



Chapter 5

**VERI: Part of the Quilt to
Rebuild a Stronger Vermont**

Chapter 5

| | |
|---|------|
| Overview | 5.1 |
| Listening and Documenting Lessons Learned | 5.2 |
| Filling the Data Gap..... | 5.4 |
| River Corridor Protocols and Maps | 5.4 |
| Identifying Vulnerable Roads Segments | 5.5 |
| Identifying Undersized Bridges and Culverts | 5.5 |
| Digital Parcel Data | 5.6 |
| Provide Tools and Training to Municipalities | 5.6 |
| VERI Framework for Targeting Investment to Protect Business and the Economy | 5.7 |
| Flood Resilience Checklist | 5.8 |
| State Planning Manual Update | 5.9 |
| Stormwater and Green Infrastructure Guidelines..... | 5.9 |
| Technical Guidance: Standard River Management Principles and Practices | 5.10 |
| Update Standards and Policies..... | 5.10 |
| Town Plan Updates: New Flood Resilience Element Required | 5.11 |
| ERAF Updates | 5.11 |
| New Rivers, Road and Bridge Standards..... | 5.13 |
| Flood Hazard Area and River Corridor Rule..... | 5.15 |
| Shoreland Protection and Water Quality Protection Acts | 5.15 |
| Strengthen Communication and Coordination..... | 5.16 |
| Information Easy to Access: Flood Ready Vermont..... | 5.16 |
| Roads and Rivers Training..... | 5.17 |
| Targeting Rebuilding and Mitigation Investments Together..... | 5.18 |
| Improve Response and Preparedness..... | 5.19 |
| Assisting Businesses Planning | 5.20 |
| Updating and Testing Emergency Preparedness Plans | 5.20 |
| Integrating Data Gathering with Emergency Management..... | 5.21 |
| Improving Response Time | 5.22 |
| Next Steps: Implementing VERI through Partnerships..... | 5.22 |
| Resources | 5.24 |
| Appendix 5.1: | 5.25 |

Overview

Vermont's hard-won experience from flooding taught us many lessons – a key one was that no one individual, business, organization, town or state agency can reduce flood vulnerabilities alone. Fortunately, projects like VERI and other studies and related initiatives deepened partnerships and identified new opportunities that have helped communities, the state, and its regional and non-profit partners develop and advance an integrated, long-term strategy of policies, programs and investments to:

- ➔ protect people and property;
- ➔ strengthen Vermont's preparedness at a business, community and state level;
- ➔ ensure a coordinated, fast and efficient response after a disaster;
- ➔ reduce the repetitive repair costs to infrastructure that impact community, state and federal budgets; and
- ➔ ensure businesses stay open and Vermont's economy remains strong after an event.

The VERI project and partnership has played a key role in the rebuilding 'quilt'. It helped fill data gaps and created a step-by-step process to help the state, RPCs, and cities and towns examine where flood and fluvial erosion hazard areas pose a risk to critical infrastructure and key economic assets. It identified five areas where flood risks intersect with key economic activity and laid out policy and project-specific strategies to reduce these risks. At the same time, it developed a comprehensive method to identify, prioritize and implement local policy changes and projects to minimize flooding for communities across Vermont and it focused mitigation efforts and funding needs for the state moving forward.

VERI created a new standard for future planning efforts which will help local municipal leaders - with limited time, staff and expertise - make informed choices on upgrading infrastructure, how to protect current businesses and where to site future developments to reduce costs and decrease risk. More significant is that the VERI process and framework is replicable and can help other Vermont

communities and states plan and take steps to minimize the costs and struggle to rebuild local infrastructure and economies.

Over time, VERI's process, along with new and improved flood data, laws, planning and education, as well as funding for projects that reduce identified vulnerabilities will not only improve the quality of Vermont's streams and rivers, but also reduce the cost of flooding to our businesses and economy. For these reasons, Vermont state agencies and their partners are committed to building on the foundation started with VERI to help other communities and businesses better analyze, understand and manage their risks.

The next section provides a snapshot of the lessons Vermont and its partners learned from its recovery. It describes how the state addressed data gaps that in turn informed the development and implementation of new policies and programs to help the state, business and communities reduce their risks and costs through improved comprehensive planning and preparedness and mitigation efforts.

Listening and Documenting Lessons Learned

After Tropical Storm Irene, as the state transitioned from response toward longer-term recovery work, several extensive outreach efforts were undertaken to better understand what worked, what didn't and what was needed to rebuild stronger and safer. Several of these efforts were led by the State of Vermont, such as the Community Recovery Partnership, which hosted 13 meetings in the hardest hit communities across the state in the months following Tropical Storm Irene to learn more about local recovery and rebuilding needs directly from those impacted (DHCD, 2012). Other efforts were led by non-profits such as the Institute for Sustainable Communities (ISC), which engaged hundreds of stakeholders in their Resilient Vermont Project that developed a report containing recommendations to help make Vermont a model of community, economic and environmental resilience (ISC, 2014). Another was a more targeted review of state policy and programs with state agency staff (Smith, 2013)

While occurring at different times in the recovery process, the findings of these and other efforts were fairly consistent and summarized on the following page.

- ➔ ***Fill the Data Gaps.*** Stakeholders were clear that consistent, easy-to-use information was needed to identify risks from flooding. FEMA’s flood maps are often out of date and incomplete as they only include inundation risk and do not identify locations at risk from fluvial erosion. Filling this data gap is critical if communities and the state are to better plan and prioritize investments.
- ➔ ***Provide Tools and Training to Municipalities.*** Many of Vermont’s municipalities have limited capacity to plan, identify and manage their risks. A better aligned and integrated support system of tools, incentives, guidance and funding would help spur the changes needed to help municipalities take action.
- ➔ ***Update Standards and Policies.*** There is a need to align Vermont’s rules and investments to ensure that they align with the information we have regarding mitigating hazards before damage occurs and reducing risk to homes, businesses and infrastructure. There was an understanding that many of our past practices – building in floodplains, paving areas that provide storage for stormwater or building to outdated standards – need to change if we are to withstand future events.
- ➔ ***Strengthen Communication and Coordination.*** Pre-planning and establishing working relations prior to an event increases efficient and effective recovery outcomes. Strengthening cross-agency partnerships in state government as well as with RPCs and among municipalities was an outcome highlighted by stakeholders.
- ➔ ***Improve Response and Preparedness.*** Planning and responding to floods and disasters crosses town and state lines and requires cooperation among individuals and many partners. It is impossible to anticipate and reduce all risks, but more opportunities to share information and resources to develop and practice emergency plans would help accelerate recovery from a variety of disasters.

Vermont has made progress in each of these five areas and the VERI project has played a role filling data gaps, providing tools and outreach to communities and strengthening partner communication and coordination needed to implement change.

Filling the Data Gap

System-wide changes take time and must be informed by accurate and timely information to be successful. A lesson learned from Tropical Storm Irene was that consistent and easy to access information was needed to identify, prioritize and act on opportunities to reduce risks at the local level. Because Vermont's cities and towns regulate land use and own and manage much of their infrastructure, work by the VERI team to create statewide maps identifying infrastructure and buildings prone to flooding was critical to its long-term flood mitigation strategy. The following are some projects that have filled the data gaps since Tropical Storm Irene:

River Corridor Protocols and Maps

VERI funding partially helped the state refine and finalize its stream geomorphic assessment protocols and river corridor procedures. By 2014, the state released an initial statewide river corridor map that is considered a national model. The river corridor maps combined with FEMA FIRM maps, created the first statewide inundation and fluvial erosion hazard map. This filled large holes in Vermont's flood maps and identified areas of greatest vulnerability. The state river corridor maps are now in a user-friendly format, accessible to everyone and illustrate where floods are likely to occur, helping individuals, businesses and municipalities better understand their risks and take steps to improve their safety and reduce or eliminate the risk (http://floodready.vermont.gov/assessment/vt_floodready_atlas).

The initial river corridor map layers hatched a number of subsequent projects to create more powerful tools to improve the decision making processes during and after a disaster, including the following:

- ***Hazard Mitigation Prioritization Tool:*** Work is currently underway to enhance the functionality of the statewide River Corridor Map Layer by creating a statewide Risk Analysis and Hazard Mitigation Prioritization Tool. When complete, local planners will have a science-based GIS river sensitivity layer to identify high priority local hazard mitigation activities. The state is also working on complementary efforts to integrate river corridor data into the transportation planning and project prioritization process.

- ➔ **State Buildings At-Risk:** Another project was launched to conduct a vulnerability assessment of all state buildings to determine which are subject to the greatest risk of flood and fluvial erosion damage. Buildings identified at-risk that play a critical role in government operations will be prioritized for further assessment including scopes of work and cost estimates to mitigate risks.

Identifying Vulnerable Roads Segments

The river corridor maps were the critical missing piece that allowed the VERI team as well as VTrans to identify vulnerable culverts, roads and bridges and analyze the risk to transportation network. The river corridor and sensitivity data identified over 400 locations on state roads and more than 2,200 locations on town highways that are vulnerable to damage from floods (see Table 5.1).

Table 5.1: Vermont Roadways with Unstable River Corridors (URC)

| Description | State Highways | Town Highways |
|---|----------------|---------------|
| Total Miles | 2,707 | 11,482 |
| Miles within URC | 207 | 349 |
| Percent of Miles within URC | 8% | 3% |
| Number of Road Segment Locations within URC | 428 | 2,239 |

Identifying Undersized Bridges and Culverts

The state has worked over several years with the RPCs to create and populate The Vermont On-Line Bridge and Culvert Inventory Tool. The inventory now includes details and locations on approximately 90,000 structures, and is continually updated and accessible online to cities, towns and the general public (www.vtvulverts.org). Applying VERI’s GIS screening tool to this data set preliminarily identified over 700 undersized bridges and culverts at risk of failure from flooding. As seen in Figure 5.1, the risks to the transportation network are statewide, but knowing their locations and understanding the extent of the challenge gives the state and municipalities critical information needed to take steps to strengthen the weak links in the transportation network.

Digital Parcel Data

Parcel data in Vermont is currently collected and managed by municipalities to support a variety of functions from property valuation and taxation to permitting and land use. However, in many communities parcel maps are outdated and/or on paper and the methodology is not consistent from town to town.

State agency partners are currently advancing a 3-year, \$1.5 million project to build a consistent statewide digital parcel data set that is online and easy to access and use. Overlaying parcel data with the river corridor maps would enhance emergency response activities and identify owners of properties for buy-outs or that are in need of floodproofing. Aggregating this data into larger regional and watershed areas will provide conservation organizations (e.g. land trusts, VHCB) with a tool to identify key parcels where the protection of a river corridor and floodplains would reduce downstream hazards and risks. The data will also support regional or watershed-based land use regulations that help protect floodplains and reduce stormwater flows.

With support from the Hazard Mitigation Grant awarded through the VT DEMHS to VT ANR, access to these and other mapping tools and information about each community's current flood preparedness is now publicly available through the Flood Ready website (<http://floodready.vermont.gov/>). An expanding array of flood and other map-based data to help communities plan and prepare for flooding is available on the Natural Resource Atlas (<http://anrmaps.vermont.gov/websites/anra/>).

Provide Tools and Training to Municipalities

While filling data gaps and giving home and business owners, local governments and state policymakers the information they need to understand risks and vulnerabilities and make informed decisions is important, this information must be integrated into local plans, policies, and regulations.

Where development and infrastructure is located, which land is prioritized for conservation and how rivers are managed directly impacts the vulnerability of Vermont's businesses and economy. In Vermont many of these decisions occur at a local level, by volunteers with little or no full-time municipal staff support. According to the Vermont League of Cities and Towns, a member organization whose mission is to serve and strengthen Vermont local governments, there are 5,000 elected and appointed volunteers making land use decisions in Vermont. Tools, training, outreach and support was a need highlighted in many of the post-Tropical Storm Irene reports and listening sessions. State agencies responded and below are highlights of some of the initiatives developed:

VERI Framework for Targeting Investment to Protect Business and the Economy

Vermont's villages and downtowns are unique historic, economic and cultural assets. Vermont's long-term economic development strategy is to support reinvestment and growth in and around Vermont's historic centers – many of which are near rivers or lakes and vulnerable to damage from floods. In most Vermont communities, it's not practical or possible to relocate buildings and infrastructure to locations outside of river corridors.

Exactly how to improve public safety and reduce damage from flooding in these areas is a challenge for many communities, as there are many competing and conflicting interests. For this reason, VERI provides municipalities with a methodology (see Chapter 3 in this report) for integrating flood information, economic and business data and on-the-ground river analyses to help prioritize updates to local plans, policies, and regulation. VERI helps communities to support growth, reduce risks from flooding and ensure local businesses stay open and the economy strong after a disaster. The five regional assessments provide a roadmap for those communities, but also pinpoints where other communities should target their limited resources to ensure existing businesses are protected and new development is not located in undeveloped floodplains and river corridors.

VERI's work also helped the five targeted areas knit together a patchwork of existing flood reduction plans, programs, projects and laws into a more integrated mitigation framework. Over time, this framework will be refined and tailored to help more Vermont communities understand and anticipate flooding and take actions to reduce the risks and costs to their economy.

Flood Resilience Checklist

To help municipalities evaluate local programs and regulations, target limited resources and determine next steps, the Vermont Department of Housing and Community Development (VT DHCD) applied for and received a grant from U.S. EPA's Smart Growth Implementation Assistance (SGIA) program. Using the communities in the Mad River Valley as the test case, this project developed a checklist to help communities identify changes to regulatory and non-regulatory programs that reduce the cost and impact of future floods. This checklist includes overall strategies to improve flood resilience as well as specific strategies to conserve land and discourage development in river corridors; to protect people, businesses, and facilities in vulnerable settlements; to direct development to safer areas; and to implement and coordinate stormwater management practices throughout the whole watershed (see Appendix 5.1 for checklist).

The VERI team utilized this checklist as the basis for the policy and program review for the municipalities in the five study areas. In these study communities, the checklist highlighted the importance of including priority projects in their hazard mitigation plans and capital improvement plans for successful implementation. This more comprehensive approach to effect lasting change will help other communities take steps to better withstand and more quickly recover from flood-related disasters.

VT DHCD has also requested that the RPCs utilize the checklist when communities are developing municipal plan updates to ensure that flood resilience is front and center in the minds of local decision makers and that plans, policies and program updates are identified and prioritized.

State Planning Manual Update

State statute defines how local and regional planning occurs in Vermont and creates a framework for regulatory and non-regulatory implementation. The local planning process and the zoning regulations that implement the plans are described in a VT DHCD published manual to assist communities in complying with the rules. The manual explains how to develop, prepare or amend a municipal plan and outlines implementation tools. The guide, published in 1987 and republished in 2000, is sorely out of date and missing key planning elements, like economic development and the newly required flood resilience element. VT DHCD, state agencies and a diverse group of stakeholders are currently working on a comprehensive update of the guide that will provide current regulations and examples of best practices to assist communities, including information to help communities learn from VERI and take steps to integrate and align local plans with implementation programs. Upcoming modules of the planning manual will also include model bylaws and a range of options to protect river corridors and floodplains and manage stormwater. The manual will be released in November 2015.

Stormwater and Green Infrastructure Guidelines

By using multiple strategies to keep stormwater runoff close to where it falls and letting it infiltrate into the ground rather than rushing it off the land and into streams and rivers, the state, communities and business can reduce flooding and at the same time improve the quality of water.

The state's new Stormwater Master Planning Guidelines are designed to help municipalities manage stormwater with guidance, case studies, funding sources and sample stormwater regulations (http://www.vtwaterquality.org/erp/docs/erp_SWMPFinal5-30-13.pdf). This guidance, along with new clean water requirements, has resulted in more municipalities incorporating stormwater management into capital improvement projects and creating regulatory provisions to reduce the amount of storm and floodwaters flowing into our rivers and streams.

Green stormwater infrastructure (also called Low Impact Development or LID), are systems and practices that help address the problem of flooding and runoff by using vegetation and soil to slow, sink and spread stormwater.

At the state level, the Interagency Green Infrastructure Council, comprising the Secretaries of VT ACCD, VT ANR, Vermont Department of Buildings and General Services and VTTrans have developed plans and guidance to incorporate green stormwater infrastructure into existing and planned development at the state and local level (http://www.watershedmanagement.vt.gov/stormwater/htm/sw_green_infrastructure.htm). Refer to Chapter 6 for details on green infrastructure practices and tools.

Technical Guidance: Standard River Management Principles and Practices

Completed in 2013, Vermont's new Standard River Management Principles and Practices helps municipalities, contractors and property owners manage rivers to reduce future flood and erosion risks (http://www.watershedmanagement.vt.gov/rivers/docs/SRMPP_Edition_1.2_lowres.pdf). This guidance explains how to manage rivers toward their least erosive, equilibrium (or naturally stable) condition – which helps break the cycle of flood recovery activities that can make property near post-flood river channels more vulnerable to damages from future flooding.

With the adoption of Flood Hazard Area and River Corridor Protection Procedures in 2014, the state re-organized and compiled this best practices guidance for managing streams and rivers toward the creation of functioning floodplains and least erosive stream channels into the following categories:

- Slowing, Spreading, and Infiltrating Runoff
- Avoiding and Removing Encroachments
- Improving River and Riparian Management

Update Standards and Policies

Prior to Tropical Storm Irene, flooding on a statewide scale had not been seen since the 1970s, and before that, 1927. However, local and regional flooding occurs almost every year and costs individuals, businesses, municipalities and the state millions of dollars. Experience has shown that tools, training and outreach is not enough to create the change that is needed to reduce Vermont's risk.

Vermont has made progress in aligning statute, rules and programs in support of more resilient communities. Vermont has also taken a number of steps to reduce or eliminate long-term risk to people and property from hazards and their effects. Specific progress includes:

Town Plan Updates: New Flood Resilience Element Required

State laws were updated in 2012 requiring all Vermont community and regional plans after July 1, 2014 to have a flood resilience element that identifies their vulnerabilities and risks and outlines strategies and projects to reduce those risks. The plans must identify flood hazard and fluvial erosion hazard areas, based on the new state river corridor maps. To reduce the risk of flood damage to infrastructure and property, the plans must designate areas for protection, including floodplains, river corridors, and land adjacent to streams, wetlands, and upland forests. Communities and regions must also recommend policies and strategies to protect the areas identified to decrease risks to public safety, critical infrastructure, existing buildings and municipal investments. These plans and maps create the foundation for future development regulations that exceed NFIP minimums.

Municipalities were also encouraged to ensure that the flood resilience elements in town plans were also consistent with Hazard Mitigation Plans to confirm that recommendations did not conflict, and instead worked in harmony. In 2015, over 60% of Vermont's 290 municipalities include flood resilience plans and 57 percent have submitted Local Hazard Mitigation Plans (34% of these are approved by FEMA).

ERAF Updates

Vermont also restructured its ERAF through the rule-making process to further incentivize local flood planning activities and the adoption of local land use regulations that go beyond the NFIP minimum regulations (http://floodready.vermont.gov/find_funding/emergency_relief_assistance). ERAF provides state funding to match Federal Public Assistance grants provided through FEMA after a federally-declared disaster. FEMA covers 75 % of eligible project costs for cities and towns to repair damaged infrastructure after a presidentially-declared disaster, leaving 25% of the cost to be covered by the municipality. To assist communities in dealing with this cost, the State of Vermont established ERAF. Before Tropical

Storm Irene, ERAF split the 25% cost and paid 12.5% and 15 % if the community had adopted road and bridge and NFIP standards. With the new rules, starting in October 2014, the ERAF rule established three different levels of state contribution towards the 25% non-federal share, creating financial incentives for municipalities to take steps to plan and reduce their risk. Depending upon the level of adoption of recommended mitigation actions (see Table 5.2), the ERAF match requirement will vary from 7.5 percent to 17.5 percent of the total project costs.

Table 5.2: ERAF Matching Requirements

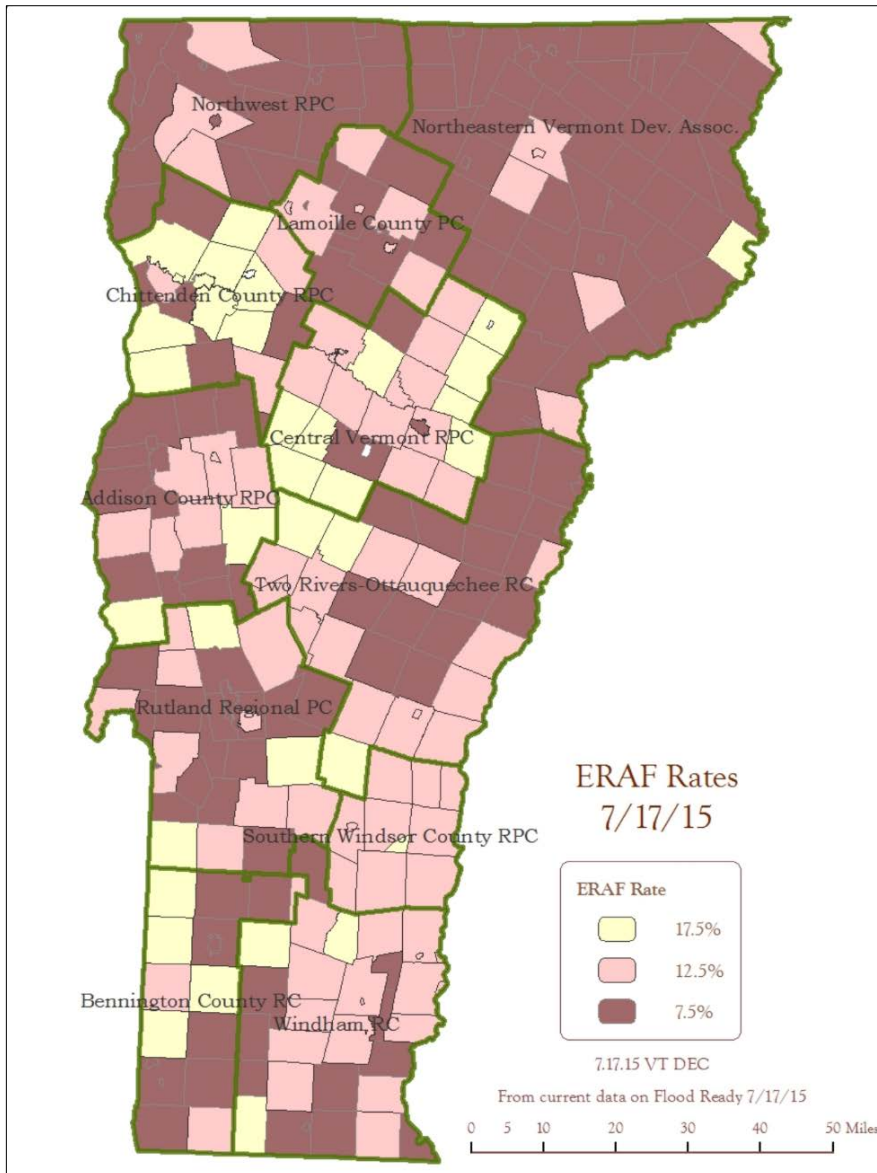
| |
|--|
| State aid to towns for federally-declared disasters is 7.5 % |
| Base level, no mitigation actions required |
| Steps to increase State aid to 12.5% (all four required to qualify) |
| Participate in the National Flood Insurance Program |
| Adopt 2013 State Road & Bridge Standards |
| Annually Adopt Local Emergency Operations Plan |
| Adopt Local Hazard Mitigation Plan |
| Step to increase State aid to 17.5% (one required to qualify) |
| Adopt no new development in a River Corridor |
| <i>-or-</i> |
| Adopt no new development in Flood Hazard areas and participate in the Federal Community Rating System |

In two short years, the changes to the ERAF program has delivered meaningful results, detailed in Table 5.3 and Figure 5.2.

Table 5.3: Municipalities and ERAF Requirements – 2014 Compared with 2015

| 2014 | 2015 | ERAF Mitigation Actions |
|------|------|--|
| 87% | 89% | Participate in the National Flood Insurance Program |
| 70% | 87% | Adopt 2013 State Road & Bridge Standards |
| 36% | 82% | Adopt Local Emergency Operations Plan |
| 35% | 57% | Adopt Local Hazard Mitigation Plan |
| 0% | 24% | Adopt Interim River Corridor Protection: no new encroachment in a Special Flood Hazard Area or FEH, or no new encroachment in a River Corridor |
| 0% | 3% | Adopt River Corridor Protection (explicit based on river corridor maps posted 1/2/2015 on the Natural Resources Atlas tinyurl.com/floodreadyatlas) |
| 0% | 0% | Adopt no new development in Flood Hazard areas and participate in the Federal Community Rating System |

Figure 5.1: Map of ERAF participation (July 2015)

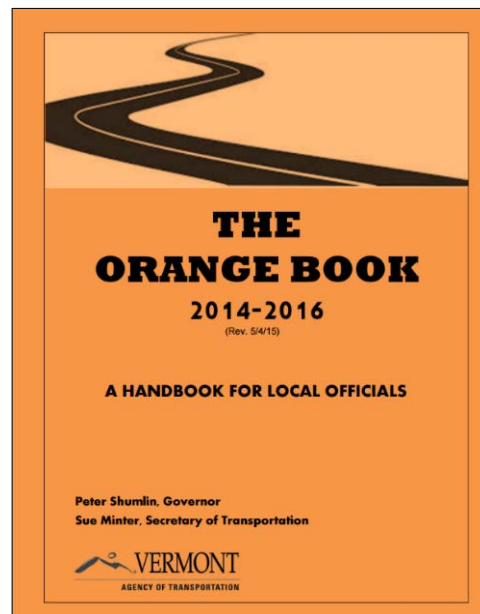


New Rivers, Road and Bridge Standards

In response to Tropical Storm Irene, Vermont pushed to make sure bridges and culverts were rebuilt to more flood-resistant standards. However, without consistent statewide “codes and standards” FEMA reimbursement is limited to the cost to rebuild or restore the restructure to its pre-disaster conditions. To assure Vermont builds stronger and avoids future confusion related to FEMA reimbursement policies, a number of rules, performance measures and design standards were updated to assure consistency.

In 2013, VTTrans updated the ‘Orange Book’ of road and bridge standards to improve safety, reduce life cycle costs and reduce environmental impacts (see Figure 5.3). As seen in Table 5.3, 87% of municipalities have adopted local transportation standards that meet or exceed the Agency of Transportation 2013 recommended template for town road and bridge standards. Training and education to support the statewide flood mitigation framework is ongoing and it now incorporates a variety of environmental protection measures and new engineering requirements. The state continues to assist municipalities in interpreting and adopting the 2013 Town Road and Bridge Standards. These standards include practices aimed at reducing erosion and allowing drainage structures to pass debris during flood conditions, reducing damage and repair expense. Other related updates include changes to the hydraulic manual to ensure upgrades to the transportation network are designed to withstand increased water flows as well as new stream alteration rules that consistently regulates river management practices like streambank stabilization and road improvements.

Figure 5.2: VTTrans Updated the Orange Book in 2013



Flood Hazard Area and River Corridor Rule

Vermont closed regulatory loopholes with the new Flood Hazard Area and River Corridor Rule that took effect March 1, 2015. The rule assures full state compliance with NFIP by regulating development exempt from municipal regulation like state buildings and transportation projects, public utilities and agricultural and silvicultural activities. The rule creates “No adverse impact” procedures and standards that prohibits development (e.g., roads, buildings, berms) that would change the height or velocity of floodwaters. The general permit is now finalized, as are Memoranda of Understanding with the VT AAFM and VTrans.

Shoreland Protection and Water Quality Protection Acts

Activities that protect and improve water quality often go hand-in-hand with sinking, slowing and spreading stormwater which reduces the impact of flooding. Communities, RPCs, the Vermont Legislature and state agencies have been working together to develop and implement legislation that reduces velocity of flood waters and improves water quality.

The Shoreland Protection Act went into effect July 1, 2014. It regulates development along lakeshores and limits clearing of vegetation and the creation of new impervious areas near lakes, ponds and reservoirs with a surface area of greater than 10 acres. This law is intended to protect water quality, preserve habitat and natural shoreline stability and protect the economic and recreation benefits of lakes and their shores.

Figure 5.3: Governor Shumlin Signing the Shoreland Protection Act into Law



In June 2015, the Governor signed the Water Quality Protection Act into law that is designed to curb stormwater runoff into Vermont's waterways and create a new municipal roads permit and program to fund local stormwater and erosion controls. The law also establishes the State Clean Water Fund that raises \$5.3M to improve river, river corridor, floodplain, and stormwater management practices that reduce flood hazards. A broad array of groups are working closely to ensure flood protection and water quality goals are aligned and achieved with this new statute.

Strengthen Communication and Coordination

Tools, guides, manuals, projects are for naught if there is duplication of effort, organizations are working in silos and decision makers do not know where to find information and support. Response and recovery efforts after Tropical Storm Irene clarified the need for cross-collaboration, understanding partner needs, goals and language and coordinated strategies that met multiple objectives. Those lessons after Tropical Storm Irene were not forgotten and state agencies have been working to effectively communicate and collaborate. Results include the following:

Information Easy to Access: Flood Ready Vermont

Led by VT ANR, other state agencies, communities, RPCs and others worked on develop the 'Flood Ready Vermont' website to provide a site where communities could find the information, tools and guidance to help them develop in safer places, protect the functions of watersheds that provide protection, adapt critical infrastructure and prepare for emergencies (www.floodready.vermont.gov). The site includes information on the cost of flooding, how to conduct a community risk assessment or update your plan, funding availability and tools to update infrastructure or project floodplains.

Roads and Rivers Training

After Tropical Storm Irene, roads were being repaired by VTrans and rivers stability evaluated by VT ANR. Often this work was not done in partnership with an understanding of each other's goals and needs. In an effort to improve this understanding, the state launched the 'Roads and Rivers' Training Program which incorporates education on design and construction techniques that reduce flood risks and vulnerabilities into road projects. The curriculum offers three levels of training - introductory, intermediate, and advanced - for state and municipal staff, RPCs, private engineers and equipment operators. Level One is a desktop version that introduces river health and fluvial erosion concepts and is available on-line (<http://wsmd.vt.gov/rivers/roadstraining/>). Level Two combines classroom and fieldwork and demonstrates how model designs and maintenance practices can reduce river impacts, future flooding and erosion. Level Three trains VTrans designers in river science so they too can understand how to interpret and apply best practices when VT ANR are understaffed after a disaster. The program is now in its third year and to date has trained over 423 municipal and state staff and private engineers and operators.

Figure 5.4: Road and Rivers Training Program



Targeting Rebuilding and Mitigation Investments Together

The scale and devastation of Tropical Storm Irene to Vermont's business, infrastructure and individuals was massive for a small rural state. State agencies along with our local, regional and statewide partners realized the imperative of working together to integrate and target funding that helped rebuild the state quickly, but also reduced the risk of future flooding. Thus, the state partnered with local, regional, state and federal organizations to help communities rebuild infrastructure, restore services and assist residents and businesses rebuild.

Two major sources of rebuilding and mitigation funding were the \$23 million in Hazard Mitigation Grants from FEMA and the \$40 million of US Housing and Urban Development's Community Development Block Grant- Disaster Recovery allocation. VT DEMHS and VT DHCD oversaw these funding sources and worked together along with VHCB, the Vermont Community Foundation, local philanthropic organizations and others to ensure funds were maximized and state recovery goals met.

Together they provided business grants and loans to help them recover from flood damages and keep their doors open.

Municipalities received funding or planning grants to:

- Move municipal buildings and services out of the floodplain.
- Buyout of 136 homes and commercial properties, restoring floodplain access and creating more than a dozen new river access points and recreation areas.
- Build replacement affordable housing for 82 households in Brattleboro and Waterbury.
- Assist nearly two dozen communities with infrastructure improvements for increased resilience- including up-sizing culverts and bridges and protecting roads from further erosion, installing storm-water management systems, repairing and flood proofing buildings, relocating roads away from rivers, repairing a flood control dam and installing municipal sewer/water to replace onsite services that washed away.

- ➔ Prepare for the future, by obtaining detailed elevation data and studying key transportation infrastructure and treatment options for vulnerable sites along the Mad and Winooski Rivers.
- ➔ Analyze risk of natural disaster to every mobile home park in the state and funding the development of emergency plans for park residents.

Funding supported a wide range of projects and plans to reduce the cost and impact of future disasters and efforts to work together to target funding and project to increase our resilience. Other initiatives, led by diverse organizations and stakeholders, built upon this collaborative approach (see Figure 5.6).

Figure 5.5: Stafford Hill Solar Farm Increases Vermont’s Safety and Resilience



An innovative public-private partnership between the U.S. Department of Energy, the State of Vermont, GMP and Dynapower recently installed the first microgrid powered solely by solar and battery back-up. The project’s 4 megawatts of battery storage maintains critical services to a nearby high school that serves as an emergency shelter when the grid goes down. Recently, GMP announced a partnership to create clusters of self-sustaining microgrids that are more resilient than the existing power distribution system that depends on a vulnerable network of poles and wires.

Improve Response and Preparedness

Vermont has experienced flooding in every year since 2007, and has had at least one federally-declared disaster in 21 of the past 25 years. Vermont does not have resources to mitigate and anticipate every risk, therefore a strong emergency management network of local, regional and state partners are key part of the state’s ongoing work to plan, prepare, respond and quickly recover from disasters and other and other disruptions.

Assisting Businesses Planning

In the wake of Tropical Storm Irene it was clear that many of Vermont's small businesses lacked plans and resources to help them withstand serious weather-related disasters and extended power or other service outages. Vermont learned that the most effective way for towns and businesses to recover and rebound from disasters is to plan ahead. As 96.5% of Vermont's employers are small businesses, Vermont's Small Business Development Centers, RPCs and RDCs provide regional trainings and one-on-one services to support business disaster planning, preparedness and recovery planning. In September 2015, local, state and federal partners, including FEMA, are sponsoring a statewide training to help more of Vermont's small businesses write continuity of operations plans (COOP). Participants will leave the training with a business continuity plan and training on how to use it before and during disruptions as well as a list of local, state and federal resources to help them re-open and get back to business faster the next time a crisis occurs.

Updating and Testing Emergency Preparedness Plans

Training and preparation is key to successfully navigating any natural disaster. After Tropical Storm Irene, state agencies, led by VT DEMHS, worked to strengthen our preparedness and response. Vermont participates in Emergency Management Assistance Compact (EMAC) to promote intergovernmental coordination, training and the sharing of resources during natural and man-made disasters. Since Tropical Storm Irene, state agencies have been more active and involved in EMAC.

In 2013, state agencies and regional and local partners collaborated to update the State Emergency Operations Plan (SEOP) that describes Vermont's plans and capacity to respond to emergencies resulting from all identified hazards. VT ACCD is responsible for recovery in the areas of economic development, community development and historic and cultural resources. Lessons learned and updates were included in the SEOP update to ensure that experience and updated procedures were captured and not lost.

Planning is underway for July 2016 Vigilant Guard – a simulated disaster to help the National Guard, states, state agencies, regional planning commissions, cities, towns, utilities, first responders and others practice, test and refine their emergency plans, procedures and operations.

Integrating Data Gathering with Emergency Management

In 2014, Vermont implemented and provided statewide training on emergency operations and updated DisasterLAN (DLAN), a web-based tool that gathers and shares information to help the emergency operations center teams work as quickly and efficiently as possible. The state continues to develop, train, and implement the incident command process model to manage emergencies and trained the State Rapid Assessment and Assistance Teams (S-RAAT) to assess disaster damages and report immediate impacts to health and safety, homes, and critical infrastructure.

All VTrans, VT AAFM and RPC staff have now received basic training on the Incident Command System and senior managers and operation staff have received more advance training. Town staff are also receiving training. The state also launched the “Local Liaison” program, allowing towns to work directly with their RPC and VTrans district staff following a disaster to report initial damage information.

During Tropical Storm Irene, there was no centralized source of information on businesses and land owners that were impacted and thus, could not aggregate recovery need and track progress. VT DHCD working with VT AAFM, VT DEMHS, local and regional partners collaborated to develop and train field staff on the Business, Agricultural, Cultural and Historic Resources Damage Assessment (BACH-DA) tool. This is a web-based assessment forum that gathers information on damage from businesses, farms and historic and cultural resources in one centralized database. The training and tool is designed to improve communication and coordination of support after an event and ensure those impacted have information on recovery resources.

Improving Response Time

Examples of the state's ongoing commitment to deliver better results through collaboration and information sharing, include:

- ➔ A rapid response joint field task force of river engineers, scientists, and restoration specialists to deploy along with transportation engineers and RPC staff in the immediate aftermath of a flood disaster to provide regulatory, technical and administrative assistance for in-stream reconstruction projects to ensure they are incorporating design measures that increase flood resilience.
- ➔ The VT-Alert system, an all hazards alert and notification system to assure people accurate and up-to-date information when disasters strike. The system shares information about severe weather warnings, significant highway closures, hazardous materials spills, the response actions of local and state agencies, and if needed, recommends protective actions to protect life and property. Information is shared via web, email, and cell phones for those who sign up.

Next Steps: Implementing VERI through Partnerships

While this first phase of the VERI projects has helped identify and focus funding needs to ensure a strong economy, resilient to flooding, to be truly successful project recommendations need to be prioritized and funded. During the response and recovery phase, the Irene Recovery Office supported an interagency effort to coordinate recovery work across state agencies, RPCs and non-profit partners that clearly demonstrated the benefits of collaboration. This same strategy of partnership is being employed with the funding and implementation phase of VERI.

Currently the agencies are collaborating on developing the next iteration of the State Hazard Mitigation Plan, due to be completed by November 2018, which will support integration of VERI's methodology and recommendations including:

- ➔ Prioritizing state funding for local infrastructure projects and maintenance practices that strengthen the transportation network.

- ➔ Creating a strategic plan that identifies and targets high risk properties to buyout and critical floodplain to conserve.
- ➔ Establishing a dedicated fund to support the purchase of hazard-prone properties that are at high risk but are not eligible for funding through FEMA or other programs.
- ➔ Creating grant and loan funding criteria to ensure that all new construction takes place outside the designated floodplain, river corridor and repetitive loss areas.
- ➔ Integrating the “no adverse impact” development standard across state policies and programs, and encouraging municipalities to adopt the same standards through regulation, education and financial incentives.
- ➔ Designating pilot “adaptation areas” and directing public investments into those areas.
- ➔ Developing private and public funding sources to floodproof and elevate commercial and residential properties.
- ➔ Assessing state and non-state programs and economic development investment decisions to determine the degree to which they support long-term recovery goals to reduce vulnerabilities.

The state is committed collaborating to support the VERI communities’ implementation of local programs as part of a comprehensive strategy to reduce the state’s flood risks.

- ➔ The Resilient Vermont Project, a joint effort between the State of Vermont and the Institute for Sustainable Communities (ISC), developed a number of priority recommendations to reduce the state’s flood vulnerabilities – one was to create “Vermont Strong Network” a cross-sector collaboration that includes nonprofit, public and private organizations involved in resilience work to align efforts, share best practices, and leverage resources to advance resilience efforts statewide. The network is currently working to support VERI’s recommendations and identify an expanded partnership network for implementing and supporting community priorities.

- ➔ High Meadows and the Vermont Community Foundation have launched a new statewide pilot program called Community Resilience Organizations, that aims to create local teams and help them identify actions that would benefit from broader community engagement, such as developing emergency and continuity of operations plans for business, completing stream bank plantings, or training local officials and volunteers on their emergency operations plans.

VERI built upon the relationships developed and strengthened during the recovery – and brought together state, regional and local partners to create a new model to help towns identify changes and investments needed to break the cycle of repetitive loss, speed post-disaster economic recovery and reduce the long-term financial burden of disasters on impacted communities, businesses, and individuals. VERI showed businesses and communities that the state is concerned with their welfare and it expanded the capacity of public officials to make policy changes and take steps to implement identified critical infrastructure improvement to ensure their economic viability in the years to come.

Resources

- ➔ Department of Housing and Community Development, State of Vermont (October 2012). Community Recovery Partnership Report. The Report can be found at: http://accd.vermont.gov/sites/accd/files/Documents/strongcommunities/cpr/CRP_Report10_2012_F.pdf
- ➔ Smith, Gavin. Coastal Hazards Center, University of North Carolina at Chapel Hill (2014). Vermont State Agency Policy Options. Smart Growth Implementation Assistance Program: Disaster Recovery and Long-Term Resilience Planning in Vermont. Funded by US EPA and FEMA. The Report can be found at: http://accd.vermont.gov/sites/accd/files/Documents/strongcommunities/cpr/VT-StateAgencyPolicyOptionsFINAL_web.pdf
- ➔ Institute for Sustainable Communities (2014). Vermont's Roadmap to Resilience: Preparing for Natural Disasters and the Effects of Climate Change in the Green Mountain State. Link to the report can be found at: <http://www.iscvt.org/wp-content/uploads/2014/06/vermonts-roadmap-to-resilience-web.pdf>

Flood Resilience Checklist

Is your community prepared for a possible flood? Completing this flood resilience checklist can help you begin to answer that question. This checklist was developed as part of the U.S. Environmental Protection Agency's Smart Growth Implementation Assistance project in the state of Vermont. More information about the project can be found by reading the full report, *Planning for Flood Recovery and Long-Term Resilience in Vermont*, found online at www.epa.gov/smartgrowth/sgia_communities.htm#rec1.

What is the Flood Resilience Checklist?

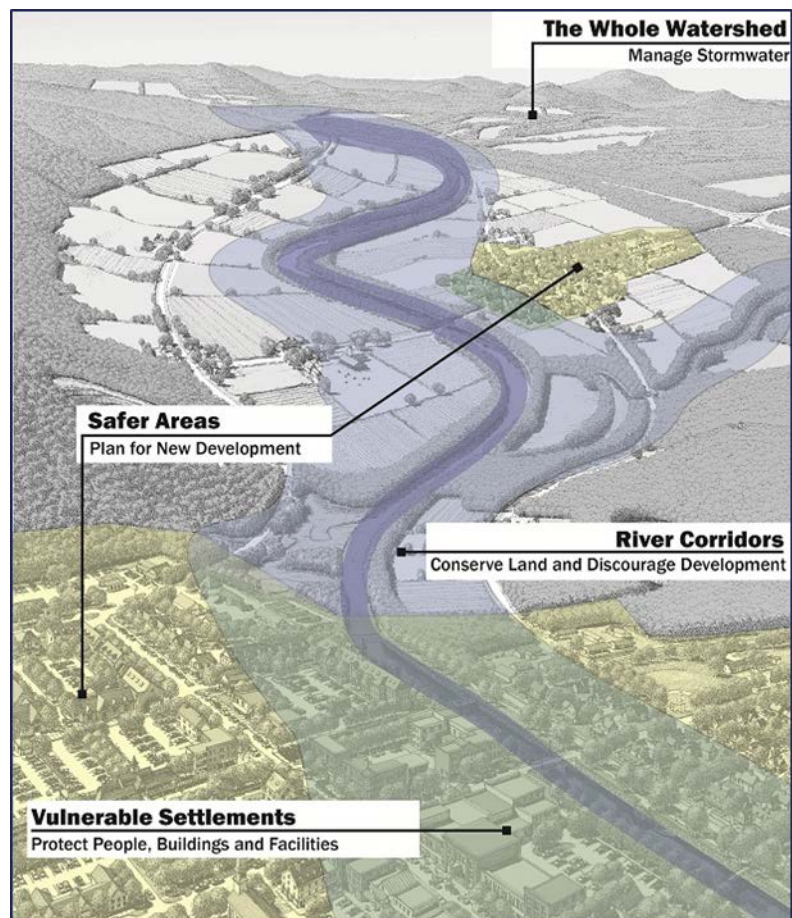
This checklist includes overall strategies to improve flood resilience as well as specific strategies to conserve land and discourage development in river corridors; to protect people, businesses, and facilities in vulnerable settlements; to direct development to safer areas; and to implement and coordinate stormwater management practices throughout the whole watershed.

Who should use it?

This checklist can help communities identify opportunities to improve their resilience to future floods through policy and regulatory tools, including comprehensive plans, Hazard Mitigation Plans, local land use codes and regulations, and non-regulatory programs implemented at the local level. Local government departments such as community planning, public works, and emergency services; elected and appointed local officials; and other community organizations and nonprofits can use the checklist to assess their community's readiness to prepare for, deal with, and recover from floods.

Why is it important?

Completing this checklist is the first step in assessing how well a community is positioned to avoid and/or reduce flood damage and to recover from floods. If a community is not yet using some of the strategies listed in the checklist and would like to, the policy options and resources listed in the [Planning for Flood Recovery and Long-Term Resilience in Vermont](#) report can provide ideas for how to begin implementing these approaches.



This graphic illustrates the four categories of approaches to enhance resilience to future floods. Credit: Vermont Agency of Commerce and Community Development.

FLOOD RESILIENCE CHECKLIST

| | | |
|--|------------------------------|-----------------------------|
| <p>3. Does the community require developers who are rebuilding in flood-prone locations to add additional flood storage capacity in any new redevelopment projects such as adding new parks and open space and allowing space along the river's edge for the river to move during high-water events?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>4. Is the community planning for development (e.g., parks, river-based recreation) along the river's edge that will help connect people to the river AND accommodate water during floods?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>5. Does the comprehensive plan or Hazard Mitigation Plan discuss strategies to determine whether to relocate structures that have been repeatedly flooded, including identifying an equitable approach for community involvement in relocation decisions and potential funding sources (e.g., funds from FEMA, stormwater utility, or special assessment district)?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>Plan for and Encourage New Development in Safer Areas (Learn more in Section 3.C, pp. 26-27 of Planning for Flood Recovery and Long-Term Resilience in Vermont)</p> | | |
| <p>1. Does the local comprehensive plan or Hazard Mitigation Plan clearly identify safer growth areas in the community?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>2. Has the community adopted policies to encourage development in these areas?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>3. Has the community planned for new development in safer areas to ensure that it is compact, walkable, and has a variety of uses?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>4. Has the community changed their land use codes and regulations to allow for this type of development?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>5. Have land development regulations been audited to ensure that development in safer areas meets the community's needs for off-street parking requirements, building height and density, front-yard setbacks and that these regulations do not unintentionally inhibit development in these areas?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>6. Do capital improvement plans and budgets support development in preferred safer growth areas (e.g., through investment in wastewater treatment facilities and roads)?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <p>7. Have building codes been upgraded to promote more flood-resistant building in safer locations?</p> | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

FLOOD RESILIENCE CHECKLIST

Implement Stormwater Management Techniques throughout the Whole Watershed

(Learn more in Section 3.D, pp. 27-31 of

[Planning for Flood Recovery and Long-Term Resilience in Vermont](#))

| | | |
|--|------------------------------|-----------------------------|
| 1. Has the community coordinated with neighboring jurisdictions to explore a watershed-wide approach to stormwater management? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 2. Has the community developed a stormwater utility to serve as a funding source for stormwater management activities? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3. Has the community implemented strategies to reduce stormwater runoff from roads, driveways, and parking lots? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4. Do stormwater management regulations apply to areas beyond those that are regulated by federal or state stormwater regulations? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 5. Do stormwater management regulations encourage the use of green infrastructure techniques? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 6. Has the community adopted tree protection measures? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 7. Has the community adopted steep slope development regulations? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 8. Has the community adopted riparian and wetland buffer requirements? | <input type="checkbox"/> Yes | <input type="checkbox"/> No |