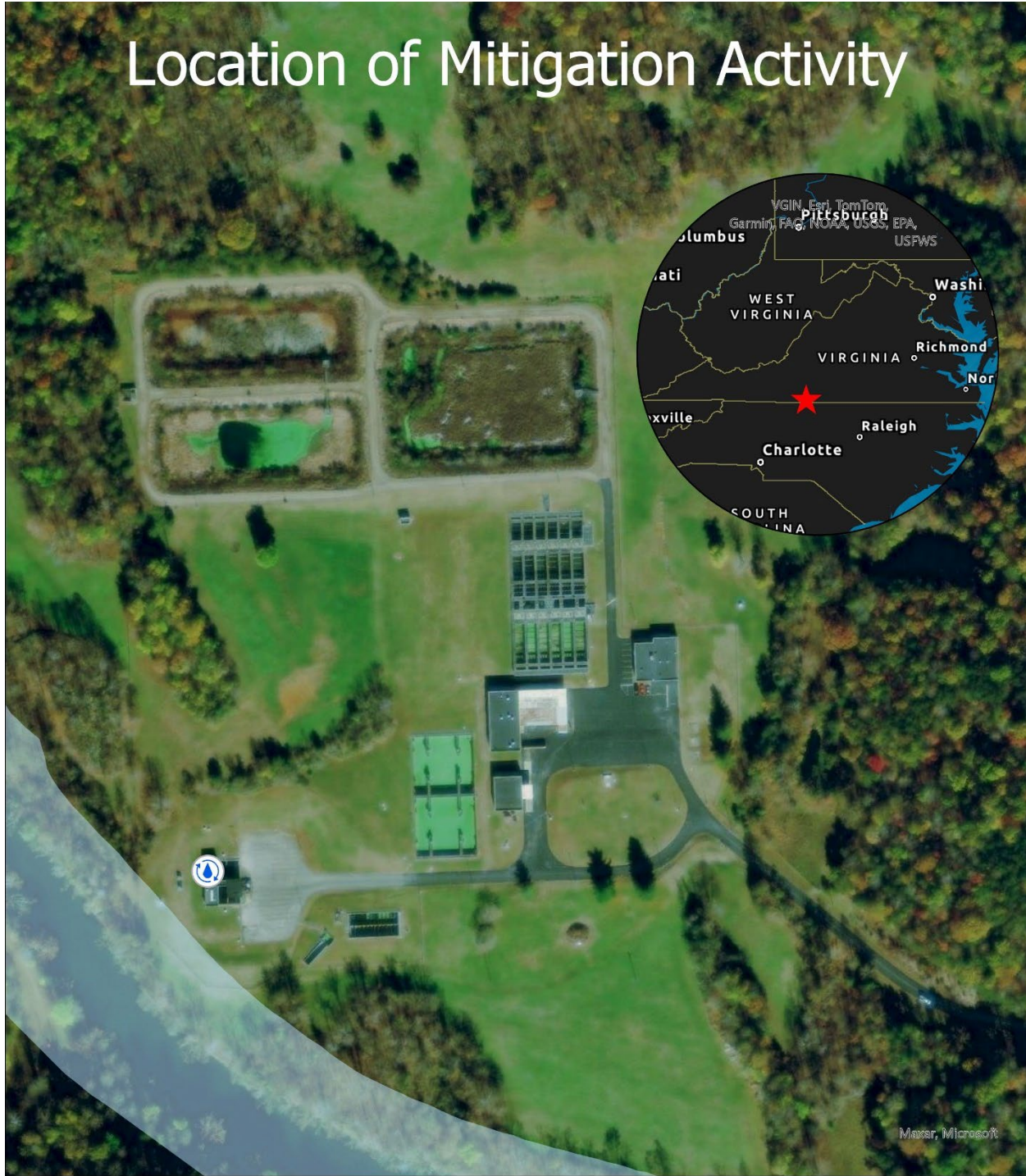
Benefit-cost analysis generated a benefit cost ratio of 3.11 with \$248,923 losses avoided over the project useful life.



Annualized Damages & Losses (\$)

- Pre-mitigation - \$10,400
- Post-mitigation - \$541

³ West Piedmont Multi-Jurisdictional Hazard Mitigation Plan 2021 Update (FEMA Approved 2022)

Location of Mitigation Activity



 Henry County LSR
WWTP Project
 AE Flood Zones

0 0.05 0.1 0.2 Miles



Figure 1: Approximate location of mitigation activity

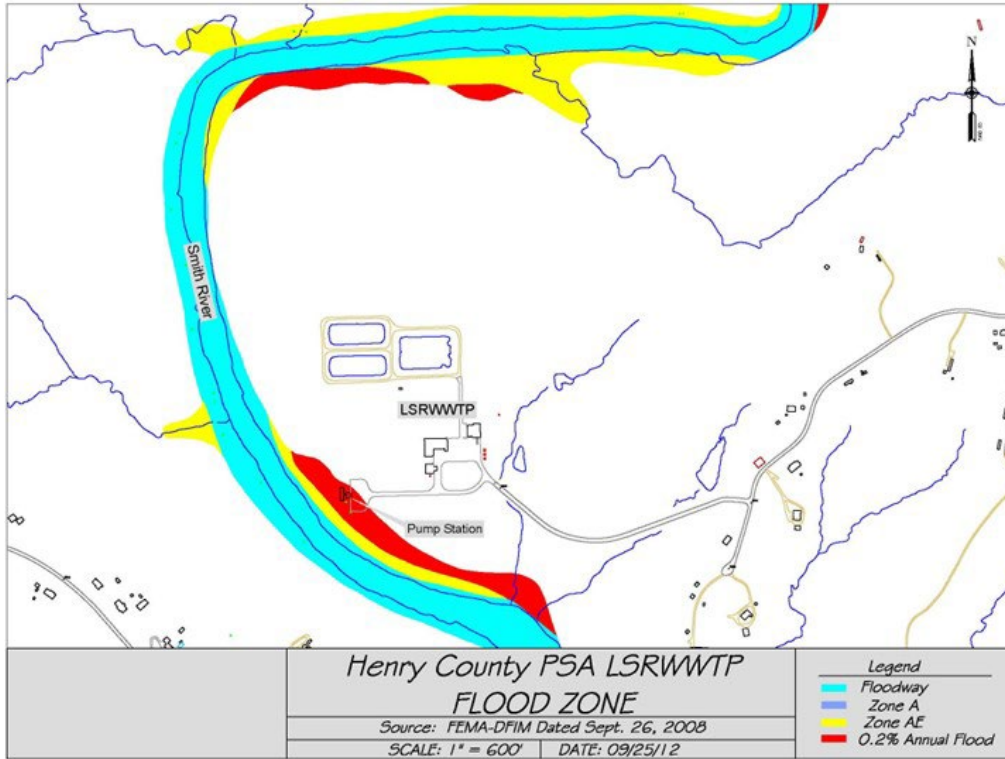


Figure 2: Lower Smith River floodway and wastewater treatment plant

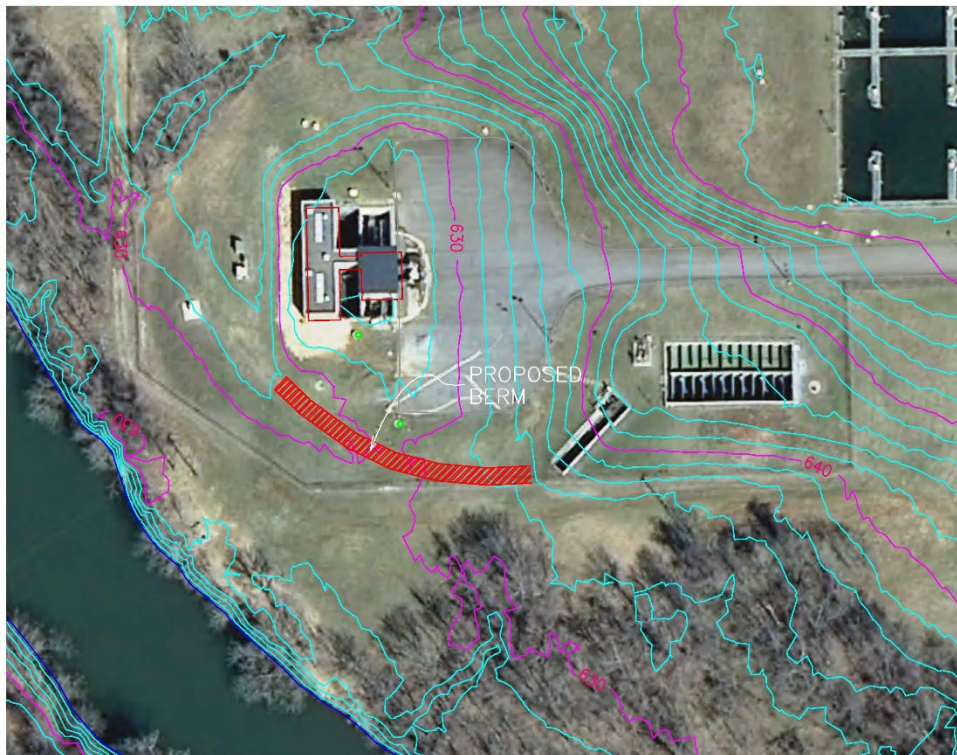


Figure 3: Lower smith river proposed berm & wastewater treatment plant

Project Summary

The project structure(s) included in this LAS were mitigated through the construction of an earthen berm and installation of a backflow check valve. The project was completed June 21, 2018.

Grant Program - Hazard Mitigation Assistance (HMA)

Grant - DR-VA-4042 - Earthquake August 23, 2011 - Declared November 4, 2011

Applicant – Henry County (Subrecipient)

FEMA Approved Multi-Hazard Mitigation Plan – West Piedmont Planning District Commission *2021 Multi-Jurisdictional Hazard Mitigation Plan* (FEMA Approved 2022).

Flood Zone Designation – N/A

Flood Insurance Study – Henry County, Virginia and Incorporated Areas, 51089CV000A, September 26, 2008.

Project Type – Utility/Infrastructure Protection

Project Useful Life – 50 Years.⁴

*Pre-Mitigation Problem Description*⁵

Henry County is located in south-central Virginia along the North Carolina border. The county is part of the Upper Piedmont Plateau with elevation ranges from 600 to 1,000 feet with a few high points at 1,400 feet above sea level. Slopes vary from gentle to severe with most of the flatlands located along rivers.

Low lying areas along streams forming the drainage basins in Henry County are subject to damaging flooding. The Smith and Mayo rivers and their tributaries and minor tributaries of the Dan and Pigg rivers make up the Henry County stream systems. The most severe flooding in the county occurs along the Smith

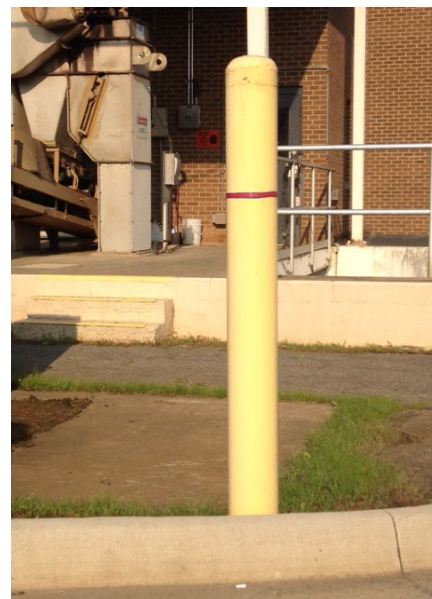


Figure 4: 1996 Hurricane Fran high water mark (approximately 3.5 feet above grade).

⁴ FEMA Benefit-Cost Analysis *BCA Reference Guide*, June 2009 at <https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis>

⁵ West Piedmont Planning District Commission 2021 Multi-Jurisdictional Hazard Mitigation Plan (FEMA Approved 2022)); Henry County, Virginia and Incorporated Areas, 51089CV000A, September 26, 2008.

River and its tributaries and is generally the result of heavy rains from tropical storms and local thunderstorms.

The mitigation activity took place along the floodway and 100 and 500-year floodplains. This area has experienced repetitive flooding causing service disruption, costly cleanup, and damage to property and equipment. Notable flooding events occurred resulting in the following approximate losses:



Figure 5: Stormwater fallout maintenance

- 1996 (Hurricane Fran) (Figure 4), 2 days of service disruption, \$10K in cleanup, and \$10K in equipment damage
- 1999, 2 days of service disruption
- 2007, \$10K in cleanup
- 2010 (Figure 6), \$10K in cleanup



Figure 6: Pretreatment and pumping facility



Figure 7: 2010 flood event (peak flood depth approximately 18 inches above grade)

Post-Mitigation Event(s)

Following completion of the mitigation activity(s), two post-mitigation events were identified for the focus of this study and include heavy rain/flash flooding events occurring in May of 2018 and 2020.

The first major post-mitigation event occurred May 20, 2018⁶ resulting in a local declaration of emergency, and an estimated \$9.3 million in damages for the county.⁷ Heavy rain caused riverbanks to overflow and flash flooding to occur. Flooding and mudslides washed out roadways stranding motorists and forcing some residents to shelter in place or require water rescue. More than 100 businesses, public buildings, and residences experienced flooding and/or structural damages.⁸

On May 25, 2020, another event occurred resulting in a local declaration of emergency, and an estimated \$1.2 million in damages for the county. Again, roads were washed out, partial evacuations occurred, and water rescue was required. High winds were also reported.

Study Methodology

A loss avoidance study (LAS) provides a justification for existing and future mitigation projects and activities. The ability to assess the economic performance of mitigation projects over time is important to encourage future funding and continued support of mitigation projects, activities, and programs. An LAS requires that the project(s) studied be completed prior to the event(s) analyzed, as losses avoided through the mitigation measure



Figure 8: Earthen berm

⁶ Despite a project completion date of July 21, 2018, the flood protection measures were already implemented prior to the flood event.

⁷ National Centers for Environmental Information (NCEI) Storm Events Database.

<https://www.ncdc.noaa.gov/stormevents/>

⁸ Martinsville Bulletin:

https://martinsvillebulletin.com/news/henry-county-is-now-under-a-state-of-emergency/article_4926c706-5c5e-11e8-893a-b30b45f64b9b.html

https://martinsvillebulletin.com/news/storm-causes-more-than-7-million-in-damages-to-henry-county/article_cfbd06a-5d5d-11e8-98e9-7b33208fbec1.html

are determined by comparing the damage that would have been caused by the event had the projects not been implemented.

The following list provides examples of standard data inputs for conducting an LAS of this type:

- Cost of the mitigation measure
- Project useful life
- Annual maintenance costs
- Year property was built
- Service type
- Number of customers served
- Historic damages before mitigation
- Expected damages after mitigation



Figure 9: Valve check

Assumptions

- Benefit-cost analysis (BCA) inputs were updated based on available data and knowledge/recollection of plant management and therefore may be limited in scope.
- Annual maintenance costs increased to \$800.
- Impact days as estimated using the FEMA BCA Toolkit exceeded that of the annual operational budget and were therefore reported by the study, but not included in the BCA calculations. No significant economic loss was identified for operational downtime.
- The 2010 event was added to the BCA along with costs for cleanup.
- The normal river height at the location is 3 feet (622 Ft.)
- Pre-mitigation ground elevation ranged from 628 ft. – 630 ft.
- Normal water level at the location is approximately 3 ft (622 ft.)
- It was reported that during the May 25, 2020 event, the water level rose 10 feet higher than normal rising to 632 feet at the location of the berm which is at 634 feet setting the baseline for analysis.

Loss Avoidance Calculations

To complete this study, the following calculations were performed to estimate losses avoided through mitigation from the post-mitigation storm event(s):

- Ground Elevations

- Stream Discharge⁹
- Water Level Elevations
- Benefit Cost-Ratio

Losses Avoided

Using the May 25, 2020 event water levels as a baseline, it was determined that the berm would protect from up to an estimated 12 feet of increased water level. This would approximate the conditions of the 2010 pre-mitigation event. Meaning an event in greater magnitude would have the potential to breach the levee leaving the property exposed to potential future damages. However, zero flooding or damage has been reported since the installation of the mitigation measure. Therefore, Hurricane Fran damages were used as a proxy for post-mitigation damages for benefit-cost analysis.

Benefit-cost analysis generated a benefit cost ratio of 3.11 with \$248,923 losses avoided over the project useful life.

Annualized Damages & Losses (\$)

- Pre-mitigation - \$10,400
- Post-mitigation - \$541

⁹ USGS gage at Smith River at Martinsville, VA – 02073000. [Smith River at Martinsville, VA - USGS Water Data for the Nation](#)