

# Vermont Multi-Hazard Map Modernization Business Plan

*Partnering to develop up-to-date multi-hazard NFIP flood maps in order to reduce conflicts between human land use and the dynamic adjustments of fluvial systems.*



Tyler Branch, Enosburg

**Vermont Agency of Natural Resources  
Department of Environmental Conservation  
Water Quality Division  
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## INTRODUCTION

The National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRMs) for Vermont are aging. The average age of the State's FIRMs is 17 years (Figure 1). As a result, many of the maps contain outdated and inaccurate flood hazard information that, for many communities, limits their utility for insurance and floodplain management purposes. In addition, many of the flood maps were prepared using outdated base maps, road network information, and manual cartographic techniques, which make the maps inaccurate for the state and floodplain communities to use and expensive for the Federal Emergency Management Agency (FEMA) to maintain.

FEMA developed a plan in 1997 to modernize the flood mapping program and eliminate the backlog of outdated flood hazard maps. The plan outlined the steps necessary to update FEMA's flood maps for the nation to digital format and streamline FEMA's operations in raising public awareness of the importance of the maps and responding to requests to revise them. The primary goals of FEMA's Multi-Hazard Flood Map Modernization Program are to reduce the loss of life and property, minimize suffering and disruption caused by disaster, and better prepare the Nation to address the consequences of flooding and other hazards.

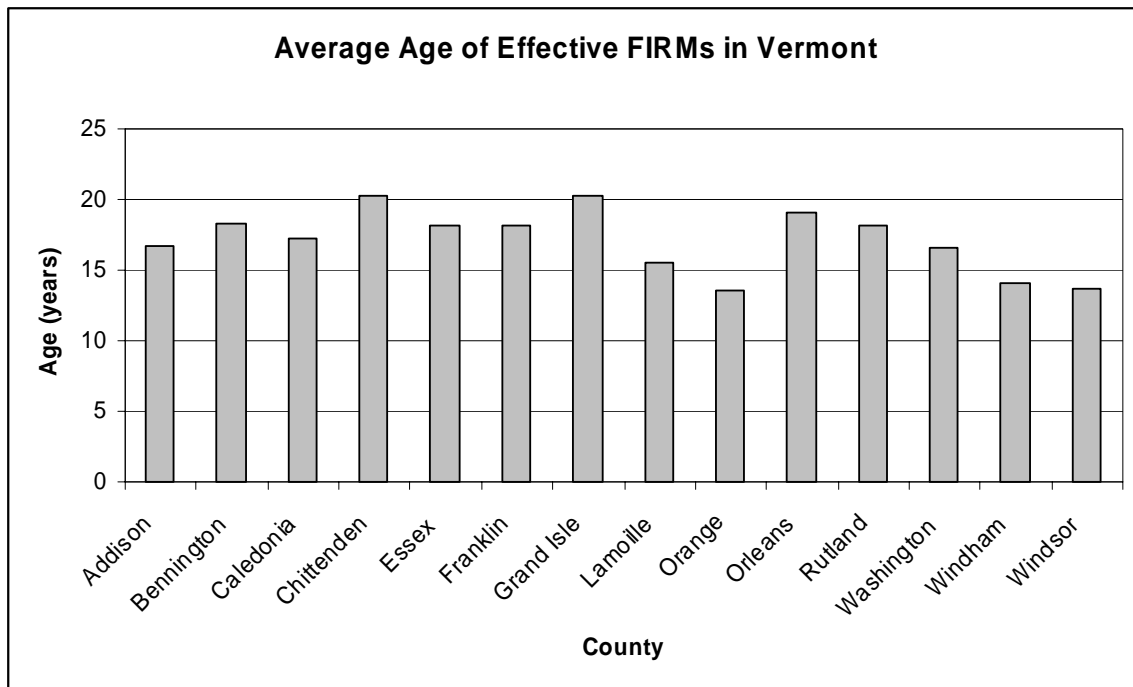


Figure 1. Average Age of Effective Flood Insurance Rate Maps (FIRMs) in Vermont

FEMA recognizes that while flood hazard mapping is a federal responsibility it is important to involve state, regional, and local governments in the Map Modernization initiative to ensure that the flood hazard maps produced are adequate to meet current needs. In 2002, FEMA requested that states develop state Map Modernization Implementation Plans (MMIP). The 2002 Vermont MMIP identified initial mapping priorities for the State, outlined an approach for addressing the mapping needs, and

expressed the desire to explore the availability of funding for multi-hazard mapping in the State. In October 2003, FEMA offered states funds to upgrade these plans and to develop a Multi-Hazard Map Modernization State Business Plan.

The purpose of the Vermont Multi-Hazard Map Modernization State Business Plan is to identify and document mapping priorities and the level of effort needed to adequately map and maintain all flood hazard areas that have been or could be developed, to define what management or oversight roles and responsibilities state, local or regional agencies are willing to assume to improve and maintain flood maps, and to estimate the resources required to effectively manage Map Modernization activities.

## STATE BUSINESS PLAN VISION

### Overview

The Vermont Department of Environmental Conservation (VT DEC) shares the same over-arching Multi-Hazard Map Modernization goals as does FEMA in reducing the loss of life and property, minimizing suffering and disruption caused by disaster, and better preparing the Nation to address the consequences of flooding and other hazards. VT DEC believes that in order to meet these goals, it will be necessary to employ a truly *multi-hazard* approach that includes the assessment and mapping of fluvial erosion hazards and to make this information available to the public in order to reduce the presently unacceptable level of conflict between human land use and infrastructure investments and the dynamic adjustments of fluvial systems.

Key objectives to meeting these goals include:

- *Establish and maintain a premier data collection and delivery system:* Create a premier, geo-spatial system that provides easy access to reliable flood hazard data and other information and hazard data to support risk management applications and operations.
- *Achieve effective program management:* Develop and provide a continually improving program management structure that motivates partners to share responsibility and aligns partner missions to reduce the nation's vulnerability to flood and other hazards.
- *Build and maintain mutually beneficial partnerships:* Foster mutually beneficial partnerships that achieve shared outcomes through the communication of flood risk and other hazard information and improve the systems that support them.
- *Expand and better inform the user community:* Foster public and stakeholder understanding of where to obtain flood and other hazard data and how to use and analyze it in order to make sound decisions to reduce their vulnerability to natural and man-made hazards.

The VT DEC feels that it is important to work closely with FEMA in order to meet the goals of the Multi-Hazard Map Modernization program. To this end, VT DEC will have strong participation in overall program management responsibilities and will work to build its' capability and capacity to take on additional mapping management responsibilities in the future. We will partner with other state and regional agencies to

further enhance the flood mapping process in the State. VT DEC will continually work to motivate and recruit additional partners to share responsibilities and assume responsibility for information, resources, data development, and data maintenance activities through the Cooperating Technical Partners (CTP) program.

### **Support for Multi-Hazard Flood Map Modernization**

The NFIP has been a valuable tool to avoid building development in areas or at elevations prone to inundation from floodwaters. At the same time, there has been a growing awareness regarding the deficiencies of FEMA floodway delineations to adequately protect development from fluvial (riverine) erosion flood hazards.

### **Support for Fluvial Erosion Hazard Mapping in Map Modernization**

While inundation-related flood loss is a significant component of flood disasters, the predominant mode of damage is associated with the dynamic, and oftentimes catastrophic, physical adjustment of stream channel dimensions and location during storm events due to bed and bank erosion, debris and ice jams, structural failures, flow diversion, or flow modification by man made structures. Channel adjustments with devastating consequences have frequently been documented wherein such adjustments are linked to historic channel management activities, flood plain encroachments, adjacent land use practices and/or changes in watershed hydrology associated with conversion of land cover and drainage activities.



**Kate Brook, Hardwick**

In the years 1995 through 1998, Vermont experienced five major flood disaster events that resulted in nearly \$60,000,000 in damages to public and private infrastructure and property. An estimated 75% or more of these damages are associated with the dynamic physical response of stream channels during flood events resulting in catastrophic adjustments of channel dimensions, slope, and location. NFIP maps are not intended nor designed to address the hazards associated with the physical response mechanism of fluvial systems.

FEMA's floodway delineation is an inundation based methodology that relies strictly on hydraulic calculations that plot a water surface elevation associated with a design frequency storm event. The limits of this methodology center on its inability to assign any consideration for the dynamic changes of channel configuration or location, due to physical channel adjustment processes. For this reason, the FEMA floodway limits do

not adequately protect existing or proposed development within riparian corridors from fluvial erosion hazards.

Through application of fluvial geomorphology (a science which seeks to explain the physics of flowing water and sediment in varying land forms), the condition of stability and adjustment processes can be described for any discrete stream reach. This information can then be used to determine floodway limits that will help maintain the stability of the fluvial system and allow adjustment processes to proceed without undue constraints from anthropogenic influences; thereby protecting human land uses and public safety from endangerment by flooding and erosion.



**Mad River, Warren**

Section 577 of the National Flood Insurance Reform Act (NFIRA) enacted in September 1994 required that FEMA submit a report to Congress that evaluated the technological feasibility (methodologies that are scientifically sound and implementable under the NFIP) of mapping riverine erosion hazard areas and assess the economic impact of erosion and erosion mapping on the NFIP. The Riverine Erosion Hazard Area (REHA) study concluded that it is technologically feasible to map riverine erosion hazard areas and that various geomorphic, engineering, and modeling procedures can be applied for delineating riverine erosion hazard areas, depending upon site-specific conditions. The study further indicated that the authority for regulating erosion-prone areas may best lie with local jurisdictions as opposed to a federally run program in order for the process to be most cost effective and to allow for the necessary study design flexibility.

The VT DEC River Management Program (RMP) has developed a Fluvial Erosion Hazard (FEH) assessment methodology. VT DEC has utilized this methodology in a number of stream mitigation projects. In conjunction with the consideration of NFIP designated floodways, a recent landmark Vermont Supreme Court decision affirmed the responsibility of the state to consider fluvial erosion hazards to public safety in the regional and state level review of land development projects.

The Draft 2003 FEMA Region 1 Multi-Hazard Map Modernization Business Plan stated that because erosion hazards are so closely related to flood hazards, partnering with the State would be a significant asset to Map Modernization and would help validate the concept of *Multi-Hazard* Flood Map Modernization. The plan further stated that they believed that the methodology has significant applicability and could possibly serve as a

candidate to pilot the multi hazards approach of the Multi-Hazard Flood Map Modernization program.

### **Support for Fluvial Erosion Hazard Mapping in State, Regional, and Local Hazard Risk Assessment and Mitigation Planning**

The Disaster Mitigation Act of 2000 (44 CFR, Parts 201 and 206, Interim Final Rule adopted 2/19/02) establishes requirements for states and local communities for hazard mitigation planning in order to maintain eligibility for disaster recovery and mitigation funding under the Stafford Act after 11/1/03. The first step in any hazard mitigation plan is to map and identify the hazards. For this reason, State, Regional and Local Hazard Mitigation Plans adopted pursuant to the Disaster Mitigation Act of 2000 will emphasize and express a commitment to the implementation of a fluvial geomorphic hazard assessment and mapping program preferably conducted on a regional or watershed level.

Towns will be offered Fluvial Erosion Hazard Maps as a component of their Town Pre-disaster Mitigation Plan. Regional Planning Commissions will work with local planners to develop local pre-disaster mitigations plans to reduce and avoid fluvial erosion hazards. The planning process will examine, through public forums, the acceptability of risk and compatibility of public and private investments within stream and river corridors given the hazard levels identified. Municipalities will then be able to evaluate and select the riparian corridor delineation alternatives which best achieve the objectives and desired benefits expressed in the local and regional planning process. Local governments can then use fluvial erosion hazards maps in coordination with FEMA National Flood Insurance Program inundation-based flood hazard maps to advise the implementation of municipal flood hazard mitigation strategies for consideration and adoption by the town.

### **Current Efforts**

VT DEC current efforts in the Multi-Hazard Mad Modernization program include developing a prioritization for map modernization study priorities, facilitating on-going Map Modernization Activities, and enhancing the Fluvial Erosion Hazard (FEH) risk assessment methodology.

The State NFIP Coordinator, Karl Jurentkuff has served as the State Floodplain Coordinator since 1980. Over the past 23 years, Karl has conducted several hundred site visits and surveys to assist town zoning officials, developers, and individual land owners to interpret flood maps and studies on a site specific basis. At one time or another, Karl has worked with and used every map and flood study in the state, and in using them has found numerous errors with the maps, hydrology, and flood profiles. Using this extensive experience in working with the existing maps, the RMP has developed the prioritization for map modernization study priorities listed in this plan.

VT DEC has been working with FEMA in facilitating the on-going Map Modernization activities currently conducted by FEMA including: completion of the floodplain re-mapping studies that have been started in the towns of Hinesburg, West Rutland, Woodstock, and Stowe; digitization of the existing Windham and Windsor County maps associated with the Connecticut River mapping study; as well as beginning the scoping

process for Washington County. VT DEC activities have included digital base map inventories, digital base map sharing, hydrologic and hydraulic reviews, assessment of community mapping needs, review of preliminary maps, and outreach activities.

The VT DEC has been working to enhance the FEH assessment and mapping methodology. In support of this methodology and in order to provide necessary geomorphic data, VT DEC has been working with partner Regional Planning Commissions (RPCs) to conduct Phase I and Phase II assessments utilizing the *Vermont Agency of Natural Resources Stream Geomorphic Assessment Protocols*. In addition, a draft model FEH zoning overlay district has been developed to assist towns that are interested in addressing fluvial erosion hazards as a way to mitigate future costs and risks associated with the fluvial erosion.

### **MULTI-HAZARD FLOOD MAPPING PRIORITIES**

VT DEC strongly believes that there needs to be a balance between simply digitizing, often outdated, manual FIRM data and conducting needed updated hydrologic and hydraulic (H/H) studies for a number of communities across Vermont. At the same time, we must balance the need to implement FEH mapping with FIRM updates from an overall mitigation benefits realization standpoint.

VT DEC recognizes that even with the significant increases in funding available through the Map Modernization program, there will not be enough funding to support new flood studies everywhere they are needed. VT DEC has conducted a preliminary prioritization to determine which flood prone areas should be mapped or remapped at a detailed level and which areas have source material that is still valid and do not require additional or new study at this time. Careful consideration was given to prioritization of new flood studies, while at the same time, avoiding digital conversions of existing maps that have erroneous information.

Following FEMA objectives, initial mapping prioritization was based on countywide DFIRM production. Mapping prioritization by county is primarily based on the proportion of specific flood hazard areas needing map upgrades that have problems identified with the existing information, the age of the existing FIRM, and population.

Prioritized list of counties to be mapped:

1. Washington
2. Rutland
3. Chittenden
4. Windsor
5. Windham
6. Bennington
7. Caledonia
8. Lamoille
9. Franklin
10. Grand Isle

- 11. Orange
- 12. Orleans
- 13. Addison
- 14. Essex

Within the counties, prioritization and scoping of flood mapping needs has been organized by stream and stream segment, and then ranked within each county (Priority Levels 1-3). The reaches with the greatest need for map upgrades have been given the highest priority (Priority Level = 1) for map modernization upgrades. While mapping priorities have been primarily organized by county, some overlap exists near watershed boundaries. Counties not listed in the preliminary prioritization have source material that is still valid and do not require additional or new study at this time. The digitized maps that will be produced for these counties potentially utilizing better base maps, better elevation models, and in some cases, automated hydrologic and hydraulic modeling, will be sufficient.

**Washington County**

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
2	Winooski	Bolton Dam to Middlesex Dam	56	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
1	Winooski	Middlesex Dam to Main St. Montpelier	36	Washington	Obtain new base maps (have Montpelier), New hydrology needed, Rerun hydraulic model using existing cross sections, Conduct ice jam analysis
1	Winooski	Main St. Montpelier to E. Montpelier town line	18	Washington	Obtain new base maps (have Montpelier), New hydrology needed, Rerun hydraulic model using existing cross sections
2	Winooski	E. Montpelier town line to Cabot Village	138	Washington	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model; new study from Marshfield to Cabot Village
1	Stevens Branch	Confluence to Williamstown town line	50	Washington	Obtain new base maps (have Barre City), New hydrology needed, Resurvey cross sections and rerun hydraulic model
1	Stevens Branch	Williamstown to end of detailed study	28	Orange	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
1	Gunners Brook	Confluence to 2500 feet upstream	3	Washington	New study
2	Jail Branch	Confluence to East Barre Dam	24	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
3	Tributaries in Williamstown	Confluence to end of detailed study	6	Orange	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
3	Dog River	Confluence to end of detailed study	96	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
3	Cox Brook	Confluence to end of detailed study	7	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
3	Union Brook	Confluence to end of detailed study	2	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
3	Sunny Brook	Confluence to end of detailed study	7	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
2	Great Brook	Confluence to end of detailed study	3	Washington	New study (obtain base maps, obtain hydrology, survey cross sections, run hydraulic model)
3	Mad River	Confluence to Moretown Dam	14	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
3	Mad River	Moretown Dam to Moretown Village	20	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections, Conduct ice jam analysis
3	Mad River	Moretown Village to end of detailed study	42	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
3	Shepard Brook	Confluence to Fayston town line	5	Washington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections, Conduct ice jam analysis
1	Mill Brook	Confluence to end of detailed study	19	Washington	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model

### Rutland County

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
3	Otter Creek	Addison County line to Proctor town line	97	Rutland	New study
2	Otter Creek	Proctor town line to Center Rutland	66	Rutland	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
1	Otter Creek	Center Rutland to Wallingford Village	100	Rutland	Obtain new base maps (have Rutland City), New hydrology needed, Resurvey cross sections and rerun hydraulic model

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
3	Otter Creek	Wallingford Village to end of detailed study	60	Rutland	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
1	East Creek	Confluence to Rutland Town town line	14	Rutland	Obtain new base maps (have Rutland City), New hydrology needed, Rerun hydraulic model using existing cross sections
1	East Creek	Rutland Town town line to end of detailed study	20	Rutland	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
1	Moon Brook	Confluence to end of detailed study	8	Rutland	Obtain new base maps (have Rutland City), New hydrology needed, Resurvey cross sections and rerun hydraulic model
2	Mill River	Detailed Study Area	36	Rutland	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
2	Roaring Brook	Detailed Study Area	3	Rutland	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model, Alluvial fan study
3	Neshobe River	Confluence to end of detailed study	36	Rutland	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
3	Clarendon River	Town of West Rutland	13	Rutland	New study
3	Cold River	Detailed Study Area	11	Rutland	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
2	Castleton River	Confluence to North Breton Brook	60	Rutland	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model

### Chittenden County

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
3	Browns River	Confluence to Essex town line	51	Chittenden, Franklin	New study
2	Browns River	Essex town line to end of detailed study	77	Chittenden	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
1	Winooski River	Essex Junction Dam to Bolton Dam	99	Chittenden	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model

### Windsor County

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
1	Ottauquechee	Town of Bridgewater	23	Windsor	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
3	North Branch Ottauquechee	Confluence to 1200 feet upstream of end of detailed study	12	Windsor	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
1	Kedron Brook	Confluence to end of detailed study	43	Windsor	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
2	Barnard Brook	Confluence to end of detailed study	11	Windsor	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
2	Gulf Stream	Confluence to end of detailed study	17	Windsor	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
1	Connecticut River	Wilder Dam to Comerford Dam	354	Windsor, Orange, Caledonia	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
1	White River	Towns of Sharon and Pomfret	32	Windsor	New study
2	First Branch White River	Confluence to Tunbridge town line	16	Windsor	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
3	First Branch White River	Tunbridge town line to end of Chelsea town line	55	Orange	New study

### Windham County

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
1	Whetstone Brook	Confluence to end of detailed study	29	Windham	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
1	Saxtons River	Town of Grafton	51	Windham	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
3	North Branch Deerfield	Town of Wilmington	38	Windham	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
3	North Branch Deerfield	Wilmington town line to Blue Brook	16	Windham	New Study

### Bennington County

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
1	South Stream	Confluence to end of detailed study	13	Bennington	Alluvial fan study
2	Batten Kill River	NY state line to Sunderland town line	49	Bennington	Use existing base maps, New hydrology needed, Rerun hydraulic model using existing cross sections
1	Batten Kill River	Town of Sunderland	17	Bennington	New study
1	Batten Kill River	Sunderland to Bourn Brook	28	Bennington	Obtain new base maps, New hydrology needed, Resurvey cross sections and rerun hydraulic model
1	Winhall River	Town of Winhall	12	Bennington	New Study

### Franklin County

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
1	Missisquoi River	Sheldon Junction	10	Franklin	Restudy ice jam analysis

### Essex County

Priority Level	Stream	Segment	Length (1000 ft)	County	Study Required
1	Connecticut River	Gilman Dam to N.H. State Line	297	Essex	New Study

This prioritization will be refined on a year-to-year basis and may change based upon available funding and on the possibility of leveraging and funding partnerships with contributions from local or regional agencies.

## MAP MODERNIZATION PROGRAM PARTICIPATION

One of the goals of the Map Modernization Program is to increase local ownership of the NFIP by the State and local governments. To this end, VT DEC will have strong participation in overall program management responsibilities and will work to build its' capability and capacity to take on additional mapping management responsibilities in the future.

### Map Modernization Management Support Activities

VT DEC staff will provide most of the necessary management and technical skills needs to coordinate the Map Modernization effort work in-house, however, some of the work will need to be preformed through contracted services. The VT DEC will manage contracts with all outside consultants hired to perform the project-related functions. VT DEC will partner with the RPCs to undertake the outreach activities and the VCGI to undertake the DFIRM maintenance and information technology management activities.

The specific management activities that the VT DEC will oversee through the Map Modernization Management Support (MMMS) program are:

		<b>VT DEC</b>	<b>RPCs</b>	<b>VCGI</b>	<b>FEMA</b>
<b>MMMS Activities</b>	Digital Base Map Inventory	X			
	Digital Base Map Sharing	X			
	DFIRM Maintenance	X		X	X
	Hydrologic and Hydraulic Review	X			
	Assessment of Community Mapping Needs	X			
	Technical Standards Agreement	X			
	Information Technology Systems	X		X	
	Outreach	X	X		
	Minimal Support Activities	X			
	Managing Updates to Information System	X			
	Training Efforts to State and Local Officials	X			
	Coordination and Effort in Building Partnerships	X			
	Staffing	X			
	Compliance and Map Adoption	X			
	Fluvial Erosion Hazard Mapping	X	X	X	

**Digital Base Map Inventory**

VT DEC will perform an investigation and provide an inventory of base maps that meet FEMA specifications for NFIP communities in the State.

**Digital Base Map Data Sharing**

VT DEC will obtain and supply base maps for use in the production of DFIRMs. The base maps will comply with FEMA minimum accuracy requirements and be distributable by FEMA to the public in hardcopy and electronic formats.

**DFIRM Maintenance**

VT DEC, in partnership with FEMA, and the Vermont Center for Geographic Information (VCGI), will assume responsibility for periodic maintenance of the DFIRM. This can include base map and/or flood hazard information.

**Hydrologic and Hydraulic Review**

VT DEC will review hydrologic and hydraulic studies prepared for FEMA-funded flood data updates and/or map revisions processed under Part 65 of the NFIP regulations. The review will focus on compliance with the technical and regulatory requirements contained within *Guidelines and Specifications for Flood Hazard Mapping Partners*, the pertinent NFIP regulations, as well as standard accepted engineering practices.

**Assessment of Community Mapping Needs**

VT DEC will perform a detailed community-by-community assessment of mapping needs for all mapped and unmapped NFIP communities within its jurisdiction.

For communities with effective FIRMs, the purpose of the mapping needs assessment is to evaluate whether the accuracy of the flood hazard data shown on the FIRM are adequate. For communities without effective FIRMs, the purpose of the mapping needs assessment is to determine whether the community is flood prone and whether a FIRM should be produced.

In performing this evaluation, VT DEC will complete the following activities: determine the age of the most recent analyses, compare flood hazard information from the most recent flood events to the flood hazard information shown of the effective FIRM, assess factors that affect hydrologic and hydraulic analyses, and determine the presence of areas that were not studied previously and/or areas that were studied using approximate methods.

Upon completion of the mapping needs assessment, the results of these assessments of community mapping needs will be submitted to FEMA for inclusion in the MNUSS database.

### **Technical Standards Agreement**

VT DEC will work with FEMA to adopt specific technical standards or processes appropriate for local conditions for NFIP flood mapping purposes. VT DEC will work to manage the adoption of Fluvial Erosion Hazards Assessments and Fluvial Erosion Hazards Mapping as an information layer as part of the Multi Hazard Flood Map Modernization Program in Vermont. These assessments and subsequent mapping have been proven to be appropriate for local conditions and NFIP flood mapping purposes in Vermont.

### **Information Technology Systems**

VT DEC, in partnership with the Vermont Center for Geographic Information (VCGI), will manage and maintain an Information Technology System to archive, organize, and distribute, and manage DFIRMs. The system will be capable of delivering this data in an electronic format (e.g. web-based, CD-ROM, etc.) to the public. VCGI is a public non-profit charged with ensuring that all data gathered by state agencies that is relevant to the Vermont GIS community is in a form that is compatible with, useful to, and shared with that geographic information system.

### **Outreach**

The VT DEC, in partnership with the Vermont Regional Planning Commissions (RPCs) will coordinate and develop a strategy for outreach activities including the distribution of informational mailings, the organization of community meetings, and the development of multi-media promotional activities such as website postings, fact sheets, announcements, brochures, newspaper articles, etc. As each of the partner RPCs has close working relationships with its member communities, VT DEC believes that this partnership will enhance the overall outcome of outreach activities.

**Minimal Support Activities**

VTDEC will work with FEMA to provide support and information useful for map modernization efforts, such as: population, percentage of insurance policy base, vision for implementation, coordination with the FEMA Regional office, and recognizing and calling attention to gaps and shortfalls.

**Managing Updates to National Management Information System**

VT DEC will assume responsibility for ensuring that required updates to the National Management Information System are made in an accurate and timely manner.

**Training Efforts to State and Local Officials**

VT DEC will participate in the development and deployment of training in subjects that will encourage the use of digital flood mapping products.

**Coordination and Effort in Building Partnerships**

VT DEC will survey community officials to determine if they intend to actively contribute to, and participate in, flood map modernization or flood map maintenance activities. VT DEC will take steps to foster mutually beneficial partnerships that achieve shared outcomes.

**Staffing**

VT DEC will provide staff dedicated to activities which promote the flood mapping process and the adoption of effective maps by NFIP communities.

**Compliance / Map Adoption**

VT DEC will coordinate and assist activities which will ensure that new flood maps are adopted by NFIP communities.

**Fluvial Erosion Hazard Mapping**

The VT DEC RMP will function as the lead fluvial hazards management agency and oversee FEH map production. The purpose of mapping areas associated with fluvial erosion hazards is to delineate zones and to provide an assessment of the relative risk to which structures would be subject if they were located within such zones. It is anticipated that FEH maps will be produced, primarily, by RPCs and towns in coordination with the VT DEC.

During the scoping process for each county, VT DEC will develop a prioritization of those communities with the greatest need for fluvial erosion hazard risk assessment and mapping. FEH map production will be prioritized for areas that have experienced repeated fluvial erosion-related losses, areas where geomorphic assessments have been conducted using the Vermont ANR Stream Geomorphic Assessment Protocols and show a potential for high fluvial erosion hazard, and areas where fluvial erosion potential poses a relative threat to public safety or economic impact on communities.

FEH maps will be generated and technically approved following the Vermont ANR Stream Geomorphic Assessment Protocols and utilizing the Stream Geomorphic

Assessment Tool (SGAT-Version 3) ArcView GIS Extension. Stream geomorphic assessments conducted using the Vermont ANR Stream Geomorphic Assessment Protocols involve the collection of data from topographic maps and aerial photographs, from existing studies, and from limited field studies. Geomorphic reaches and provisional reference stream types are established based on valley land forms and their geology. Predictions of channel condition (departure from a reference condition), adjustment process, and reach sensitivity are based on evaluations of watershed and river corridor land use and channel and floodplain modifications. SGAT-Version 3 was developed to provide assistance to organizations performing stream geomorphic assessments using the Vermont ANR Stream Geomorphic Assessment Protocols. Use of the SGAT program significantly streamlines many of the calculations and measurements that provide the basis for determination of reference and existing geomorphic stream types as part of the Phase I assessment and the degree of channel adjustment process and stream sensitivity rating as part of Phase II. Furthermore, SGAT allows the user to assign fluvial erosion hazard types and delineate stream corridors (buffers) based on the stream sensitivity rating.

The RMP will be responsible for the technical review and final approval of fluvial erosion hazard maps. Technical approval will be based on data QA/QC reviews using established performance criteria. In cases where a FEH map review or revision is found to be necessary, any entity that believes that the FEH delineation should be adjusted may propose modification to the FEH map by submitting additional assessment information to the RMP for review.

### **Cooperating Technical Partner Activities**

In developing the Map Modernization Plan, FEMA conceptualized the Cooperating Technical Partners (CTP) initiative to increase involvement through strong, formalized Federal-State-regional-local partnerships. This cost-shared approach to funding flood mapping activities allows FEMA, the CTP, and other State and Federal agencies to leverage their available resources, eliminate duplicative efforts, and maximize output.

The VT DEC and several of its partners will participate in the Cooperating Technical Partners Program (CTP). The nature and scope of specific activities will be detailed in annual partnership agreements and will be based upon the evaluation and prioritization of statewide mapping needs and the level of interest and corporation from impacted communities.

VT DEC, VCGI, and VT AOT have contacted the FEMA Region I CTP Coordinator, Dean Savramis, and are waiting for a CTP Capability Assessment to be conducted.

The specific mapping activities that VT DEC and its partners would like to perform through the CTP program are:

		VT DEC	VCGI	VT AOT	FEMA
<b>CTP Activities</b>	Project Scoping	X			
	Outreach	X			
	Field Surveys Reconnaissance				X
	Topographic Data Development		X		
	QA/QC of Topographic Data		X		
	Hydrologic Analyses				
	QA/QC Hydrologic Analyses			X	
	Hydraulic Analyses				
	QA/QC Hydraulic Analyses			X	
	Floodplain Mapping		X		
	QA/QC Floodplain Mapping		X		
	Base Map Acquisition		X		
	DFIRM Production		X		
	QA/QC DFIRM Production		X		
	Preliminary DFIRM and FIS Distribution				X
Post-Preliminary Processing				X	

### **Project Scoping**

Project scoping will be held after a community’s mapping needs have been identified and FEMA and the community have decided to initiate a Flood Map Project to create or update the FIRM. VT DEC will partner with RPCs to complete the following project scoping activities: conduct background research and community outreach, determine what effective data can be used in the analyses and/or transferred to the new FIRM and FIS report, identify other data needed to complete the flood map project and sources of those data (e.g. base map, topography, cross sections, transects), establish priority levels for flooding sources to be analyzed and mapped, make FIRM format decisions (e.g. countywide, community-based, or otherwise), develop schedules and cost estimates of the components of the flood map project, assign project tasks to mapping partners, and develop appropriate contracts or agreements for completion of assigned work.

### **Outreach Activities**

While the management of outreach activities will be funded through MMMS funds, the development of outreach materials will be handled by a CTP agreement. The purpose of conducting outreach activities is to educate the public about flood hazards (related to both inundation and erosion) within their community, to inform and receive input from the public about planned scope and potential impact of the flood mapping project, and to inform the public about the results of the flood mapping project. In order to leverage the greatest amount of funds, the VT DEC will partner with the RPCs to conduct the outreach activities. Outreach activities will include the development of informational mailings, the scheduling of community meetings, the posting of relevant material on the internet, and the development of multi-media promotional activities.

### **Terrain Activities**

The Vermont Center for Geographic Information (VCGI) has expressed interest in participating in the Map Modernization process as a CTP in topographic data development or QA/QC review of topographic data, floodplain mapping or QA/QC review of floodplain mapping, and base map acquisition activities.

### **DFIRM Activities**

The Vermont Center for Geographic Information (VCGI) has expressed interest in participating in the Map Modernization process as a CTP in DFIRM production or QA/QC review of DFIRM production activities.

### **Engineering Activities**

The Vermont Agency of Transportation (VT AOT) has also expressed interest in participating in the Map Modernization process as a CTP in conducting independent QA/QC reviews of the hydrologic analyses and hydraulic analyses.

### **Future CTP Activities**

VT DEC will continually work to motivate and recruit partners to share responsibilities and assume responsibility for information, resources, data development, and data maintenance activities through the CTP program. As the State of Vermont and their partners build greater capability and capacity, we anticipate having a greater role in the CTP program.

## **MAP MODERNIZATION PROGRAM MANAGEMENT**

### **Program Resources, Staffing, and Needs**

VT DEC contains decades of experience in floodplain and fluvial hazard management and therefore has in-house staff capabilities sufficient to perform the specified management activities. While VT DEC has the necessary capabilities to perform all of the management activities described above, it currently does not have the capacity to perform all of the specified management activities.

In order to successfully fulfill the Multi-Hazard Map Modernization business plan's vision, the VT DEC will need to increase staffing levels by 1.5 FTE to perform all of the specified management activities as proposed in this plan. With the additional 1.5 FTE, VT DEC staff will provide most of the necessary management and technical skills needed to coordinate the Map Modernization effort work in-house. However, some of the work will need to be performed through contracted services. VT DEC will partner with the RPCs and the VCGI to undertake several of the MMMS activities. The RPCs are all staffed with dedicated individuals experienced in the area of floodplain management, flood mitigation, and community outreach. The VCGI has experience in the development of data standards, guidelines, and procedures; the development of essential statewide databases; and the development and web hosting of interactive map applications to increase the public's access to information. The VT DEC will manage contracts with all outside consultants hired to perform the project-related functions. A Map Modernization

Coordinator position will serve as the lead for managing the Map Modernization program and for overseeing, monitoring, and approving the contracted MMMS activities.

VT DEC staff and its partners will need to be provided with the appropriate information, data, updates, and training necessary to take over all management activities previously conducted by FEMA and its contractors. After VT DEC has been provided this information, VT DEC will be able to fully take on all MMMS activities after a 90-day lead time.

**Program Administration Cost**

Following is an estimated yearly FTE and costs projection that our proposed MMMS efforts would represent above and beyond current staff levels and budget resources. The budget represents the total amount of federal funds required to perform the level of work on an annual basis. Because funding through MMMS is a Cooperative Agreement, there is no funding match required, however it is anticipated that VT DEC will provide 20% leverage of the funding received from FEMA.

	<b>Description</b>	<b>FTE</b>	<b>Costs</b>
<b>Personnel Costs</b>	Digital Base Map Inventory	0.05	\$ 3,750
	Digital Base Map Sharing	0.05	\$ 3,750
	DFIRM Maintenance	0.2	\$ 15,000
	Hydrologic and Hydraulic Review	0.2	\$ 15,000
	Assessment of Community Mapping Needs	0.1	\$ 7,500
	Technical Standards Agreement	0.1	\$ 7,500
	Information Technology Systems	0.2	\$ 15,000
	Outreach	0.2	\$ 15,000
	Minimal Support Activities	0.05	\$ 3,750
	Managing Updates to Information System	0.05	\$ 3,750
	Training Efforts to State and Local Officials	0.1	\$ 7,500
	Coordination and Effort in Building Partnerships	0.05	\$ 3,750
	Staffing	0.05	\$ 3,750
	Compliance / Map Adoption	0.1	\$ 7,500
	<b>Total Personnel Costs</b>	<b>1.5</b>	<b>\$112,500</b>
<b>Other Costs</b>	Fluvial Erosion Hazard Mapping		\$ 40,000
	Travel / Training		\$ 3,000
	Equipment / Supplies		\$ 2,000
	Indirect (25% of personnel cost)		\$ 28,125
	Overhead		\$ 1,350
<b>Total Other Costs</b>		<b>\$ 74,475</b>	
<b>Total Costs</b>		<b>\$186,975</b>	

Activities to be preformed through the CTP program will require additional funding and will be detailed in annual partnership agreements.

**Program Performance Goals and Measures**

In accordance with the Government Performance Results Act (GPRA) performance measures suggested by the Office of Management and Budget (OMB), the Multi-Hazard Map Modernization plan is designed to accomplish the following:

- Reduce the average age of the State’s FIRMs from nearly 17 years to 8.5 years
- Produce digital flood hazard maps with up-to-date flood hazard data for the 15% highest priority areas; and
- Develop flood hazard maps for half of the unmapped, flood prone communities

The State’s effort to successfully initiate, implement, and reach it’s Map Modernization goals is dependent upon the availability of predictable steady funding levels to support staff efforts on the initiative.

VT DEC believes that the best approach towards meeting FEMA’s annual targets for the “Sub-Program Element Performance Measures” is to phase map scoping, production, and adoption activities by county, completing groups of counties over a 3-year cycle. The number of counties scheduled to begin in each year is dependent upon the detail of the map study required, as detailed in the prioritization above.

The following chart outlines the phasing of map scoping, production, and adoption and compares Vermont’s Map Modernization Plan general goals with the GPRA performance measures. Actual year-to-year goals will be more specific and will be based upon adjusted priorities and upon available funds.

	Mapping Activity			% Population Digital Maps Online		% Population Maps Adopted	
	Map Scoping	Map Production	Map Adoption	Vermont Plan	FEMA Targets	Vermont Plan	FEMA Targets
<b>2004</b>	Washington Rutland				20%		10%
<b>2005</b>	Chittenden Windsor Windham	Washington Rutland		20%	50%	0%	20%
<b>2006</b>	Bennington Caledonia Lamoille	Chittenden Windsor Windham	Washington Rutland	61%	65%	20%	35%
<b>2007</b>	Franklin Grand Isle Orange Orleans Addison Essex	Bennington Caledonia Lamoille	Chittenden Windsor Windham	75%	75%	61%	50%

	Mapping Activity			% Population Digital Maps Online		% Population Maps Adopted	
	Map Scoping	Map Production	Map Adoption	Vermont Plan	FEMA Targets	Vermont Plan	FEMA Targets
<b>2008</b>		Franklin Grand Isle Orange Orleans Addison Essex	Bennington Caledonia Lamoille	100%	85%	75%	70%
<b>2009</b>			Franklin Grand Isle Orange Orleans Addison Essex	100%	100%	100%	90%

VT DEC goals largely meet or exceed GPRA performance measures. Consideration was given to switching the priority of counties so as to complete more of the less intensive counties first in order to immediately meet the GPRA measures for each year. However, it was decided that the map modernization needs of Vermont are best served by a mapping prioritization primarily based on the counties that are most in need of map upgrades due to problems identified with the existing information, have a large proportion of total population, and have the oldest FIRM's. By year 2007, all VT DEC goals meet or exceed GPRA performance measures.

**Program Alternatives Analysis**

VT DEC will contribute as much as it can towards meeting national performance measures, given the following alternative funding levels:

**Full Funding Levels**

Given full funding to accomplish each proposed activity, VT DEC will be able to complete all proposed MMMS activities.

**Medium Funding Levels**

Given approximately 2/3 of full funding to accomplish only the top prioritized activities that meet Map Mod objectives, the meeting of performance measures would be at risk. VT DEC would only be able to perform those MMMS activities associated with Digital Base Map Inventory, Digital Base Map Sharing, Hydrologic and Hydraulic Review, Assessment of Community Mapping Needs, Outreach, Minimal Support Activities, Managing Updates to National Information System, Training Efforts to State and Local Officials, Coordination and Effort in Building Partnerships, Staffing, and Compliance and Map Adoption. FEMA and the NSP would have to take on an increased responsibility to meet the strategic goals and metrics.

### **Low Funding Levels**

Given approximately 1/3 of full funding to accomplish only the top prioritized activities that meet Map Mod objectives, FEMA and the NSP would have to take almost complete control of the management of the mapping process. VT DEC would only be able to perform those MMMS activities associated with Hydrologic and Hydraulic Review, Assessment of Community Mapping Needs, and Outreach activities. As a result, FEMA would have to take on an even greater responsibility to meet the strategic goals and metrics.

For each of the alternative funding levels presented above, FEH mapping activities will only be able to be performed to the extent that they are funded.

### **SUMMARY**

The primary goals of the Multi-Hazard Map Modernization include reducing the loss of life and property, minimizing suffering and disruption caused by disaster, and better preparing the Nation to address the consequences of flooding and other hazards. VT DEC believes that in order to meet these goals, it will be necessary to employ a truly *multi-hazard* approach that includes the assessment and mapping of fluvial erosion hazards and making this information available to the public in order to reduce the presently unacceptable level of conflict between human land use and infrastructure investments and the dynamic adjustments of fluvial systems.

Key objectives to meeting these goals include developing a continually improving effective program management structure, building and maintaining mutually beneficial partnerships, establishing and maintaining a reliable and easy accessible geo-spatial flood hazard data information technology system, and better informing the community in the understanding of where to obtain flood hazard and how to use it to make sound decisions to reduce the vulnerability to natural and man-made hazards.

The VT DEC feels that it is important to work closely with FEMA in order to meet the goals of the Multi-Hazard Map Modernization program. To this end, VT DEC will have strong participation in overall program management responsibilities and will work to build its' capability and capacity to take on additional mapping management responsibilities in the future. We will partner with other State and regional agencies to further enhance the flood mapping process in the State. VT DEC will continually work to motivate and recruit additional partners to share responsibilities and assume responsibility for information, resources, data development, and data maintenance activities through the Cooperating Technical Partners program.