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## Appendix 4: Mitigation Projects

**NRV Hazard Mitigation Projects - 2017**

**Floyd County**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Early Warning System: stream gauges and rain gauges	2016	Flooding and Drought	There are no stream gauges in Floyd County. And there are no real-time rain gauges within the Little River Watershed of Floyd County. This area had no warning in the significant flash-flooding of 2015 when 25+ houses were destroyed or had major damage from flooding. There is significant risk for loss of life and property. \$5,000,000+	\$150,000	33.3	High	FEMA, VDEM	Floyd County	2017	Submitted to VDEM in 2016 for FEMA HMGP funding.	Despite early interest from the state to help with this from FEMA mitigation funds, they have now turned their attention away from the flash-flood early warning system in southwest Virginia.
2	Communication Coverage within Floyd County	2005	All natural and human-caused	Floyd County is at the top of the mountain and has a series of ridges and "valleys"; this terrain is difficult to cover for communication services. There are currently gaps in coverage areas that hamper emergency responders, and thus threaten lives= \$10,000,000	\$500,000	16.0	High	FEMA, Homeland Security	County administration	As funding becomes available	On-going	The Dispatch Center and County's communication system have undergone many upgrades in recent years, and yet these gaps in service area remain.
3	Detailed Flood Studies along portions of Little River to identify 100-year floodplain elevation.	2017	Flooding	More accurate flood maps to enable more effective development regulation; protect homes and lives. \$10,000,000	\$500,000	20.0	High	USGS, FEMA, VDOF, VMME, VDEM	County administration	As funding becomes available	Not sure how to pursue help.	FEMA provided a flood map update in 2008; it did not provide additional studies, but we do now have the layers electronically. Further, we now have electronic soil layers, mineral layers, and historic mine/claim layers. Also, the PDC and Radford University have developed some important private well-related layers.

**NRV Hazard Mitigation Projects - 2017**

**Floyd County**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
4	Upgrading and Expanding Public Water and Wastewater Systems	2010	Drought and Flood	The Flood of 2015 damaged the Floyd-Floyd County PSA's wastewater systems, such that replacement lines are now being installed. But the PSA's water system also needs expansion as more than 90% of households in Floyd County are served by individual wells and spring. This makes these households entirely dependent on one source of water, which could be disrupted by drought or contaminated by flood (as in 2015) or other sources. The PSA's system currently has 5 active wells that are inter-linked, but it could also use more. Benefit: \$20,000,000	\$5,000,000	4.0	High	USDA, DHCD	Floyd-Floyd County PSA	As funding becomes available; ideally in next 2 to 5 years	Some Replacement line work (sewer and water) will begin 2017, but more is needed. Plus, water system expansion is needed.	
5	Work with RC&D for Firewise training at more woodland home locations.	2010	Wildfire	Protecting woodland homes and residents from wildfire danger.	\$10,000		Medium	VA Dept of Forestry	VA Department of Forestry	2018	There is funding available for this, but.....	The difficulty is getting permission of private land-owners and them having driveways that are good enough for fire trucks.
6	Water Resource Study	2005	Drought, Wildfire, Flooding	Identify critical run-off, recharge areas and potential public well and reserves to meet demand; initial implementation; agricultural losses in last drought = \$4,000,000	\$1,000,000	4.0	Medium	USDA, USGS, FEMA, VDEM, VDEQ	County administration	2019	Pieces of work done in regional water supply plan, which is again being updated.	Portions in Progress (2017) via Regional Water Supply Plan (PDC). Some areas of special concern identified in Floyd County Source Water Protection Plan (with Virginia Rural Water in 2010.) Related to Wildfire threats during drought, one of the most vulnerable communities in the County (Slatemont) has completed the Firewise program.
7	Additional dry hydrants	2005	Wildfire	Give the lack of a central water system in 95% of the County, additional dry hydrants are needed to supply firefighting efforts. Based on 50 home at high risk * \$150,000; estimate = \$7,500,000	\$300,000	25.0	Medium	VDOF	VDOF	2018-2019	When more willing landowners can be found with accessible driveways	The difficulty is getting permission of private land-owners and them having driveways that are good enough for fire trucks.

**NRV Hazard Mitigation Projects - 2017**

**Floyd County**

<b>Project #</b>	<b>Project Name</b>	<b>Year Added</b>	<b>Hazards Mitigated; Plan Goal/Objective</b>	<b>Benefit</b>	<b>Cost</b>	<b>Benefit to Cost Ratio</b>	<b>Priority</b>	<b>Funding Partners</b>	<b>Implementation/ Lead Agency</b>	<b>Proposed Timeframe</b>	<b>Project Status</b>	<b>Comments</b>
8	Table-top exercise to identify needs related to private gas and oil tanks in/near Town of Floyd.	2010	Human-caused	Minimize damages should a gas leak or fire occur.	\$5,000		Medium	VDEM	County and VDEM	2018-2020		
9	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County administration	As needed		

**NRV Hazard Mitigation Projects - 2017  
Giles County**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Identify culvert replacement needs to reduce flooding	2005	Flooding	Engineering studies to determine appropriate size for problem culvert areas. Reduce future flooding; estimate = \$2,000,000+	\$200,000	10.0	High	VDOT, USACOE	USACOE, VDOT, County administration	July 2005	Completed, Deferred	Completed inventory by County Staff and VDOT of several problem culverts. Entire drainage study deferred due to lack of funding.
2	Replace culverts to reduce flooding	2005	Flooding	Reduce "damming" effect; reduce future flooding; estimate = \$2,000,000+	25 culverts at \$30,000 = \$750,000	2.7	High	USACOE, VDOT, FEMA, VDEM	VDOT, County administration, USACOE	Ongoing	Still progressing (2010)	Several problem culverts have been upgraded (Bowens Rd, McCall Motors, Kow Kamp, Lucas Street), will proceed as additional funding becomes available.
3	SRL Structure Acquisition and Demolition	2017	Flooding	Removing property in Pembroke will reduce damage property loss, repetitive insurance claims, and threat to personal safety	\$200,000	2.0	High	FEMA, VDEM	County administration, engineering	As funding becomes available	Grant application to be submitted in next round of FMA funding	
4	A full-time state forester for Giles County	2005	Wildfire	Person to coordinate wildfire education, mitigation, and response; estimate (life saved) = \$2,000,000	\$75,000	26.7	High	VDOF	VDOF, County Administration	As funding becomes available	Deferred	Lack of funding
5	Emergency Services Coordinator Position	2005	All natural and human-caused	Person to align and integrate emergency services; estimate (life saved) = \$2,000,000	\$60,000	20.0	Medium	FEMA, VDEM, County	County administration	January 2006	Deferred	Lack of funding to establish new position
6	Pursue additional water sources	2005	Drought, Wildfire	Reducing dependence on sole water supply well for public system through planning; improve long-term security; estimate = \$6,900,000	\$50,000 (PER)	40.0	Medium	USDA, FEMA, VDEM	County administration, Giles County PSA	Ongoing	Ongoing planning (2010)	River withdrawal planning/design underway. Funding application to USDA/Rural Development has been submitted.
7	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County planning	As needed		

**NRV Hazard Mitigation Projects - 2017**

**Town of Narrows**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Stormwater facilities	2005	Flooding	Currently stormwater largely flows in open ditches on private property, resulting in frequent flooding; facilities would reduce frequency and impact of flooding to at least 97 structures.	\$10,000,000	3.9	High	CDBG, FEMA, VDEM	Town manager's office	As funding becomes available		
2	Replacement of Wastewater Treatment Plant	2005	Flooding	The Wastewater Treatment plant is currently in the floodway, is subject to flooding, and has exceeded it's replacement life. Estimate value = \$7,000,000+	\$7,000,000	1.3	High	USDA, FEMA, VDEM	Town manager's office, PSA	As funding becomes available		

**NRV Hazard Mitigation Projects - 2017  
Town of Pearisburg**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Upgrade Stormwater System	2005	Flooding	Improvements needed in 3 watersheds: Grand Avenue, Midtown, and Orchard Avenue to fix drainage system impacting 60+ structures. Estimate value = \$3,000,000	\$1,500,000	2.0	High	USDA, FEMA, VDEM	Town management	As funding becomes available	Deferred	Project is pending funding source becoming available
2	Business 460 stormwater mitigation	2008	Flooding	Study to mitigate stormwater flooding on Business 460 on west side of town	\$50,000		High		Town management	As funding becomes available	Deferred	Project is pending funding source becoming available
3	Monitor and update the Town's zoning ordinance as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town management	As needed	Cancelled	Town does not have any structures in the floodplain

**NRV Hazard Mitigation Projects - 2017  
Town of Pembroke**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Engineering study of structural needs	2005	Flooding	Corps of Engineers Study to assess structural remedies to flooding; most recent damage exceeded \$400,000; overall estimate = \$4,000,000	\$100,000	40.0	High	USACOE, FEMA, VDEM, VDOT	USACOE, VDOT, County administration	As funding becomes available	Not started	Lack of manpower
2	Early warning system	2005	Flooding	Automated communication system for emergency notification; life save, estimated = \$2,000,000	\$50,000	40.0	High	FEMA, VDEM	Town manager's office, County coordinator	As funding becomes available	Not started	Lack of manpower
3	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town manager's office	As needed		



**NRV Hazard Mitigation Projects - 2017**  
**Town of Rich Creek**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Replacement of Wastewater Treatment Plant	2005	Flooding	The Wastewater Treatment plan is currently in the floodway, and is subject to flooding. Estimated value=\$10,000,000+	\$7,000,000	1.3	High	USDA and Towns of Glen Lyn & Rich Creek	Towns of Glen Lyn and Rich Creek	As funding becomes available	Started	USDA Grant Awarded
2	Storm Water Drain Replacement	2010	Flooding	The storm drains in the downtown area are deteriorated and under sized.	\$450,000	1.3	Medium	VDOT Tea-21 & Town of Rich Creek	Town of Rich Creek	5 Years as funding is available	Started	Tea-21 Grant Awarded
3	Adoption and enforcement of floodplain management requirements, including regulating all and substantially improved construction in the Special Flood Hazard Area	2010	Flooding		not applicable		Medium		Town of Rich Creek	As needed		
4	Floodplain identification and mapping, including any local requests for map updates, if needed	2010	Flooding		not applicable		Medium		Town of Rich Creek	As needed		

**NRV Hazard Mitigation Projects - 2017  
Montgomery County**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Equalization basin	2005	Flooding	Will enable protection of wastewater treatment plan in 100-year events; protecting thousands of public water	Design, excavation, tank, &	4.0	High	FEMA, VDEM, County	PSA	2006	Not started	Lack of funding & manpower
2	Property acquisition in floodprone area	2005	Flooding	Residential property acquisition in high risk areas of Roanoke River watershed, wherever there is citizen willingness	\$1,000,000		High	FEMA, VDEM, County	County ESC, Planning	2005-2010	Not started	Lack of funding & manpower
3	Pre-development database	2005	Flooding, Geologic, Wildfire, Drought	Full integration of zoning, permitting, building, 911, & real property info	\$100,000		High	VDCR, FEMA, VDEM, VMME, VT	County ESC & Planning	Implementation 2005	Partially Completed	Shrink swell soils and flood zone designation are reviewed during the process of obtaining a zoning
4	Develop and promote pipeline safety	2010	Human-caused	We have one underground gas transmission line that runs through Montgomery County and into Pulaski Co. Staff will work with	\$25,000	30.0	High	NaCo , County	County Planning	2010		
5	Expand current karst mapping	2005	Geologic	A karst feature inventory to enable, inform better development regulations & ordinance to limit future risks; value of one home lost	\$50,000	3.0	Low	VDCR, FEMA, VDEM, VT	County Planning	2007	Not started	Lack of manpower
6	Acquisition of Plum Creek area businesses	2005	Flooding	Reducing repetitive loss structures and threats to life; estimate = \$2,000,000	At least 13 structures = \$600,000	3.3	Low	FEMA, VDEM	County Planning	2010-2015	Not started	Lack of funding
7	Residential acquisition (landslide) on Elliot	2005	Flooding, Geologic	Reducing repetitive loss structure (flooding and landslide) and threats to life; estimate = \$2,000,000	Acquisition & demolition of 2 structures	13.1	Low	FEMA, VDEM, County	County Planning	2010-2015	Not started	Lack of funding; HMGP funding denied 2004
8	Streambed/streambank restoration	2005	Flooding, Drought	Reducing peak-flows and increasing recharge	\$50,000		Low	USACOE, VDOT, FEMA, VDEM	County Planning	2007-2010	Partially Completed	Montgomery County does not have a program; however they have supported many
9	Additional I-FLOWS gauges	2005	Flooding	Enhance prediction and warning abilities; better protection of lives; estimate + \$2,000,000+	\$50,000	40.0	Medium	NOAA, NWS	NOAA/NWS, County ESC	2010-2015	Not started	Lack of funding
10	Utilize zoning ordinances to further restrict undeveloped floodplains	2010	Flooding		not applicable		Medium		County planning dept.	As needed		
11	Encourage standards above NFIP standards when considering floodplain development	2010	Flooding		not applicable		Medium		County planning dept.	As needed		
12	Develop swift-water rescue capacity (regional)	2005	Flooding	At least 5 lives have been lost in swift water in the NRV this year; estimate (life saved) = \$2,000,000	\$100,000	20.0	High	FEMA, VDEM, County	County ESC	2004-2005	Completed	

**NRV Hazard Mitigation Projects - 2017  
Montgomery County**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
13	Identification and study of Village floodplains; including GIS	2005	Flooding	Already at least \$14,000,000 in development in floodplain; more accurate maps would enable more effective regulation = est. \$1,000,000 in future development	\$50,000	33.3	High	FEMA, VDEM, County	County Planning	2005-2007	Completed	All new floodplain maps, effective 9.25.2009, have been mapped in GIS. A new study done in Plum Creek during 2009.
14	Flood map modernization	2005	Flooding	More accurate flood maps to enable more effective development regulation; protect homes and lives; estimate (10 homes @\$150,000) = \$1,500,000	\$150,000	10.0	High	FEMA	VT, County Planning	2005-2008	Completed	Completed with the adoption of a revised floodplain ordinance and revised maps in September 2009.
15	Reverse 911 as emergency warning tool	2005	All natural and human-caused	Will enable automated calling of 900 households per hour vs the current slow, dangerous, door-to-door notification by Sheriff's Dept; estimate = \$2,000,000+	\$51,000	39.92	High	FEMA, VDEM, County	County ESC, Sheriff	HMGP grant approved 2004; Implementation in 2005	Completed	
16	Montgomery County Certified as Storm Ready Community	2010	Flood, Snowfall, Ice Storms	To be better prepared to save lives from the onslaught of severe weather through advanced planning, education and awareness.	unknown	10	High	NOAA, NWS, County	ESC/County Planning	2010	Completed	
17	Shrink-swell soil mapping	2005	Geologic	More accurate shrink-swell soil maps to enable more effective development regulation; protect homes and businesses; past damage unknown; potential home values in high hazard areas estimated to exceed \$5,000,000	\$50,000		Medium	VDCR, FEMA, VDEM, VT	County Planning	2005	Completed	Shrink swell soils are reviewed at the time a zoning permit is issued and logged into a database.
18	More hazard related GIS data	2005	Flooding, Geologic, Wildfire, Drought	Capturing damage data, more detailed risk data, critical infrastructure data, etc.	\$100,000		Medium	VDCR, FEMA, VDEM, VMME, VT	County ESC & Planning	2004-2010	Completed	A elevation certificate database has been created, and locations of pipelines have been mapped.
19	Public education: flooding, wildfire, karst	2005	All natural and human-caused	Educating the public about hazards and threats to life and property and ways to minimize those threats; estimate = \$2,000,000	\$100,000	20.0	Medium	FEMA, VDEM, County	County ESC	2005-2010	Completed	A series of meetings discussing floodplains were held in 2009 with the adoption of new maps, all property owners with land in the floodplain were notified by mail. FP property owners are also made aware when they come in for zoning permits. There is literature available at the office as well.

**NRV Hazard Mitigation Projects - 2017  
Town of Blacksburg**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/Lead Agency	Proposed Timeframe	Project Status	Comments
1	Series of stormwater detention ponds	2005	Flooding	Create a series of stormwater detention ponds to reduce peak-flow especially during 100-year event; last significant flood caused \$4,000,000 in damage at VT	\$1,000,000	4.0	High	USACOE, FEMA, VDEM, DEQ	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	Stormwater Utility funding has been approved by Town Council. New regional detention facilities are being evaluated on a case by case basis.
2	Hazard related GIS layers	2005	All natural and human-caused	More accurate flood, groundwater, geologic maps to enable more effective development regulation; protecting lives, natural resources, & homes; estimate \$1,000,000 in future	\$100,000	10.0	High	USGS, FEMA, VDOF, VMME, VDEM	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	Floodmap, geology, soils, aerials of forest cover, open streams are complete. Stormwater and subsurface mapping is complete and will be updated annually.
3	Development of water supply plan which includes a drought ordinance	2010	All natural and human-caused	Provides continuous water supply to all homes, business and Virginia Tech. The drought ordinance provides guidance of water saving measures in times of drought; \$5,000,000 as water	\$25,000	200.0	High		Town of Blacksburg & Town of Christiansburg, Virginia Tech, BCVPIWA	Fall, 2011	In progress	
4	Creation of development guidelines for wildfire prevention	2005	Wildfire	Improving ability and means to prevent future wildfire damage through development guidance; 10 homes saved at \$250,000 = \$2,500,000	\$25,000	100.0	Low	FEMA, VDEM, VDOF	NRVPDC	As funding becomes available	Deferred	No funding available
5	Undergrounding utilities	2005	Wildfire, wind, winter weather	Burying major utility lines to prevent outages and accidents related to natural hazards; estimate = \$10,000,000 (safety and business not lost)	\$7,500,000	1.3	Low	FEMA, VDEM, CDBG, TEA-21	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	Note that existing Town Zoning Ordinance regulations require new utilities to be placed underground.
6	Town Stormwater Assessment of Impact from Potentially More Volatile Storms	2017	Flooding	A review of the Town's stormwater system capacities as storm intensities increase.	not applicable		Low		Town of Blacksburg Engineering and GIS dept.	As needed	In progress	
7	Implement remote monitoring system for utility operation	2005	All natural and human-caused	Allow monitoring of wastewater pump stations operations and water system pressures during power outages; estimate = \$500,000	\$70,000	7.1	Medium	BCVPIWA, BVPISA	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	
8	Provision of back-up power for critical infrastructures	2005	All natural and human-caused	Allow water and wastewater systems to continue operations during major power outages; estimate = \$2,000,000 (safety and business not lost)	\$200,000	10.0	Medium	FEMA, VDEM	BCVPIWA	As funding becomes available	In Progress	with generators in place at critical facilities and utilities.
9	Emergency water interconnection between High System and Low System	2010	All natural and human-caused	Serve users on either system in case of interruption on either system; home saved and health and safety, minimum disruption to homes, business and Virginia Tech, \$5,000,000	\$500,000	10	Medium	Town of Blacksburg, Virginia Tech	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	Remove	This project is no longer a priority.

**NRV Hazard Mitigation Projects - 2017  
Town of Blacksburg**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/Lead Agency	Proposed Timeframe	Project Status	Comments
10	Provision of back up power at critical intersections	2010	All natural and human-caused	Through natural gas backup generator at major signalized intersections, traffic will be able to flow as normal without the addition of emergency personnel who may be needed elsewhere. Allows businesses and residents to continue operations at \$1,000,000 per event	\$220,000	4.55	Medium		Town of Blacksburg, Engineering & GIS depts	As funding becomes available for existing signals, but as others are replaced or proposed, all new signals to be constructed with backup systems in case of power outages.	In progress	Existing and proposed roundabouts are not signalized and provide for normal traffic flow routinely and in case of power outages.
11	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town of Blacksburg planning dept.	As needed		
12	Continuous Sewer Capacity Studies	2017	All natural and human-caused	A continuous review of new developments coming online and existing infrastructure to identify capital improvement needs.	not applicable		Medium		Town of Blacksburg Engineering and GIS dept.	As needed	In progress	
13	Water Supply Redundancy - Construction of new line from the water treatment facility to provide redundancies in water supply.	2017	Flooding	A review of the Town's stormwater system capacities as storm intensities increase.	not applicable		Medium		Town of Blacksburg Engineering and GIS dept.	As needed	In progress	
14	Increase fireflow for Town's High System	2010	All natural and human-caused	Increase fireflow available to the Town's High Water system in the Southeast Quadrant; estimate=10 Homes saved at \$500,000 each, \$5,000,000	\$700,000	7.14	Medium		Town of Blacksburg, Engineering & GIS depts	As funding becomes available	Complete	
15	New Rescue Station	2010	All natural and human-caused	Provide emergency shelter for citizens, provide training areas for regional rescue members and enhance response times; \$10,000,000	\$5,000,000	2	High		Town of Blacksburg, Engineering & GIS depts	As funding becomes available	Completed	New Rescue Station on Patrick Henry Drive was completed in the summer of 2016.
16	Increase water storage	2005	All natural and human-caused	Increasing water storage capacity to serve both the Town and VT; estimate = \$5,000,000 (security)	\$2,000,000	2.5	Medium	FEMA, VDEM, CDBG	PSA	As funding becomes available	Completed. This will be periodically evaluated as growth at Virginia Tech and within the Town increases demand.	The new tanks that have been constructed are the Highland Park Tanks. There were originally 2 tanks on the site, 1- one million gallon tank and 1- 0.5 million gallon tank. We constructed 3 new tanks; 1- 2.0 million gallon tank, and 2-1.0 million gallon tanks. So we have added an additional 2.5 million gallons worth of storage.

**NRV Hazard Mitigation Projects - 2017  
Town of Christiansburg**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Park Street Sidewalk and Storm Drain Project - Phase 2	2016	Flooding	Reduce roadway and private property flooding on Park Street	\$900,000		High	VDOT/HUD	Town engineering dept.	ongoing	construction	
2	Church, Rigby, Ellett Drainage Improvements	2016	Flooding	Reduce roadway and private property flooding on Church, Rigby, and Ellet Streets	\$1,500,000		High	VDOT	Town engineering dept.	ongoing	design	
3	Downtown Drainage Improvements - West Main Street	2017	Flooding	Reduce private property flooding	\$800,000		High	VDOT	Town engineering dept.	ongoing	concept	
4	Downtown Drainage Improvements - North Franklin Street Project	2017	Flooding	Reduce private property flooding	\$400,000		High	VDOT	Town engineering dept.	ongoing	design	
5	Hans Meadow Drainage Improvements - Phase 2	2017	Flooding	Reduce roadway and private property flooding on Hans Meadow Road	\$800,000		High	VDOT	Town engineering dept.	ongoing	design	
6	Home acquisition	2005	Flooding	Purchase 8 homes (@ \$150,000); no information available on exact damage, but recurrent flooding and damage	\$1,200,000	1.7	Low	FEMA, VDEM	Town management	As funding becomes available	Deferred	Lack of funding
7	Undergrounding utilities	2005	Wildfire, wind, winter weather	Burying utility lines to prevent outages and accidents; estimate = \$4,000,000 (accidents & lost revenue)	\$2,000,000	2.0	Low	FEMA, VDEM	Town management	As development occurs	In progress	
8	Monitor and update the Town's zoning ordinance as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town planning dept.	As needed		
9	Study of series of stormwater ponds	2005	Flooding	Reduce flooding on College St.	\$100,000		Medium	USACOE, FEMA, VDEM	Town management	As funding becomes available	Cancelled	Lack of support
10	Floodplain GIS layer	2005	Flooding	More accurate flood maps to enable more effective development regulation; protect homes and lives; estimate (5 homes @ \$150,000) = \$750,000	\$50,000	15.0	High	FEMA, VDEM	Town planners & GIS	FY 2007 (pending FEMA coordination)	completed	
11	Diamond Hills Stream Restoration and Independence Boulevard Culvert Replacement	2009	Flooding	Reduce Flooding	\$400,000		High		Town engineering dept.	complete	completed	
12	Effective Water Storage Improvement	2012	All	Improve water storage capacity for everyday use and for uninterrupted service during emergencies	\$200,000		High		Town engineering dept.	2012-2016	completed	
13	Brown, Church, Lucas Storm Drain Improvements	2015	Flooding	Reduce roadway and private property flooding on Brown, Lucas, and Church St.	\$1,100,000		High	VDOT	Town engineering dept.	ongoing	completed	

**NRV Hazard Mitigation Projects - 2017  
Pulaski County**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Updgraded rescue and utility communication equipment	2005	All natural and human-caused	Improved coordination within and among jurisdictions; increased communication reliability' quicker response times & improved access to total services; multiple lives saved; estimate = \$5,000,000	Includes broadband and wireless technology for emergency operations & utilities = \$2,000,000	2.5	High	FEMA, VDEM, USDA	County administration	June 2005	On going	Mostly completed, finished as funding allows
2	Elevating homes	2005	Flooding	Elevating homes in high-hazard areas; willing participants not yet identified	unknown		High	FEMA, VDEM	Planning	Ongoing	Not started	Lack of participants
3	Relocate ECC/Sheriff's Office	2008	All natural and human-caused		\$2,000,000		High	Local budget	Sheriff/County Admin	Dec 2012 (proposed)	In planning	To be completed by 2012 (goal)
4	Wildfire Mitigation -- Creating Defensible Space for High Risk Communities	2008	Wildfire		\$455,000		medium	VDOF	Emergency services Coordinator	Planning started 2010	Not started	Applied for VDEM funding
5	Ready Pulaski!	2008	All natural and human-caused	Education/Survival Kit program	\$25,000		medium	NWS	Emergency services Coordinator	As funding becomes available	Deferred	Lack of funding/staffing
6	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County planning dept.	As needed		
7	Dredging of upper Claytor Lake	2005	Flooding	Dredging the upper end of Claytor Lake to enable additional storage capacity in flood events; help downstream areas including Radford and Giles County; estimate = \$5,000,000	\$1,500,000	3.3	Low	USACOE, FEMA, AEP	Planning	January 2010	Planning in progress (2008)	Still planning, pending funding from USACOE
8	Reverse 911/Early warning system	2005	All natural and human-caused	Will enable automated calleing of 900 households per hour vs the current slow, dangerous, door-to-door notification by the Sheriff's Dept.; estimate = \$2,000,000+	Includes new system plus upgrading GIS records for integration = \$75,000	26.7	High	FEMA, VDEM, USDA	County administration	June 2007	Completed	
9	Upgrading New River Trail	2005	Flooding	Upgrading the New River Trail for use during floods as a means of emergency transportation for residents in Allisionia; estimate = \$2,000,000	\$500,000	4.0	High	FEMA, VDEM, TEA-21	Planning	May 2008	Completed	
10	Additional I-FLOWS rain and stream gauges	2005	Flooding	Enhance prediction and warning abilities; better protection of lives; estimate = \$2,000,000+	\$50,000	40.0	Low	NOAA, NWS	NOAA/NWS, Emergency Coordinator	April 2005	Completed	

**NRV Hazard Mitigation Projects - 2017**

**Town of Pulaski**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Channel dredging, straightening	2005	Flooding	Very old channel through Town does not hold major rain events; peak flow could be reduced by more rapid discharge of flood waters; channel contains questionable sediment washed to downstream water supplies in flood; estimate = \$6,000,000	2 miles by 40' width by 5' depth = \$5,000,000	1.2	High	USACOE, FEMA, VDEM, VDOT, EPA, DEQ	Town management, engineering	As funding becomes available	Deferred	Lack of Funding.
2	Replace or rehabilitate railroad bridge (acting as dam)	2005	Flooding	Reduce elevation of flood waters by opening flow impeded by railroad structure; probably the difference between downtown damage or not in 100-year event; estimate = \$10,000,000 at risk	\$1,000,000	10.0	High	USACOE, FEMA, VDEM, VDOT, N&S	Town management, engineering	As funding becomes available	Deferred	Lack of Funding.
3	Acquisition of other Repetitive Loss properties	2005	Flooding	Reduce repetitive loss and decrease danger to lives; estimate = \$2,000,000+	\$250,000	8.0	High	FEMA, VDEM	Town management, engineering	As funding becomes available	Deferred	Lack of Funds to Purchase Repetitive Loss Properties.
4	Flood Warning & Evacuation	2017	Flooding - Flood Prevention & Assistance	Earlier Warning for flooding upstream peak Creek for the Town of Pulaski, This would give the Town more warning for evacuations or other means of flooding precautions necessary.	\$21,000	1.1	High	Virginia Dept. Emergency Mangt., Town of Pulaski	Town management, Engineering	As funding becomes available	Ongoing	Waiting to hear from Grants
5	Flood Warning & Evacuation	2017	Flooding - Flood Prevention & Assistance	Earlier Warning for flooding upstream peak Creek for the Town of Pulaski, This would give the Town more warning for evacuations or other means of flooding precautions necessary.	\$77,000	1.1	High	DCR-Dept. Conservation & Recreation, Town of Pulaski	Town management, Engineering	As funding becomes available	Ongoing	Waiting to hear from Grants
6	Localized flood control projects to include but not limited to stormwater management improvements	2017	Flooding	Reduce flooding impacts locally and downstream (especially on Peak Creek and its tributaries)	unknown	unknown	High	FEMA, VDEM	Town	As funding becomes available	Not started	
7	Flood education/ outreach	2005	Flooding	Educating the public about hazards and threats to life and property and ways to minimize those threats; estimate = \$2,000,000+	\$50,000	40.0	Medium	FEMA, VDEM	Town and County emergency coordinator	Ongoing	Deferred.	Personnel reductions; lack of funding.
8	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town planning dept.	As needed		



**NRV Hazard Mitigation Projects - 2017  
Town of Pulaski**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
9	Active 911 - App for Firefighter to use on their smartphone for directions and details on the emergency.	2015	All natural and human-caused	In the Event of any emergency, this let's Administrative staff which resources throughout the Town & County are available and also responding and where they are responding from. Also has mapping capabilities for responders to find the emergency even sooner than before.	\$1,500	1.1		Pulaski County, Town of Pulaski	Pulaski County 911 Communications Center	N/A	Completed	
10	Text to 911 - Allows the public to text 911 calls in to our 911 dispatch center.	2015	All natural and human-caused	For Hearing or Speech impaired subjects, this allows anyone to text 911 calls. Also for someone who couldn't talk in a situation, this allows them to still get help enroute. If cell service was bad, might still be able to text	\$4500 per year	1.1		Pulaski County, Town of Pulaski	Pulaski County 911 Communications Center	N/A	Completed	
11	Integrated Early Warning system or Reverse 911	2005	All natural and human-caused	Automate communication system for emergency notification; live saved = \$2,000,000	\$50,000	40.0	High	FEMA, VDEM	Town and County emergency coordinator	not applicable	Completed	
12	Acquisition of other Repetitive Loss properties for Lottier Bottom	2005	Flooding	Reduce repetitive loss in Lottier Bottom area; decrease danger to lives.	unknown			FEMA, VDEM	Town and County emergency coordinator	As funding becomes available	Completed.	Three homes removed from Lottier Bottom area.

**NRV Hazard Mitigation Projects - 2017**  
**City of Radford**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Intermediate Water System Improvement Project	2009	Flooding, Drought	Public Health	\$1.8 M		High	CIP, ARRA	Engineering Department, Water Department	2017-2018	In progress	
2	Regional stormwater detention project: Connelly's Run	2005	Flooding	Reducing peak flows from 5.45AC drainage area to reduce flooding in lower reaches	\$2,500,000		Low	FEMA, VDEM, USACOE	Engineering Department	2017-2019	Ongoing based on Available Funding	Need regional cooperation 177 Corridor plan
3	Improvements to Impervious Surface Maps	2009	Flooding	improve quality of runoff quality and quantity.	unknown		Medium	none	GIS Dept, Engineering and City Managers Office	2016-2018	In progress	
4	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		City Planning Dept.	As needed	Ongoing	
5	Little River Dam Improvements	2010	Flooding	Maintenance and improvements to the flood gates	\$30,000-50,000		Medium	Electric Dept	Electric Department	2017	Under Construction to be completed in 2017	
6	Storm Drainage Basin Map Improvements	2009-2010	Flooding	community development, quality of life, sustainability	unknown		Medium	City Engineering, GIS Dept., Virginia Dept. of Forestry	Engineering & GIS Department	2009-2018	Phase I completed 2010	
7	Detention pond at Sunset Park	2005	Flooding	Reduce periodic flooding	\$1,000,000		High	CIP	Engineering Dept	2004-2005	Complete	
8	Swift water rescue equipment & training (regional)	2005	Flooding	At least 5 lives have been lost in swift water in the NRV this year; estimate (life saved) = \$2,000,000	\$500,000	4.0	High	FEMA, VDEM	Fire Chief	2005-2006	Complete	
9	Tie-pile removal along New River	2005	Flooding, Wildfire	Reduce flooding and wildfire risk of 1,000,000+ old railroad ties, piled along New River; also possible burning toxins putting lives at risk; estimate = \$10,000,000	\$2,000,000	5.0	High	EPA, DEQ, FEMA, VDEM	City Mangers Office	2008-2009	Complete	
10	Code Red	2009	All natural and human-caused	Emergency notification system	unknown		High	General Fund	GIS Dept and City Managers Office	2009	Complete	
11	Flood Insurance Relief Map Update	2009	Flooding	Community planning resource, meet new federal insurance requirements.	unknown		High		Engineering Dept, GIS Dept, FEMA	2009	Complete	
12	Improvements to Dispatch Software and Equipment	2009	All natural and human-caused	Upgraded the GIS software and servers for E911 to improve response times and access to information	\$30,000		High	GRANT?	Police Dept, GIS, Dept and ?	2009	Complete	
13	Little River Dam Study	2009	Flooding	Evaluated working components, structural integrity and assessed other general metrics related to the function and safety of the dam	\$100,000		High	Electric Dept	Electric Dept	2008-2010	Complete	
14	Mutual Aid Agreements for Emergency Response	2009	All natural and human-caused	improve response time for emergencies	unknown		Low			2012-2016	Completed	
15	Gibsondale Sanitary Sewer Project	2006	Flooding		unknown			CIP	Engineering Department	not applicable	Completed 2008	
16	New stormwater drainage structures	2008	Flooding		\$15,000/year		Medium	General fund	Public Works	Ongoing	Completed (annual project)	
17	Inventory of City Trees	2007	Flooding	Evaluate existing city owned tree canopy, determine benefit to neighborhoods, community development, costs to maintain.	none, received Departme of Forest grant to perform study.		Low		Engineering Dept, Commission on Forestry and Civic Beautification	2008-2010	Completed 2010	

**NRV Hazard Mitigation Projects - 2017**  
**Region-wide**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Additional hazard, risk, damage and scientific data points	2005	Flooding, Geologic, Wildfire, Drought	Capturing damage data, more detailed risk data, critical infrastructure data, etc.; estimate = \$2,000,000+ (guiding development away from risk areas)	\$200,000	10.0	High	FEMA, VDEM	NRVPDC and/or local govt.	Ongoing	Ongoing as part of hazard mitigation planning	
2	Regional Water Supply Planning	2005	Drought, Wildfire	Research, coordination and planning to secure safe and adequate water supplies for drinking water, household, agricultural, commercial and industrial uses; agricultural losses alone in most recent drought exceeded \$10,000,000; estimate = \$20,000,000 +	\$500,000	40.0	High	USDA, FEMA, VDEM	NRVPDC, Local govt's and PSA's	Ongoing	Plan completed. Periodic updates will be made.	
3	Create all hazards educational materials	2010	All natural and human-caused		unknown		High		NRVPDC	As funding becomes available		
4	Develop a regional strategy for participation in "Turn Around, Don't Drown"	2010	Flooding		unknown		High		NRVPDC	As funding becomes available		
5	Wildfire prevention and mitigation such as Firewise training at more woodland home communities, creating defensible space, hazardous fuels reduction, and ignition resistant retrofitting	2010	Wildfire		unknown		High		NRVPDC/Localities	As funding becomes available		
6	Acquisition and demolition, acquisition and relocation, retrofitting, elevation, floodproofing, mitigation reconstruction of NFIP defined SRL properties, or other mitigation for properties in flood-prone areas	2010	Flooding		unknown		High		NRVPDC/Localities	As funding becomes available		
7	Obtain and install VDOT high water area signage with flood-gauge markers	2017	Flooding		unknown		High			As funding becomes available		
8	Develop a Regional Damage Assessment Team	2005	All natural and human-caused	Establishing a trained, equipped, and ready-to-respond group to open and speed assessment and access to fed and state help; estimate = \$1,000,000	25 (5 per major juris) = \$120,000	8.3	Low	VDEM	NRVPDC and/or VDEM.	1 year	Deferred	Funding unavailable
9	Develop a regional damaged infrastructure and debris impact management planning model	2005	All natural and human-caused	Expedite removal of storm debris by identifying high-risk and neighborhood staging areas; with a goal of quick recovery and reduction of unnecessary landfill utilization; estimate (every acre saved) = \$1,000,000	\$50,000 for each of 5 major jurisdiction \$250,000	4.0	Low	FEMA, VDEM	NRVPDC	5 years	Deferred	Funding unavailable
10	Identify and create maps of inaccessible areas for emergency equipment and establishing criteria for inaccessible roads as a planning tool for development	2010	All natural and human-caused		unknown		Low		NRVPDC/Emergency Responders	As funding becomes available		
11	Rockfall and landslide inventory for secondary roads	2010	Rockfall/Geologic		unknown		Low		NRVPDC/Radford University	As funding becomes available		
12	Improve detour routing	2010	All natural and human-caused		unknown		Low		VDOT	As funding becomes available		
13	Develop and implement notification systems at likely rockfall locations	2010	Rockfall/Geologic		unknown		Low		Localities	As funding becomes available		

**NRV Hazard Mitigation Projects - 2017**  
**Region-wide**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
14	Inventory public and private bridges for weight capacity (especially with respect to capacity to carry first responder vehicles)	2010	Flooding		unknown		Low		NRVPDC/Localities	As funding becomes available		
15	Review and identify opportunities to improve ISO rating in the region's communities	2017	All natural and human-caused		unknown		Low			As funding becomes available		
16	Upgrade emergency response systems to improve regional capacity and interoperability	2005	All natural and human-caused	Improved coordination within and among jurisdictions; upgrading equipment; increased communication reliability; quicker response times and improved access to total services; estimated 20 lives saved; estimate = \$40,000,000	Broad-band and wireless services for local emergency services operations = \$10,000,000	4.0	Medium	EDA, ARC, CDBG, FEMA, VDEM	NRVPDC and local govt's.	2-4 years	Ongoing by localities	
17	Create a regional inventory of emergency response equipment needed in communities	2010	All natural and human-caused		unknown		Medium		Emergency responders	As funding becomes available		
18	Provide weather radios to vulnerable populations	2010	All natural and human-caused		unknown		Medium		NWS/Emergency responders	As funding becomes available		
19	Create all hazards educational program & distribute preparedness kits	2010	All natural and human-caused		unknown		Medium		NRVPDC/Emergency Responders	As funding becomes available		
20	Inventory culverts & identify those that need attention	2010	Flooding		unknown		Medium		NRVPDC/Localities	As funding becomes available		
21	Identify emergency shelters & coordinate their use and equipment	2010	All natural and human-caused		unknown		Medium		Emergency responders	As funding becomes available		
22	Inventory potential rockfall areas for mitigation benefits	2010	Rockfall/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available	Completed	
23	Identify rockfall issues on trails and walkways	2010	Rockfall/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available		
24	Coordinate with VDEM to identify companies to provide large, reliable water supplies	2010	Drought		unknown		Medium		NRVPDC/Localities	As funding becomes available		
25	Create karst program to actively map and educate landowners	2010	Karst/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available		
26	Support localized flood control projects to include but not limited to stormwater management improvements	2010	Flooding		unknown		Medium		NRVPDC/Localities	As funding becomes available		
27	Upgrade and implementation of emergency response systems	2010	All		unknown		Medium		NRVPDC/Localities	As funding becomes available	Cancelled	Combined with 16
28	Hazard education and outreach	2010	All		unknown		Medium		NRVPDC/Localities	As funding becomes available		
29	Provide weather radios to vulnerable populations	2017	All		unknown		Medium			As funding becomes available		

**NRV Hazard Mitigation Projects - 2017**  
**Region-wide**

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
30	Review regional solid waste management capacity during and after disasters	2017	All		unknown		Medium			As funding becomes available		
31	Regional Swift Water Rescue Team	2005	Flooding	At least 5 lives have been lost in swift water in the NRV this year; estimate = \$2,000,000	Training and Equipment for 7 fire and rescue squad rep's = \$500,000	4.0	High	FEMA, VDEM	Local Fire and Rescue Teams	Ongoing	Completed	
32	Regional Reverse-911	2005	All natural and human-caused	Rapid dispatch to protect many lives; estimate = \$10,000,000	17 entities (including VT & RU) @ \$75,000 = \$1,275,000	7.8	High	FEMA, VDEM	NRVPDC and local govt's.	2-3 years	Completed	
33	Updated flood maps	2005	Flooding	More accurate flood maps to enable more effective development regulation; protective homes and lives; estimate (33 homes @ \$150,000) = \$5,000,000	\$50,000 per jurisdiction = \$750,000	6.7	High	FEMA	NRVPDC and/or local govt.	3-5 years	Completed by FEMA	
34	Inventory potential rockfall areas for mitigation benefits	2010	Rockfall/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available	Completed	