A Review of Best Practices for Natural Disaster Infrastructure Recovery to Inform Hurricane Helene Recovery Strategy in Western North Carolina

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16. Abstract

This research investigates the best practices for local communities and state governments in the recovery process following natural disasters, with a particular focus on transportation and infrastructure restoration. The study explores how different approaches to recovery impact long-term community vibrancy, including socio-economic factors such as population retention, economic growth and community cohesion. A review of disaster recovery literature, including policies, practices, processes, and funding, was conducted. The study highlights existing best practices and lessons learned, including strategies that have proven effective for recovery and identifying recovery challenges. The study focuses on post-incident actions in transportation and infrastructure sectors, assessing how recovery decisions influence both physical reconstruction and socio-economic dynamics. The research presents three case studies focused on local and state infrastructure decision-making and long-term recovery outcomes, including the 2016 West Virginia Flood, the 2011 Joplin MO Tornado, and the 2022 Eastern Kentucky Flood/ 2021 Western Kentucky Tornado. These case studies provide insights into effective recovery strategies and their broader implications for disaster recovery and resilience in Western North Carolina.

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Abstract:

This research investigates the best practices for local communities and state governments in the recovery process following natural disasters, with a particular focus on transportation and infrastructure restoration. The study explores how different approaches to recovery impact long-term community vibrancy, including socio-economic factors such as population retention, economic growth and community cohesion. A review of disaster recovery literature, including policies, practices, processes, and funding was conducted. The study highlights existing best practices and lessons learned, including strategies that have proven effective for recovery and identifying recovery challenges. The study focuses on post-incident actions in transportation and infrastructure sectors, assessing how recovery decisions influence both physical reconstruction and socio-economic dynamics. The research presents three case studies focused on local and state infrastructure decision-making and long-term recovery outcomes, including the 2016 West Virginia Flood, the 2011 Joplin MO Tornado, and the 2022 Eastern Kentucky Flood/ 2021 Western Kentucky Tornado. These case studies provide insights into effective recovery strategies and their broader implications for disaster recovery and resilience in Western North Carolina.

Introduction

Natural disasters can devastate communities, leaving behind destruction that challenges recovery efforts and long-term resilience. The recovery process following a natural disaster presents numerous challenges for local communities and state governments, particularly in areas of transportation and infrastructure restoration. The effectiveness of recovery strategies can have long-lasting impacts on the vibrancy of affected communities, influencing key socio-economic factors such as population retention, economic growth, and community cohesion. This research aims to explore best practices for recovery efforts, offering valuable insights for other disaster-stricken areas. Specifically, this study explores lessons learned and recovery opportunities that could support long-term recovery efforts for communities in Western North Carolina impacted by Hurricane Helene in September 2024.

The study explores how recovery strategies affect long-term community vibrancy, including factors such as population retention, economic growth, and overall social well-being. Through a comprehensive review of disaster recovery literature and analysis of case studies, the research highlights effective approaches and strategies, as well as identifies challenges that hinder recovery. Special attention is given to post-incident recovery in transportation and infrastructure sectors, assessing how decisions in these areas influence both physical reconstruction and broader socio-economic outcomes. By analyzing the recovery efforts following the 2016 West Virginia floods, the 2011 Joplin, Missouri tornadoes and the 2022 Kentucky Flood/2021 Kentucky Tornado this study aims to provide valuable insights for communities, including those in Western North Carolina, on how to best navigate the complex recovery process after disaster.

The research team reviewed sources including academic literature, federal and state policy documentation, national best practices, national innovative approaches, and case study specific documentation. The emphasis was placed on case study centered literature to better assess lessons learned from selected scenarios. The study documents over 50 relevant sources, provides lessons learned from other states, and provides analysis on what recovery practices could support North Carolina's Hurricane Helene recovery efforts and future disaster recovery in the state.

The results of the research are a series of recovery practices, opportunities, and barriers, including federal funding barriers (see Exhibit 4), case study lessons learned (see Exhibit 5), and opportunities to apply recovery practices to Western North Carolina (see Exhibit 6). Future research could include more in-depth research on alternative disaster funding and insurance options; developing support and training materials to prepare local communities for disaster recovery; or expanding the lessons learned with regional partners to create a Southeast Appalachia lessons learned study.

CASE STUDIES

The three case studies that highlight responses and recovery efforts following significant disasters can be examined for applicability in Western North Carolina: the 2016 West Virginia floods, the 2011 Joplin Missouri tornado and the 2022 Kentucky Flood/2021 Kentucky Tornado. The West Virginia floods, which affected several counties in 2016, caused severe damage due to excessive rainfall. Lessons can be learned from the West Virginia recovery efforts due to the challenges they faced, such as limited resources, recovery process barriers, and the complexity of rebuilding infrastructure, with a focus on mitigating flood risk for future events. In Joplin, the devastating EF5 tornado caused massive destruction. The City of Joplin's recovery was propelled by the collaboration between citizens, businesses, and government, which led to a

quicker than expected recovery. The Kentucky case study capture both a devastating EF-4 tornado in Western Kentucky that hit in December 2021 and a July 2022 storm-event that lead to catastrophic flooding in the mountains of Eastern Kentucky. All three of these case studies provide important lessons learned that can be applied to communities facing disaster.

The West Virginia case study was selected by the research team to study practices and lessons learned from a similar natural disaster (severe flooding in Appalachia). The similarities in geography, community culture, and disaster impacts provide an opportunity to make direct comparisons to Hurricane Helene long-term recovery efforts. The 2016 West Virginia floods were triggered by heavy rainfall in less than 24 hours, causing widespread devastation across 44 counties. This event led to 23 deaths, significant property damage, and severe infrastructure issues, including the destruction of hundreds of bridges and roads. FEMA and other agencies responded with financial assistance and support for rebuilding efforts. However, recovery was hindered by several challenges, such as financial constraints, coordination issues, legal barriers, and socio-cultural practices (see Exhibit 1). Public sector-private sector collaboration was key in rebuilding, particularly with the West Virginia Voluntary Organizations Active in Disaster (WV WOAD) helping restore private bridges and other non-profit organizations leading community center home-buyout efforts.

Despite tornadoes being an inherently different disaster than flooding, Joplin is an excellent case study to highlight practices that can lead to long-term success when rebuilding an entire community. In May 2011, Joplin, Missouri was devastated by an EF5 tornado, causing extensive damage to infrastructure. In response, the city, along with federal, state and local authorities, initiated a recovery plan focusing on cleaning debris, reopening schools by the fall, and ensuring long-term housing for displaced residents. The recovery also allowed for the reimagining of the city's infrastructure, with a focus on dense walkable development, improved transportation, and sustainable design. The recovery of Joplin serves as a valuable case study in long-term rebuilding, demonstrating the importance of community visioning, resilient infrastructure, and a coordinated recovery plan. The experience can offer valuable insights for communities affected by other disasters, such as Hurricane Helene in North Carolina.

Approaching the Kentucky case study, the research team began by examining a 2022 flood event in Eastern Kentucky to complement the West Virginia case study with another Appalachia flooding case study. However, it became clear that several recovery approaches in the 2022 flood were informed by the recovery from a 2021 tornado event in Western Kentucky. The research team then expanded the Kentucky case study to include both the 2022 Eastern Kentucky flood and the 2021 Western Kentucky tornado. Lesson learned from the Kentucky events included the development of high-ground community sites, the utilization of state parks as disaster shelters, the need for a post-event community vision, and the importance of knowledge retention and best practice transfer between events. The case study also highlights that best practices and lessons learned during previous state recovery experiences can translate across varying geographies and natural disaster types. This type of cross-state best practices transfer highlights the opportunity to support Western North Carolina recovery efforts with some best practices utilized in Eastern North Carolina hurricane recovery efforts.

Federal Disaster Recovery Funds, Considerations and Constraints

Before exploring the specific case studies, it is important to contextualize current federal disaster funding. Many of the innovative programs and recovery efforts highlighted here are funded by federal disaster funds. This research was conducted between November 2024 and February 2025. During this timeframe, many changes to federal funding occurred. The research

team attempted to present the most up-to-date information and to provide context on the funding. For the most up-to-date information on funding availability and allocations, please consult current documentation and guidance.

The primary sources of federal disaster recovery funds associated with infrastructure come from:

- The Federal Emergency Management Agency Public Assistance (FEMA-PA)
- The Federal Highway Administration (FHWA) Emergency Routes (FHWA-ER)
- Housing and Urban Development (HUD) Community Development Block Grant – Disaster Recovery (CDBG-DR) funds

The FEMA-PA funds, FHWA-ER, and HUD CDBG-DR funds have a complex set of eligibility requirements and reimbursement criteria. The FEMA-PA and FHWA-ER funds focus on building back public infrastructure and public services to pre-disaster standards. CDBG-DR funds are more flexible and can apply to both private housing support and public infrastructure.

Many of the innovative programs highlighted in these case studies use CDBG-DR funds to secure long-term community recovery and economic viability. These funds have also been used to build more resilient infrastructure, which can be challenging with FEMA-PA and FHWA-ER funds (that stipulate building back to pre-disaster infrastructure or current design standards). CDBG-Mitigation (CDBG-MIT) funds can also be used to improve resilience and mitigation of natural disaster impacts. These HUD mitigation funds were independently allocated from 2015 to 2018[1]. Since 2021, the CDBG-MIT funds have been administered as a 15% set-aside in the allocated CDBG-DR funding.[2] The block grant programs highlight effective approaches to support prosperous and resilient long-term recovery for communities.

FEMA reimbursement for roadway improvements (such as capacity improvements) are not eligible for FEMA disaster reimbursement funds. Use of these funds for permanent roadway repair require that states restore roadways to the pre-disaster state, with the exception that infrastructure be brought up to current state standards and codes. This allows roadway and stormwater infrastructure (culverts, pipes, etc.) that do not meet the current design standards to be brought up to current state standards. While some mitigation efforts are allowable with justifications such as bank stabilization design, most resilience and mitigation improvements require additional design work, justification, approval, and documentation that often push past the 18-month window to make FEMA Public Assistance reimbursement claims.

However, FEMA does offer Public Assistance Hazard Mitigation Funding as an element of the Public Assistance disaster recovery program. According to the FEMA guidance, mitigation efforts eligible for these funds must[3] [4] [5]:

- Mitigate potential of future damage to the impacted portions of the facility
- Meet federal cost-effectiveness criteria
- Be technically feasible and effective

[1] *Community Development Block Grant Mitigation Funds*. (2024). Hudexchange.info.
[2] *Community Development Block Grant Disaster Recovery (CDBG-DR) Mitigation Set-Aside Funds. (2022). Disaster Recovery & Special Issues Division Office of Community Planning & Development.*
[3] *Public Assistance Hazards Mitigation, FEMA.gov. (2023).*
[4] Stafford Act § 406(e), 42 U.S.C. § 5172; 44 C.F.R. § 206.226(e)
[5] *United States. Federal Emergency Management Agency. (2023).* FEMA Policy: Public Assistance Simplified Procedures, FP-104-23-001.

- Be compliant with federal laws, regulations and Executive Orders
- Be a part of a facility that is being repaired/replaced with FEMA Public Assistance funds

Cost-effectiveness is determined by one of three criteria: (1) does not exceed 15% of the total eligible repair cost for a facility; (2) was pre-determined to be cost-effective up to 100% of eligible repair cost[6]; or (3) determined to be cost-effective by an acceptable benefit-cost analysis[7]. Examples of acceptable mitigation improvements include[8]:

- Construct floodwalls around damaged facilities
- Install new drainage facilities (including culverts) along a damaged road
- Replace drainage structure with a larger structure
- Install submersible pumps in water or wastewater plants
- Elevate equipment vulnerable to flood damage
- Replace damaged power poles with higher-rated poles

By adding mitigation efforts to infrastructure repair, the transportation system will become more resilient and better able to withstand future natural disasters. Another opportunity to ensure that mitigation efforts are allowable expenditures for federal disaster recovery funds is adopting resilience-focused state design standards and codes, as recovery funds allow rebuilding to current state standards.

Beyond federal funding grants, some novel insurance programs are beginning to emerge to support local community recovery efforts. An emerging non-federal funding source that is starting to be offered to communities in the United States is private parametric insurance. Parametric insurance, also known as index-based insurance, can be used to cover gaps in traditional insurance coverage for natural disasters, such as flood, drought, and wind-related losses. Parametric insurance is being used to provide additional municipal and community scale natural disaster insurance in California and New York[9]. Unlike traditional insurance policies that are based on actual losses and assessment of estimated losses, parametric insurance is based on triggering events. For example, insurance payout may be tethered to triggers such as amount of rainfall and wind speeds. Payments are transparent and paid out very quickly based on triggering events. This can serve to have a nearly instant cash flow while communities wait for federal funding or to cover gaps not traditionally covered by federal disaster funding.

Summary of Case Study Approach

The 2016 West Virginia floods, the 2011 Joplin, Missouri tornado and the 2022 Eastern Kentucky Flood/2021 Western Kentucky Tornado, provide valuable lessons for disaster recovery. The West Virginia floods, caused by heavy rainfall, led to widespread devastation and significant infrastructure damage, with recovery hindered by limited resources, legal barriers, and coordination challenges. Private sector collaboration, such as with the West Virginia Voluntary Organizations Active in Disaster, played a key role in rebuilding efforts. Meanwhile, Joplin's recovery from the EF5 tornado was driven by strong collaboration among citizens, businesses, and government, leading to rapid rebuilding with a focus on resilient infrastructure and sustainable community planning. The Kentucky case study highlights the value of intra-

[6] *United States. Federal Emergency Management Agency. (2020).* Public Assistance Program and Policy Guide. "Appendix J" *Cost-Effective Public Assistance Hazards Mitigation Measures,* pp 242-246
[7] Poling, K. (2023). *Relationship Building and Pre-Disaster Planning: Effective Strategies for Rural Resilience Following the 2016 West Virginia Floods*
[8] *Public Assistance Hazards Mitigation Project Examples, FEMA.gov. (2023).*
[9] Glinskis, E., & Murphy, D. (2025). *How parametric insurance is building climate resilience*. World Economic Forum

state best practice transfer and the opportunity to leverage state resources, such as state parks, as a novel element of disaster recovery plans. These case studies emphasize the importance of community involvement, coordinated recovery efforts, and rebuilding with a vision for the future, offering valuable insights for other disaster-stricken areas, including those affected by Hurricane Helene in North Carolina.

2016 West Virginia Flood Event

Between June 23-24, 2016, West Virginia experienced devastating flooding caused by intense thunderstorms, which brought more than nine inches of rain in less than 24 hours. The extreme rainfall led to catastrophic flooding, especially since the region had already received above-average rainfall in May of that year. The flood affected a significant portion of the state, 44 out of 55 counties declared a State of Emergency. The flooding claimed 23 lives, destroyed thousands of homes and businesses, and caused substantial infrastructure damage. The disaster resulted in more than $1 billion in property damage, including $46 million in damage to roadway infrastructure[10]. The devastating flood event washed out more than 1,300 state roads, and damaged 123 federal and state-maintained bridges, including completely destroying 15 public bridges.

While the flooding was a catastrophic event, the rainfall itself was not unusual.[11] Flooding tends to be more prevalent in mountainous areas like West Virginia as rain from mountains flows down into valley waterways and water levels rise as they move downstream. With a limited amount of 'flat land' in the area, much of the state's development occurs along floodplains that are prone to flooding.

Despite media reports, the 2016 flood event was not a '1 in 1,000-year' occurrence. The rainfall event was closer to a '1 in 100-year' event, which translates to a 1% flood event. A 1% flood event means there is a 1% chance each year of a similar event and a 26% chance over the life of a 30-year mortgage[11]. This confusion over flood risk language underscores the need for clearer flood risk descriptors that can be better understood by government agencies and private property owners. Additionally, a study by the US Geological Survey (USGS) and FEMA confirmed that while flood insurance rate maps accurately represented flood risks in many areas, a significant number of people outside the designated flood zone suffered extensive damage[11]. The USGS study highlights the need for better flood mitigation strategies and reveals gaps in insurance coverage, a need to understand flood hazards beyond traditional floodplains, and the importance of more clearly conveying flooding risk to the general public.

By selecting the 2016 West Virginia flooding event, the research team was able to study practices and lessons learned from a similar natural disaster (severe flooding in Appalachia) with over 8 years of post-event recovery efforts. This case study has also been documented with a FEMA lessons learned report[11], a doctoral dissertation[12]with follow-up dissemination article[13], and an on-going NSF Civic Innovation Challenge project[14] to ensure future flooding resilience in West Virginia. The similarities in geography, community culture, and disaster impacts provide an opportunity to make direct comparisons to Hurricane Helene long-term

[10] *Understanding Flood Dangers in Central West Virginia: Lessons Learned from the June 2016 Flood*. (2018).
[11] *Public Assistance Hazards Mitigation, FEMA.gov. (2023).*
[12] Poling, K. (2023). *Relationship Building and Pre-Disaster Planning: Effective Strategies for Rural Resilience Following the 2016 West Virginia Floods.*
[13] Poling, K., & Shealy, T. (2024). Barriers to Long-Term Disaster Recovery in Rural Appalachia: A Retrospective Analysis of the 2016 West Virginia Flood. *International Journal of Disaster Risk Reduction*
[14] Civic Innovation Challenge (CIVIC). (2024). NSF – National Science Foundation.

recovery efforts. Additionally, the West Virginia Department of Transportation (WVDOT) builds and maintains most of the roadways in the state and uses a central office-regional division organizational structure similar to NCDOT.

A potential future resource from this documentation that could inform North Carolina community recovery is the forthcoming results from the NSF Civic Innovation Challenge, entitled *Creating the West Virginia Flood Resilience Framework for comprehensive disaster response and long-term community recovery*[15]. The NFS pilot study is anticipated to be completed by September 2025. The goal of the project is to develop a "West Virginia Flood Resilience Framework [and] an online toolkit that will empower communities and local governments across WV with the knowledge they need for coordination and capacity building to better prepare for future floods."[16]

Barriers to Recovery

In the aftermath of the 2016 floods, recovery efforts in rural areas faced multiple barriers, including financial, coordination, legal, and socio-cultural challenges. A study by Poling and Shealy (2024) focused on four towns severely affected by the floods: Clendenin and Elkview in Kanawha County, and Rainelle and White Sulphur Springs in Greenbrier County. The study highlighted a private residential bridge project and the creation of a community-centered buyout program for residential properties. Another study by Shealy (2023) documented a series of barriers to long-term disaster recovery in Appalachia. Exhibit 1 presents Shealy's four categories of barriers, the barriers themselves, and practices to address and mitigate these barriers in the future.

[15] Ransom, B. (2023). *CIVIC-FA Track B: Creating the West Virginia Flood Resilience Framework for comprehensive disaster response and long-term community recovery*. U.S. National Science Foundation.
[16] Shinn, J. (2023). *Creating the West Virginia Flood Resilience Framework for comprehensive disaster response and long-term community recovery*. U.S. National Science Foundation.

Barriers to Recovery

Exhibit 1. Barriers to Long-term Recovery in Appalachia

	Barriers	Practices to Address Barriers
Financial	1. Limited Economic Resources 2. Lack of Flood Insurance 3. Late/Slow Funding Allocation 4. Insufficient Skilled Labor 5. Aging Infrastructure 6. Supply Chain Shortages	1. Create a recovery plan or long term community plan 2. Skilled volunteer labor 3. Funding for disasters
Coordination	1. Improve Communication 2. Unclear roles and responsibilities 3. Long-term Community Planning 4. Lack of Asset Mapping 5. Lack of Management Capacity	1. Have long-term recovery groups 2. Transfer focus to mitigation & preparedness
Legal	1. Regulatory Delays 2. Onerous Reimbursement Process 3. Professional Liability in Uncertain Design Standards 4. Difficulty filling out Government Assistance Forms 5. Difficulty Assisting Renters	1. Long-Term plan that guides post-disaster decision-making that streamlines planning & approval process 2. Don't create an unrealistic recovery timeline that adds stressors
Socio-cultural	1. Mental Health & Cognitive Ability 2. Historical Development Patterns 3. Cultural Ties to Land 4. Insufficient Local Building Code Expertise	1. Buyout programs that allowed community to stay connected to generationally held land 2. Organizations, volunteers, etc., with similar cultural backgrounds can eliminate the distrust among survivors 3. Resources to help residents comprehend all of the paperwork

Data from Shealy & Poling (2024). Table created by ITRE

Most of the practices recommended are lessons learned that should be developed in-between disasters, rather than specific disaster recovery efforts after a disaster has occurred. Two specific constraints to recovery are further explored below: (1) coordination and community trust building and (2) funding and design constraints.

Coordination and Community Trust Building

Coordination barriers rank as one of the most challenging types of barriers to the recovery process[17]. According to Poling and Shealy, there are seven coordination barriers during the 2016 flood event that were described by interviewees: (1) a broad need for improved communication, (2) unclear roles and responsibilities, (3) long-term community planning, (4) lack of asset mapping, (5) lack of management capacity, (6) need for accurate flood models, and (7) knowledge retention between disaster. The lack of disaster planning and strong recovery networks in West Virginia led to these coordination barriers.

Immediately following the flood event, long-term recovery committees were established and the West Virginia Legislature passed House Bill 2935 (HB 2935). HB 2935 created a joint legislative committee on resilience and the State Resiliency Office that is responsible for supporting planning and implementing resiliency efforts. With increased flood events in West Virginia, the state saw a need to retain the lessons learned from previous events and then pro-actively coordinate with communities to develop disaster management plans. However, in rural areas where resources are constrained, the capacity for planning and coordination is often limited. Additional investment in rural communities to support pre-disaster planning, skill development, and resource mapping can better equip communities for disaster recovery.

During the 2016 flood event, not-for-profit organizations and faith-based groups, which share cultural ties with the local communities, played a critical role in bridging the gaps of trust, supporting coordination efforts, and providing financial resources[18]. Building trust and establishing relationships between organizations and community leaders prior to disasters led to more effective cooperation during recovery.

Funding and Design Constraints

Two related and relevant constraints that can impact the recovery process are federal disaster reimbursement and infrastructure rebuilding being limited to typical design standards. FEMA Public Assistance disaster recovery funds are known to be difficult and documentation-intensive processes. Like many states, WVDOT documents disaster-related expenses and recovery repairs from day one. WVDOT's disaster recovery policy is to immediately work to start clearing debris and establish roadway access to first responders and supply routes. As damage assessments are being conducted at a given site, the damage is documented via photos, GPS coordinates and documentation context (location, date/time, description of damage, etc.). This documentation will be used to apply for FEMA Public Assistance disaster recovery funds and FHWA – Emergency Relief (ER) funds[19].

As the disaster recovery efforts move toward long-term recovery, specifically as efforts transition to restoration and repairs, WVDOT focuses on restoring the transportation system to the pre-disaster condition[20]. This is due to FEMA's reimbursement requirements that stipulate roadway improvements (such as capacity improvements) are not eligible for FEMA disaster reimbursement funds. However, FEMA-PA funds allow permanent roadway repair to be brought up to the current state standards and codes. This allows the allocation of FEMA funds for

[17] Poling, K., & Shealy, T. (2024). Barriers to Long-Term Disaster Recovery in Rural Appalachia: A Retrospective Analysis of the 2016 West Virginia Flood. *International Journal of Disaster Risk Reduction*
[18] Poling, K. (2023). *Relationship Building and Pre-Disaster Planning: Effective Strategies for Rural Resilience*
[19] Natural Disaster Response Manual November 2024 (West Virginia Department of Transportation Division of Highways, 2024)
[20] Conversation with WVDOT Division staff, 2024

updating roadways and stormwater infrastructure (culverts, pipes, etc.) that do not meet current design standards, providing an opportunity to bring infrastructure up to the current state standards.

While some mitigation efforts are allowable with justifications, such as bank stabilization design, most resilience and mitigation improvements require additional design work, justification, approval and documentation that often push past the 18-month window to make FEMA-PA reimbursement claims[21]. West Virginia takes the approach of repairing roads to pre-disaster condition while ensuring all repairs and up to the current state code. This ensures the permanent roadway is delivered more quickly and with the reduced risk of having a FEMA claim rejected (either due to work being conducted past the reimbursement deadline or ineligible resilience improvement work).

The Bridge Home Program

The Bridge Home Program is a program to support the repair and replacement of private residential bridges that provide first-mile/last-mile connectivity between primary residences and the public transportation network.

Private bridges connecting residential property and neighborhoods to the public roadway system are common in Appalachian communities. These bridges serve as crucial access points to the public road network, as they bridge rivers, creeks, and uneven topography. During the 2016 flooding in West Virginia, hundreds of these private bridges were washed out or severely damaged[22]. One of the key recovery efforts in West Virginia was a public-private effort to rebuild private residential bridges. As of June 2023, 70 bridges have been completed and 82 families have regained access to the transportation network[23].

Initial impacts included the loss of critical access for disaster recovery efforts, as these residents were cut off from emergency services and basic supplies in the initial aftermath of the storm. Damaged and displaced bridges can also act as debris, blocking waterways and potentially causing increased floodwaters to reach homes and exacerbate property damage[24]. The longer-term ramifications are that these residential areas became cut off from the public road network, resulting in a need to restore access to the transportation system. Many of these private bridges were not insured, and FEMA recovery funds do not allow individuals to make private residential bridge rebuilds as part of residential disaster recovery funds. Nevertheless, local residents needed a mechanism to repair and rebuild their bridge infrastructure.

The West Virginia Voluntary Organizations Active in Disaster (WV VOAD), in collaboration with several private and governmental organizations, initiated the West Virginia Bridge Home Program to provide vital support to communities by reestablishing safe access routes for families living in flood-prone areas. Initially, the program was organized and funded by three key non-governmental organizations (NGOs) focused on recovery efforts: the Lutheran Disaster Response, Operation Hope, and Mennonite Disaster Service. The program received technical expertise from the Federal Emergency Management Agency (FEMA), U.S. Army Corps of

[21] Conversation with WVDOT Division staff, 2024
[22] Poling, K., & Shealy, T. (2024). Barriers to Long-Term Disaster Recovery in Rural Appalachia: A Retrospective Analysis of the 2016 West Virginia Flood. *International Journal of Disaster Risk Reduction*
[23] *West Virginia Reviewed and Approved Declaration Number Community Development Systems Disaster Recovery Grant Reporting System* (DRGR). 2023. https://wvfloodrecovery.com/wp-content/uploads/2024/05/January-1-2024-thru-March-31-2024-Performance-Report.pdf
[24] *Apply for Bridge Program Assistance. WV VOAD. (2024).* West Virginia VOAD

Engineers (USACE), West Virginia Department of Transportation (WVDOT), state floodplain managers and county planning and permitting offices.

To support the assessment, WV VOAD worked with the State of West Virginia and FEMA to utilize Community Development Block Grant - Disaster Recovery (CDBG-DR) funding to study the scale of need after the flooding event. The study revealed 346 bridges with some level of damage that could be a candidate for future repair and replacement[2526]. To better address this need and be prepared for future flooding events, the State of West Virginia is working with WV VOAD to continue to make repairs to private bridges that connect low-middle-income primary residences to the public transportation network. This program is being funded as part of the RISE West Virginia disaster recovery program[27], using CDBG-DR funds from the US Department of Housing and Urban Development (HUD) to provide long-term recovery from the 2016 floods.

The Bridge Home Program funding is available to Low-to-Moderate Income (LMI) families that suffered damage during the flooding event. The HUD-funded program is designed to address urgent unmet needs for LMI families. WVDOT and USACE engineers are serving in an advisory capacity to ensure safe and resilient bridge design and construction. Eligible expenses include bridge rehabilitation/reconstruction and bridge bank stabilization with a grant limit of $30,000 per primary residence access. Funding only applies to primary residences and does not apply to second homes, vacation homes or short-term rentals[28]. Private bridges that are repaired and replaced by the program are being designed to exceed federal and state standards, including ensuring future flooding mitigation design features to withstand future flood events. Exhibit 2 below highlights the Bridge Home Program funding goals and requirements.

[25] *CDBG. WV VOAD.* (2024). West Virginia VOAD.
[26] Poling, K., & Shealy, T. (2024). Barriers to Long-Term Disaster Recovery in Rural Appalachia: A Retrospective Analysis of the 2016 West Virginia Flood. *International Journal of Disaster Risk Reduction*
[27] *Home – WV Flood Recovery Office.* (2021). WV Flood Recovery Office.
[28] *Rise West Virginia Bridge Home Program: Policies & Procedures. (2021).* WV Flood Recovery Office

Exhibit 2. Funding Goals & Requirements for the Bridge Home Program

National Objectives (HUD CDBG-DR)	
	Benefit Low-to-Moderate Income
	Urgent Unmet Need
Eligibility Requirements	
	Must have been primary residence at the time of the flooding event (Second home or short-term rental property not eligible)
	Single Family or Mobile Home Unit in one of the 12 WV National Disaster Declared Counties
	Documented damage from the 2016 flooding event
	Meet HUD Low-to-Moderate Income (LMI) requirements (Income may not exceed 80% of Area Median Income)
Funding Limit	
	$30,000 Limit per primary residence access
Eligible Activities	
	Bridge Reconstruction or Rehabilitation
	Bridge Site Flood and Erosion Mitigation
	Bank Stabilization

National Objectives for the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery Grant Funds (CDBG-DR)

Bridge Home Takeaway

The Bridge Home Program highlights the need to consider private bridges that serve as vital connections between residences and the public transportation network. The state of West Virginia worked with private NGOs and utilized federal Community Development Block Grant - Disaster Recovery (CDBG-DR) funds to assess the need to support private residential bridges and to fund bridge rehabilitation and bank stabilization for impacted residents.

Community-Centered Home Buyout Program - The Hope Village Project

The restructuring of land use after a natural disaster can have large impacts on long-term community recovery and future infrastructure needs. After a disaster that has a large impact on residential areas, the need to rebuild existing housing or establish new affordable housing in a more resilient location is often required. After natural disasters, a lack of affordable housing options can lead to population decline in a local community. These declines can have devastating impacts on community cohesion and the economic viability of smaller rural communities.

At the same time, families with generational ties to their land and communities prefer to not leave the area, and can have a difficult time breaking the emotional connection with family property. Even if residents stay in the same community, the idea of relocating from this land can be difficult. If these lands are in high-risk locations along floodplains, it can create a huge financial burden and cause hesitation to participate in federal home buyout programs after a disaster.

In an effort to stabilize the local population and support affordable housing while also honoring family connection to the land, Tom Crabtree, a partner at an architectural firm in Pennsylvania developed a community-centered buyout program for flood-damaged properties called Hope Village. The program allowed residents to trade in their flood-damaged land for new homes in a newly developed community in a nearby location less prone to flooding[29]. This project is unique in that it focused on relocating citizens as a community rather than rebuilding individual homes. The key to the success of the buyout and relocation effort was that the land traded in for a new home was turned into public community parks and open spaces. This ensures relocated residents' access to the family land they were connected to, establishes an important community amenity, and increases open green space that supports mitigating future flood events.

Hope Village rises in White Sulphur Springs – West Virginia Press Association. (2016). West Virginia Press Association. https://wvpress.org/copydesk/wv-press-videos/hope-village-rises-white-sulphur-springs/ Register-Herald photo by Jenny Harnish.

Aerial View of Hope Village Pre-Construction: Poling, K. (2023).

During the 2016 flooding event, Mill Hill Drive in White Sulphur Spring was one of the most critically damaged neighborhoods within the state. Five lives were lost along one road alone[30]. To support this community and mitigate the future loss of life in the neighborhood, Homes for Hope worked with Home for West Virginia, a newly funded disaster recovery group, to develop construction plans and coordinate the development efforts. This development was a community effort, as the organization received donations from corporations, non-profits, community

[29] Lanicanese, A. (2017). Hope Village, an innovative housing program, welcoming those who lost their homes in flood. *Beckley Register-Herald*

[30] Raby, J. (2017). *Memorial, parks honor victims of 2016 West Virginia floods.* The Seattle Times. https://www.seattletimes.com/nation-world/memorial-parks-honor-victims-of-2016-west-virginia-floods/

members, and celebrities[31]. The land was provided by the Town of White Sulphur Springs[32]. Development plans were donated by a local engineering firm[33].

The buyout program was especially beneficial for property owners in floodplains who lacked the resources to rebuild or repair their homes due to floodplain regulations. The flood-prone land from the buyout was converted into community parks, helping to reduce long-term flood risk in the region. In addition to the 42 new homes developed in Hope Valley, the project created new community amenities like the Brad Paisley Community Park on the bought-out land[34] [35].

Brad Paisley Community Park. (2024). Greenbrier WV

The need to provide opportunities for residents to stay within the community is essential in the reduction of community population loss. Creating affordable post-disaster housing options and community amenities that support community cohesion and family attachment to their land can support efforts to retain population and economic vibrancy after a disaster. The impacts of these efforts can yield mixed results, as efforts can be successful at retaining residents directly involved in the program but other community members may still relocate. Greenbrier County, where White Sulphur Springs is located, had a 2020 population of 32,977, which is 7.3% reduction from the 2015 population total (the year prior to the flood event).

Community-Centered Buyout Takeaway

Community-centered buyout projects like the Hope Valley can be beneficial to post-disaster communities as they can support retaining the population, which supports economic vitality. Appalachian communities have a strong sense of place and are an attachment to intergenerational family land. Hope Village allows residents to live within the same community and maintain attachment to their family's land. In addition, a housing buyout program creates new community park amenities and creates open spaces to mitigate future flood impacts. Creating open spaces along floodplain plains presents an opportunity to develop local and

[31] Ali, A. (2016). *"Hope Village" breaks ground in White Sulphur Springs, WV.* WV News. https://www.wvnews.com/statejournal/news/hope-village-breaks-ground-in-white-sulphur-springs-wv/article_db7982dd-c232-5cf9-a102-2928e9df0fd9.html
[32] Lanicanese, A. (2017). Hope Village, an innovative housing program, welcoming those who lost their homes in flood. *Beckley Register-Herald*
[33] Poling, K. (2023). *Relationship Building and Pre-Disaster Planning: Effective Strategies for Rural Resilience Following the 2016 West Virginia Floods.*
[34] *Rise West Virginia Bridge Home Program: Policies & Procedures. (2021).* WV Flood Recovery Office
[35] *Brad Paisley Community Park.* (2024). Greenbrier WV.

regional greenways, connecting local communities and potentially generating tourism opportunities.

TAKEAWAYS **2016 West Virginia Flooding Case Study**
Private Residential Bridge Repair
Private residential bridges are a key part of the transportation network in Appalachian communities. This infrastructure is vulnerable to flooding damage and impacts the mobility and accessibility of community members. Private bridge damage can impact long-term recovery efforts to impacted community members and limit the access of first responders.
Collaboration between state, federal and private organizations led to the development of the *Bridge Home Program.* Utilizing federal Community Development Block Grant - Disaster Recovery (CDBG-DR)* Funds to identify damaged bridge infrastructure and fund rehabilitation and bank stabilization efforts.
Through the program, up to $30,000 per primary residence is available for eligible Low-to-Middle Income (LMI) residents to repair their bridge infrastructure and bridge site bank stabilization.
WVDOT Engineers (along with USACE engineers and FEMA flood managers) are providing design standards to ensure private bridges in the program exceed state and federal standards and are resilient enough to withstand future flooding.
Community-Centered Home Buyback and Public Green Space
In an effort to support post-flood housing needs, stabilize community cohesion and reduce post-disaster population loss, the local community raised donations to fund community-centered home buyouts. The Town of White Sulphur Springs donated land for the new neighborhood.
Land acquired in the buyouts was developed into a community park space that allowed families to continue to have a connection to their family land.
This effort supported population retention, as small rural communities tend to lose population after natural disasters. Maintaining the community population can support building and maintaining a viable economy.
The benefits of redeveloping flood-damaged property into community parks along floodplains include creating open space that can serve to mitigate flooding impacts and opportunities to develop greenways that can stimulate future tourism revenue.

2011 Tornado in Joplin, Missouri Tornado

In May 2011, Joplin Missouri was struck by a catastrophic EF5 tornado in one of the most powerful and destructive storms in U.S. history. The tornado devastated the town, causing extensive damage to homes, public infrastructure and schools. The storm claimed 161 lives and caused an estimated $3 billion in property damage[36]. In the immediate aftermath of the tornado, the City of Joplin worked with both public and private sectors to provide immediate and long-term recovery. The destruction of 5,000-7,000 homes left many residents without shelter[37] [38].

Within hours of the tornado, the City of Joplin leadership laid out three key pillars promised to the people of Joplin. This promise was designed to keep the community together and reduce any population decline during the recovery process. The mayor promised[39]:

1. That the debris filled streets would be cleared to allow first responders and supplies to access impacted neighborhoods.

2. Schools would be open in time for the next school year. Local school buildings were destroyed by the tornado, and a quick rebuilding was an important goal for keeping families with children in Joplin. With the tornado occurring in May with a week left in the school year, it was very important for the community that the schools would be rebuilt to start school in the fall.

3. That everyone in Joplin would have housing, both in the immediate and long term.

With Joplin's three pillars of recovery laid out, federal, state, and local officials provided crucial services, including cleaning debris and securing public safety. FEMA provided 600 temporary housing units for displaced residents[37], and private-sector organizations, including insurance companies, worked to support immediate needs. Insurance companies quickly provided advanced checks to homeowners and businesses (usually $5,000) to provide immediate financial relief. Additionally, the volunteer effort was an important aspect of recovery, with over 92,000 volunteers that contributed more than 528,000 person-hours in the months following the disaster[37].

Despite the tragic impacts of the tornado, Joplin's recovery can be viewed as a success story. The town met its goal of having schools operational by the next fall. The city population did not have a long-term decline: in fact, the population grew by 3.2% between the 2010 and 2020 census and continues to grow, with a 2.6% growth rate between the 2020 census and the 2023 census estimate[40]. Neosho, Missouri, a nearby town that was not impacted by the tornado, saw its population increase by 6.2% between 2010 and 2020[41]. The current population of Joplin is 53,095, which is an increase of almost 3,000 residents since the tornado. Beyond the population growth, the city used the tornado as an opportunity to restructure its transportation and land use. Specifically, the city designated several overlay districts that would have dense

[36] Onstot, Lynn. *Fact Sheet – City of Joplin.* 2021.
[37] Smith, D. J., & Sutter, D. (2013). Response and recovery after the Joplin tornado: Lessons applied and lessons learned.
[38] Anguiano, D. (2022). *Once in a Lifetime Opportunity: The Stunning Comeback of a Tornado-Wrecked Town.* The Guardian.
[39] Conversations with City of Joplin planning staff, December 2024
[40] *QuickFacts: Joplin city, Missouri.* (2023). Census Bureau QuickFacts; United States Census Bureau
[41] QuickFacts: Neosho City, Missouri. (2023). Census Bureau QuickFacts; United States Census Bureau

development, walkable infrastructure and streetscape improvements. The restructured land use also created an opportunity to develop a nationally recognized complete streets program[42].

Despite tornadoes being an inherently different disaster than flooding, Joplin is an excellent case study to highlight practices that can lead to long-term success when rebuilding the entire community. Paralleling the communities in Western North Carolina that lost their entire downtowns or large swaths of their community neighborhoods to Hurricane Helene, Joplin had to rebuild their 'tornado zone' or 'recovery area' from scratch. The intentional community visioning and an aggressive timetable for restoring key community assets helped the Joplin community not only stay afloat, but thrive. One element of recovery was the development of planned corridors and districts in the downtown recovery area to allow higher density and encourage infill development, increased walkability and multiuse trail connectivity.

Elements of the Joplin Tornado recovery that could be used to inform Hurricane Helene recovery efforts in North Carolina are presented below. It is worth noting that unlike NCDOT and WVDOT, the Missouri Department of Transportation (MoDOT) does not own most of the roadway in the state. The transportation decision-making and funding prioritization mostly occurs at the municipal or MPO level, in this case the City of Joplin and the Joplin Area Transportation Study Organization (JATSO). MoDOT owns and maintains the state thoroughfare roads in the city and supported the Joplin TIGER grant efforts, however, many of the post-disaster, long-term recovery efforts were developed and administered at the municipal level.

The community recovery focused not only on housing and commercial development, but also transportation and infrastructure improvements that would increase multimodal connectivity, improve stormwater infrastructure, and encourage resilient low-impact design (LID).

The plan recommended the commercial recovery area, development districts, public parks, and schools be required to meet design standards to ensure walkability and infrastructure resilience.

Population Retention and Economic Stability

In the aftermath of the devastating 2011 tornado, Joplin officials took proactive steps to support residents and ensure a smooth recovery. To retain population, Joplin worked to ensure: (1) schools were operational by the next school year, (2) displaced residents could find temporary housing in close proximity to Joplin (within 30 miles), and (3) displaced citizens would be kept as engaged as possible. The city also set up a program to offer down payment and closing cost support for residents purchasing or rebuilding homes in the storm-damaged area.

The city worked to ensure schools that were destroyed in May 2011 would be ready for the new school year in the fall (2011). To maintain community connection, Joplin schools sent buses to pick up displaced Joplin students in nearby communities to allow a sense of community and continuity. Joplin officials encouraged citizens to find temporary housing in close proximity to the city and offered transportation solutions, such as busing displaced residents back to Joplin for community events and disaster recovery committee meetings[43]. Officials also provided pickup

[42] Araya, A. (2023). Joplin, MO*: The key to getting a Complete Streets policy passed? People – Smart Growth America.* Smart Growth America.
[43] Conversations with City of Joplin planning staff, December 2024

and drop-off services for residents attending public meetings, ensuring citizen participation in the rebuilding process[44].

Joplin's recovery efforts included work to prioritize temporary housing in Joplin and support for displaced residents by securing transportation from nearby communities for public meetings and committees. Additionally, displaced citizens were kept informed about available resources, helping ease their transition during the challenging time and trying to encourage them to permanently relocate back in Joplin as housing opportunities became available. The city set up a mailing list to communicate with displaced residents, keeping them informed of the community recovery process and housing assistance programs that could support their return to Joplin.

In terms of housing, significant progress was made. By 2016, Joplin built an average of five new homes per week. The Joplin Housing Assistance Program (J-HAP) played a crucial role in helping residents secure permanent housing. The city used CDGB-DR funds to establish J-HAP, which provided up to $30,000 for a down payment and closing cost for qualified homebuyers. This was an effort to retain population and economic vitality by encouraging homeownership and providing affordable home-buying options.

Non-profit organizations such as Habitat for Humanity were also key in the recovery efforts. The Joplin Area Habitat for Humanity completed 138 new homes and offered programs like "A Brush with Kindness," which provided exterior repairs to homeowners who couldn't afford them[45]. Another initiative, the Critical Home Repair Program, completed 22 large-scale repair projects for homeowners in need. The efforts helped fill the housing deficit and gave residents the opportunity to return to safe, stable living conditions.

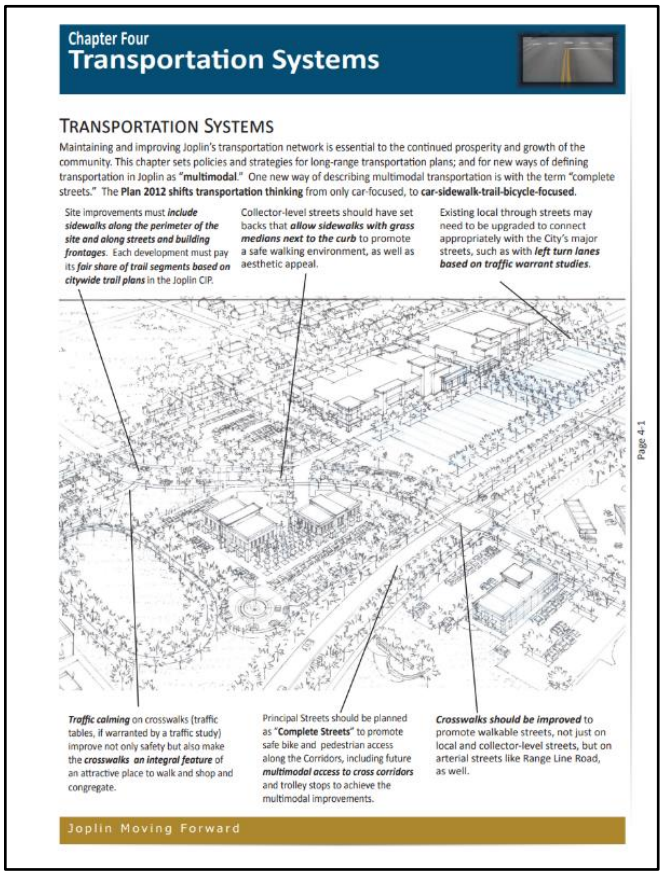
The Joplin economy was fortunate that many key community employers did not experience excessive damage. The largest local employer that suffered extreme damage was Mercy Hospital. The hospital helped play a key role in economic recovery by continuing to pay employees as the hospital was rebuilt on a new location[44]. This ensured financial stability for many families and allowed many residents to stay in Joplin. The city also had more than 300 new businesses open in the post-tornado recovery years between May 2011 and February 2016[46].

Comprehensive Plan and Complete Streets Approach

After the immediate recovery efforts of clearing debris and providing basic temporary shelter, the focus turned to medium to long-term recovery efforts. As part of this phase of recovery, the city reached out to the community to develop a shared vision for what Joplin would look like post-tornado. This citizen engagement played a significant role in shaping the future of Joplin. Community members were encouraged to provide feedback on what they wanted the new Joplin to look like, which included requests for more parks, trails, and sidewalks (see 'Community Buy-In and Public Education Section' [44]).

[44] Conversations with City of Joplin planning staff, December 2024
[45] Lanicanese, A. (2017). Hope Village, an innovative housing program, welcoming those who lost their homes in flood. *Beckley Register-Herald*
[46] Onstot, Lynn. *Fact Sheet – City of Joplin.* 2021.

Concurrent with the community engagement effort, the Joplin Planning Department created a new comprehensive plan called Joplin Moving Forward. The goal of the plan was to solicit community feedback, generate a community vision for the city and develop new land use and transportation policies that reflected the community vision. One of the key elements of the plan established planned development corridors that focused investment in the downtown area, including overlay districts that established mixed-used development corridors and infill development corridors in the recovery area. These districts and corridors were paired with updated development design standards and codes that improve bicycle/pedestrian connectivity, allowed higher density, and encouraged infill development. The hope was that this effort would foster a vibrant downtown commercial space, increasing housing opportunities, and approving mobility and accessibility.


Chapter Four
Transportation Systems

TRANSPORTATION SYSTEMS

Maintaining and improving Joplin's transportation network is essential to the continued prosperity and growth of the community. This chapter sets policies and strategies for long-range transportation plans; and for new ways of defining transportation in Joplin as "**multimodal**." One new way of describing multimodal transportation is with the term "complete streets." The **Plan 2012 shifts transportation thinking** from only car-focused, to **car-sidewalk-trail-bicycle-focused**.

Site improvements must ***include sidewalks along the perimeter of the site and along streets and building frontages***. Each development must pay its ***fair share of trail segments based on citywide trail plans*** in the Joplin CIP.

Collector-level streets should have set backs that ***allow sidewalks with grass medians next to the curb*** to promote a safe walking environment, as well as aesthetic appeal.

Existing local through streets may need to be upgraded to connect appropriately with the City's major streets, such as with ***left turn lanes based on traffic warrant studies***.

Page 4-1

Traffic calming on crosswalks (traffic tables, if warranted by a traffic study) improve not only safety but also make the ***crosswalks an integral feature*** of an attractive place to walk and shop and congregate.

Principal Streets should be planned as "**Complete Streets**" to promote safe bike and pedestrian access along the Corridors, including future ***multimodal access to cross corridors*** and trolley stops to achieve the multimodal improvements.

Crosswalks should be improved to promote walkable streets, not just on local and collector-level streets, but on arterial streets like Range Line Road, as well.

Joplin Moving Forward

Joplin Moving Forward; Joplin's 2012 Comp Plan, Page 4-1

Local planners described Joplin as a 'blue collar' town with a large Low-to-Moderate Income (LMI) population. A significant portion of the residents lack reliable transportation, so a walkable network is important for local residents. As part of the community engagement process, a community stakeholder laid out her goal for a future Joplin, "I want to be able to safely walk and get an ice cream and get to my next destination before it melts."[47]. This view painted a picture of Joplin that has safe, reliable, and efficient multimodal transportation facilities. The comprehensive plan captured this approach, laying out multimodal goals and approaches to reach those goals.

The transportation chapter of the 2012 Comprehensive Plan sets up the primary tenant of what Joplin's rebuilt transportation system would become. The comprehensive plan:

> *"sets policies and strategies for long-range transportation plans; and for new ways of defining transportation in Joplin as "**multimodal**." One new way of describing multi-modal transportation is with the term "complete streets." **The Plan 2012 shifts transportation thinking** from only car-focused, to **car-sidewalk-trail-bicycle-focused**."*[48]

Despite the extensive land use restructuring in the tornado zone, the plan recognized that the multimodal improvements must be phased in over a long period of time based on funding availability and opportunity. One of the multimodal infrastructure improvements prioritized was

[47] Conversations with City of Joplin planning staff, December 2024
[48] *Joplin Moving Forward*. (2012). City of Joplin Comprehensive Plan; Original emphasis.

the connection of schools to community neighborhoods by building new bicycle and pedestrian facilities, as well as, expanding the multiuse path system using a safe-routes-to-school strategy. Another transportation priority was to ensure that the corridors and districts in the downtown area were improved with walkability in mind. The approaches to long-term transportation and infrastructure recovery were laid out in the following list of key elements: multimodal, sidewalk investment, trails system, low-impact stormwater systems, public education and sustainability incentives[49].

To build a more multimodal transportation system, the plan calls for increased sidewalks, crosswalk improvements, ADA curb improvements, expansion of the multiuse trail system, improved roadway/trail stormwater systems and development of new planning policies and standards. Proposed new policies and standards included developing new access management standards based on level of service (LOS), a complete streets standard, and updated street sections that would reflect a multimodal system and land use plan[49].

Updated Access Management Plan for Roadways

While structures along arterials were being rebuilt, Joplin instituted a series of access management standards to improve transportation safety and ensure the appropriate LOS of roadways[50] [51]. Updated access management plan standards were designed to limit the number of curb cuts and access points along the roadways. Approaches such as providing parallel service roads and requiring adjacent commercial parcels to have connectivity between the two help reduce the number of access points along an arterial road. This helps support the better flow of traffic along the route and reduces vehicular and pedestrian conflict points. While the updated access management plan does not necessarily apply to MoDOT owned and operated roads, the land use regulations such as the internal connection of adjacent commercial parcels would apply.

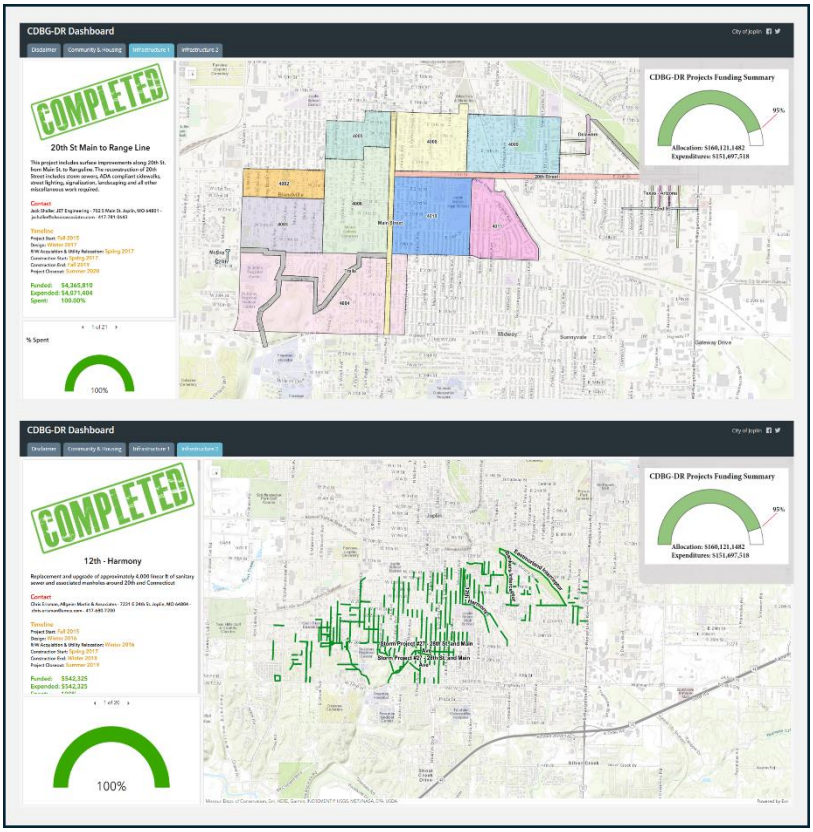
Complete Streets Plan and Multimodal Funding

The policy established a complete streets review committee to assess all transportation infrastructure improvements and developments in the designated corridors and districts. The Complete Streets Committee reviews, recommends and ensures the adherence to complete street standards for each applicable local infrastructure or development project. The committee is designed to be representative of community needs, having dedicated committee spots for an ADA representative and a Low-to-Moderate Income (LMI) community representative.

[49] Anguiano, D. (2022). *Once in a Lifetime Opportunity: The Stunning Comeback of a Tornado-Wrecked Town.* The Guardian.
[50] *Joplin Moving Forward*. (2012). City of Joplin Comprehensive Plan.
[51] Conversations with City of Joplin planning staff, December 2024

Design standards updates included: [52] [53]

- prioritizing buffers between sidewalks/multiuse paths and roadways
- increasing the number of high-visibility crosswalks
- ADA-compliant curb cuts
- increase on-street bike lanes
- develop more multiuse trails
- improved streetscaping along designated development corridors.



The city also established new typical section designs that incorporate complete street elements, thus encouraging safe, efficient multimodal transportation. To fund and prioritize the complete street and multimodal transportation improvements, the city developed a Capital Improvement Plan (CIP) to allocate CDBG-DR funding. The top four prioritized projects were transportation and streetscaping projects. Multiuse trail construction and expansion were also included in the top ten prioritized projects. Joplin was also awarded a competitive TIGER grant to make additional infrastructure improvements to at-grade railroad crossings and expand the trail system. All CDBG-DR-funded infrastructure projects are highlighted and mapped in a public recovery dashboard[54].

Community Buy-In and Public Education Efforts

The community's buy-in and commitment to the vision of rebuilding the city were critical elements in Joplin's recovery. Community feedback and engagement significantly influenced the city's recovery and vision for the future. The formation of the Citizen Advisory Recovery Team (CART) was instrumental in establishing the vision for a rebuilt Joplin and guiding the review and approval processes for both public and private sector revitalization investments[55]. By involving citizens early in the decision-making process, officials helped alleviate doubts and uncertainties, creating a sense of shared ownership in the city's future. To ensure temporarily displaced community members were able to weigh in on the future Joplin, the city created

[52] *Joplin Moving Forward*. (2012). City of Joplin Comprehensive Plan.
[53] *CDBG-DR Capital Plan; Community Development Block Grant Disaster Recovery.* (2016). City of Joplin. (p. 124) https://www.joplincdbg.com/DocumentCenter/View/804/CDBG-DR-2016-Capital-Plan-
[54] *"City of Joplin, CDBG-DR Project Dashboard, Transportation Infrastructure Projects 1 and 2."* https://joplinmo.maps.arcgis.com/apps/MapSeries/index.html?appid=4ee5fa0f343343208192ef0df3305b06)
[55] *Joplin Moving Forward*. (2012). City of Joplin Comprehensive Plan. (p.1-1) https://www.joplinmo.org/DocumentCenter/View/1101/Comprehensive-Plan-2012?bidId=

transit options to bring displaced residents from temporary housing in nearby communities into Joplin for the CART committee meetings.

At the start of the long-term recovery revision, Joplin assembled CART to capture broad swaths of community input. By utilizing several advisory subcommittees and public engagement efforts, Joplin gained valuable buy-in from its residents. Having a transparent, public committee also helped overcome some local skeptics of (local and federal) government and concerns that the Federal Emergency Management Agency (FEMA) would dictate the city's future. To ensure the process was community-led, Joplin city staff served as committee support staff rather than serving in leadership roles. The city staff coordinated meeting efforts and took notes, but allowed community stakeholders to drive the envisioning process. The CART community advisors advocated for multimodal transportation, specifically more walkability in the city. Based on the community feedback, the Joplin planning department developed the 2012 Joplin Forward Comprehensive Plan[56] [57].

One area where community engagement and buy-in could have been improved was public education efforts for the entire community. In retrospect, Joplin staff say they would increase their efforts to educate the general public on the complete streets initiative and provide specific examples prior to the initial implementation of some complete streets and road-diet efforts. The lack of awareness or tangible examples of a road-diet or complete street corridor led to some public pushback for early implementation[58].

Public education efforts after the initial implementation attempt were successful at gaining more public support and played a vital role in rebuilding trust and reducing skepticism. New approaches to educate residents about upcoming projects, such as complete streets and road corridor development examples and benefits were later implemented. The U.S. Environmental Protection Agency (EPA) contributed to these educational efforts, sending staff and resources to inform residents about these infrastructure improvements[59]. The US Environmental Protection Agency (EPA) also provided Joplin with support in the public education process for complete streets education and low-impact-design (LID) standards by holding public workshops and supporting community-wide public education efforts. LID design standards include requiring more native vegetation, vegetation swells, and bioretention ponds adjacent to roadway and bike/pedestrian facilities. The new standards also recommend the increased use of pervious surface and stormwater infiltration on sidewalks and parking lots. The new town LID standard also provides guidelines for increased building setbacks, grading and bioretention infrastructure for new buildings.

[56] *Joplin Moving Forward*. (2012). City of Joplin Comprehensive Plan.
[57] Conversations with City of Joplin planning staff and former staff (2024)
[58] Conversations with City of Joplin planning staff, December 2024
[59] Conversations with City of Joplin planning staff, December 2024

TAKEAWAYS 2011 Joplin, MO Tornado
Population Retention and Economic Stability
In order to retain population, Joplin worked to ensure: (1) schools were operational by next school year, (2) displaced residents could find temporary housing in close proximity to Joplin (within 30 miles), (3) keep displaced citizens as engaged as possible, and (4) offered down payment and closing cost support for residents purchasing rebuilt homes.
The city worked to ensure that schools that were destroyed in May 2011 would be ready for the new school year in the fall (2011). To maintain community connection, Joplin schools sent buses to pick up displaced Joplin students in nearby communities to allow a sense of community and continuity.
Joplin recovery efforts included work to prioritize temporary housing in Joplin and supported displaced residents by securing transportation from nearby communities for public meetings and committees. The city also set up a mailing list to communicate with displaced residents, keeping them informed of community processes and housing assistance programs that could support their return to Joplin.
The city used CDGB-DR funds to establish the Joplin Housing Assistance Program (JHAP) which provided up to $30,000 for a down payment and closing cost for qualified homebuyers. This was an effort to retain population and economic vitality by encouraging homeownership and providing affordable home buying options.
Comprehensive Plan and Complete Streets Approach
Joplin produced a comprehensive plan that envisions the future transportation and land use of the city. Understanding that large amounts of infrastructure would have to be rebuilt and replaced after the tornado, the plan took a community-centered approach to studying transportation and land use. The results were that the city designated specific walkable and high-density development corridors and districts in the tornado recovery area.
For any businesses needing to rebuild in commercial areas along arterials in the recovery area, Joplin implemented new access management standards along roadways. By utilizing roadway connectivity between parcels and service road access, the level of service (LOS) can be better maintained along arterials. Better access management also reduces conflict points for both vehicles and pedestrians.
Joplin's recovery efforts included improvements and expansion to the local trail/greenway system. Specifically, they prioritized routes that would connect residential areas to local schools. They ensured trail improvements were consistent with safe-route-to-school (SRS) approaches.
As a result of the updated comprehensive plan, the city developed a nationally recognized complete streets plan, including an assessment process and design standards.
A Complete Streets Committee was established that reviews, recommends and ensures the adherence to complete street standards for each applicable local infrastructure or development project. The committee has dedicated committee spots for an ADA representative and a Low-to-Moderate Income (LMI) representative from the community.
Following from the community engagement and comprehensive plan, the city developed a Capital Improvement Plan (CIP) to allocate CDBG-DR funding. This included multimodal infrastructure and completed streets projects. Joplin was also awarded a competitive TIGER grant to make additional infrastructure improvements to at-grade railroad crossings and expand the trail system.

Community Buy-In and Public Education Efforts
At the start of the long-term recovery, Joplin assembled a Citizens Advisory Recovery Team (CART) that captured broad swaths of community input. Utilizing serval advisory subcommittees and public engagement efforts, the city gained valuable buy-in from residents. Having a transparent, public committee also helped overcome some local skeptics of (local and federal) government and concerns that the Federal Emergency Management Agency (FEMA) would dictate the city's future. To ensure temporally displaced community members were able to weigh in on the future Joplin, the city had transit options to bring displaced residents from temporary housing in nearby communities into Joplin for the CART committee meetings.
The CART community advisors created the push for multimodal transportation, specifically asking for more walkability in the city.
In retrospect, Joplin would increase their efforts to educate the general public on complete streets initiative and provide specific examples prior to the initial implementation of some complete streets and road-diet efforts. The lack of awareness or tangible examples of a road-diet, complete street corridor led to some public pushback for early implementation. Public education efforts after that initial attempt to implement were successful at gaining more public support.
The US Environmental Protection Agency (EPA) provided Joplin with support in the public education process for complete streets education and low-impact-design (LID) standards. EPA staff came down to hold public workshops and support public education efforts.

2021 Tornado and 2022 Flooding in Kentucky

In an effort to further understand recovery lessons learned for Appalachian flooding, the research team planned to study a 2022 flood event in Eastern Kentucky. During the case study work, it became apparent that the recovery efforts for the 2022 flood were heavily informed from the recovery of the 2021 tornados in Western Kentucky. The research team decided to study both the 2021 tornado event and the 2022 flood event as part of this case study. Many of Kentucky's recovery efforts were either led by and/or supported by the Kentucky Transportation Cabinet (KYTC), the Commonwealth of Kentucky's department of transportation. After these two events, KYTC became tasked as a key agency lead for future immediate and long-term recovery efforts for natural disaster recovery.

2021 Tornado Event in Western Kentucky

On December 10th, 2021, a devastating storm system moved across several states in the central U.S. Multiple tornadoes formed, including a deadly EF-4 that caused catastrophic damage to Mayfield, Kentucky and the surrounding area. The tornado was on the ground for nearly an hour and covered 165.6 miles with peak wind speeds at 190 mph[60]. Over 80 people across five states were killed[61]. In Mayfield, 3,778 residential buildings, 183 commercial properties, and 103 other buildings were either damaged or totally destroyed, including the county courthouse and the Mayfield Consumer Products candle factory[62]. The December 10th storm became one of the deadliest storms in the state's history. The recovery relief efforts moved quickly, coming from the local, state, and national levels.

One key project that was very successful for housing local residents in close proximity to their community was an effort to use Kentucky state parks as temporary housing sites for displaced residents. The second key lesson learned was the need for the local community to organize and coordinate their own vision for recovery.

2022 Flood Event in Eastern Kentucky

From July 26th through July 30th, 2022, heavy rainfall hit parts of Eastern Kentucky and caused devastating impact in the Appalachian region of the state. Rural, mountain communities experienced extreme rainfall that led to the overflow of rivers and streams, causing devastating damage to infrastructure. The heavy rainfall lasted for several days, and at times, the hourly rainfall rates exceeded four inches[63]. At least 40 people lost their lives. Nearly 9,000 homes were damaged or destroyed and many roads and other infrastructure were severely damaged. Over 1,400 people were rescued, 600 by helicopter[64]. Some of the hardest-hit counties included Breathitt, Perry, Knott and Letcher.

[60] NOAA. (2021). *Dec 10-11 2021 Tornado Event*. Www.weather.gov.
[61] Rojas, R., Robertson, C., Paybarah, A., & Medina, E. (2021). Latest Tornado Updates: At Least 64 Dead in Kentucky, With Recovery "to Go on For Years." *The New York Times*.
[62] NOAA. (2021). *Dec 10-11 2021 Tornado Event*. Www.weather.gov.
[63] Klesta, M. (2023). Resilience and Recovery: Insights from the July 2022 Eastern Kentucky Flood. *Community Development Reports*.
[64] Klesta, M. (2023). Resilience and Recovery: Insights from the July 2022 Eastern Kentucky Flood. *Community Development Reports*.

Private Bridge Temporary Repairs

Similar to the effects of the flood event in the West Virginia case study, access to the Kentucky roadway network was impacted by the loss of private residential bridges. Kentucky took a different approach to private bridge repair than West Virginia.

A bridge across Grapevine Creek at Chavies School road in Perry County, KY

After the 2022 Kentucky flood, many private residential bridges were either damaged or destroyed. These private residential bridges are a key part of the transportation network in Appalachian communities. KYTC Engineers worked alongside FEMA to assess, document, and provide estimates for building temporary private residential bridges. Residents could apply for the assistance if they met the following requirements: (1) There were no other points of access; (2) A livable structure had to be located on the other side of the crossing; and (3) Damage had to be documented and repairs cost estimated. KYTC lead efforts to identify, document and estimate eligible private residential bridges. Once they received the final FEMA-approved list, KYTC worked with county governments to let the bid for private bridge repair. Counties then worked with approved contractors to start the placement of temporary bridge infrastructure. The temporary bridge repair cost could not exceed $35,000 per bridge, and these bridges are only designed to be temporary replacements to ensure access by first responders and provide residents access to the property until a permanent bridge can be established. Some bridges, specifically swing bridges, could not be repaired or replaced, as the counties could not procure a contractor able to repair or provide a temporary swinging bridge to the site.

High-Ground Community Sites

To provide housing options for displaced residents who could not return to their original home sites on the floodplain, the state developed 'high-ground community sites' located on reclaimed mining sites. Decades ago, mountaintop removal coal mining, which is a form of surface mining at the summit or summit ridge of a mountain, altered the Eastern Kentucky landscape[65]. Federal law required the mine sites to be leveled and replanted with trees and vegetation. Because of the mountainous and steep terrain in Eastern Kentucky, there are limited building sites not situated along the floodplain. Following the 2022 flood event, Kentucky officials utilized these reclaimed mine sites to establish high-ground community sites by developing small residential communities on the mountaintop removal sites. The high-ground community sites became crucial for long-term recovery housing efforts. Kentucky officials developed seven of the ten high-ground community sites, which are designed to house more than 500 total families and include open spaces like parks, playgrounds, and trail systems[66].

Photo: New York Times

These affordable housing opportunities provide opportunities for displaced residents to live near their community in less flood-prone development. Supported by high-ground sites and other recovery efforts, three-quarters of the residents have stayed within their original community[67].

To support this effort, KYTC designed and constructed new access roads up to the high-ground community sites. Many of these sites require lengthy sections of road that have to ascend steeply to high elevations. The high-ground communities required coordination between transportation infrastructure, utility infrastructure and geotechnical assessments.

State Parks for Temporary Housing

Immediately after the 2021 Kentucky tornado, the KYTC and the Kentucky State Park system played a significant role in relief efforts by providing temporary housing, such as campsites, cabins and RV sites to displaced residents. These sites were also used to place emergency housing trailers. These shelters provided basic amenities, including food, water, and medical supplies. Following the 2022 Kentucky flood disaster, Kentucky state parks reopened to help shelter individuals. Jenny Wiley State Park, Buckhorn State Park, and Pine Mountain State Park

[65] Gaffney, A., & Cherry, J. (2025). Kentucky's Mountaintop Mines Are Turned Into Neighborhoods. *The New York Times*.

[66] Hicks, J. (2024). *Kentucky's first high-ground housing site for 2022 flood survivors is almost ready*. Louisville Public Media; LPM

[67] *The Climate Migration Question: Rebuild or Relocate?* (2025). Nytimes.com; The New York Times

helped shelter residents temporarily[68]: In total, over 360 individuals found shelter and resources through the Kentucky state park system[69].

This approach proved so effective that the state provided funds to improve the infrastructure of the park, including improving access roads to State Park camp sites and winterizing water infrastructure. During the recent flooding in February 2025, state park sites were again used for emergency shelters and post-flooding housing. KYTC has supported these efforts in many ways, including coordination and improving park roads to accommodate the increased traffic volume of displaced residents.

The use of the state park locations as post-disaster housing and staging areas highlights the impact that best practice transfer can have on recovery efforts, even across different geographies and disasters. Post-disaster assessments should include documenting, retaining, and disseminating lessons learned, best practices and recovery barriers. By retaining and circulating this knowledge to all state agencies and local communities, the state can be better prepared for future disasters.

Community Coordination and Visioning

Much like the Joplin case study, one of the key takeaways from the 2021 Western Kentucky tornado was the importance of local community coordination and having community stakeholders that develop a vision for the post-disaster event. Unlike the Joplin case, the areas impacted in Kentucky did not have full-time city engineers or planners and had limited planning-zoning regulations. Given the situation, it took a couple of years for the community stakeholders to create a vision for the redevelopment of Mayfield, Kentucky. The delay caused confusion and hesitation among private developers trying to invest in the rebuilding of the area. The establishment of a community vision has improved long-term recovery efforts, including establishing improved bike/ped connectivity and roadside stormwater infrastructure. KYTC took the role of convener, supporting and facilitating local stakeholders and regional agencies recovery conversations.

[68] Birmingham, T. (2022). *Kentucky opens flooding shelters in state parks, courthouses, churches*. The Courier-Journal; Louisville Courier Journal.
[69] Birmingham, T. (2022). *Kentucky opens flooding shelters in state parks, courthouses, churches*. The Courier-Journal; Louisville Courier Journal.

TAKEAWAYS 2022 Eastern Kentucky Flood / 2021 Western Kentucky Tornado
Private Residential Bridge Repair
Private residential bridges are a key part of the transportation network in Appalachian communities. This infrastructure is vulnerable to flooding damage and impacts the mobility and accessibility of community members. Private bridge damage can impact long-term recovery efforts for impacted community members and limit the access of first responders. The Kentucky Transportation Cabinet (KYTC) worked to support a project to provide temporary bridge infrastructure to damaged private bridges.
KYTC Engineers worked with FEMA to assess, document, and provide estimates to support the building of temporary private bridges to facilitate emergency access. Candidate bridges were required to meet the following criteria: (1) There were no other points of access; (2) A livable structure had to be located on the other side of the crossing; (3) Damage had to be documented and repair cost estimated.
KYTC provided the final FEMA-approved list of private bridges that needed repair to the local counties and the local county put the temporary bridge construction into their bid process. Temporary bridge costs could not exceed $35,000 per bridge.
Barriers and considerations of the programs include that bridges are designed to only be temporary bridges (and are not designed up to normal standards). At locations with swing bridges, contractors could not be procured to repair or replace swing bridges at the allocated price.
'High-ground' Community Sites
After the Eastern Kentucky floods, KYTC supported infrastructure development for new 'high ground' community sites. Located on reclaimed mountaintop removal mining sites at high elevations, the state supports the building of approximately 10 new 'high-ground' communities to relocate residents living along the floodplain. KYTC supported the development of seven of the sites, including building extensive access roads up the mountain to the development site and supporting infrastructure and geotechnical efforts.
State Park Infrastructure Improvement for Displaced Residents
In an effort to support immediate post-disaster housing needs and to accommodate displaced residents, KYTC helped lead the state's efforts to get temporary housing trailers established after the tornado in Western Kentucky. This effort included locating temporary trailers for displaced residents at nearby Kentucky State Park RV camping sites. As part of this program, KYTC supported infrastructure improvements to state parks. This was so successful that it was replicated during the 2022 and 2025 flood events.
Kentucky is making infrastructure improvements to many state parks to pre-emptively have temporary living spaces for displaced residents for future natural disasters.

Case Study Applications for Western North Carolina's Helene Recovery

After a review of the literature and the case studies, the following barriers, lessons learned and opportunities for Western North Carolina recovery are presented below. The findings highlight lessons learned and opportunities to: (1) develop and implement innovative programs; (2) utilize federal funding; (3) coordinate community efforts; (4) support community cohesion and population stability; (5) utilize recovery repairs to increase resilience; and (6) support long-term economic recovery.

The research team recognizes that NCDOT, like all state agencies and organizations, has a defined mission and jurisdiction focused on transportation infrastructure. However, we also know the important role of NCDOT and local planning organizations (MPOs, RPO, COGs) to act as community conveyors. While some of the findings are within the purview of NCDOT, others can be achieved through collaboration and coordination across agencies and jurisdictional scales (such as planning organizations, counties or towns).

The specific barriers, lessons learned, and opportunities related to Western North Carolina are presented below in Exhibits 5 – 6.

TAKEAWAYS **Western North Carolina Hurricane Helene Recovery**
PRIMARY FUNDING BARRIERS
Infrastructure Resilience Improvements are Limited with FEMA Funding, as states are not provided much flexibility to build infrastructure back more resilient. Federal Emergency Management Agency (FEMA) funds provide some specific allowance for stabilizing banks and necessary site repair. It is more difficult to develop new resilient site designs based on reimbursement criteria and the closeout timeline for making reimbursement claims.
CDBG-DR Funding Uncertainty is a barrier to making resilient improvements to infrastructure and developing innovative community recovery programs. The Community Development Block Grant - Disaster Recovery (CDBG-DR) funds administered by the US Department of Housing and Urban Development (HUD) have historically had more flexibility than FEMA funding for recovery initiatives and infrastructure improvements. However, that funding has been slow to be allocated or not allocated over the past two years.

LESSONS LEARNED FROM CASE STUDIES
Embrace the Opportunity to Rebuild the Community with more multimodal design standards, updated land use visions, new park infrastructure, more resilient design standards, and a coordinated economic development plan.
Community Support and Public Education is an important part of recovery efforts and long-term economic vitality. A community-shared vision of what the community will look like post-recovery can help retain the population, motivate and structure recovery efforts, and improve project implementation efforts.
Community and Inter-Agency Coordination is key for complete community recovery. It is especially important to ensure coordination among transportation infrastructure, stormwater/utility infrastructure, land use, and economic development efforts. Having the right agencies and governmental entities in the room is critical to coordinating, as specific agencies have jurisdictional constraints and various sources of funding (with different eligibility requirements).
Don't Overlook Private Infrastructure (such as residential bridges); they are a critical access point to the public transportation network.
School Transportation and Community Transportation to Displaced Residents can support the stabilization of communities and reduce population loss. Especially when displaced residents are able to find temporary housing in nearby communities with reduced disaster impacts. Developing a system of sustained communication for providing recovery updates and support program opportunities can encourage residents to permanently locate back in their communities.
Community Cohesion and Sense of Place are especially key in rural communities that have multigenerational family ties to the area. Attachment to family land and community sense of place is very important in Appalachian communities. Efforts such as West Virginia non-profit approaches to community-buyouts and Kentucky's development of 'high-ground community sites' are examples of retaining population in communities.
Developing Community Parks and Greenways Along Unbuildable Floodplains supports community cohesion, honors community connection with the land, and provides flood-mitigating green space. As properties are damaged along floodplains and unable to be rebuilt, community-centered buyout programs can repurpose the space as community amenities such as parks, trails and greenways. Greenway and trail infrastructure also provide opportunities for tourism revenue to support economic recovery. Planting an array of biodiverse, native vegetation along these floodplain facilities can support better flood resilience.
Utilized Novel Approaches to State and Community Assets to support recovery can provide new resources for immediate and long-term recovery efforts. For example, using state park facilities as post-disaster housing sites or transforming under-utilized sites for community high-ground communities. State park facilities can be converted to host displaced residents after a storm event. Some sites may require upgraded access roads, utilities and/or winterizing assets. Additionally, under-utilized or marginal land can be transformed into high-ground community sites to relocate displaced residents along floodplains.
Ensure Mechanisms for Knowledge Retention and Best Practice Dissemination across the state, including utilizing the knowledge and best practices that can be transferred between geographies (mountain, coastal, and piedmont regions). A key element of knowledge retention is disseminating lessons learned and best practices to local communities and providing guidance on pre-disaster planning and mitigation efforts to enhance preparation for the future natural disasters.

OPPORTUNITIES FOR WESTERN NORTH CAROLINA COMMUNITY RECOVERY
Prioritizing Complete Streets and Multimodal Improvements while rebuilding and repairing transportation infrastructure can support community stability, improve mobility/accessibility, and support economic vitality. An opportunity exists for North Carolina state agencies to work with local planning organizations to designate locations where emphasizing multimodal improvements and complete street approaches would have the greatest impact (downtown areas, near schools, etc.).
Active Transportation Infrastructure to Support Local Tourism can help create economic vitality in Western North Carolina mountain communities. Developing dedicated easements for future trails and greenways as part of community rebuilding efforts (including unbuildable land along floodplains) provides an opportunity to connect local communities with active transportation routes and support the active tourism economy in the region.
Collaboration to Repair Private Bridge Infrastructure supports connecting residents and residential communities to the public transportation network. Ensuring that private bridge standards are safe, reliable and resilient will support resident retention and emergency management access within the community. Opportunities exist to partner with non-profit organizations to support private bridge repairs.
Building Back More Resilient as infrastructure replacement and repair projects provide opportunities to build more resilient infrastructure. While federal funding eligibility can constrain full resilient redesigns for permanent infrastructure repairs, there are FEMA Hazard Mitigation funds to support those efforts. Current NCDOT efforts to update design standards for stormwater and infrastructure resilience can provide funding justifications as infrastructure repairs are required to meet current state design standards.
Maintaining Community Cohesion by ensuring community buy-in for a recovery vision; providing temporary housing as close as possible for displaced residents; providing transportation access back to their home community; allowing students to stay in their previous school district (and provide transportation as possible); considering inter-generational connections to the land; and integrating economic opportunities in the recovery process can all support maintaining a stable population.

The results of this study present strategies and considerations for long-term disaster recovery focusing on community stability and vibrancy, including population retention, economic growth, and overall social well-being. The effectiveness of recovery strategies can have long-lasting impacts on affected communities. These findings work to offer lessons learned and innovative opportunities to support long-term recovery for Western North Carolina communities.

APPENDIX:

Composite List of Cited Sources

Appendix

Composite List of Cited Sources

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