Executive Summary

The State of West Virginia is blessed with great natural beauty and a rugged landscape that enticed the explorer, the pioneer, and the settler to travel through and settle within its majestic countryside. Prior to the advent of modern earth-moving equipment and construction technology, streams and rivers and their narrow floodplains defined the pathways and wagon trails throughout West Virginia. With the exception of recent interstate highways that crisscross numerous watersheds within the State, most U.S. and State highways and Class I railroads extend the length of every major river valley in the State. The historic use of the State's rivers for commercial navigation further reinforced this floodplain-centered transportation system.

Early villages and towns sprang up at the confluence of streams and rivers to take advantage of those transportation opportunities and the nutrient-rich floodplain. Unknowingly, these early settlers initiated patterns of movement and development that would place countless thousands of West Virginians in harms way. As abundant natural resources were discovered and exploited, the economic fortunes of the State improved and floodplain communities increased in size and density to accommodate the inflow of new workers and their families. Thousands of acres of forestland were cleared for resource development. The newly constructed railroads and massive resource processing facilities further crowded the floodplains. Excess runoff generated by the combination of expanding communities and resources development quickly overwhelmed the channel capacity of the resident streams and rivers leading to flooding, losses of life and property damages.

Historically, flooding has affected each of the 32 major watersheds and 55 counties within the State. Federally declared flood disasters are far too common in the Mountain State. Thousands of West Virginians have suffered through damaged homes and businesses, lost loved ones, and deteriorating communities. Addressing a problem of this magnitude and complexity necessitated initiation of a strategic planning process that would be comprehensive in scope, sensitive to the needs of the stakeholders and their environment and well coordinated. The Statewide Flood Protection Plan is a result of that process.

How Did the Statewide Flood Protection Plan Get Started?

After years of planning and coordinating the development of isolated flood protection projects with various Federal and State agencies, the West Virginia Soil Conservation Agency (since renamed the West Virginia Conservation Agency), took the initiative to chart a new course of flood damage reduction and floodplain management in the State. Encouraged and supported by the Governor's office and legislative leadership, the Conservation Agency presented the need for a comprehensive statewide flood protection plan to Senator Byrd. The Senator responded in 1998 by providing funds to the U.S. Army Corps of Engineers for the joint development of a statewide plan for flood protection with the Conservation Agency. Showing the level of commitment needed for this effort to be successful, the Governor's office and the Legislature responded with funding to match the Federal contribution.

In 1999, the Conservation Agency, the Corps of Engineers and the Natural Resources Conservation Service created a framework for the statewide plan that specified the need for a joint Task Force. A dedicated group that could bring to bear the technical and policy expertise and experience needed to tackle the complex flooding issues in the State.

That Task Force met for the first time in September 2000. Composed of 20 Federal, State, regional and local agencies and quasi-public organizations, the Task Force dedicated staff, data, and other resources to the development of a comprehensive strategic plan that would reduce flood damages and save lives. Representatives from the Governor and Senator Byrd's offices attended the Task Force meetings.

What are the Goals and Objectives of the Statewide Plan?

The Plan is a vision for the future of West Virginia, spelling out both long-term and short-term goals, strategies and implementation schedules. Patience and dedication will be required to successfully reach the established goals. The plan addresses six specific goals:

Reduce the unnecessary loss of lives due to flooding.

Reduce private and public property damages due to flooding.

Develop technical and administrative tools to manage flood loss reduction and floodplain management.

Promote technical and legislative tools that will reduce excessive runoff from land-conversion activities

Reduce personal and economic loss due to flooding while supporting State economic growth.

Protect the State's waterways and floodplain environments.

Objectives for each of the goals were formulated that would challenge the members of the Task Force and the agency representatives tasked to create the Plan.

How extensive is the flooding problem?

Floods have been documented in West Virginia since the earliest settlements in the 1800's. More recently, between 1996 and 2004 there have been 16 Federal disaster declarations in the State involving flooding. All 55 counties have been included in at least one of those floods. The total FEMA cost during that time span is more than $500 million.

Floods also result in a loss of life. Between 1960 and 1996, there were 252 deaths from floods or flash floods in West Virginia – more than any other state except Texas with 619 and California with 258. National statistics indicate that as many as 59% of flooding victims drown in their vehicles.

What Other Issues were raised during the study?

The task force convened a series of public workshops throughout the State to enlist the help of West Virginians in determining what the flooding problems were and what might be solutions to the problems. Information collected in those meetings helped form the foundation of the planning efforts of the Task Force.

After the meetings were completed, the primary issues were gathered into 12 categories. Those categories are discussed below:

a. Floodplain Management

The enforcement of floodplain regulations required by the National Floodplain Insurance Program has been sporadic in West Virginia, resulting in unwise development decisions within the State's floodplain.

b. Flood Warnings

Flood warnings are transmitted in a manner that is not understandable by many people; the warnings are not considered to be reliable and many times are not timely.

d. Floodplain Mapping

Existing floodplain maps are insufficient to make accurate determinations of flood hazard for new floodplain construction.

c. Flood-Damage Assessment

Information on potential flood damages in the State is not easily accessible to Federal, State or local agencies or to the public.

e. Building Codes, Permitting and Enforcement

West Virginia needs to maintain enforcement and updates to the building codes that address floodplain construction and drainage issues that can impact downstream flooding and flood damages. Citizens need information about Federal and State regulatory permit requirements when working in the State's streams.

f. Environmental Impacts of Flooding

Construction in the floodways and floodplains can have significant environmental impacts on both the stream ecology and people living in the floodplain. Increasing amounts of stormwater runoff from development in the State's watersheds are destroying stream channels, the aquatic ecosystems and creating flood damages. Placement of materials and structures in the floodplain that become floating debris during floods causes further damages downstream.

g. Stream Crossings and Access Roads

Incorrectly designed or constructed metal and concrete box culverts, bridges and other stream crossings may be easily blocked by debris and therefore contribute to local flooding. Regulation of the design, installation and maintenance of culverts and other stream crossings is often inadequate or non-existent.

h. Dredging

The public has long perceived that dredging of streams is an acceptable and effective means of reducing the negative effects of floods. The continued costs, actual impacts and marginal effectiveness of dredging streams to reduce the effects of major floods are generally unknown or misunderstood.

i. Resource Extraction

Mining, forestry operations, along with other resource extraction industries were frequently perceived as being one of the causitive factors in flooding. The Department of Environmental Protection was tasked by the Governor to conduct a study of the impacts of mining and timber harvesting on flooding in two watersheds in southern West Virginia. The conclusions of this study are included in Appendix I.

j. Stormwater Management

Excessive uncontrolled and unregulated stormwater runoff volumes create nuisance flooding in many areas of the State and the cumulative effect of these incremental runoff volumes contribute to regional flooding events within the State.

k. Education

The knowledge of floodplain management professionals, political leaders and the public is inadequate regarding the causes of flooding, methods of reducing flood damages and floodplain ordinances.

l. Existing Flood-Prone Structures and Facilities

A substantial number of structures and facilities were constructed within the designated 100-year frequency floodplain in West Virginia prior to existence of the National Flood Insurance Program and many remain subject to annual flood damages.

Are there existing programs in Federal and State government that offer solutions to these problems?

The short answer is: yes. During the creation of the Plan, Task Force members brought a host of Federal, State, and local flood protection programs to the table. Several flood protection projects had been constructed through those programs. Many of these programs provide viable solutions

to flood damages and other issues, but they require support from local governments, they require investments of capital funds and dedicated maintenance for the life of the project. Many more projects proposed through those programs had never left the pages of the reports that spoke of their positive attributes. For lack of support, funds or justification many of those projects remained only words, drawings and numbers.

What are the recommendations of the Statewide Plan?

After analysis of the basic flooding problem, consideration of the issues raised by citizens of West Virginia, and application of existing flood protection programs and the experience of the Task Force members, the following recommendations were developed.

a. Floodplain Management

Increase resources in the West Virginia Office of Emergency Services to support local floodplain managers statewide. Require owners of all new structures to obtain a permit certifying whether or not the structures are in the floodplain. Improve enforcement of floodplain management ordinances.

b. Flood Warning System

Improve and expand the network of existing rain and stream gages in the State and connect those instruments to a proposed statewide flood warning system. This system would enable the National Weather Service to issue credible and reliable flood warnings. Provide markers along roads and at stream crossings subject to frequent inundation warning motorists of possible hazards at these locations.

c. Floodplain Mapping

Update floodplain mapping to more precisely delineate floodplain areas and create more detailed hydrographic networks to improve flow models and flood risk assessment.

d. Flood Damage Assessment

Designate a single agency or point of contact where flood damage data from Federal and State resources could be stored. Develop a system that integrates the capability of Geographic Information Systems (GIS) with flood damage data so that damage information could be used as the basis for flood protection planning.

e. Building Codes, Permitting and Enforcement

Continue to support and adopt updates of International Building Code, which covers residential building, plumbing, mechanical, fuel-gas and private sewage disposal requirements and meets minimal flood-resistant design standards. Provide education and technical assistance to the public on the regulatory permit process.

f. Environmental Impacts of Flooding

Enact legislation that recognizes the attributes and hazards of the State's floodplains and the needs for stricter enforcement of floodplain ordinances. The legislation should declare floodway zones to be off-limits to new development (with some exceptions), and encourage Federal agencies to evaluate all proposed projects for effects on the State's floodplains. Legislate stricter enforcement of regulations for anchoring floatable materials and structures in the floodway and

flood fringe. Convene a "Stream Summit" to formulate a standard classification of stream quality in the State. Enact legislation that supports local regulation of stormwater runoff volume. Enact guidelines for the emergency removal of stream debris to avoid long-term environmental damage. Fund studies for identification of stable stream reaches that require protection from development.

g. Stream Crossings and Access Roads

Establish guidelines for the sizing, installation and maintenance of culverts, drainage structures and stream or river crossings. Identify ownership of abandoned stream crossings and move to demolish unused crossings.

h. Dredging

The practice of local stream dredging to reduce the damages associated with large regional floods should be terminated. Channel modifications projects (which includes some dredging) where economically justified and environmentally sound should be supported to reduce flood damages. Allocate funds for stream restoration projects that can reduce flood damages and return the natural functions of damaged streams and ecosystems.

i. Resource Extraction

The Task Force supports the recommendations of the study conducted by WVDEP regarding mining. In addition, the Task Force recommends the WV Division of Forestry accelerate revisions to Best Management Practices to reduce the impacts of forestry operations on flooding and develop BMPs on areas severely burned by wildfire.

j. Stormwater Management

The Task Force recommends that all counties implement a stormwater ordinance to control the quantity and quality of stormwater and to guide the development and implementation of a stormwater management plan. It is recommended that a State agency inspect stormwater facilities and serve as a back up for local inspection and enforcement of regulations on design, installation, operation and maintenance of these facilities. It is also recommended that special stormwater regulations be prepared for karst areas in West Virginia.

k. Education

Encourage State, county and local officials to take the Federal Emergency Management Agency independent study course related to flooding, flood mitigation and floodplain management. Encourage education outlets to develop classes and curriculums that address floodplain and flood issues. Provide visible markers to identify for the public the Base Flood Elevation level.

l. Existing Flood-Prone Structures and Facilities

Evaluate the major watersheds in the State to identify opportunities to construct upstream retention facilities for flood control and water supply. Evaluate the existing municipalities in the State to identify opportunities for protection in place of those communities serving as the economic and political centers of their respective counties. Establish a voluntary program of permanent acquisition for structures within the designated floodways and a voluntary program of floodproofing and relocations to address existing structures in the flood fringe areas.

When can these solutions be implemented?

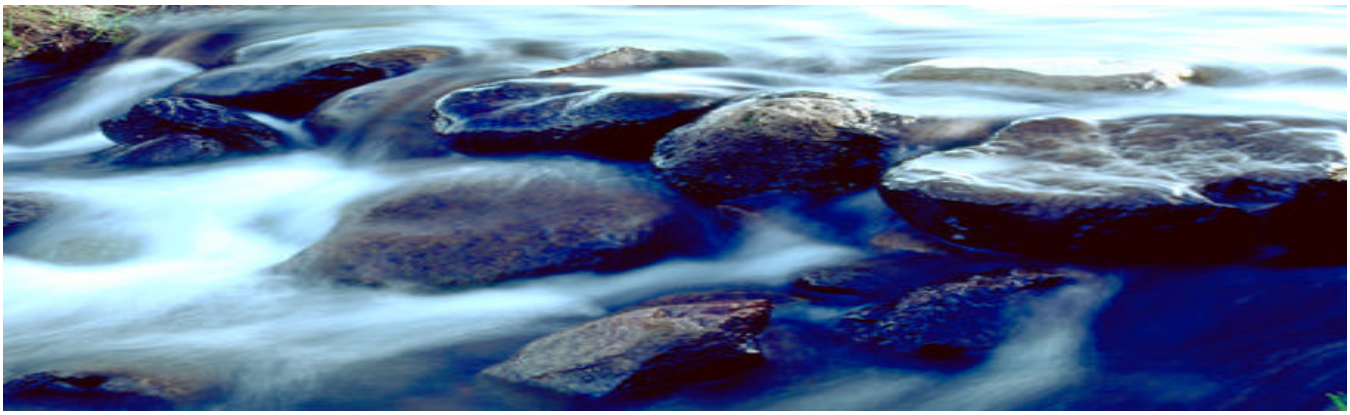
The Statewide Plan includes a number of recommendations that are not specified in this abbreviated executive summary. A complete list of the recommendations can be found in Chapter 6 of the Plan. Many of the recommendations listed above would require administrative or legislative actions by the State, county or municipal governments. There are several recommendations for capital construction that would require annual allocation of matching funds by the Federal government and the State through existing flood protection programs. The Task Force purposefully avoided recommending creation of entirely new flood protection programs that could require months of Congressional and Legislature debate at the expense of those in need.

Recommended changes in the State Code could be accomplished annually through the State Legislature. Modifications to county and municipal ordinances could be accomplished through County Commissions and Town/City Councils with required readings and public meetings.

Among the capital construction recommendations requiring allocation of matching funds is the installation of a statewide flood warning system. Given the existence of standing Federal authorities and funding for small flood protection projects, this system could be initiated as early as the fall of 2005. Several recommendations may require the addition to or restructuring of staff in State agencies. These staff proposals would require approval by the Governor and the Legislature along with funding to support the additional positions.

Fully implementing the capital construction and program recommendations included in this plan could cost hundreds of millions of dollars. Some of those required funds could be allocated through existing Federal programs for flood protection, but certain matching funds will need to be budgeted through the State Legislature. Fortunately, the flood-damage reduction benefits that will be generated as a result of those expenditures are cumulative in nature. Therefore, a sustained, modest annual program of expenditures well within the budget capabilities of the Federal and State governments would be effective in reducing losses of life and flood damages.

Allocation of public funds to reduce losses of life and property damages associated with annual floods must certainly be accomplished with consideration of other pressing State and national needs. National security, economic growth and employment opportunities, employment security, education, nutrition, environment, transportation, housing, and many other issues face both the Congress and the State Legislature. Allocating funds and resources to address these various issues in a responsible manner must be accomplished with a reasonable promise of some positive outcome or benefit. The recommendations outlined in this Statewide Flood Protection Plan will each yield positive benefits in reducing the reality and threat of future losses of life and property damages associated with flooding.



WEST VIRGINIA FLOOD PROTECTION PLAN

1. Introduction

a. Authority for the Study. West Virginia has endured years of uncoordinated efforts to reduce flood damages by numerous Federal and State agencies. In 1991, the West Virginia Conservation Agency (previously known as the West Virginia Soil Conservation Agency) was directed to prepare a Flood Damage Assessment and Mitigation Plan for West Virginia in an attempt to understand and control flood damages.

Chapter 19-21A of the State Code establishes the State Conservation Committee and Conservation Districts. The Conservation Agency, as an agent of the State Committee, is charged to conserve natural resources, control floods, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, conserve wildlife, protect the tax base, protect public lands, and protect and promote the health, safety, and general welfare of the people. The Conservation Agency coordinates these activities with the State's Conservation Districts.

All State and Federal agencies having responsibilities related to floodplain management and flood mitigation activities in the State were invited to participate. An interim draft of this plan

entitled "West Virginia Statewide Flood Damage Assessment and Mitigation Plan" was prepared in 1993. A final version of the plan was never produced.

In 1998, Senator Robert C. Byrd obtained funding for the Corps of Engineers (USACE) to formulate a comprehensive strategy for reducing economic, property, and personal losses due to flooding in West Virginia. Those funds were provided to match State funds and in-kind resources to complete the 1993 Plan. Due to the time lapse since completion of the interim draft plan in 1993, portions of the current Plan would be updated with new chapters added.

The West Virginia Conservation Agency and the Corps of Engineers have developed a partnership with numerous Federal and State agencies to formulate a comprehensive strategic plan for reducing flood damages in the State. The first step in that process was the creation of a Task Force composed of Federal, State, and quasi-public organizations that have participated in

past flood protection and floodplain management activities. Over 20 agencies and organizations participated in this effort. This group has been identified as the West Virginia Flood Protection Task Force (Task Force). Contact information for organizations participating in the Task Force and other organizations involved in flood preparation, mitigation, response and recovery can be found in Appendix O.

In 2001, a series of intense storms crossed southern West Virginia. As these storms vividly demonstrated, flooding remains a hazard to life and property throughout the State. In addition to millions of dollars in property damages and emergency costs, several lives were lost in the flood.

Figure 1-1. Severe Thunderstorms Are Common in West Virginia

Governor Bob Wise requested that the Task Force refocus the statewide plan on a regional plan that would significantly reduce the impacts of future flooding in the six counties hardest hit. The regional plan was used as a template to prepare this statewide plan. This statewide plan incorporates and supersedes the Regional Plan produced in October 2002.

b. Goals and Objectives of the Statewide Plan. Despite the many flood protection programs available through Federal and State agencies and the many existing flood protection projects, flooding continues to be West Virginia's most common and widespread natural disaster. A comprehensive statewide study of flooding has never been undertaken and until now, only a gross estimate of the severity of the problem could be made.

The Task Force recognizes that certain components of the problem are largely out of our control. The incidence of storms, rainfall, and runoff and the State's rugged topography are components of the flooding problem that cannot be significantly altered by any government plan, program or

agency. High water events where waters overflow stream banks and invade normally dry land will continue to occur and floodplains will serve their natural function as avenues of conveyance for floodwaters. Other components of the flooding problem such as the volume of rainfall runoff, placement of undersized or incorrectly designed stream crossings, unwise placement of floatable debris in the floodplain, or the placement of damageable property within the floodplain can be modified to reduce damages.

Figure 1-2. Flooding in Southern West Virginia

The Plan is intended to be a vision for the future, spelling out both long-term and short-term goals and objectives and recommending strategies for attaining those goals. The strategies include optimum use of existing Federal, State, local, and private resources for creating a reliable warning system, for strengthening floodplain management and reducing flood damages.

This Plan is not a "magic bullet". It is not a cure-all for those living in the State's floodplains. This Plan provides a roadmap for reducing flood damages, but a portion of the responsibility for reducing damages must reside with each citizen of the State. The daunting tasks of reducing flood damages, identifying potential flood situations and issuing warnings, restoring damaged streams, reducing stormwater runoff, and strengthening floodplain management in the State will not be accomplished tomorrow, next week or next year. Successful deployment of the strategies recommended in this Plan will take many years of sustained effort and require significant amounts of Federal, State and local funds. More importantly, successful deployment of these strategies will require cooperation and coordination between all levels of government and the public.

To ensure the Plan will be viable for the future, all of the agencies involved have committed to regular meetings of the Task Force to guide the development of the Plan, to review its findings and recommendations, and to implement the Plan through their respective missions and authorities. The Task Force members have also committed to revising the Plan in response to an ever expanding and improved database, to experiences (lessons learned) in implementation,

changes in resources (funds and staff) and expertise, and with changes in disaster situations and the needs of West Virginia citizens.

This Plan does not belong to any one agency. Instead, the Plan is a dynamic approach to reducing flood impacts with all agencies having ownership. This plan does not replace response and recovery plans developed by and for individual agencies. The Plan incorporates response and recovery plans into a unified "plan of plans" or compilation of each agency's mission, action plans, and procedures. This compilation should reduce fragmented planning and ensure that all agencies are knowledgeable about each other's activities.

Past flood reduction efforts provide the foundation for today's efforts. West Virginia is now in a position to improve and extend yesterday's advances in flood protection. This Plan not only builds upon past efforts, but stretches toward the ultimate goal of a reduction in potential flood losses and loss of life and a reduction in the loss of natural and beneficial floodplain resources.

The West Virginia Office of Emergency Services and other cooperating agencies have developed a well-conceived plan for responding to the catastrophic effects of flooding throughout the State and recovering after a flooding event.

Past flood-damage reduction efforts have been reactionary in nature resulting in site-specific projects designed to solve damages at a single geographic location. This plan is different in that it stresses strategic concepts and a proactive approach rather than a reactive one. The need for a proactive plan is driven by the value of the lives, property, and resources at risk in the State's floodplains weighed against the catastrophic and destructive forces of anticipated future flooding.

The Plan recognizes the leadership and expertise at all levels of government and provides data and information to support the needs of local jurisdictions, community organizations, and local sponsors in floodplain management and flood-damage reduction. The plan goals address:

(1) reducing the loss of life due to flooding, (2) reducing property damages, (3) developing programs and tools that will assist in implementing a sound program of flood damage reduction and floodplain management, (4) reducing economic losses while supporting a viable State economy, and (5) protecting the floodplain environment.

The plan goals and objectives were formulated based upon the combined experience and institutional knowledge of the Task Force members and the comments received from advisory groups, public officials and citizens during statewide workshops. The goals and their corresponding objectives are listed below.

Goal 1: Reduce the unnecessary loss of lives due to flooding in West Virginia.

Objective 1: Develop and maintain an effective and reliable flood warning system for West Virginia that includes recommendations for needed gages (new and upgraded), software, and hardware needs, and coordination between Federal and State agencies.

Objective 2: Identify available education, information, and equipment necessary for floodplain occupants to receive and comprehend flood warnings.

Objective 3: Identify needed equipment and training for public officials in each county so that flood warnings are received and disseminated in an effective and timely manner.

Objective 4: Develop a framework for creation of emergency evacuation plans for each county that identifies emergency service resources, escape routes, and temporary evacuation centers, and establishes a communications network between emergency service organizations.

Objective 5: Identify education and information resources to be disseminated to floodplain residents on the hazards of the floodplain and potential for loss of life due to flooding.

Objective 6: Prioritize proposed flood damage reduction projects and programs such that structures located within the regulated floodway are expeditiously evacuated.

Goal 2: Reduce private and public property damages.

Objective 1: Identify floodplain mapping needs for previously unmapped areas and areas with outdated mapping.

Objective 2: Identify financial and technical resources to acquire needed floodplain mapping.

Objective 3: Identify educational data and information that can be disseminated to county and municipal floodplain managers to enable more informed permit decisions.

Objective 4: Promote avoidance of floodplain development (structures and facilities) by public (Federal, State, county and municipal) agencies.

Objective 5: Identify needs for county and municipal floodplain managers and legislative action to require State certification of floodplain managers.

Objective 6: Promote and identify financial support for both structural and non-structural flood damage reduction measures through Federal and State agencies.

Objective 7: Identify the need for and sources of funding for flood insurance subsidies.

Goal 3: Develop technical, administrative, regulatory enforcement, and legislative tools that will facilitate implementation of a sound program of flood loss reduction and floodplain management.

Objective 1: Identify effective hydrologic / hydraulic models that can be implemented at the county and municipal level to predict and plan for future flooding.

Objective 2: Promote continued collection and analysis of watershed level hydrologic and hydraulic data to better define flood frequencies, runoff characteristics, and flooding risks.

Objective 3: Formalize the roles, tasks, and responsibilities of the Task Force and execute a partnership agreement among the members that will ensure its continuation and effectiveness.

Objective 4: Identify legislative proposals (either new legislation or modification of existing law) that will facilitate needed infrastructure protection, establish flood damage reduction funding sources, and enable more effective enforcement of existing programs.

Objective 5: Develop and deploy an education and training package for county and municipal floodplain managers, county commissioners, and city councils based upon existing FEMA data and information.

Objective 6: Recognize and legitimize the role of Watershed Associations in the planning and implementation of flood damage reduction and floodplain management activities through State legislation.

Goal 4: Promote technical, administrative, regulatory enforcement, and legislative tools that will reduce incrementally excessive runoff from land-conversion activities in West Virginia.

Objective 1: Identify needs for stormwater management and deployment (legislation, program enforcement, and State subsidies) of technical, administrative and legislative components.

Objective 2: Identify potential agency or agencies responsible for oversight of statewide stormwater management program.

Objective 3: Identify needs for State subsidies to assist counties and municipalities in establishing stormwater ordinances and enforcement administration.

Objective 4: Identify land-conversion activities that generate excessive runoff leading to property damages from flooding.

Objective 5: Use appropriate available data and information existing or being developed to determine the potential effects of runoff from resource extraction activities on streams and floodplain development.

Goal 5: Reduce personal and economic losses due to flooding while supporting a viable State economy.

Objective 1: Identify a long-range strategy for reducing personal and economic losses due to flooding.

Objective 2: Identify property damage reduction solutions that are economically efficient and leverage Federal matching funds.

Objective 3: Identify sources of Federal funds to support implementation of the Plan's goals.

Objective 4: Identify potential State revenue sources for property damage reduction projects and floodplain management activities.

Objective 5: Identify alternative development processes that facilitate economic growth (jobs and revenues) while avoiding unnecessary impacts to the State's floodplains.

***Goal 6*: Protect the State's waterway and floodplain environments.**

Objective 1: Identify stable reaches of streams to be protected from dredging, modification, restoration, or inundation.

Objective 2: Identify streams or stream reaches with aquatic or terrestrial resources protected by laws or regulations.

Objective 3: Prepare and execute a Memorandum of Agreement between Federal and State agencies on protected streams.

Objective 4: Identify streams or reaches of streams requiring restoration of aquatic resources that can be addressed by available State and Federal restoration programs.

Objective 5: Promote wise use of the State's streams and floodplains through the State's education system.

c. Flooding in West Virginia.

Floods have been documented in West Virginia since the earliest settlements. The highest known flood on the Greenbrier River occurred in 1812.

Between 1996 and 2004, there have been 16 Federal disaster declarations in West Virginia. Eight of these involved flooding. All 55 counties have been included in at least one of these floods. During this period, the Federal Emergency Management Agency (FEMA) has disbursed over $500 million in assistance payments to individuals and communities for property damages in West Virginia.

In addition to the Federal disaster declarations, West Virginia has declared several flood disasters since 1996 that did not generate sufficient property damages to be declared Federal disasters. While not as widespread or damaging as the floods that were declared Federal disasters, these floods were just as devastating to the people affected by them.

The dollar amounts in Table 1-1 merely indicate the amounts of money dispersed by FEMA for those items covered by the provisions of the disaster declarations. It does not fully capture the total damage to residential and business property or structure contents. These dollar amounts do not include funds expended by other State and Federal agencies providing assistance. Nor does it include the dollars spent by counties or municipal governments, individuals, faith-based organizations and charities after the floods.

Table 1-1

FEMA Aid to Individuals and Communities for Disasters in West Virginia, 1996-2001

(All totals as of December 2001.)

Date of Flood Event	Aid to Individuals	Aid to Communities (Infrastructure Repairs)	Hazard Mitigation	State Funds Expended	Total Combined Aid
January 1996	$12,589,172	$21,966,279	$5,985,342	$10,135,198	$50,675,991
May 1996	$7,442,239	$5,379,933	$1,982,319	$2,533,799	$17,338,290
July 1996	$2,024,199	$1,567,717	$631,471	$3,167,249	$7,390,636
September 1996	$2,862,082	$11,423,311	$2,069,837	$3,959,061	$7,390,636
March 1997	$8,122,201	$4,942,615	$2,576,444	$3,910,315	$20,314,291
June 1998	$8,153,859	$6,606,081	$1,969,318	$4,182,315	$19,551,575
February 2000	$2,896,637	$5,402,158	$570,714	$2,217,377	$11,086,886
May-July 2001	$77,292,490	$42,940,000	$9,000,000	$18,092,549	$147,325,039
Totals	**$121,382,879**	**$100,228,094**	**$24,785,445**	**$48,197,863**	$294,594,281

These numbers do not account for expenditures by railways to repair and replace infrastructure and rolling stock damaged by the floods. In addition to these expenditures, the West Virginia Housing Development Fund contributed to flood recovery operations from 1996 through 2001. These figures also do not include the dollar amount spent by the West Virginia Department of Transportation rebuilding roads, bridges and other parts of our transportation infrastructure. (See Table 1-2).

Floods impact or destroy people's homes, schools, churches, businesses, and places of work. Floods have recurring adverse effects on individual's physical and mental health. Many flood victims report that they are unable to sleep when it rains because of the potential for disastrous floods like those they have experienced.

Table 1-2

Department of Transportation Expenditures
Related to Flooding in West Virginia, 1996 to 2001
(Not FEMA- or Federal Highway Administration-Reimbursed)

Event	Department of Transportation Expenditures
January 1996	$3,566,318
May 1996	$1,178,714
July 1996	$120,813
September 1996	$2,110,230
March 1997	$808,065
June 1998	$1,235,719
Feb. 2000	$1,434,323
May-July 2001 (estimated)	$10,000,000
	Total $20,454,182

Figure 1-3. Example of Transportation Damages in July 2001

In addition to creating safety and public health hazards, floods result in loss of life. Floods are the leading cause of death from natural disasters in the United States. Between 1960 and 1996, there were 252 deaths from floods or flash floods in West Virginia. This is more than any other state except Texas (619) and California (258). If the 125 deaths caused by the Buffalo Creek disaster in 1972 are excluded, West Virginia would still rank tenth in flood fatalities during this period. West Virginia has a long history of deaths, mental trauma, and property damage attributable to flooding. Six people perished in southern West Virginia during the July 2001

flooding. National statistics show that 59% of flood-related fatalities in the last 10 years occurred in vehicles.

d. Issues Raised by the Study. The Task Force held public meetings around West Virginia to obtain public input on the issues surrounding flooding. Each of the meetings addressed issues raised by local government officials as well as the views and concerns of the general public. Table 1-3 summarizes the most frequent comments received. A complete summary of the comments received is included in Appendix N.

Table 1-3
Most Frequent Comments Received from Statewide Public Meetings
(January through December 2001)

Subject	Comment	Frequency
Dredging	Dredge streams.	22
Debris	Debris blocks small streams, causing local flooding.	15
Mapping	Improve and update floodplain mapping.	15
Culverts	Old culverts cannot handle stormwater flows from new development and other changes.	14
Development	Development such as new housing, commercial and industrial development, is causing floods.	14
Highway	Department of Highways and railroad bridges are too low and catch debris, causing flooding.	11
Permitting	Streamline the permitting process and clarify permit requirements and agency authority.	10
Problem	Roads are blocked during high water.	10
Dam	Dam the Greenbrier River.	9
Timbering	Logging is causing floods.	9
Highway	"New" highway construction projects cause flooding.	8
Enforcement	Require retention/detention ponds at every new development.	7
Small ponds	Need more small watershed dams and retention ponds.	7
Stormwater	Stormwater management is needed.	7
Coordination	Coordinate plan and future flood protection activities with towns and cities.	6
Coordination	Coordination and cooperation among State federal and local agencies needs to be in place.	6
Dam	Do not dam the Greenbrier River.	6
Enforcement	Enforce floodplain regulations.	6

Figure 1-4. Example of Flood Damages in July 2001

e. Planning Constraints and Opportunities. The Plan is based on both existing and newly generated data. Time and personnel constraints limited the development of new data. Existing data was analyzed and updated to current conditions and price levels. Newly generated data is based upon 2000 Census figures and information supplied by the West Virginia Department of Tax and Revenue among others. The professional judgment and experience of agency personnel played a large part in identifying viable damage reduction options and in the formulation of the overall plan. Where possible, data is categorized by 11-digit watershed units.

Several opportunities were realized during the planning for flood damage reduction programs in West Virginia. Chief among those were opportunities for improved emergency communications through improvements to the flood warning system, opportunities for stream restoration and improvement of housing quality through floodplain relocations. These opportunities would surface as by-products of the planning for reductions in loss of life and property damages.

f. Implementing The Plan. It should be obvious from examining the recommendations included in this plan that no one solution will eliminate flooding in West Virginia. Even implementing all of the recommendations provided in this plan will not completely eliminate the risk of flooding. Man does not have the power to eliminate these dangers. However, implementing the recommendations included in this plan will reduce the flood related risks to lives and properties in West Virginia.

Implementing these recommendations will cost time, resources and money that could be allocated to other pressing State issues. Implementing the recommendations included in this plan would cost billions of dollars if they were implemented concurrently. Fortunately, the benefits of the recommendations are cumulative in nature. Therefore, a sustained annual program of expenditures well within the budget capabilities of the Federal and State governments would be

effective in reducing the loss of life and flood damages. Regardless of the final costs, implementing these recommendations will be cheaper than the continuing financial and social costs of lives and property lost to flooding each year (See Tables 1-1 and 1-2).

The recommendations are not arranged in a priority list. Nor should it be assumed that all of one group should be accomplished before starting on the items in another group or that one group is more important than another. Nor should it be assumed that these recommendations are all that should ever be done to reduce the effects of flooding. As our knowledge grows, as technology develops and as we succeed in reducing the effects of flooding, we will learn new and even more effective ways to reduce the effects of flooding.

g. Description of the Plan Area.

The Plan area encompasses the entire State of West Virginia. There are approximately 15.5 million acres of land (24,231 square miles) within the State contained within 55 counties and approximately 240 municipalities. About 145 square miles of the State are covered by water features (primarily streams and rivers). The mean elevation of the State is approximately 1,500 feet above sea level leading to the State's nickname "the Mountain State". There are 32 major river watersheds in the State that contain approximately 31,000 miles of rivers and streams. Figure 1-5 shows the distribution and extent of the major watersheds in the State.

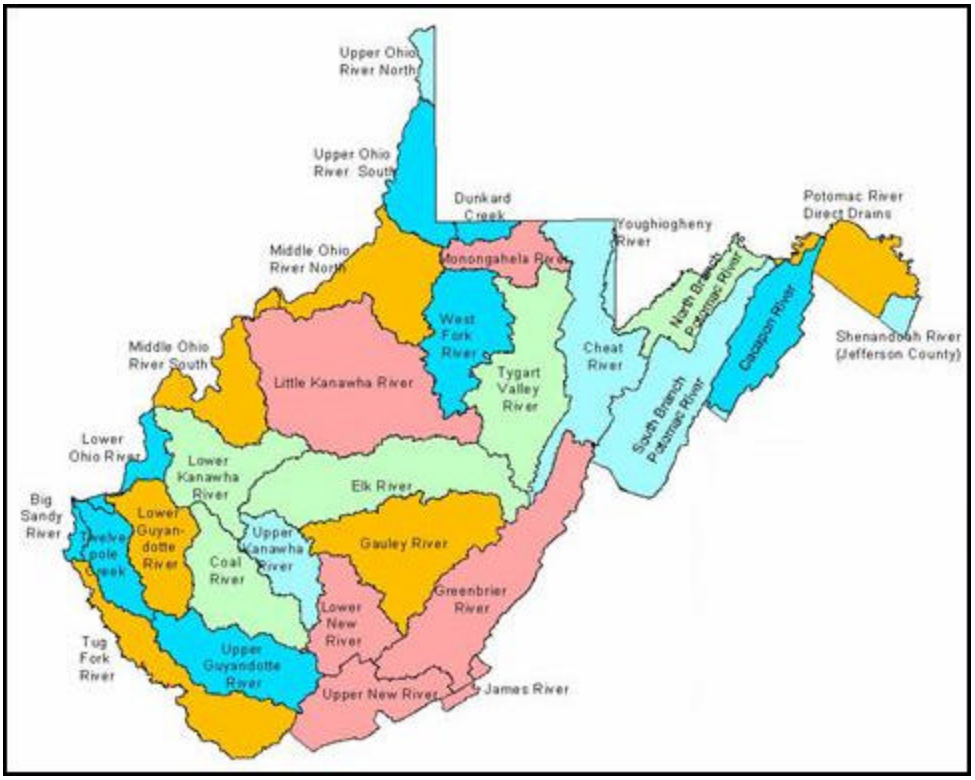


Figure 1-5. Major Watersheds in West Virginia

According to the 2000 Census, there are approximately 1,806,000 people residing in the State. The 1990 Census population count was 1,793,477. Table 1-4 shows the distribution of the 2000 population by county within the State. The ten most populous counties are shown in yellow, all have populations in excess of 50,000. Each of the fifty-five counties contains one or more major

municipalities and commercial/residential centers that support the daily needs of the county population.

Table 1-4. Population by County (2000 Census)

County	Population	County	Population
Barbour	15557	Mercer	62980
Berkeley	75905	Mineral	27078
Boone	25535	Mingo	28253
Braxton	14702	Monongalia	81866
Brooke	25447	Monroe	14583
Cabell	96784	Morgan	14943
Calhoun	7582	Nicholas	26562
Clay	10330	Ohio	47427
Doddridge	7403	Pendleton	8196
Fayette	47579	Pleasants	7514
Gilmer	7160	Pocahontas	9131
Grant	11299	Preston	29334
Greenbrier	34453	Putnam	51589
Hampshire	20203	Raleigh	79220
Hancock	32667	Randolph	28262
Hardy	12669	Ritchie	10343
Harrison	68652	Roane	15446
Jackson	28000	Summers	12999
Jefferson	42190	Taylor	16089
Kanawha	200073	Tucker	7321
Lewis	16919	Tyler	7592
Lincoln	22108	Upshur	23404
Logan	37710	Wayne	42903
Marion	27329	Webster	9719
Marshall	56598	Wetzel	17693
Mason	35519	Wirt	5873
McDowell	25957	Wood	87986
		Wyoming	25708

The majority of the State's population is clustered into several Metropolitan Statistical Areas (MSA) located wholly or partially within the State. Those MSA's are Charleston, Cumberland, MD (includes portions of Mineral County), Huntington/Ashland, Parkersburg/Marietta, Weirton/Steubenville, Washington, DC (includes portions of Berkeley and Jefferson counties) and Wheeling/Bridgeport. Major transportation routes, employment centers, and municipalities within these regions support these population density patterns. Figure 1-6 shows the distribution of population density within the State with major interstate routes superimposed.

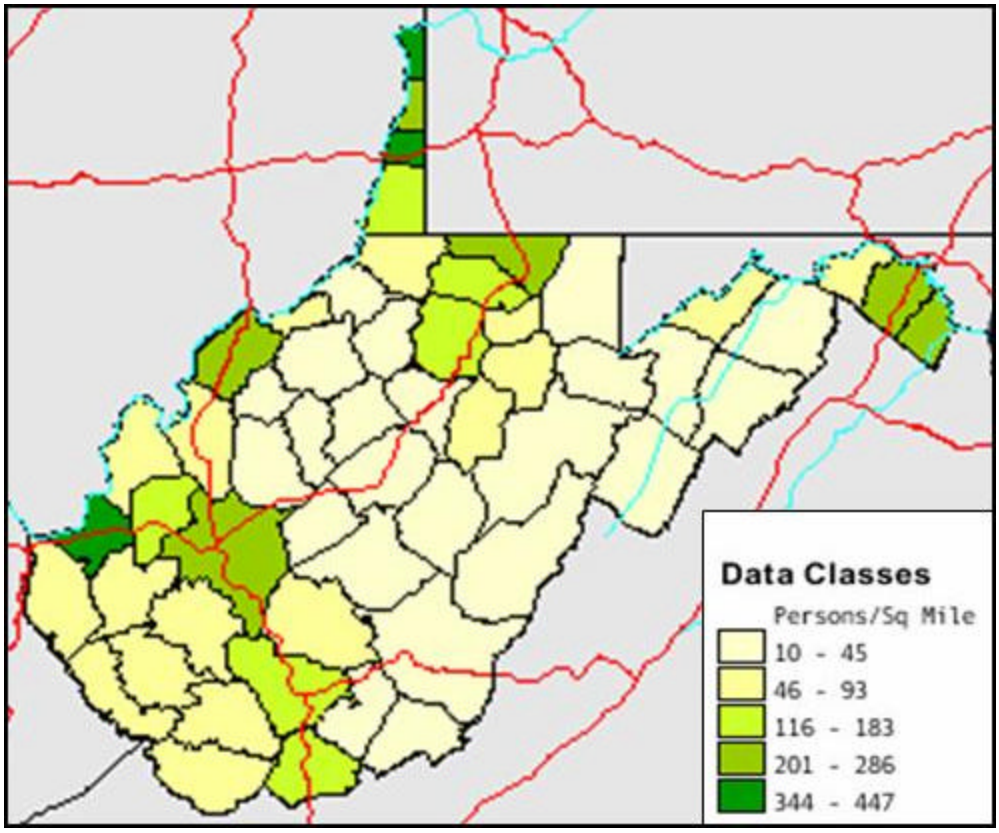


Figure 1-6. Distribution of Population Densities by County

According to the 2000 Census, there are 844,623 residential housing units in the State (an increase of 8% over that same category in the 1990 census). Of those total units, 736,841 are occupied and of those occupied units, 553,699 (75%) are occupied by the unit's owner. Of the total 844,623 residential housing units, 583,695 (69 percent) are single-family detached units and 142,728 (17 %) are identified as mobile homes. At least 70% (591,236) of the residential units identified in the 2000 Census were constructed before 1980. The majority of these units were constructed before the enactment of floodplain management ordinances in the State.

The State's population has been financially supported by coal mining, wood products, steel manufacturing, tourism/recreation and chemical processing industries. Total non-farm payroll employment in 2001 was 792,000 persons. Of that total, 133,600 worked in the goods production sector and 601,800 worked in the services sector. Total agricultural-related employment in 2001 was approximately 4,292 persons. The State's average unemployment rate in 2001 was 4.9% (41,000 persons). Table 1-6 shows the number of places of employment, number of employees, and total wages by two-digit industrial codes in the State. This table shows that the State's labor

force is concentrated in business sectors such as Manufacturing, Mining, Construction, Transportation and public utilities, Wholesale and retail trade, Services, Finance, Insurance and Real Estate (F.I.R.E.), and government.

Table 1-6. Employment Statistics by Industrial Code

INDUSTRY BY 2-DIGIT CODE	UNITS	EMPLOYMENT	WAGES (in $$)
TOTAL, ALL INDUSTRIES	46,584	685,771	19,189,237,777
AGRICULTURE	664	4,292	82,162,380
01 Agricultural Production-Crops	73	692	11,002,481
02 Agricultural Production-Livestock	60	303	7,792,873
07 Agricultural Services	496	3,162	59,201,677
08 Forestry	31	116	3,814,804
MINING	861	22,457	1,124,685,481
10 Metal Mining	6	83	2,958,107
12 Coal Mining	416	17,599	945,289,742
13 Oil and Gas Extraction	391	3,883	140,354,643
14 Nonmetallic Minerals, except Fuels	48	892	36,082,989
CONSTRUCTION	5,420	34,197	1,108,468,865
15 General Building Contractors	2,067	9,480	250,509,552
16 Heavy Construction, exc. Building	525	7,479	298,282,802
17 Special Trade Contractors	2,828	17,238	559,676,511
MANUFACTURING	2,080	77,401	2,957,948,279
20 Food and Kindred Products	58	4,405	111,532,221
22 Textile Mill Products	6	544	13,072,020
23 Apparel and Other Textile Products	42	916	16,026,945
24 Lumber and Wood Products	757	11,054	268,450,828
25 Furniture and Fixtures	35	599	13,285,599
26 Paper and Allied Products	17	1,243	38,374,609
27 Printing and Publishing	222	5,840	143,318,801
28 Chemicals and Allied Products	76	13,411	890,419,650
29 Petroleum and Coal Products	23	727	31,563,410
30 Rubber and Misc. Plastics Products	52	3,777	105,952,587
32 Stone, Clay, and Glass Products	146	5,932	180,917,911
33 Primary Metal Industries	44	9,955	460,226,798
34 Fabricated Metal Products	136	5,831	209,706,749
35 Industrial Machinery and Equipment	286	5,124	176,156,404
36 Electronic & Electric Equipment	27	1,610	57,666,795
37 Transportation Equipment	38	3,793	167,526,772
38 Instruments and Related Products	43	1,495	46,653,669
39 Misc. Manufacturing Industries	69	908	19,938,809
TRANSPORTATION & PUBLIC UTILITIES	2,644	34,084	1,329,868,383
41 Local and Interurban Passenger	115	1,582	27,672,108
42 Trucking and Warehousing	1,401	10,919	305,454,213
44 Water Transportation	55	1,220	48,480,125
45 Transportation By Air	96	2,119	68,538,744
47 Transportation Services	98	654	18,145,641
48 Communications	488	8,381	328,308,339
49 Electric, Gas, and Sanitary Services	390	9,168	531,776,261

INDUSTRY BY 2-DIGIT CODE	UNITS	EMPLOYMENT	WAGES (in $$)
WHOLESALE TRADE	3,353	29,828	1,034,056,501
50 Wholesale Trade-Durable Goods	2,225	18,363	656,089,147
51 Wholesale Trade-Non-durable Goods	1,129	11,465	377,967,354
RETAIL TRADE	10,113	131,777	1,950,650,796
52 Building Materials & Garden Supplies	547	5,939	129,097,588
53 General Merchandise Stores	441	19,465	290,522,215
54 Food Stores	1,379	20,342	277,902,247
55 Automotive Dealers & Service Stations	1,704	16,869	386,493,934
56 Apparel and Accessory Stores	496	4,730	60,204,738
57 Furniture & Home furnishings Stores	701	4,316	86,110,737
58 Eating and Drinking Places	2,969	45,117	445,900,168
59 Miscellaneous Retail	1,877	15,001	274,419,169
FINANCE, INSURANCE, & REAL ESTATE	3,508	26,807	805,269,293
60 Depository Institutions	728	10,631	285,830,866
61 Non-depository Institutions	218	2,197	68,824,198
62 Security and Commodity Brokers	163	810	64,430,225
63 Insurance Carriers	226	3,212	121,079,256
64 Insurance Agents, Brokers, & Service	820	4,490	129,205,701
65 Real Estate	1,257	4,891	102,081,125
67 Holding and other Investment Offices	98	576	33,817,922
SERVICES	14,901	190,185	4,660,290,459
70 Hotels and Other Lodging Places	382	9,581	149,649,371
72 Personal Services	1,031	6,249	102,699,333
73 Business Services	2,164	31,135	592,319,577
75 Auto Repair, Services, and Parking	1,158	5,247	103,963,004
76 Miscellaneous Repair Services	428	3,043	89,990,099
78 Motion Pictures	211	1,523	18,423,768
79 Amusement & Recreation Services	530	9,108	128,811,793
80 Health Services	3,231	74,805	2,339,891,565
81 Legal Services	1,017	5,452	182,757,060
82 Educational Services	155	4,335	107,333,859
83 Social Services	1,193	19,839	308,390,873
84 Museums, Botanical, Zoological Gardens	14	173	3,052,024
86 Membership Organizations	790	5,503	79,582,897
87 Engineering & Management Services	1,639	12,485	431,796,291
88 Private Households	937	1,615	19,826,826
89 Services, n.e.c.	23	92	1,802,119
NON-CLASSIFIABLE ESTABLISHMENTS	423	764	23,402,601
99 Non-classifiable Establishments	423	764	23,402,601
GOVERNMENT	2,619	133,981	4,112,434,739
Federal Government	811	21,807	1,000,849,551
State Government	869	40,845	1,241,792,300
Local Government	940	71,329	1,869,792,888

Coal mining and processing remains one of the largest employers and revenue generators within the State. Appendix L shows the dollar value of the Coal Severance Taxes distributed throughout the State. Significant volumes of coal are exported from the State to fuel power plants along the lower Ohio River and industrial uses in Europe. In 2000, West Virginia mines produced 169 million tons of coal, accounting for approximately 15% of all coal produced in the nation. The State exports over 50 million tons of coal to twenty-three nations accounting for approximately 47% of all U.S. coal exports. Remaining, recoverable coal resources in the State indicate that mining will continue to be a strong influence in the State's economy unless environmental concerns and global market forces turn towards alternative energy sources. Figures 1-7 and 1-8 show the distribution of surface and underground mining permits in the State.

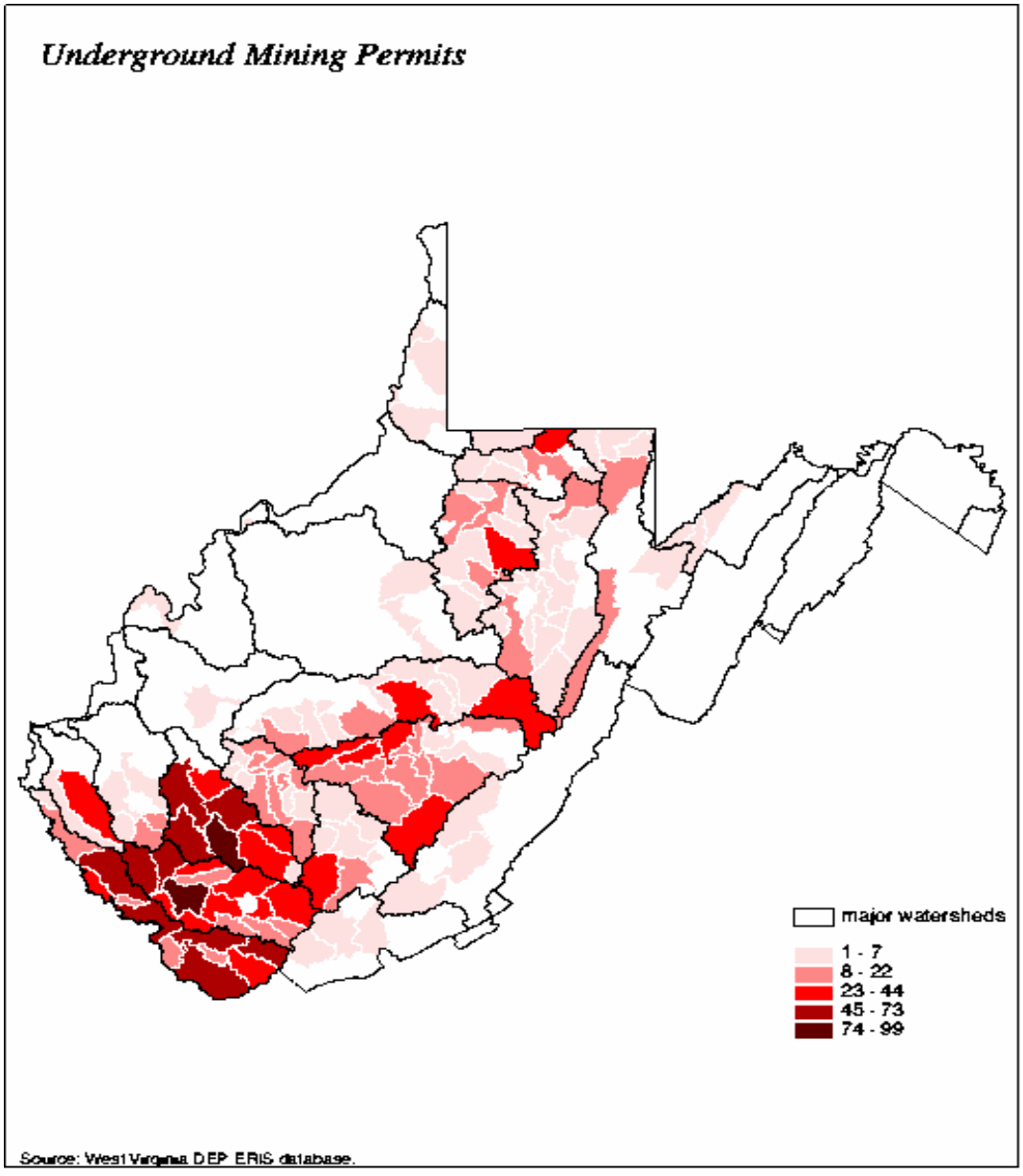


Figure 1-7. Underground Mining Permits

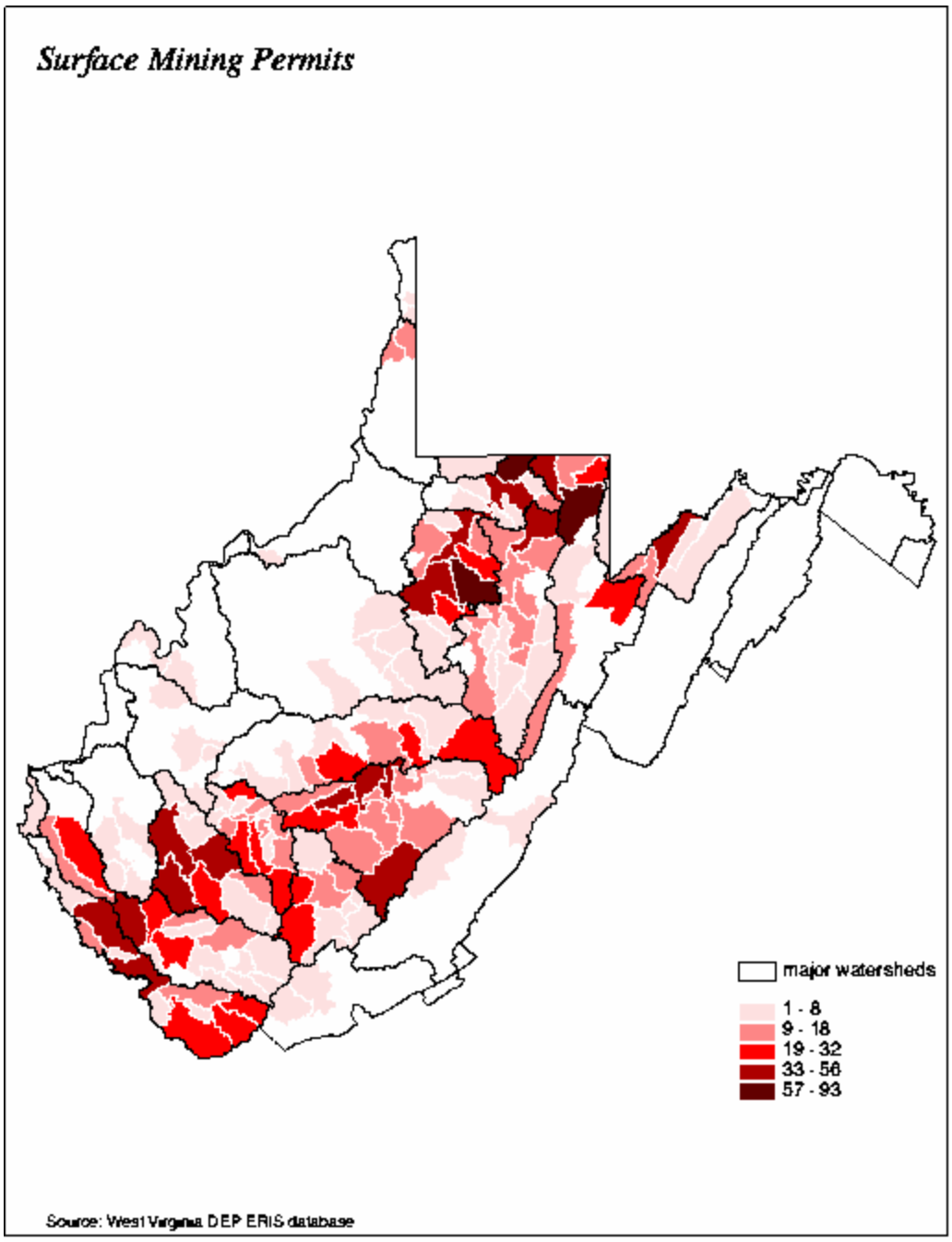


Figure 1-8. Surface Mining Permits

Harvesting and processing of wood resources in the Mountain State is a significant part of the economy for several regions of the State. As a part of the great mixed-mesophytic Appalachian Forest complex, the State's forests represent a renewable resource of inestimable value. Most of the prime forest resources are located within the most scenic and fragile ecosystems within the State. Figure 1-9 shows the percentage of each watershed covered by mixed forest (deciduous and coniferous) resources.

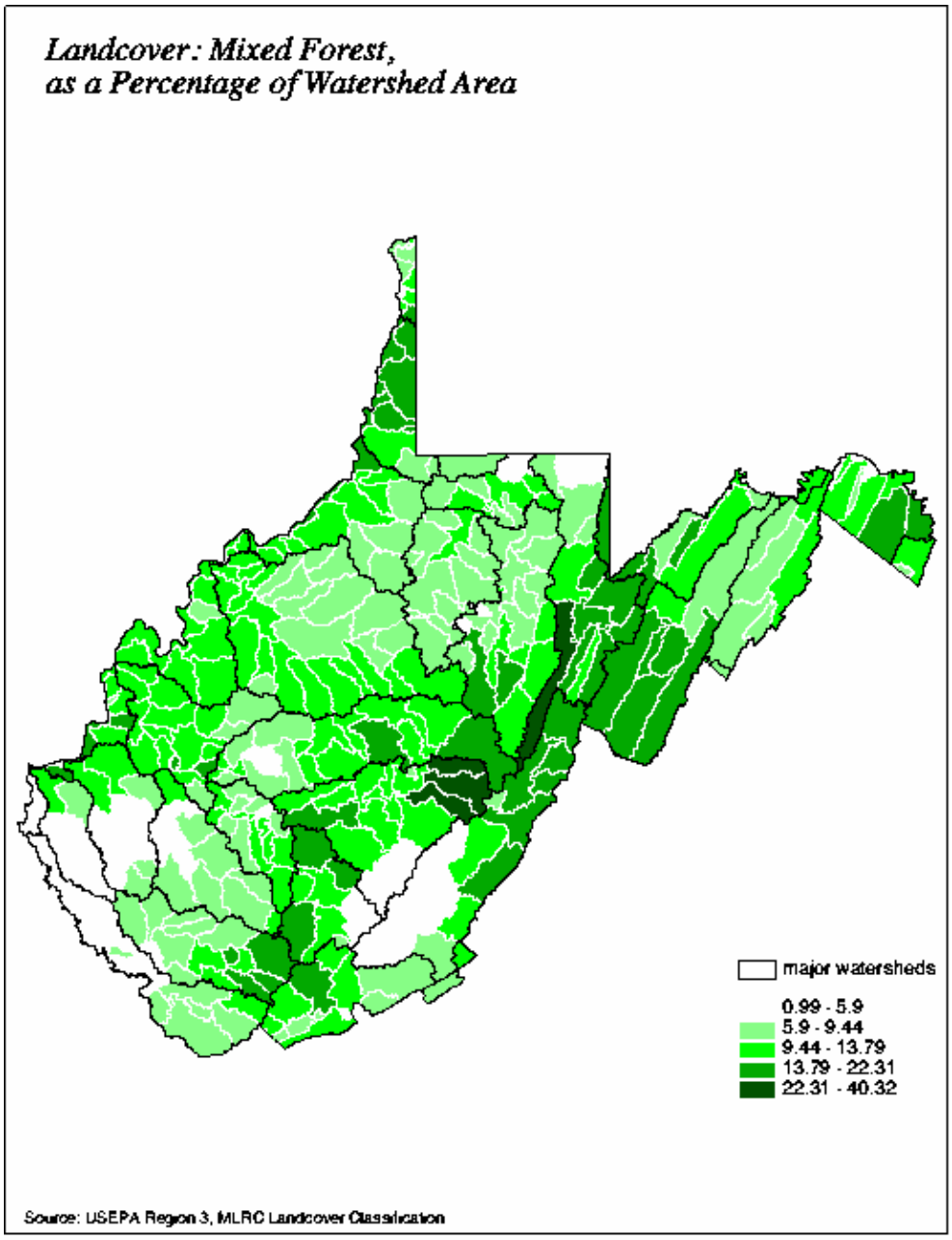


Figure 1-9. Mixed Forest Coverage by Watershed

Through wise silvicultural practices, the State's forests could provide endless employment opportunities in timber harvesting, processing and end-product development and manufacturing. Advances in wood product manufacturing and forest development have uncovered numerous opportunities within the State. Significant volumes of wood products are exported from the State to both national and international markets. However, wood resources must be developed in a responsible manner to assure that the State's forests and associated aquatic ecosystems are not irretrievably damaged.

Although not as extensive as the coal and forest resources described above, gas and oil resources in the State are substantial and provide both employment and revenue to the population. Figure 1-10 shows the extent of the gas and oil fields in the State. The majority of these fields are located within the Little Kanawha River, Lower Kanawha River, Coal River, Lower Guyandotte River and Twelvepole Creek watersheds. Several of the now depleted fields are used to store gas supplies. Exploration, extraction and processing of these resources must be accomplished with consideration for protection of surface and groundwater resources. Construction of exploration roads and preparation of drilling sites can seriously affect adjacent waterways and critical species areas. Likewise, potential flooding of these fields results in losses in production and damages to transmission facilities.

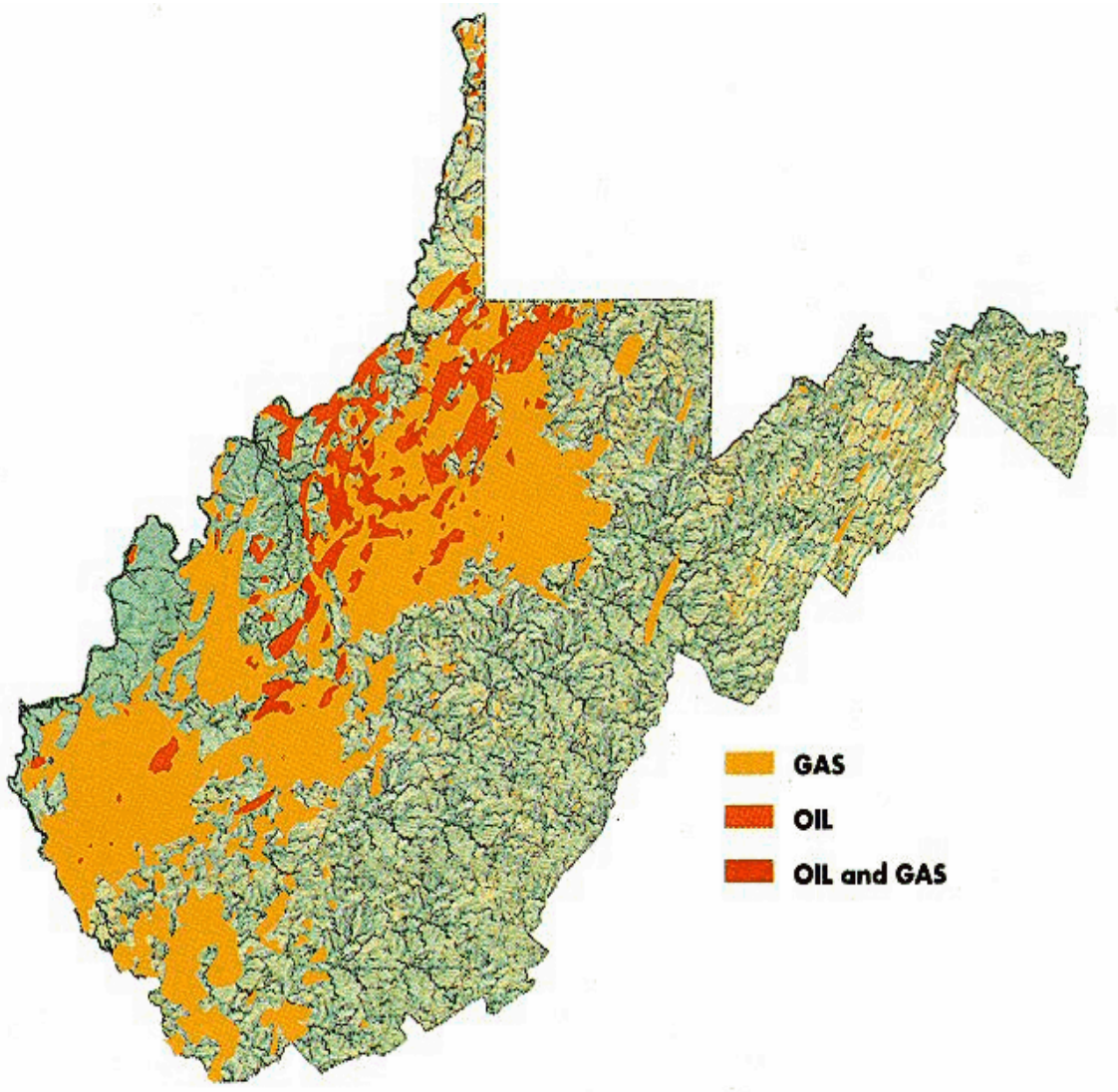


Figure 1-10. Location of Oil and Gas Fields

Small communities inhabit the narrow floodplains in the valleys and coalmines sprawl across and through the mountains. Residential, institutional, and commercial development in the region is generally found in the floodplains. In addition to the 55 county seats, there are approximately 190 other municipal areas in the State that provide employment and services to the surrounding rural county population. Many of these communities are located within floodplain areas. Figure 1-11 shows the population density for each of the watersheds in the State. Most transportation arteries, including railways and highways, as well as most utility distribution networks and facilities, are located in the floodplains. Fortunately, most cellular phone and radio transmission facilities that are critical to emergency communications during floods are located on the ridges and mountaintops.

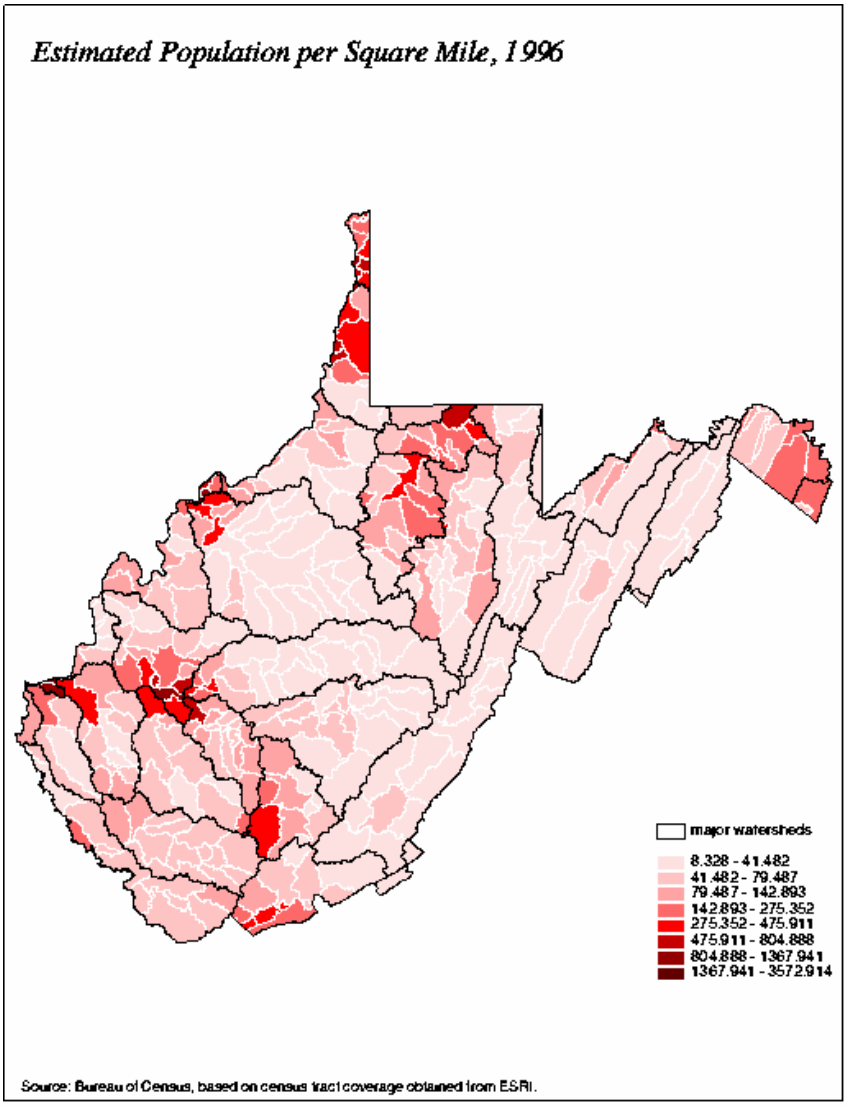


Figure 1-11. Population Density by Watershed

Historically many of the State's largest industrial complexes were located within floodplains to take advantage of transportation routes (roads, railroads, and waterways) and large expanses of flat land for production and storage facilities. Major industrial complexes in the Kanawha River Valley and along the Ohio River are largely protected by upstream dams and floodwalls.

Of the State's many assets, colleges, universities and vocational schools provide the intellectual capital necessary to power the State's research, production, and service industries. Many of these institutions are located at municipalities within floodplain areas and therefore subject to flood damages. These institutions also provide substantial employment opportunities and act as magnets for residential and service industry growth.

West Virginia is blessed with great natural beauty and a varied landscape that contains a wide variety of terrestrial and aquatic ecosystems. Many of these ecosystems are linear in nature following river corridors within the floodplain. Figure 1-12 shows the distribution and concentration of wetland acres within the State.

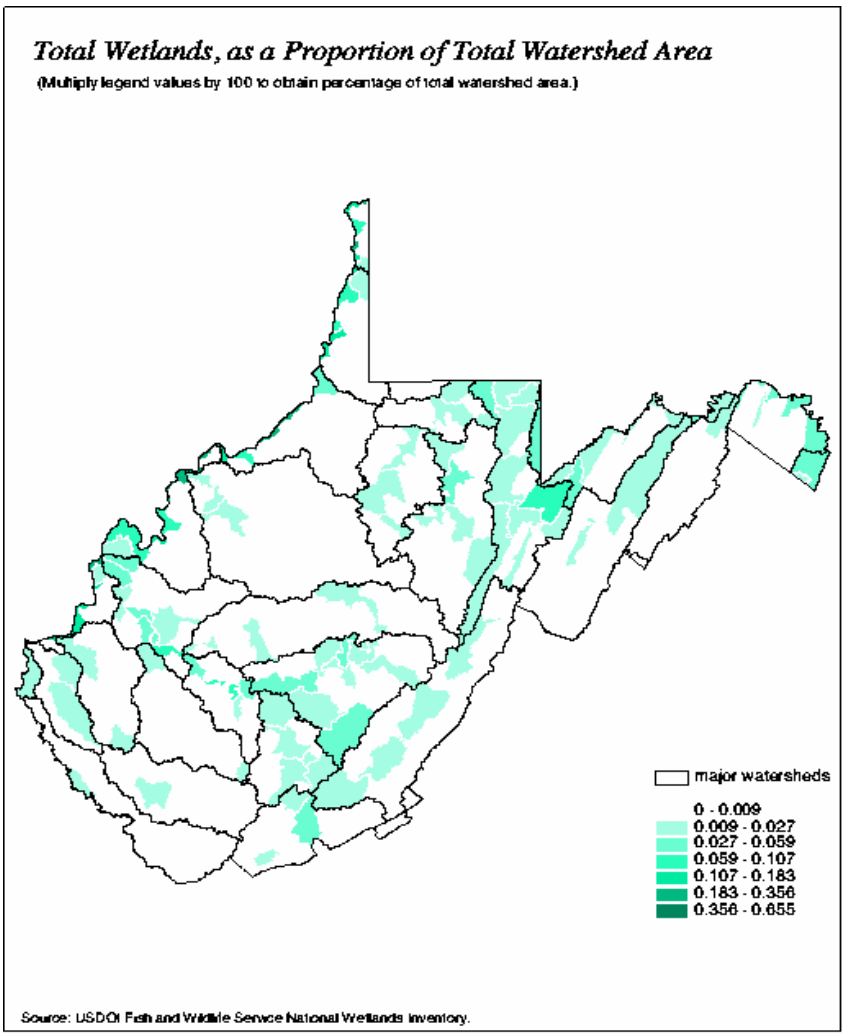


Figure 1-12. Acres of Wetlands as Percentage of Total Land Area by Watershed

These sensitive ecosystems are continually at risk from land development (structures, transportation routes and utility corridors), resources extraction and pollution. Our environmental resources represent a significant component of the foundation of the tourism industry in the

State. In 2000, approximately 21 million visitors contributed $3.9 billion to West Virginia's economy supporting 83,900 jobs.

The beauty and landscape of the State concurrently entices and hinders settlement by humans. Historically, development in the "Mountain State" has occurred within the floodplains of steep-sided, narrow valleys where most transportation routes and the majority of developable land are located. The State is likewise blessed with abundant natural resources including timber, coal, minerals, natural gas, and abundant water resources located in numerous watersheds.

Unfortunately, development of the natural resources in these watershed areas has led to significant non-point pollution and sedimentation in the State's streams. This process has been accompanied by permanent occupation of residential, commercial and industrial uses that increase stormwater runoff volumes well beyond the conveyance capacity of the resident streams. This largely unplanned combination of human settlement, natural resources development and floodplain intrusion has led to flood damages throughout the recorded history of the State. Recurring cycles of statewide damages continues to drain the financial and service resources of the local and State governments and further depresses the morale of the citizens. The correction of flood damages within the State is one of many significant issues facing State and local government.

2. Issues Identification and Assessment

The problems of flooding and flood damages in the State are numerous and complex. Through a series of workshops conducted between January and July 2001, the Task Force collected information from citizens and officials throughout the State. The following discussions highlight the primary issues raised both during those workshops and by members of the Task Force. The specific recommendations relating to these issues and findings can be found in Chapter VI. An extensive discussion of each topic with alternative recommendations can be found in this Plan and in the appendices.

a. Flooding

Issue: The public perceives nature as something that can be controlled and natural disasters as something that can be prevented.

Findings:

- Flooding is a natural disaster. Mankind is not and never will be able to prevent floods.
- Damage from flooding can be reduced by taking several common sense steps that will divert flood waters away from existing communities, remove man and his creations from the path of the flood water, eliminate new structures in the path of future floods and/or reduce the elevation of the flood water.
- Many things, such as land use conversion, inappropriate construction, inadequately designed stream crossings, and placing fill material in stream channels and floodways exacerbate flooding.

b. Floodplain Management (Appendix A)

Issue: The quality and consistency of the administration and enforcement of the National Flood Insurance Program have been sporadic in West Virginia. This condition has

resulted in unwise development within the State's floodplains in spite of officially enacted floodplain management ordinances.

Findings:

- In the years between 1996 and 2004 all 55 counties in West Virginia have been impacted by flooding.
- County and municipal governments in West Virginia do not adequately manage development in the floodplain.
- In some instances, local officials are aware of the floodplain ordinances, but either have ignored them or have subverted the variance process due to political and economic development pressures.
- The State Administration has not publicly endorsed the need for or the importance of strict enforcement of the floodplain management ordinances enacted by county and municipal governments under the National Flood Insurance Program.
- County and municipal departments responsible for regulating development in floodplains need additional funding, staffing, training, and certification.
- Enforcement of floodplain-management ordinances is inconsistent and inadequate. The State needs to improve oversight of floodplain management to ensure consistent enforcement statewide.
- Increasing amounts of floatable structures and materials are being placed and stored in the State's floodways. These structures and materials are transformed, during a flood event, into floatable debris that can cause extensive damages downstream. Currently, there is little control or regulation of the placement of these floatable hazards in the floodway.

c. Flood Warning System (Appendix B)

Issue: Flood warnings are not always received and understood by the public in a timely manner.

Findings:

- The existing system of rain and stream gages within West Virginia has some geographical gaps in coverage and does not provide the National Weather Service the information needed in a timely manner. These gaps increase the risk to lives and property of West Virginia residents. Appendix B shows the distribution of rain and stream gages throughout the region.
- The data obtained from rain and stream gages are not archived in one system that is accessible to the public.
- Communication software for the warning system needs to be improved.

- Current funding levels to support annual operations and maintenance costs associated with the existing system of rainfall and stream flow gages are insufficient to adequately maintain the system.
- Some jurisdictions and individuals don't receive flood warnings in a timely manner.
- The rural nature of West Virginia prevents some individuals from receiving flood warnings via the normal communication network.
- Some rain gages are vandalized on a regular basis, resulting in unforeseen gaps in data.
- Motorists are unaware of the dangers that inundated roadways and stream crossings can pose.
- The existing municipal and county evacuation plans are not consistent statewide and do not always follow the framework provided by the WV Office of Emergency Services.

d. Floodplain Mapping (Appendix C)

Issue: Existing floodplain maps are insufficient to make accurate determinations of flood hazard for new floodplain construction or to effectively manage or enforce the floodplain management ordinances.

Findings:

- West Virginia's floodplain mapping was initiated in 1970. The determination of floodplain areas to be mapped during this time period was based upon the population density of the floodplain area and not development potential. Therefore numerous floodplain areas (especially tributary streams) were not mapped in detail leaving many gaps in the floodplain mapping.
- Due to the age of the current floodplain mapping, many modifications to the river corridors have not been accounted for on the mapping. These mapping "gaps" and "outdated" maps further complicate management and enforcement by county and municipal floodplain managers.
- Existing floodplain maps don't provide sufficient detail to easily and accurately locate property in all cases. Through FEMA's Map Modernization Initiative, many maps in West Virginia will be improved and converted to electronic format.
- Floodplain maps aren't available electronically as "layers" useful in digital mapping applications, enforcement, or planning. Watersheds of less than 1 square mile haven't been mapped.
- Digital floodplain maps compatible with Geographic Information System (GIS) layers are needed to facilitate planning and enforcement.
- Several agencies are spending scarce State and Federal funding to develop digital maps of the same regions.

- There's no current approved program for systematically studying and identifying flood-hazard areas.
- Existing floodplain maps (Flood Insurance Rate Maps) don't delineate potential flooding caused by failure of existing dams under sunny day or heavy rainfall failure conditions.
- Dam-failure inundation maps do exist for some Federal structures and selected State-regulated dams, but all of that data is not available in an electronic format suitable for public use.

e. Flood Damage Assessment (Appendix D)

Issue: Information on potential flooding problems and flood damages within the State isn't easily accessible to Federal, State, or local agencies or to the public.

Findings:

- Each agency defines flood damages in a different manner based on the mission of that particular agency. It's difficult to access or compare the variety of data maintained by the Federal, State, and non-governmental organizations involved in flooding and floodplain management.
- Information on flooding and flood damage is held by several different agencies in several different formats. Since no one agency is responsible for keeping all flood-damage data current, available data is typically outdated and unreliable for predicting future damages.
- Flood and flood damage data is either kept on a county-by-county basis or on a watershed basis. It's difficult to reconcile the two collection systems using the available data.
- It's unclear which Federal or State agency or organization maintains what flood and flood damage data or whom to contact for flood information.

f. Building Codes, Permitting, and Enforcement (Appendix E)

Issue: The current building codes being used in the State do not adequately address floodplain construction and drainage issues. Inadequate floodplain construction can result in increased structural damages and increased downstream flooding and flood damages.

Findings:

- Section 29-3-5b of the West Virginia Code specifies that the State Fire Commission shall adopt a building code for use by local entities throughout the State.
- The current State Building Code does not address manufactured housing. Manufactured housing is regulated by a separate agency (The Manufactured Housing Construction and Safety Board). This agency is located in the WV Division of Labor and is charged with enforcing Federal (HUD Manufactured Housing Code) standards. Although enforcement has recently improved, historically these codes have not been adequately enforced. During recent floods, extensive damage has been generated by floating manufactured housing that was installed in violation of code standards.

- Many structures are built in the floodplain to an elevation that is unlikely to reduce or prevent flood damages.

- Many local officials and the general public are not aware of the regulatory permitting requirements of the Federal Clean Water Act, the State permitting requirements under West Virginia Division of Environmental Protection or the Public Lands Corporation (WVDNR).

g. Environmental Impacts of Flooding (Appendix F)

Issue: Mankind's intrusion into the floodways and floodplains creates significant positive and negative environmental impacts. Some of these intrusions place peoples' lives and property in the area of greatest flooding potential.

Findings:

- Floodplains are natural landforms that must remain functional so water flows can be discharged without causing excessive damage to human lives and property.

- Man-made structures and impediments can negatively impact the water flow and impair the natural functions of the floodplain.

- Wetlands are important because of their wildlife habitat value, ability to store stormwater runoff, ability to facilitate aquifer recharge and infiltration of groundwater, and for their ability to take up and attenuate water-borne pollutants.

- Stable streams have a dimension, pattern, and profile that convey the range of flows and effectively transports the sediment produced within the watershed such that the stream neither aggrades (fills in) nor degrades (scours). Stable streams may or may not also be defined as high-quality streams.

- The accumulation of solid waste, hazardous materials, and floatable debris in the floodplains may cause stream-crossing blockages, impede the discharge of flood flows, and create significant hazards during flood events.

- There are a number of activities occurring within the State's watersheds that can negatively affect our streams. Those activities include:

    1. Resource extraction,
    2. Road construction,
    3. Commercial, industrial and residential development,
    4. Recreation (water based, in-stream and along stream)
    5. Increased erosion and sedimentation from land development and agricultural practices.
    6. Loss of riparian buffers
    7. Deforestation through fires or development.

- Agencies do not always consider the long-range effects of their in-stream activities during removal of debris blockages immediately after a flood event.

h. Stream Crossings and Access Roads (Appendix G)

Issue: Incorrectly designed, installed or constructed corrugated metal and concrete box culverts, bridges, and other stream crossings may be easily blocked by debris and therefore contribute to local flooding. Regulation of the design, installation, and maintenance of culverts and other stream crossings is often inadequate or non-existent.

Findings:

- Some public and private stream-crossing culverts have not been properly sized or constructed and many of those stream crossings have not been properly maintained.
- The effects of potential development in watersheds located upstream of stream crossings haven't been given adequate consideration when designing the initial crossing. The Division of Highways (WVDOH) has recently requested that site development within watersheds upstream of their constructed stream crossings include stormwater detention structures before issuing permits for access to public highways.
- Local floodplain management ordinances are often overlooked or ignored during design, construction, and maintenance of stream crossings.
- Debris blockages at stream crossings often result in increased flooding levels in the vicinity of the stream crossing that are greater than that predicted on Flood Insurance Rate Maps (FIRM's).

i. Dredging (Appendix H)

Issue: The public has long perceived that dredging of streams and rivers is an acceptable and effective means of reducing the negative effects of floods. For this reason, the public continues to request that streams and rivers throughout the region be dredged to reduce flooding.

Findings:

- High water events that occur on a frequent basis (2 to 5 years) are normally contained within the stream channel or result in nuisance flooding (shallow flooding of yards, basements, and outbuildings). Removal of woody debris, trash and sediment on a frequent basis typically has a minimal effect on the elevation of these events.
- Low frequency flood events (25 to 100 years) usually overflow the existing stream channel and occupy the defined floodplain. These floods have greater depth of water, higher velocities, cover broader areas and cause extensive damages to roads, bridges, utilities, residential and commercial structures.
- There are a number of flood recovery, flood damage reduction and both commercial and recreational river traffic maintenance activities that are included under the term "dredging". The purposes for, effects from and impacts of each can be widely different.

- Dredging, as perceived by the public, is the removal of sediment and streambed material in an attempt to confine all flood-flows within the reconstructed stream channel.
- The Corps of Engineers conducts dredging on several rivers within West Virginia to maintain authorized commercial navigation channels.
- Many commercial terminal owners dredge sediment material from their docks to allow access by commercial barges and towboats.
- The Corps of Engineers conducts snagging and clearing projects in West Virginia under Section 208 of the Continuing Authorities Program (CAP) that remove standing and fallen vegetation from the stream corridor to increase the hydraulic efficiency of the stream channel to pass flood waters.
- Both the Corps of Engineers and the Natural Resources Conservation Service design and construct channel modification projects that enlarge the carrying capacity of stream and river channels to pass large flood flows through affected communities. These projects are effective in reducing flood damages, but they require sustained annual maintenance of the channel to maintain their effectiveness.
- The WV Conservation Agency in partnership with local conservation districts and the Natural Resources Conservation Service conducts stream channel restoration activities to recover a portion of the hydraulic efficiency of the stream channel following flood events.
- Figures numbered L-3 and L-4 in Appendix L – Dredging show the differences in channel modification for flood damage reduction and excavation for stream channel restoration and the anticipated effects on flood heights.

- Stream dredging causes environmental impacts to the aquatic and riparian communities located within and along the stream channel. These impacts are long-term due to the need for annual maintenance of the channel.

- Many private citizens are unaware of the regulatory permits required under the Clean Water Act to conduct construction activities within the waters of the State. Channel excavation projects conducted by the Federal and State agencies and by commercial terminal operators are evaluated for environmental impacts through the permitting process (see Appendix D – Building Codes, Permitting and Enforcement)

- Deposition of dredged materials from the stream channel within the regulatory floodway negates and in some cases amplifies the flooding heights in the local area due to blockage of the flood flows.

- Stream channel restoration as defined above may reduce flooding on smaller, more frequently occurring flood events, if, and only if, the project is properly constructed and continually maintained. This type of stream channel modification has little to no effect on larger, less frequent floods that require the entire floodplain to discharge the flows.

- Attempts to increase channel capacity by altering the dimension, pattern, and profile of a stream will cause bank erosion, lateral stream migration, channel down-cutting and increased sedimentation. Ultimately this will lead to increased flooding and flood-related damage both upstream and downstream from the dredged segment.

- In most cases the negative impacts far outweigh any positive benefits attributable to stream dredging.

j. Resource Extraction (Appendix I)

Issue: During the public workshops it became apparent that the public perceives mining, forestry operations and other resource extraction activities as being major contributors to flooding in West Virginia. Based on the information from these workshops, many individuals believe resource extraction should be more strictly regulated or stopped.

Findings:

- The Department of Environmental Protection has determined, through a study of two watersheds in southern West Virginia that mining and forestry operations may have had a combined effect of –3% to +21% on the discharge of water during the flood of July 8, 2001.

- Forested land adsorbs approximately 90% of all rainfall through interception, infiltration and soil moisture storage; even so the forest cannot prevent floods.

- Forests do prevent erosion and sedimentation, thus forests help maintain stream-channel capacity so they can carry storm flows with a minimum of flooding.

- Forestry operations increase erosion not by removal of the tree itself, but by the soil disturbance that accompanies the cutting and removal of the tree. Infiltration of stormwater is decreased, and erosion increased only to the extent that the forest soil is disturbed and compacted.

- Most land where forestry operations have occurred remains bare for a very short period, before rapid re-growth covers it with sprouts, tree seedlings, and herbaceous vegetation.

k. Stormwater Management (Appendix J)

Issue: Excessive uncontrolled and unregulated stormwater runoff volumes create nuisance flooding in many areas of the State and the cumulative effect of these incremental runoff volumes contribute to regional flooding events within the State.

Findings:

- Conversion of forested lands into land uses that increase the impermeability of the soil result in increased stormwater runoff.

- Installation of impermeable pavements and roof surfaces increases the likelihood of excessive stormwater runoff.

- Increased stormwater runoff from any one source or multitude of sources that exceeds the capacity of the receiving streams will result in flooding and may damage the stream channel stability and the riparian ecosystem.

    - The quality of stormwater generated by land conversion from some sites is regulated through WVDEP's NPDES permit system.

- Some counties and municipal governments regulate stormwater runoff volume through local ordinances.

- Increased residential and commercial growth within rural watersheds upstream from municipalities generates increased stormwater runoff and nuisance flooding in municipalities.

- Most industry standards require stormwater facilities to be designed to retain rainfall events in the 20-25 year frequency storm range. Rainfall events that exceed this standard will exceed the carrying capacity of most stormwater facilities.

l. Education (Appendix K)

Issue: Education of floodplain management professionals, political leaders, and the public is inadequate regarding the causes of flooding, alternative methods of reducing flood damages, regulatory permit requirements and floodplain management issues.

Findings:

- The risks and consequences of living in the floodplain are unknown to most residents and business owners. In addition, the methods of reducing these risks aren't commonly known or understood.

- In some cases risks and methods of reducing those risks are known and ignored by floodplain residents.

- Citizens, business owners, and public officials are unaware of the risks and consequences of potential dam failures in their areas.

- Few public officials or citizens are taking advantage of the available training in floodplain management, mitigation, and retrofitting residences to make their structures more resistant to flooding.

- Educational outlets in West Virginia (vocational-technical schools, community colleges, publicly owned colleges and universities) don't address floodplain management issues or flood-damage reduction issues.

- The requirements and processes for obtaining regulatory permits under the Clean Water Act to perform construction activities within the waters of the State are not well understood by the general public.

- FEMA provides funding for State-specific training for various disaster-preparedness situations that would benefit the region's floodplain managers, public officials and citizens.

- There is a lack of communication between the public and both Federal and State agencies regarding flooding and floodplain management issues.

m. Existing Flood-Prone Structures and Facilities (Appendix L)

Issue: Prior to the advent of the National Flood Insurance Program in 1979, a substantial number of structures and facilities were constructed within the designated 100-year frequency floodplain. Most of those structures and facilities were not constructed in such a way to avoid flood damages. Many of these structures and facilities remain subject to annual flood damages.

Findings:

- According to current information, it is estimated that at least 110,000 – 112,000 structures (residential, commercial and institutional) and associated facilities are located within the 100-year frequency floodplain in West Virginia. Table L-1 of Appendix L shows the potential numbers of structures and associated damages in the State's floodplains.

- Pre-FIRM (Flood Insurance Rate Map) structures and facilities were "grand-fathered" into the NFIP program as the various county and municipal floodplain management ordinances were enacted.

- The 2000 Census indicates that as much as 70% of the State's housing stock was constructed prior to the advent of the NFIP in West Virginia.

- A substantial number of those structures in the floodplain are located within the regulatory floodway as defined by the Flood Insurance Rate Maps (FIRMS).

- These pre-FIRM structures and facilities comprise a substantial portion of the damageable property located in the State's floodplains.

- Structures located within the regulatory floodway are subjected to frequent damaging floods that are characterized by high-velocity floodwaters, floatable debris and transported sediments.

- The number of these pre-FIRM damageable structures only decreases through catastrophic flooding losses, structure fires or structural deterioration and then only through strict enforcement of the existing floodplain management ordinances.

3. Identification of Existing Roles

This section will discuss government programs that have impacts on floodplain management and flood damage reduction. While many programs can have an impact on or can be impacted by flooding, this section is pointed toward those with greatest potential impact on floodplain management and flood damage reduction in West Virginia. Contact information for these agencies and other organizations can be found in Appendix P.

a. State Agencies

West Virginia Board of Examiners of Land Surveyors

P. O. Box 925
Fayetteville, WV 25840
(304) 574-2980

This Board is responsible for licensing surveyors. Licensure requires a certain level of knowledge to be displayed to obtain the license. Licensure can require agents to prove knowledge concerning floodplain location, use of floodplain maps, elevation certificates, basic flood-insurance knowledge, etc.

West Virginia Conservation Agency

1900 Kanawha Boulevard East
Charleston, WV 25305-0193
(304) 558-2204

Chapter 19, Article 21A of the West Virginia Code authorizes the creation of the State Conservation Committee and the Conservation Districts. The purpose is to conduct surveys, investigations, and research relating to the character of soil erosion, floodwater, and sediment damage to the conservation, development, use, and disposal of water and the preventive and control measures needed. The Conservation Agency is the umbrella under which the 14 districts operate. The Agency reviews and makes recommendations to the State Conservation Committee on all applications for assistance and final reports for all work carried out in the State under the

Watershed Protection and Flood Prevention Act (PL 566), administered by the USDA - Natural Resources Conservation Service (NRCS).

Watershed Resource Center

The Watershed Resource Center (The Center), funded through US Environmental Protection Agency, WV Department of Environmental Protection, and the WV Conservation Agency is West Virginia's centralized resource for watershed information. The Center provides training, information transfer and assistance to the local watershed associations and groups throughout West Virginia. Development of the resources needed by watershed groups, agencies, and others, both physical and web based, is another service provided by the Center. In addition, specific training and education, identified by local groups as necessary to understand their watershed and the variety of impacts and solutions available to them, is provided.

The Center could serve as a clearinghouse for flood information as well as be a contact for watershed and community groups working with flooding issues. The Center disseminates information on watershed issues through a variety of means including a web based list serve, a quarterly newsletter, its web site – www.wvwrc.org, attendance at watershed meetings, and through training provided to watershed groups.

West Virginia Department of Environmental Protection Division of Water and Waste Management

601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

The Division of Water and Waste Management (DWWM) implements programs to protect the quality of water resources of the State.

DWWM programs cover water-quality assessment and certification, permitting and engineering, construction assistance, groundwater protection, dam safety, and environmental enforcement. Significant portions of the Division of Water and Waste Management's responsibilities are designated to administer Federally mandated water-quality programs. Programs such as the National Pollutant Discharge Elimination System (NPDES), a water-pollution control permitting strategy; and underground injection control (UIC), a groundwater-protection permitting plan; strive to meet Clean Water Act objectives. The State revolving fund (SRF), a low-interest loan program, focuses on West Virginia communities seeking financial assistance to plan and construct sewer projects. The 401 Water Quality Certification program reviews and prepares certification responses for Army Corps of Engineers 404 permits and Federal Energy Regulatory Commission license applications.

Rules/regulations/laws
WV Code, Chapter 22, Article 11 – Laboratory Certification
WV Code, Chapter 22, Article 11 – Water Pollution Control Act
WV Code, Chapter 22, Article 12 – Ground Water Protection Act
WV Code, Chapter 22, Article 13 – Natural Streams Preservation Act
WV Code, Chapter 22, Article 14 – Dam Control Act
WV Code, Chapter 22, Article 15 – Solid Waste Management Act
WV Code, Chapter 22C, Article 02 – Water Pollution Control Revolving Fund Act
Regulation, Title 46, CSR, Series 1, 12
Regulation, Title 47, CSR, Series 3, 5A, 10, 11, 26, 31, 34, 38D, 55, 56, 57, 58, 59, 60
Federal Clean Water Act
Federal Safe Drinking Water Act

Flood Recovery Assistance Role

The Department of Environmental Protection's Division of Water and Waste Management provides up-to-date information on the status of sewage, drinking water, and wastewater treatment systems damaged or inoperable because of a flood event. The Department provides technical assistance to the owners/operators of such systems to expeditiously bring them into compliance. Point of Contact: William D. Brannon (304-558-2107).

West Virginia Department of Environmental Protection
Division of Mining and Reclamation

601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

The Division of Mining and Reclamation (DMR) provides protection to the environment through the enforcement of West Virginia's Surface Mining Control and Reclamation Act (chapter 22, article 3) and Surface Mining and Reclamation of Minerals other than Coal (chapter 22, article 4). DMR also has jurisdiction in all matters pertaining to coal and other mineral resources (articles 11, 12, 13, and 14 of chapter 22, and article 1 of chapter 22B). This division establishes the goals and guidelines of the permitting program and is responsible for the review of all types of permit applications. Review teams in each of DMR's four regional offices consist of engineers, geologists, environmental inspectors, and resource specialists. Two subunits within permitting are responsible for specific application reviews: the hydrologic protection unit and the permit support unit. Inspection and enforcement of mining operations is an important function of the DMR. This section establishes and decides the goals and evaluation standards for inspection and enforcement activities.

Rules/regulations/laws
WV Code, Chapter 22, Article 3
WV Code, Chapter 22, Articles 11, 12, 13, 14
WV Code, Chapter 22B, Article 1
WV Code, Chapter 22, Article 4
Regulations, Title 38, Series 2 - West Virginia Surface Mining and Reclamation

Flood Recovery Assistance Role

The Department of Environmental Protection's Division of Mining and Reclamation maintains a listing of surface-mining permits and provides them to the West Virginia Housing and Development Fund, Office of Emergency Services, Federal Emergency Management Agency and other appropriate agencies and officials for potential use as temporary/permanent housing. In extreme situations, these sites may be useful for solid-waste disposal and burn sites. Point of Contact, Mike Shank (304-759-0520).

West Virginia Department of Environmental Protection
Office of Waste Management

601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

The Office of Waste Management (OWM) protects the public health and the environment by reducing the extent and duration of un-permitted releases. Through a technically sound compliance program, OWM works to ensure that an economic advantage is not gained by non-compliance. OWM operates two major sections, the Hazardous Waste and Solid Waste sections, with joint control over environmental enforcement.

Hazardous Waste section performs site inspections and compliance assistance, manages the technical and financial assurance requirements on the generation, collection, treatment, storage and disposal of hazardous waste by responsible persons and entities, resolves issues involving violations of environmental law, maintains an accurate database of underground storage tanks (UST) in West Virginia and this unit certifies UST workers.

Solid Waste section reviews and approves permits for all non industrial landfills and transfer stations, cleans up and reclaims open dumps and deals with the State closure of former unlined landfills. Environmental enforcement works with the Department of Environmental Protection's Division of Water and Waste Management. It promotes compliance by providing compliance assistance and/or enforcing permit conditions required of municipalities, solid waste facilities, industry and the public.

Rules/regulations/laws

WV Code, Chapter 22, articles 15, 16, 17, 18, 19
Regulations 47 CSR 35, 36, 37, and 38

Flood Recovery Assistance Role:

The Department of Environmental Protection's Division of Waste Management manages solid waste and hazardous waste handling and disposal. Following a flood event, access to permitted solid waste facilities, reopening of closed facilities or disposal and surface mine sites (only when absolutely necessary) is critical for disposal of the enormous amounts of solid waste generated. Hazardous waste handling, transporting and disposal, as well as coordination with the Federal Environmental Protection Agency, are equally critical. Contact Persons and telephone numbers: Sudhir Patel, Solid Waste, (304) 558-6350; Tom Fisher, Hazardous Waste, (304) 558-5989.

West Virginia Department of Environmental Protection
Office of Environmental Remediation

601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

The Office of Environmental Remediation (OER) was created in November 1997 to consolidate the agency's remediation programs. The organizational structure allows the office to focus its energy and technical talent solely on the remediation sciences and procedures used to restore a contaminated site. The office is committed to consistency among its cleanup programs. The office is organized along a project management function, which oversees site activities; and a technical support function, which provides specialized technical support. OER operates four sections, Brownfield/voluntary remediation, Leaking Underground Storage Tanks, Hazardous Waste Management and Superfund.

These sections encourage voluntary remediation activities and brownfield revitalization, provides oversight of the cleanup of releases of regulated substances from leaking underground storage tanks, piping, or overfill spills, administers the federal Resource Conservation and Recovery Act (RCRA) that oversees the investigation and cleanup of hazardous waste releases, and coordinates federal Superfund cleanups with the EPA and the U.S. Department of Defense.

Rules/regulations/laws
WV Code, Chapter 22, Articles 17, 18, 19, 22
State regulations, 60 CSR 3, 33 CSR 30

West Virginia Department of Environmental Protection
Division of Air Quality

601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

The Division of Air Quality (DAQ) develops and implements regulations and related programs mandated by the federal Clean Air Act, and the State Air Pollution Control Act. It works for the protection of public health, and the prevention or mitigation of environmental impacts, resulting

from air pollutant emissions. DAQ monitors air quality and regulates emissions of air pollutants from industrial and commercial facilities.

DAQ operates six sections that provide administrative support, monitors air quality; performs laboratory analyses of air quality samples, administers facilities that treat, store, and dispose of solid and hazardous waste, implements West Virginia's air permitting programs, and develops and revises the State implementation plan (SIP) that details how a state plans to attain and maintain compliance with National Ambient Air Quality Standards (NAAQS).

Rules/regulations/laws

Federal Resource Conservation and Recovery Act
Federal Clean Air Act
Federal Clean Air Act Amendments of 1990
State Air Pollution Control Act
Regulations, 45CSR13, 45CSR14, 45CSR16, 45CSR19, 45CSR23, 45CSR24, 45CSR25, 45CSR30, and 45CSR34

Flood Recovery Assistance Role:

The Department of Environmental Protection's Division of Air Quality regulates open burning, an issue that arises when handling and disposing of combustible flood debris by burning. Where appropriate, the Division of Air Quality waives strict compliance with the open burning regulations, but monitors, instructs and involves local fire departments in the appropriate methods for operating burn sites. Contact Person and phone number: Jesse Adkins (304) 926-3647.

West Virginia Department of Environmental Protection
Office of Oil and Gas

601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

The Office of Oil and Gas (OO&G) deals with all aspects of the oil and gas industry. These include: well work permitting, inspection, operator transfers, training of oil and gas operators, maintaining records on the 100,000 oil and gas wells drilled since 1860, environmental permits issued under solid waste and water pollution for the oil and gas production and transportation industry, gas storage wells, underground injection control (UIC) program, surface and mineral owner dispute resolution, evaluation and plugging of abandoned wells and clean up of polluted sites, and collecting, processing and maintaining Global Positioning System (GPS) data on all well locations.

OO&G operates three sections that address the permitting, enforcement and education of West Virginia's oil and gas industry; provide a forum to resolve disputes between affected parties in the oil and gas and coal industry through various hearings of the shallow gas review board, the

coal bed methane review board, and the oil and gas inspectors board; deal with the assessment of abandoned wells and oversees plugging of wells.

Rules/regulations/laws

WV Code, chapter 22, articles 6,7,8,9,10, 21
Regulation, 35 CSR 1-6

West Virginia Department of Environmental Protection Office of Abandoned Mine Lands & Reclamation

601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

A substantial number of acres of land in the United States have been disturbed by surface and underground coal mining. These un-reclaimed acres impose social and economic costs to residents, as well as impair environmental quality. With public health, general welfare, safety, and danger to property as its first priorities, the Office of Abandoned Mine Lands and Reclamation (AML&R) corrects hazardous conditions. The conditions are: old buildings, hazardous gases, refuse piles, abandoned equipment, subsidence, hazardous water bodies, mine drainage, clogged streams, mine entries (portals) and shafts, polluted water, mine fires, abandoned highwalls, and cleaning plants.

AML&R operates through eight sections responsible for the management and administration, decides what sites AML&R should reclaim, develops the most cost-effective and practical methods used to abate the many types of abandoned mine problems, obtains right-of-entry agreements from all private property owners and lessees for AML projects, administers construction contracts, in conjunction with The Federal Office of Surface Mining (OSM) addresses emergency problems and manages the water quality monitoring, and technical support for abandoned mine land reclamation environmental water pollution projects.

Rules, regulations, laws

Title IV, Surface Mining Control and Reclamation Act of 1977, of public law 95-87.
WV Code, Chapter 22, Articles 1, 3A.
WV Surface Mining Reclamation Regulation, Title 38, CSR-2D.

West Virginia Division of Forestry

Guthrie Center Building 13
1900 Kanawha Boulevard East
Charleston, WV 25305-0180
(304) 558-2788

The Division of Forestry (DOF), under chapter 19-1A-3 of the West Virginia Code, is charged with the protection and management of all West Virginia forest land resources. The DOF acts as the lead agency within the State to regulate and coordinate forestry activities of private industries

and landowners through partnerships emphasizing a stewardship ethic that protects, nurtures and promotes utilization and sustains the State's forest resources.

The DOF has a limited role regarding flooding events. However, many of the programs the DOF is charged with can have a positive impact on land use activities. Forest protection, Logging Sediment Control Act and management planning to name a few programs, all deal with land use activities and in part ensure those activities reduce or eliminate the movement of soil to our State's waters. These and other programs are ongoing across the State and will ensure our forests continue to provide jobs, scenic beauty, recreational opportunities and clean water.

West Virginia Division of Highways

Building 5, Room 109
1900 Kanawha Boulevard East
Charleston, WV 25305-0403
(304) 558-3505

The Division of Highways has limited responsibilities regarding flooding. Primarily, the Division maintains the highway system during and after flood events. Floodplain management by the Division is limited to monitoring highway construction activities to ensure new construction or maintenance does not increase the Base Flood Elevation. Indirect effects, however, may result from new construction incidental to the location of roads and highways in or adjacent to floodplains.

West Virginia Division of Labor

Building 3, Room 319
1900 Kanawha Boulevard East
Charleston, WV 25305-0570
(304) 558-7890

West Virginia Division of Labor – Manufactured Housing Section, licenses dealers and installers of manufactured homes and has rules concerning proper installation of manufactured homes including those located in the floodplain.

West Virginia Division of Natural Resources

Building 3, Room 669
1900 Kanawha Boulevard East
Charleston, WV 25305-0660
(304) 558-2754

One mission of the West Virginia Division of Natural Resources (DNR), under Chapter 20-2-1 of the West Virginia Code, is to protect and maintain all species of wildlife in the State for public benefits including hunting, fishing, recreational values, economic contributions and for scientific and educational uses.

DNR's role in floodplain management lies in its authority to protect wetlands, recreation opportunities and fish and wildlife habitats in the State and in its exercise of the legislative mandates of the Public Land Corporation that exist in these areas. Through a Memorandum of Agreement with the Department of Environmental Protection (DEP), DNR provides comments to DEP concerning their certification for wetland fills in accordance with the Federal Fish and Wildlife Coordination Act. The Public Land Corporation authorizes private sector actions that affect publicly owned minerals in the streambeds of the State.

DNR has developed management plans that preserve, enhance and protect floodplains on many State owned or controlled areas. DNR maintains a statewide inventory on wetlands; significant/sensitive fisheries and wildlife habitat; rare, threatened, and endangered species; and fish and wildlife related recreation areas. It also is developing GIS capabilities to assess the vegetative conditions and uses of the State's stream bank habitats.

West Virginia Geological and Economic Survey

Mont Chateau Research Center
Morgantown, WV 26507
(304) 294-5331

The West Virginia Geological and Economic Survey has no direct role in the assessment of flood damage. However, agency activities related to flood mitigation are summarized below:

- A set of USGS and FEMA flood maps are maintained and are available for public use;
- One staff member is available to assist the public in the use of these maps (fee service);
- Staff members are available to perform mineral and geological hazard reports for proposed development sites. These reports routinely consider the potential for flood hazards (fee service);
- Staff members provide consultations or presentations to inform the public about floods and other geologic hazards; and
- Landslide-prone area maps are maintained for the major urban areas of the State and information about the interrelationships between landslides and flooding is available.
- The agency manages the Mineral Lands Mapping Program (MLMP). This program is creating new and more accurate coal geology coverage in a GIS format to better assess the value of remaining coal reserves in the State. Other MLMP partners include the West Virginia University GIS Technical Center and the Department of Tax and Revenue.
- The agency has fiscal and administrative oversight of the State Geographic Information System (GIS) program and the State GIS Coordinator is an employee of the GES.

West Virginia Insurance Commission

1112 Smith Street
P. O. Box 50540
Charleston, WV 25305-0540
(304) 558-3345

The West Virginia Insurance Commission has responsibility for licensing Insurance Agents, requires certain level of knowledge to be displayed before issuing license, can require agents to prove knowledge concerning flood insurance. The Insurance Commission can also require insurance agents to notify customers that homeowner's policies do not usually cover flood damage.

West Virginia Office of Emergency Services

Capitol Complex
Building 1, Room EB-80
1900 Kanawha Boulevard East
Charleston, WV 25305-0360
(304) 558-5380

The Office of Emergency Services is designated by Chapter 15, Article 5, of the West Virginia Code as the coordinating agency for emergency services in the State. This includes the four phases of emergency operations known as mitigation, preparedness, response and recovery. These activities meet the demands of all hazards faced by the State, including flooding. Under the Integrated Emergency Management System concept, every activity of the office has some relevance to flood-loss reduction. However, the three principal activities are the Hazard Mitigation Grant Program (HMGP), the Integrated Flood Observing and Warning System (IFLOWS) and the National Flood Insurance Program (NFIP).

Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, the Hazard Mitigation Grant Program (HMGP) administered by the Federal Emergency Management Agency (FEMA) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster.

IFLOWS originated in the late 1970's as a result of the April 1977 flood. It has expanded beyond the area affected by that flood to include 46 of West Virginia's 55 counties. IFLOWS goal is to provide better warning of flooding, especially on the upper portions of small streams. Information from automated, radio-reporting rain gages is available to counties participating in the system and to the National Weather Service. This allows the proper response activities, e.g., warning and/or evacuation, to be initiated as soon as possible.

The National Flood Insurance Program is a partnership between the Federal and local governments. The federal government ensures flood insurance is available in communities (counties, and incorporated municipalities) that regulate development in Special Flood Hazard Areas. The primary control is requiring new development to be built at an elevation above that of

the Base Flood Elevation or "100-year flood". State law delegates to local governments the authority to take all actions necessary to participate in this program. WVOES, through the NFIP's Community Assistance Program, provides technical assistance to local governments who manage the NFIP program.

West Virginia Real Estate Commission

1033 Quarrier Street
Suite 400
Charleston, WV 25301-2315

The West Virginia Real Estate Commission has the responsibility of licensing Real Estate Agents, requires certain level of knowledge to be displayed to obtain license, can require agents to prove knowledge concerning floodplain location, how to use a Flood Insurance Rate Map (FIRM), basic flood insurance knowledge, etc. The Real Estate Commission could also require agents to disclose if a property is located in a regulated floodplain.

West Virginia State Board of Professional Engineers

608 Union Building
Charleston, WV 25301-2104
(304) 558-3554

The West Virginia State Board of Professional Engineers has the responsibility of testing and registering graduate engineers, many of whom practice in the area of Civil Engineering. Many of these engineers design drainage structures and are proficient in the science of hydraulics. They are not only capable of establishing the floodplain and floodway from maps and other data, but can predict with reasonable accuracy the effect that modifications in the floodplain or floodway will have in future flooding events.

West Virginia University Cooperative Extension Service

PO Box 6031
West Virginia University
Morgantown, West Virginia 26506
(304) 293-5691

The West Virginia University, Cooperative Extension Service has a grass-roots educational delivery system that extends the University into communities throughout the State. Community development is one of the primary missions of the Extension Service. In support of this mission, County Extensions Agents (1) provide technical assistance and information for group decision-making and action, (2) organize and initiate community development efforts, and (3) offer leadership development and training. The Cooperative Extension Service, accordingly, can

assume a vital role in working with local communities to help them recover from flood events and to mitigate future flood damage.

The Extension Service also provides an educational framework and delivery system through which diverse University resources can be extended to local communities. Again, this can be relevant to helping communities recover from flood events and to mitigate future flood damage.

West Virginia University
GIS Technical Center

Department of Geology and Geography
425 White Hall
Morgantown, WV 26507
(304) 293-5603

The GIS Technical Center has no direct role in the assessment of flood damage. However, as a partner in the Mineral Lands Mapping Program (MLMP) and in cooperation with the USGS, the center has generated digital versions of USGS quad sheets, including hydrographic and elevation contour layers. The center maintains a comprehensive set of GIS data for the State, a directory of state GIS users and services, as well as links to other GIS resources in the State and nation. The information is available for viewing at the website: http://wvgis.wvu.edu

West Virginia University
Natural Resources Analysis Center (NRAC)

College of Agriculture, Forestry, and Consumer Services
2009 Agriculture Sciences Building
Morgantown, WV 26506
(304) 293-6253

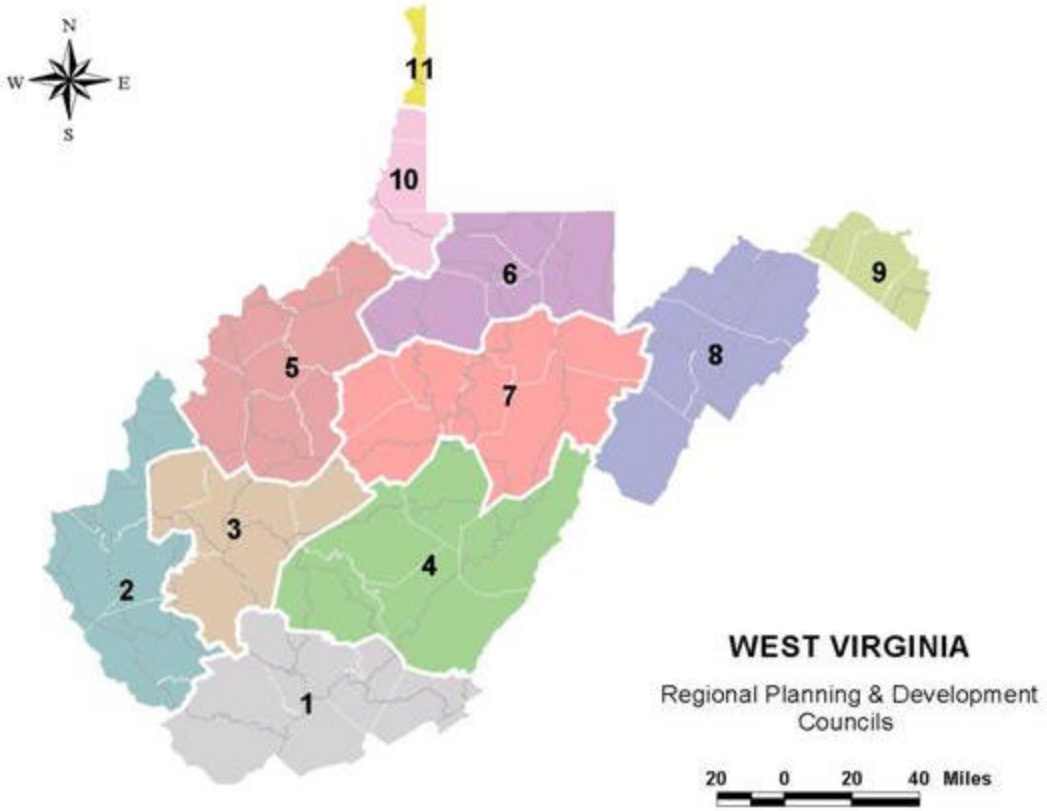
NRAC has no direct role in the assessment of flood damage. However, the center applies the latest remote sensing and digital mapping technology to analyze environmental issues such as watershed management and land use. The wide range of research and teaching activities at NRAC includes environmental planning, environmental and natural resource economics, forest and wild land recreation, wildlife management, forest ecology, and land and water resource reclamation.

One current effort is underway to convert National Hydrographic Data (NHD) files to a 1:24,000 scale for improved stream network information for the State. Researchers at NRAC also developed the Watershed Characterization and Modeling System (WCMS) to bring spatial data and water quality modeling to the desktop in a customized GIS interface that combines a wide variety of spatial data layers and water quality modeling components to complete common tasks for WV DEP personnel. Other projects can be viewed at the center website at http://www.nrac.wvu.edu/

Regional Planning & Development Councils

The eleven (11) Regional Planning and Development Councils (RP&DC) were established in 1972 by the West Virginia Legislature under Chapter 8, Article 25. They were formed as local, multi-jurisdictional agencies to assist with planning and development for improvement within their region. They prepare and recommend ordinances and regulations to implement plans.

The Councils' mission is to convert community and economic development needs into proactive strategies and plans. These plans become realistic opportunities and eventually become projects or programs. They operate as facilitators in a systematic and synergistic process. Their roles range from identification and prioritization of local goals, to assisting local, State, and federal bureaucracies in their pursuit of grants or project endorsement.



Map 3 –1: Regional Planning and Development Councils

The Councils are structured as locally oriented, public corporations. They are directed by elected officials from the counties and communities within their jurisdictions, as well as non-elected appointees from a cross-section of a region's social and economic institutions. Each Council has a staff adept in public administration, regional/community planning and economic development.

Typically, the Councils are able to leverage $7 in grant funds for every $1 of local matching funds. In other words, a local investment of $140 million brings in an additional $840 million in project capital.

West Virginia Conservation Districts

Under the "Conservation Districts Law of West Virginia." (Chapter 19, Article 21A of the West Virginia Code) Conservation and Water Improvement districts may be established in West Virginia. West Virginia has fourteen fully functional conservation districts. These districts cooperate with Federal, State and local agencies in conservation activities across the State. The districts have assumed local leadership responsibilities for many flood protection projects in West Virginia.

Map 3 –2: Conservation Districts In West Virginia

Chapter 19, Article 21B of the West Virginia Code authorizes the creation of Watershed Improvement Districts. A Watershed Improvement District may be established within a Conservation District to promote soil conservation or the conservation, development, utilization or disposal of water by the construction of improvements for such purpose or purposes. A Watershed Improvement District may levy taxes; issue bonds and has the power to condemn property.

C. LOCAL ROLES AND RESPONSIBILITIES IN FLOOD PROTECTION

This brief section on local roles discusses a critical part of floodplain management. Under the WV Code, county and municipal governments are given authority to plan and control land uses within their jurisdictions. These local units of government also are responsible for the public safety and security of the residents within their jurisdiction. The code also provides opportunities for cooperative agreements between local units of government to perform certain of these activities on a regional scale. Regional corrections and solid-waste management are two good examples of these cooperative efforts. More opportunities for regionalizing floodplain management activities and flood protection need to be explored. Existing watershed associations that extend across many political boundaries are a prime example of the regional organizations that can play a critical local role in reducing flood damages, assuring sound floodplain management and accommodating economic growth without increasing damageable property.

Local units of government may ignore floodplain management or they may develop floodplain management programs that are national models. They use their planning and zoning authority to determine the complexion of the floodplain in their community. Local governments significantly influence the application and implementation of the mandatory state and federal floodplain management programs. The authority to issue floodplain construction permits (or not), the authority to grant variances from floodplain ordinances, and the opportunity to completely ignore these legal responsibilities falls directly on the shoulders of the county or municipal leadership. This local/regional authority and responsibility should not be subordinated by State or Federal government, but rather should be supported and encouraged through education, technical assistance and where appropriate financial resources.

Chapter 7, Article 1, Section 3v authorizes local governments to take the minimum actions necessary to maintain eligibility in the National Flood Insurance Program. This includes managing development in the Special Flood Hazard Areas, which requires new residential construction to be elevated above the Base Flood Elevation (the level of the 100-year flood). The success of this program rests in the hands of local officials who are often not committed to it.

Chapter 7, Article 1, Section 3u of the West Virginia Code known as “Authority Of Counties And Municipalities To Treat Streams To Prevent Floods”, empowers counties and municipalities to re-channel, dredge streams, remove debris, snags, sandbars, rocks and other obstructions from streams; straighten channels; and carry out erosion and sediment control programs. These units of government are also empowered to levy, acquire property by purchase, right of eminent domain, or other legal manner for the purpose of preventing floods. All activities of these bodies must comply with applicable federal and State laws.

Community Improvement Assessment Districts (CIAD) may be formed under this act to pay for such work or cost share with federal programs.

Local governing bodies may enter into agreements with federal agencies such as the U. S. Army Corps of Engineers, the Natural Resource Conservation Service and FEMA to act as the local sponsor for flood damage reduction programs and projects. For details on federal agency programs, see the appropriate section below.

D. NON-GOVERNMENTAL ORGANIZATIONS - CITIZEN INITIATIVE AND THE PRIVATE SECTOR

Too often as a society we turn to government to set boundaries, to set limits of risk, and to identify an acceptable impact on the natural and beneficial values of the floodplain. Unfortunately, government programs are not tailor-made for all situations. Fortunately, many individuals, civic organizations, and private companies take the initiative to recognize flooding risks and impacts and to identify actions to reduce these risks and impacts. Individually these efforts may seem small, but collectively they represent a tangible benefit.

The Canaan Valley Institute

Kiena Smith
Executive Director
Canaan Valley Institute
P.O. Box 673
Davis, WV 26260
(1-800-922-3601)

The Canaan Valley Institute (CVI) is a dedicated and diverse team of scientists, landscape ecologists, economists and business professionals, watershed resources specialists, geographic information systems analysts, software developers, community and program developers, grant writers, and a highly skilled support staff, all working for the sustainability of communities in the Mid-Atlantic Highlands. The Institute's technology is cutting-edge, the expertise unparalleled, and the commitment 100 percent.

CVI serves as a clearinghouse for information about the resources of the Mid-Atlantic Highlands and shares that information with stakeholders. When gaps in information are identified, the Institute often works to fill them, using the best science and technology available. All of CVI's publications and studies are available to the public, and the Institute's staff is experienced and ready to serve as a facilitator between local groups and government agencies so that relevant information is continually collected from these sources, shared, and put to use.

The West Virginia Rivers Coalition

The coalition consists of twenty-one organizations interested in river management. This group and the West Virginia Chapter of the Sierra Club have recommended that portions of thirteen

rivers in West Virginia be evaluated for designation as Wild and Scenic Rivers. The Forest Service has agreed to include fourteen rivers (excluding the Cranberry River, which was previously studied), including five newly proposed streams, for evaluation. Designation as a Wild and Scenic River can prohibit construction of certain flood protection measures such as dams, channel modifications, diversions, floodwalls and levees.

West Virginia Beekeeper's Association

c/o John Campbell, Secretary/Treasurer
West Virginia Beekeeper's Association
102 First Street
Parsons, WV 26287
(304) 478-3675

The Association has established a program to provide a reconditioned hive, a queen and worker bees, supers (boxes where bees store honey), veil, gloves, smoker and other equipment to beekeepers that have lost their hive due to flooding or other disaster. These apian resources would cost more than $300 if purchased new. For more information about this program, or about beekeeping in West Virginia, contact Mr. John Campbell at the above address or the West Virginia State Apiarist, George Clutter at Building 9, Guthrie Agricultural Center, 1900 Kanawha Boulevard East, Charleston, WV 25305-0170, (304) 558-2212

Watershed Associations

A recent movement in West Virginia has resulted in the development of a number of watershed associations dedicated to improving the health and safety of the watersheds within the State. Many of these watershed associations have expressed concern about the impacts flooding has on their homes and neighborhoods. Four agencies, the Department of Environmental Protection, the Division of Forestry, the Conservation Agency and the Division of Natural Resources have a Basin Coordinator and a Stream Partners group that works with these associations to help them become established and navigate the bureaucratic maze of government. The Watershed Basin Coordinator can be contacted at the WV DEP Division of Water and Waste Management at (304) 926-0440. A complete list of the watershed associations in West Virginia can be found at: http://www.wvwrc.org/CONTACTS/WV_watershed_contacts.htm.

The reasons people participate in watershed associations are as numerous as the people involved. They include:

- A desire to improve their neighborhood,
- The need to resolve a particular situation,
- The desire to increase the value of a project,
- To restore harmony in the community, or
- Because it improves on existing business practices.

Whatever the motive, these efforts are important. Examples of types of initiatives include: building to a higher flood standard, flood proofing a structure, organizing cleanups and river

watch campaigns, limiting construction impacts, limiting the size of the construction site, pre-disaster emergency planning, and other activities.

Faith–Based Organizations

Numerous faith based organizations provide assistance to flood victims in the form of donated food, clothing, money, family resources, home repair, temporary housing for disaster workers and displaced families, home cleanup and in some cases housing reconstruction. Many such groups are not formally organized; and respond only to disasters in their own area. Others are formal groups which respond to disasters throughout the State, the nation and inter-nationally. The following is a listing of some faith-based organizations active in West Virginia:

- McDowell Mission (United Methodists)
- Mustards Seeds and Mountains (Baptist)
- Catholic Community Services (Catholic)
- The West Virginia Conference (The United Methodist Church)
- The West Virginia Presbytery (The Presbyterian Church in the USA)
- Mennonite Disaster Services (Mennonites)
- Church of the Brethren
- Episcopal Diocese of West Virginia
- United Church of Christ
- United Methodist Church
- Southern Baptist Disaster Relief
- Lutherans and Lions Club
- Christian Outreach International

Other Relief and Recovery Organizations

There are a number of other private sector organizations that are active in West Virginia. These organizations provide monetary assistance and relief to flood victims following disasters as well as providing home construction services and educational materials regarding flooding and floodplain issues. These organizations include:

- Highland Education Project
- United Way
- The West Virginia University Cooperative Extension Service
- The American Red Cross
- SAFE – Stop Abusive Family Environments
- Habitat for Humanity
- The Council of the Southern Mountains
- Project Recovery
- National Ruritan Association
- The Salvation Army
- Appalachian Service Project
- Rural Appalachian Improvement League

E. FEDERAL AGENCIES

U.S. Army Corps of Engineers

US Army Corps of Engineers
USAED Huntington
502 8th Street
Huntington, WV 25701
(304)-399-5636

US Army Corps of Engineers
USAED Pittsburgh
1000 Liberty Ave
Pittsburgh, PA 15222-4186
(412)-395-7502

US Army Corps of Engineers
USAED Baltimore
10 South Howard Street
Baltimore, MD 21201
(410) 962-7608

The U. S. Army Corps of Engineers (Corps) is involved with a variety of water resource management activities in West Virginia. The State is divided between the three Corps Districts shown above. The primary watersheds controlled by those three Districts are shown in Table 3-5.

Table 3-5. Corps of Engineers District Jurisdictions in West Virginia

District	River Basins
Pittsburgh	Cheat River, Tygart River, Monongahela River, and Ohio River
Huntington	Big Sandy River, Kanawha/New River, Little Kanawha River and Ohio River
Baltimore	Potomac River
Norfolk	James River

Planning activities done by the Corps for the management and development of water and related land resources are undertaken through various congressional authorizations. The majority of studies fall under one of two following programs:

- General Investigations Program – Results in individual Congressionally authorized projects for major Federal investments in flood damage reduction. Includes studies for structural and nonstructural flood damage reduction features that would exceed the funding limitations of the Continuing Authorities Program.

The Corps is known for its civil works projects for water resources development including flood control, navigation, water supply, environmental restoration, and recreation. Although flood protection issues can be addressed by the Continuing Authorities Program (CAP), many projects, by virtue of their complexity and expense are implemented through the General Investigations (GI) program (see below). Flood protection measures may include dams, levees, floodwalls, or channel modifications. In some situations, nonstructural measures such as floodproofing and/or permanent floodplain evacuation and flood warning systems can be effective means to reduce

flood damages. Due to the magnitude and expense of projects investigated under the GI program, Congress authorizes them through Water Resources Development Act legislation that is normally enacted every two years. Many of the existing Corps of Engineer flood protection projects in the state were implemented through the GI program (see Appendix L for a list of Flood Control Projects in West Virginia).

Corps structural and nonstructural flood control measures require a local or nonfederal financial commitment for planning, design, construction and operations and maintenance of the project features. Projects developed through the General Investigations (GI) program are initiated through a Reconnaissance Study (100% Federal cost) followed by a cost shared (50%-50%) Feasibility Study that includes compliance with the National Environmental Policy Act provisions. These projects are authorized for construction by Congress based upon the recommendations of the feasibility study. For flood protection projects, non-federal sponsors must provide 35% of project design and construction costs and provide 100% of project O&M costs. The technical assistance and information provided through the Floodplain Management Services Program is also an essential element in fostering local self-help to reduce flood damages. Other planning and assistance programs are offered by the Corps to reduce flood damages.

- Continuing Authorities Program (CAP)

Pre-authorized by Congress – Projects are smaller in scope and are less expensive. This program provides the COE with a standing authority to respond quickly to water resource problems. Congress has authorized the Corps to construct small projects for flood control and environmental restoration within specified funding limits. Pre-authorization saves time in development and approval of projects. Funding limits for these small projects range from $500,000 to $7,000,000.

Under Section 205 of the Flood Control Act of 1948 (Continuing Authorities Program), as amended, projects may be constructed when the Chief of Engineers determines that the work is advisable. In addition, the project must constitute a complete solution to the flood problem involved, and not require subsequent improvements to insure effective operation. The Federal share may not exceed $7,000,000. The initial $100,000 in project feasibility studies is full federal expense. Thereafter all planning, design and construction costs are shared. Cost sharing is 65% Federal and 35% non-Federal. The Small Flood Control Projects (Section 205) would be the primary program for addressing flood damages at smaller communities.

- Planning Assistance to States Program (Section 22).

Through the Planning Assistance to States Program (Section 22, Water Resources Development Act of 1974) the COE is authorized to cooperate with any State, county or municipal governmental unit in preparing comprehensive plans for the development, utilization and conservation of water and related resources. This program is significant to conservation of water and related resources because it allows a broad range of eligible activities to be completed by the COE. The program uses COE staff and expertise to encourage and promote statewide comprehensive water resources planning, to avoid duplication of Federal/State efforts and to achieve Federal, State and community goals. Section 22 can be used effectively to tie together several water resource concerns including floodplain management.

- Technical and Engineering Assistance for Streambank Erosion

Section 55, Water Resources Development Act of 1974 allows the COE to provide technical and engineering assistance to nonfederal public interests for development of methods to prevent damage from shore and stream bank erosion.

- Emergency Flood Control Activities Disaster Assistance

Through this program the Chief of Engineers is authorized to spend funds for flood emergency preparation, flood fighting and rescue operations or for the repair and restoration of any flood control work threatened or destroyed by flood, regardless or origin or ownership of the project.

United States Department of Agriculture
West Virginia Farm Service Agency

John Rader, State Executive Director
Telephone (304) 284-4800
Fax (304) 284-4821

The Farm Service Agency's mission is to respond to disasters affecting the agricultural producers of West Virginia by:

- Completing damage assessment procedures to determine the extent and type of damage along with what programs may be available and/or requested.
- Implementing farm programs like the Emergency Conservation Program (ECP) that will rehabilitate farmlands and restore farm structures to preexisting conditions.
- Crop Loss Disaster Assistance Program Payments to help stabilize farm income.
- Non-Insured Assistance Program (NAP) provides payments for qualified crop losses.
- Emergency Loans are low interest loans to provide funds needed to maintain the agricultural operations.
- Develop the programs to cover specific needs in the affected area.
- Assisting other agencies as necessary.

FSA provides the needed resources to stabilize farm income, protect farmlands and agricultural operations through the various cost share programs.

United States Department of Agriculture
Forest Service

180 Canfield Street
Morgantown, WV 26505-3101
(304) 285-1508

The United States Department of Agriculture Forest Service is a Federal agency that manages public lands in national forests and grasslands, is the largest forestry research organization in the world, and provides technical and financial assistance to State and private forestry agencies. All three-mission areas of the Forest Service are represented in West Virginia – National Forest System, Research, and State and Private Forestry.

National Forest System – The Forest Service manages public lands, known collectively as the National Forest System. The Monongahela National Forest was established in West Virginia following the passage of the 1911 Weeks Act. In 1915, the first 7,200 acres were acquired to begin what would become the Monongahela National Forest. Today the forest is over 909,000 acres in Federal ownership in ten (10) counties. The Monongahela National Forest is managed for multiple uses and benefits that include water, forage, wildlife, wood, and recreation. Watershed management on Federal lands within the Monongahela National Forest is a key component of their work.

Research – The Forest Service provides the scientific and technical knowledge necessary to protect and sustain the Nation's natural resources on all lands, providing benefits to people within the capabilities of the land.

The laboratory in Parsons, researches the natural and human induced factors in the sustainability of central Appalachian forest ecosystems. It provides guidelines for managing central Appalachian forests for a range of products and benefits while maintaining the productivity and diversity of the soil, water, and forest resources. Watershed management is a key component of this. The Fernow Experimental Forest, a field laboratory located in Parsons, supports this research.

State and Private Forestry – Forest Service State and Private Forest programs offer technical expertise and financial support for landowners to manage, protect, and better use their forests.

Fire Management protects lives, homes, and improved property as well as natural resources from uncontrolled wildfires by building strong, efficient West Virginia Division of Forestry and local fire protection programs.

Forest Stewardship encourages West Virginia private landowners to apply ecological and economic resource management principles as they manage their forestland to produce forest benefits for the present and future generations. The **Watershed and Clean Water Program** is a component of Forest Stewardship.

Forest Legacy fosters protection and continued use of forested lands threatened with conversion to non-forest uses by purchasing conservation easements or fee titles from willing private landowners.

Urban and Community Forestry enhances West Virginia cities and communities through planning and managing urban forest resources to promote their environmental, cultural, and biological health.

Addressing water issues, including flooding, on private lands requires integration of State and Private Forestry Programs. Implementing State and Private Forestry programs within watersheds results in an effective way to target actions, and to build partnerships with other agencies and groups to leverage results.

The Forest Service participates in the Emergency Watershed Protection (EWP) program, a component of the National Forest System emergency response program. It provides emergency response on National Forest System lands for a range of disasters such as earthquakes, hurricanes, and floods.

The Morgantown Field Office works closely with the West Virginia State Forester in flood related program areas. The Field Office assisted the State Forester in facilitating and producing the West Virginia Forest Resources Strategic Plan, that addresses water quality and flow, forest management, and wildfire control that affect flooding events in West Virginia. The Morgantown Field Office has representation on the West Virginia Governor's Advisory Committee to the State Forester. The Morgantown Field Office worked with the West Virginia State Forester in developing a proposal that utilizes Forest Service State and Private Forestry programs to provide a wide range of assistance to the State following the July 2001 flooding in West Virginia.

US Department Of Agriculture – Natural Resources Conservation Service

75 High Street Room 301
Morgantown, WV 26505
(304) 284-7540

Under Public Law 83-566 (PL 566), the U.S. Natural Resources Conservation Service (NRCS) has the authority to assist local sponsors who are undertaking activities for the purpose of flood prevention, water conservation, fish and wildlife development, recreation, groundwater recharge, water quality management, and land conservation. The Act provides for technical, financial, and credit assistance by the US Department of Agriculture to local sponsors representing the people living in small watersheds. The NRCS's authority extends to all small watersheds with less than 250,000 acres. That distinction delineates the authorities of the NRCS and the US Army Corps of Engineers.

The NRCS has special authority under Public Law 78-534 (PL 534), for the Potomac Headwaters Drainage within West Virginia. PL 534, enacted in 1944, was the forerunner of PL 566 and authorized NRCS to carry out activities in eleven (11) selected watersheds across the United States. The Potomac Headwaters is one of these watersheds. The purposes and authorities of PL 534 are similar to PL 566, with some differences in cost sharing provisions.

PL 566 and PL 534 are administered by NRCS in cooperation with the WV State Conservation Agency, Conservation Districts, local units of government and the USDA Forest Service. These authorities are excellent examples of strong Federal, State and local partnerships designed to protect and enhance the soil, water and related resources of the State.

Requests for PL 566 and PL 534 assistance are channeled through the WV Conservation Committee, who approve applications for assistance and forward them to NRCS for action. If funding and staff resources are available, NRCS will prepare a watershed plan and if necessary a NEPA compliance document. Once a watershed plan is approved and authorized for operation, the sponsors are eligible for financial and technical assistance from NRCS for installation of the works of improvement.

Through PL 566 and PL 534, NRCS can assist local sponsors in planning and implementing flood damage reduction projects. These projects are based on watersheds, rather than political boundaries. NRCS has the authority to plan and implement a full spectrum of flood damage reduction measures including structural (dams, channel improvements, dikes, etc.), non-structural (flood warning systems, floodplain acquisition, relocation, retrofitting structures, etc.), and more innovative projects such as natural stream restoration. NRCS's authorities are unique in that assistance can also be provided to address land conservation issues on both public and private lands that impact flooding.

NRCS can also provide technical assistance in the form of floodplain management and watershed management studies. Since 1977, there have been fifty (50) floodplain Management Studies coordinated and completed by the NRCS in West Virginia. These studies have been used by local units of government to make land use planning decisions and develop land use regulations.

Since the 1950's, NRCS has received seventy-eight (78) applications for assistance from local communities. Sixty-six (66) of the applications were for assistance under PL 566. The others were for assistance under PL 534. Servicing the applications has resulted in forty-one (41) projects being approved for operations. Ten (10) are PL 534 projects and thirty-one are PL 566 projects. Nineteen (19) watershed projects have been completed and another seventeen (17) are in various stages ranging from just getting started to essentially complete. Four (4) projects have been de-authorized and one (1) project has been placed in an inactive status. Preliminary planning indicated that nineteen (19) projects lacked sufficient local support for implementation or would be unfeasible, resulting in those applications being withdrawn. Planning was terminated on ten (10) other applications. Eight (8) applications have not been serviced. NRCS is currently assisting project sponsors with the development of detailed plans on four watersheds in West Virginia.

Completed and operational projects cover almost two million acres of the State. They include applying 307,500 acres of land treatment measures, construction of 157 dams, 265,650 feet of

channel work and 4,600 feet of dikes. To date, approximately 233,100 acres of land treatment measures, 157 dams, 234,180 feet of channel work and 4,600 feet of earthen dikes have been installed.

Section 216 of Public Law 81-516 authorizes the NRCS's Emergency Watershed Protection (EWP) program. The EWP program assists sponsors and individuals in implementing emergency recovery measures to relieve imminent hazards created by a natural disaster that causes a sudden watershed impairment. EWP assistance may be made available upon a declaration by the State Conservationist when a Federal emergency has been declared by the President, or upon a request for assistance from a sponsoring agency. EWP assistance consists of the installation of emergency measures to reduce hazards to life and property and reduce further disaster expenditures through the purchase of floodplain easements by the Federal government. This program is designed for recovery work, not emergency response efforts or flood prevention measures. Requests for EWP assistance can be made through local NRCS service centers or through eligible sponsors, who then would request NRCS assistance.

Department of Commerce (DOC) Economic Development Administration Disaster Recovery Coordinator, EDA Herbert C. Hoover Building Room 7327 Washington, DC 20230 (202) 482-2659	

Economic Adjustment Assistance Program

The Economic Adjustment Assistance Program is activated by the President declaring a disaster or by another federal declaration. Its purpose is to respond to the short and long-term effects of severe economic dislocation events on communities. The types of assistance provided includes: Categorical project economic adjustment grants (usually funded from supplemental appropriations) for planning, technical assistance, revolving loan funds, and infrastructure construction to assist affected communities in accelerating economic recovery and implementing strategic actions to reduce the risk of economic damage and loss in commercial and industrial areas from future disasters.

US Department Of Commerce - National Oceanic and Atmospheric Administration National Weather Service

400 Parkway Road
Charleston, WV 25309
(304)-746-0180

The National Weather Service (NWS) is concerned with the atmospheric events, and the monitoring and/or prediction of routine and destructive weather events. The NWS describes and predicts those processes of the hydrologic cycle which impact the functioning of the nation's economy and communities. The information produced by the Weather Service takes the form of several different "products". One of the principal functions of the Weather Forecast Office (WFO) and Hydrologic Service Area (HAS) is issuance of river forecasts and flood warnings to the general public, specialized users and disseminating to media such as newspapers, radio and TV stations.

The National Weather Service operates three specific programs related to water management. These include the River Forecast Centers and River Districts activities, the Flood and Flash Flood Warning program and the Hydrologic Services activities. River and rainfall records kept by the weather service are indispensable to riverside industries and their engineers as they design flood protection systems. The flood and flash flood warnings issued by the NWS are a reliable tool to assist emergency operation managers in implementing flood fighting strategies. The river forecast centers produce forecasts which are essential for navigation activities, transportation commerce, crop management, reservoir operation, fish and wildlife management and industrial practices along rivers.

The operations of the WFO include the flash flood and flood watch/warning programs. Generally, flood/flash flood watches are issued by WFOs and focus on large areas such as portions of states. Flood/flash flood warnings are issued by the WFO and are primarily county-based. The River Forecast Center (RFC) focuses on longer-term flood events. Accordingly, RFCs prepare forecasts for rivers and river systems detailing river stages at specific gauging points.

The flood watch and warning program provides the following products:

- Flood Outlook (ESF) – An ESF may be issued by the WFO if forecast meteorological conditions indicate that a significantly heavy precipitation episode may occur that would either cause flooding or aggravate existing flooding.
- Flood Watch (FFA) – This product is used to inform the public and cooperating agencies that current and developing hydro-meteorological conditions are such that there is a threat of flooding, but the occurrence is neither certain nor imminent. Persons in the watch area are thereby advised to check flood action plans, keep informed and be ready to take necessary actions if a warning is issued or flooding is observed.
- Flash Flood Warning (FFW) – An FFW is a public warning issued by WFOs for life or property threatening situations within six (6) hours of the causative event. It is as specific as possible, focusing on specific communities, streams or areas where flooding is imminent or in progress. Persons in the warning area are advised to take necessary precautions immediately.
- Flood Warning (FLW) – An FLW is a public warning issued by WFOs for life or property threatening situations more than six (6) hours after the causative event or for river flooding when forecasts or conditions indicate that rivers will exceed flooding thresholds. It is as specific as possible, focusing on specific river points or communities, streams or areas where flooding is imminent or in progress. Persons in the warning area are advised to take necessary precautions immediately.
- Flood Statement (FLS) and Flash Flood Statement (FFS) – The office issuing a flood watch or a flood/flash flood warning is responsible for issuing follow-up statements keeping the public fully

informed about current conditions. The FLS can also be used to inform the public of minor or nuisance flooding problems.

- Ice Jam Flooding, Dam-break Flooding, Levee Failure – These are forms of flooding which are usually associated with already existing flooding conditions and would be announced along with the FFA, FFW, and FFS.

The NWS recognizes the importance of local flood warning and response systems to improve flood warning service to communities, and provides technical assistance to communities with flood problems. Technical support includes:

- Recommending alternative flood warning systems,
- Helping communities in the design, installation and implementation of warning and response systems,
- Training of personnel, and
- Providing operational support to responsible community officials.

The National Weather Service operates a StormReady program to assist local governments in becoming more resistant to weather related disasters.

The NOAA weather radio broadcasts 24 hours per day with local and regional weather forecasts. These forecasts can be monitored on any radio with the capability to monitor between 162.40 and 162.55 MHz. Some of these radios can be placed in a standby "mode" and will be activated by an emergency tone broadcast by the NWS alerting the user to the broadcast of an emergency message.

S.A.M.E. or Specific Area Message Encoding radios can be programmed to only receive advisories and warnings for specific counties. Three more S.A.M.E. transmitters are needed to cover the entire State.

Integrated Flood Observing and Warning System (IFLOWS) is an automated rain and river gauges early warning system installed in seven Appalachian states. This system is about 45 percent complete in the 46 West Virginia counties where it currently is under development. IFLOWS is monitored locally with information relayed to the State emergency operation center, and to the NWS office responsible for flood forecasting. State and local emergency personnel and NWS forecasters use the information for monitoring developing flooding situations and implementing emergency response plans.

US Department Of Interior - Fish and Wildlife Service

US Fish and Wildlife Service
694 Beverly Pike
Elkins, WV 26241
Phone: (304) 636-6586
Fax: (304) 636-7824

The mission of the U.S. Fish and Wildlife Service is "working with others to conserve, protect, and enhance fish and wildlife habitats for the continuing benefit of the people". The Service's

broad-based wetlands initiative includes floodplain management as the majority of wetlands occur in floodplains. The Service's wetlands and floodplain activities can be grouped under three headings: 1) protection; 2) restoration, enhancement and management; and 3) research, information transfer, and education.

Protection: The Service protects wetlands by assisting regulatory agencies with assessing impacts to wetlands and other waters of the United States from land and water development projects. These projects range from wetland fills for development and highway projects to stream channel alterations and dams. Based on their findings the Service makes recommendations to avoid, minimize and compensate for impacts to fish and wildlife resources to the Federal or State permitting agency. Wetlands protection occurs as a result of the Service's involvement with the implementation of the Farm Bill (including Swampbuster, Conservation Reserve Program, Wetland Reserve Program and Farm Debt Restructure and Conservation Set-Aside programs).

The Service also protects wetlands by managing easements on wetlands and purchasing priority wetlands. Land acquisition for the National Wildlife Refuge System is funded, in part, by the sale of Federal duck stamps. The National Wetlands Priority Conservation Plan identified priority wetlands for acquisition using Land and Water Conservation Act funds. The Service implements the North American Waterfowl Management Plan, an agreement between the U.S. and Canada relating to wetland habitat protection and the restoration of waterfowl populations.

Restoration, Enhancement, and Management: The Service investigates environmental contaminant sites (90 percent of which are located in wetlands) and assists with remediation and restoration of these sites. The Service's Partners for Fish and Wildlife program provides technical and financial assistance to private land owners for the protection and restoration of fish and wildlife habitat. The West Virginia Field Office Partners program specializes in riparian and wetland restoration via livestock exclusion fencing.

Research, Information Transfer, and Education: The National Wetlands Inventory is a project to map wetlands in the United States. NWI maps are based on the USGS 1:24,000 scale mapping. Wetland research is conducted at several locations nationwide.

US Department of the Interior - Geological Survey

US Geological Survey
Water Resources Division
11 Dunbar Street
Charleston, WV 25301
(304) 347-5130

The U.S. Geological Survey (USGS), in cooperation with several State and Federal agencies, conducts a wide range of activities related to the monitoring, measuring, and modeling of water in all phases of the hydrologic cycle. The USGS stands as the sole science agency for the Department of the Interior and serves the Nation by providing reliable information to 1) describe

and understand the earth; 2) minimize loss of life and property from natural disasters; 3) manage water, biological, energy, and mineral resources; and 4) enhance and protect our quality of life.

Information on the flow of rivers is a vital national asset that safeguards lives and property and ensures adequate water resources for a healthy economy. The USGS operates about 7,000 streamflow-gaging stations that keep watch on the Nation's rivers. Over 100 such gages are operated in West Virginia that transmit near real-time data via the world wide web at http://water.usgs.gov or directly to the National Weather Service for flood forecasting. Additional flood peak information is obtained from a network of 20 small streams equipped with crest-stage gages. Streamflow information obtained from these gaging stations is analyzed periodically by the USGS to predict the magnitude and frequency of future floods. This flood information is the basis for Federal Emergency Management Agency floodplain studies as well as many other flood-related evaluations such as bridge and culvert design.

USGS data are available to the public through published reports and the previously mentioned web site and includes:

- Daily streamflow records for all gaging stations,
- Annual peak discharge values,
- Topographic maps, and
- Flood magnitude and frequency studies.

The USGS is proud of its outstanding history of public service and scientific advances. The USGS has been at the forefront in providing information for understanding the earth. Better scientific data, tools, and understanding of the Nation's rivers are important to virtually all USGS stakeholders and customers. The Nation's rivers are in many ways the lifeblood of our country and represent a resource that needs protection and proper management for the benefit of present and future generations.

US Department of the Interior – National Park Service

P.O. Box 246
Glen Jean, WV 25846
(304) 465-0508

The role as steward of historic and natural area sites is the National Park Service's (NPS) most well known function. The NPS also provides valuable natural resource planning and technical assistance and educational opportunities through its Rivers and Trail Assistance Program. Through the Rivers and Trails Program, communities and regional organizations can request assistance from the NPS staff to help assess and prepare river corridor plans for a particular segment of river. Communities must apply for this service and are evaluated on a competitive basis. Factors considered include unique or special attributes of the resource, the level of local support and commitment, and the manageability and scope of the project. This program allows top quality professionals to become involved with local and regional river corridor planning projects, which may otherwise never get off the ground.

The National Park Service also coordinates the Nationwide Rivers Inventory, which generates a "Final List of Rivers." This list identifies rivers that meet the minimum criteria for further study and/or potential inclusion into the National Wild and Scenic Rivers System.

US Department of Transportation
Federal Highway Administration

700 Washington Street East
Geary Plaza
Suite 200
Charleston, WV 25301
(304) 347-5928

The Federal Highway Administration (FHWA) is responsible for the design, construction and maintenance of the Nation's Federal highways. The construction of highways can pose a significant impact upon the ability of floodplains to function. The Federal Highway Administration is directed to minimize this impact through Federal regulations that reflect Executive Order 11988 Floodplain Management. Executive Order 11990 Protection of Wetlands contains provisions which are also addressed by Code 23 of Federal Regulations pertaining to highways.

Part 650 - The Emergency Relief Program governs the administration of emergency funds for the repair or reconstruction of Federal-aid highways, which are found to have suffered serious damage by natural disasters over a wide area or serious damage from catastrophic failures. This includes damage from floods.

US Environmental Protection Agency

Region 3
1650 Arch Street
Philadelphia, PA 19103-2029
(800) 438-2474
(215) 814-5000
http://www.epa.gov/region03

The Environmental Protection Agency's (EPA) primary activities in floodplain management relate to regulations affecting water quality, wetlands protection and review of federal projects as established by the Clean Water Act. EPA has undertaken significant efforts to monitor wetland activities nationwide. This has bearing upon floodplain management concerns because of the overlapping nature of wetlands and floodplains. This work has produced information about the current status of wetlands in the State. Although EPA is the administering agency for the Clean Water Act, the Army Corps of Engineers actually issues 404 permits. The National Environmental Policy Act (NEPA) requires that impacts from projects involving Federal action be made public. Lead agencies must produce a document (Environmental Impact Statement or Environmental Assessment) discussing the existing environment, proposed action, alternatives, impacts and other information pertinent to reviewing the degree of environmental impact.

Encroachment on any water of the United States is prohibited without a permit from the Army Corps of Engineers section 404(b) (1) of the Clean Water Act (404). Information developed during the NEPA process may be utilized for the analysis required under Section 404. The standards, however, are not identical; NEPA requires the disclosure and evaluation of reasonable alternatives; Section 404 allows only the least environmentally damaging alternatives to be permitted.

The Section 404 guidelines set up four general restrictions. Under these guidelines discharges are not allowed if:

- There is a practicable alternative which would have less adverse impacts (so long as it does not have other adverse consequences),
- The discharge violates certain water quality standards, or, jeopardizes confirmed existence of endangered species,
- The discharge causes significant degradation of waters of the United States, or
- All appropriate and practicable measures to minimize potential harm to the ecosystem have not been taken.

This is what EPA considers to be mitigation under Section 404. In evaluating the potential short-term and long-term effects, the impact analysis must include consideration of physical and chemical values, biological values, special aquatic sites, human use characteristics and contaminated sediments.

In 1987 EPA created the Office of Wetlands Protection, within the Office of Water, to strengthen EPA's commitment to wetlands protection. That office has an important role in facilitating the implementation of the recommendations of the National Wetlands Policy Forum, a 20-member panel chaired by Governor Thomas Kean of New Jersey. The Forum produced a report entitled, Protecting American's Wetlands: An Action Agenda. The report contains over 100 specific actions for all levels of government and the private sector.

The EPA has adopted the goal of the National Wetlands Policy Forum to achieve no overall net loss of the Nation's remaining wetland base, as defined by acreage and function; and to restore and create wetlands, where feasible to increase the quality and quantity of the Nation's wetlands resource base. Consistent with this goal, EPA will review and, when necessary, revise its programs to protect the chemical, physical and biological integrity of wetlands.

To implement this goal, EPA has established the following objectives:

- Wetlands Planning Initiative – EPA will provide technical support and participate in the application of planning approaches to protect wetland resources including the preparation of State Wetlands Conservation plans.

- Mechanisms to Increase State/Local Role in Wetlands Protection – EPA will provide guidance, technical assistance and support to enhance the role of State and local governments in both regulatory and non-regulatory wetlands protection efforts.

- Section 404 Regulatory Fixes - EPA will increase enforcement through the application of administrative and judicial penalty authorities. EPA will work with the Corps of Engineers to increase enforcement against un-permitted discharges into wetlands.

- EPA will work with the Corps of Engineers to reduce uncertainty and confusion regarding the implementation of the Section 404 permit program.

- EPA will work with the Corps of Engineers, U.S. Fish and Wildlife Service, and Natural Resources Conservation Service to establish and implement a single delineation methodology for jurisdictional wetlands.

- Mitigation Policy – EPA actions will reflect a policy that unavoidable wetland impacts should be fully offset by wetlands restoration or creation. EPA will work with the other key Federal agencies in the Section 404 permit program to develop a joint mitigation policy focusing in particular on the goal of no net loss of wetlands.

- Information And Education – EPA will work to increase public awareness of wetland functions and values, of the Clean Water Act regulatory programs affecting wetlands, and of non-regulatory approaches for protecting wetlands.

- Cumulative Impacts – EPA will develop and test methods for assessing the cumulative effects of wetland loss and degradation. EPA will work to incorporate these assessment approaches into comprehensive planning and permit decisions for wetlands.

- Wetlands Restoration – EPA will identify opportunities and initiate projects to restore and create wetlands, to increase the quantity and quality of wetlands and to meet other national environmental goals, including those of the Clean Water Act. EPA will also identify areas appropriate for wetland restoration based upon advance planning processes and consideration of cumulative impacts such as point or non-point source problems within watershed areas.

These objectives and other activities of the Office of Wetlands protection affect floodplain management. Functioning wetlands serve an important role to attenuate or detain floodwaters in wetland areas, thereby reducing the peak flow of a flooding event downstream. Quantifying this function of wetlands to store floodwaters would be a useful tool for floodplain managers. It would give floodplain managers a specific basis on which to promote wetlands protection as a flood-loss reduction strategy. The activities of EPA's Office of Wetland Protection will undoubtedly link more carefully defined relationships between wetlands and floodplains.

Federal Emergency Management Agency

FEMA Region III
One Independence Mall, Sixth Floor
615 Chestnut Street
Philadelphia, PA 19106-4404
Phone: (215) 931-5614
www.fema.gov

The Federal Emergency Management Agency (FEMA) plays the most prominent role of all Federal agencies in floodplain management. FEMA's National Flood Insurance Program (NFIP) is a program that encourages property owners to buy federally backed flood insurance. The NFIP provides flood insurance to meet the rising costs of repairing damage caused by floods. Flood insurance is a better alternative than disaster assistance. The NFIP is based upon an agreement between local communities and the Federal government, that if the community will enforce certain practices in the 100-year floodplain, then flood insurance will be available in the community.

The NFIP is a voluntary program where communities elect to join and participate. However, if a community with identified flood hazard areas chooses not to participate, it will not be eligible for certain financial assistance in the event of a Presidentially declared disaster. To participate, communities must adopt a Floodplain Management Ordinance that requires a permit for all construction and development with FEMA mapped floodplains. This provides the basis for a local floodplain management program and should help the community identify its problems, develop resources to confront flooding problems, and establish realistic, achievable measures to reduce flooding risk in the community.

FEMA publishes Flood Insurance Rate Maps (FIRMS) that show the flood risk areas within a community along with Flood Insurance Studies (FIS) that include 100-year flood elevations, floodways, stream profiles, discharge amounts and other hydrologic and hydraulic information pertinent to understanding flooding. Currently 258 localities within the State have had these studies prepared.

Flood Mitigation Assistance

The Flood Mitigation Assistance program (FMA) is made available to a State on an annual basis. The FMA program provides grants to communities for projects that reduce the risk of flood damage to structures that have flood insurance coverage. This funding is available for mitigation planning and implementation of mitigation measures only. The State is the administrator of the FMA program and is responsible for selecting projects for funding from the applicants submitted by all communities within the State. The State then forwards selected applications to FEMA for an eligibility determination. Although individuals cannot apply directly for FMA funds, their local government may submit an application on their behalf.

Sustainability/Sustainable Re-development

A new initiative and integral part of the mitigation function is the concept of sustainability/sustainable re-development. The concept of sustainability brings a relatively new approach to environmental, economic, and social thought, and has the potential to enhance the achievement of mitigation goals in the post-disaster (as well as pre-disaster) environment. Sustainability is development that maintains or enhances economic opportunity and community well being while respecting, protecting and restoring the natural environment upon which people and economies depend. Sustainable re-development is simply the application of the concepts and practices of sustainable development to the disaster recovery process.

Mitigation Assistance Program

The Mitigation Assistance Program (MAP) provides financial assistance to states for the purpose of the development and maintenance of a comprehensive statewide hazard mitigation capability for the purpose of implementing pre- and post-disaster mitigation.

Community Assistance Program – State Support Services Element

The Community Assistance Program (CAP) is a product-oriented financial assistance program directly related to the flood-loss reduction objectives of the National Flood Insurance Program (NFIP). States and communities that are participating in the NFIP are eligible for this assistance. The CAP is intended to identify, prevent, and resolve floodplain management issues in participating communities before they develop into problems requiring enforcement action.

The NFIP's Community Rating System (CRS) was implemented in 1990 as a program for recognizing and encouraging community floodplain management activities that exceed the minimum NFIP standards. The National Flood Insurance Reform Act of 1994 codified the Community Rating System in the NFIP. Under the CRS, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet the three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating; and (3) promote the awareness of flood insurance

A reduction in flood insurance costs is only one of the benefits of a community participating in the CRS. Others include: increased public safety; avoidance of economic disruption and losses; reduced risks upon local public safety officials and utility personnel; and reduced human suffering. No communities in West Virginia participate in the CRS.

FEMA coordinates the Federal Disaster Relief Programs whenever the President declares an "emergency" or a "major disaster" under the Robert T. Stafford Disaster Relief and Emergency Assistance Act. FEMA provides grants to individuals, state, and local units of governments and qualified nonprofit agencies for the restoration, repair, or replacement of eligible buildings, bridges, roads and other eligible items. FEMA chairs a Federal Interagency Hazard Mitigation Team that examines the incident and issues recommendations to reduce future exposure to flood hazards.

Through the "Section 1362, Purchase of Flood Damaged Property Program" FEMA can purchase flood-damaged property that had flood insurance to provide property owners the chance

to relocate to non-flood-prone areas. This helps reduce the loss of lives and property in high-risk flood areas. The program also provides a community with a permanent open space in a floodplain that will be available for recreation. This enhances the beneficial natural values of the floodplain.

Through Section 1316 of the National Flood Insurance Act, flood insurance policy holders may file claims for structures that are subject to imminent collapse or subsidence from erosion due to their location along waterways.

The purpose of the Hazard Mitigation Grant Program (HMGP) is to provide 75/25 matching funds to states and to local communities to implement immediate and long-term hazard mitigation measures after a major disaster. The goal of the program is to effectively reduce a state's or community's vulnerability to natural hazards. Eligibility is the same for the HMGP as it is for the Public Assistance Program. Examples of hazard Mitigation Grant Program projects include:

- Structural hazard control, such as debris basins or floodwalls,
- Retrofitting (flood proofing) to protect structures from future damage,
- Acquisition and relocation of structures out of hazard prone areas,
- Warning systems and plans to protect communities from loss of life and property, or
- Development of state or local standards to protect new and substantially improved structures from disaster damage.

4. Present Activities and Roles

The present missions, authorities, activities and roles of the various agencies involved with flood protection, floodplain management and flood-damage reduction are identified in the following tables. Table 4-1 provides a listing of the programs administered by each agency. Tables in Appendix L provide a listing of the projects (operating, under construction or proposed) in the state and the locks and dams constructed by the Natural Resources Conservation Service, the West Virginia Conservation Agency, the U.S. Army Corps of Engineers and dams subject to regulation by the Department of Environmental Protection, Division of Water and Waste Management, Dam Safety Program. The navigation locks and dams constructed by the Corps of Engineers are operated and maintained for navigation purposes only and provide no increment of flood protection to downstream communities.

The tables do not include farm ponds constructed with the assistance of the NRCS. Mining impoundments regulated by DEP are not listed in the tables. For more information on mining impoundments, contact the DEP at:

Division of Mining and Reclamation
601 57th Street SE
Charleston, WV 25304-2345
(304) 926-0490

Other agency programs not directly related to flood damage reduction, flood warning systems or floodplain management can be found by accessing the various Internet sites and agency home pages displayed in Chapter 3 at local public libraries or on home computers with Internet access

Dams judged to be deficient by the WV Department of Environmental Protection (DEP), Division of Water and Waste Management (DWWM), Dam Safety Program may be found in Appendix M. For more information on these structures and the Dam Safety Program, contact the Dam Safety Program Manager at:

Division of Water and Waste Management
Dam Safety Program
601 57th Street SE
Charleston, WV 25304-2345
(304) 926-0495

a. ROLE OF FLOOD CONTROL DAMS:

The role of flood control dams is to reduce downstream flooding that would result from the 100 year, six hour duration, storm. Corps of Engineers flood control dams are designed to reduce flooding in large watersheds (flows greater than 800 cfs). Natural Resources Conservation Service (NRCS - formerly Soil Conservation Service) dams generally provide flood control for small watersheds. Figures 4-1 and 4-2 show a typical small flood control dam. Design of a typical flood control dam has the following features:

- An earth embankment or concrete structure creates a relatively small volume reservoir under normal weather conditions for sediment accumulation and other purposes. The dam contains a pipe spillway or multiple intake structure to discharge normal stream flow (which maintains normal reservoir level), plus an overflow channel spillway at a higher elevation for discharge of large rainfalls.

Figure 4-1

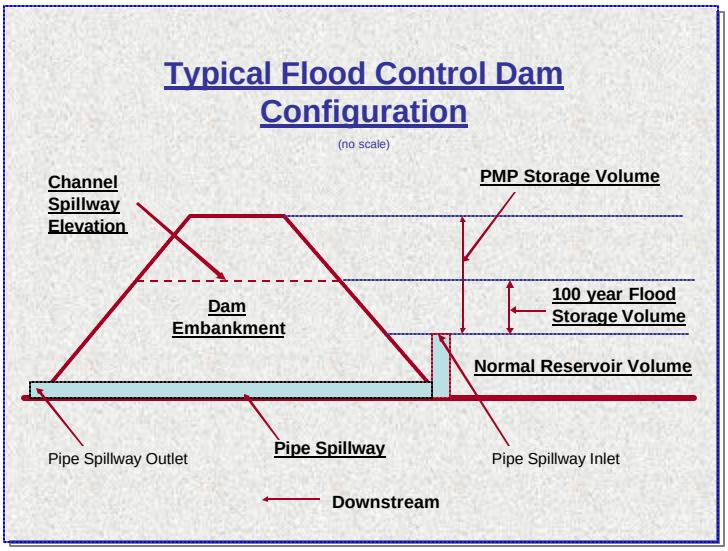
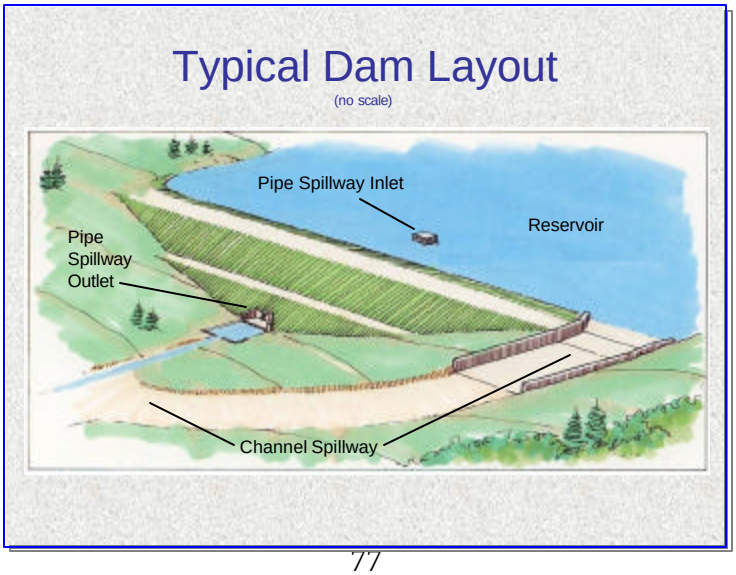


Figure 4-2



- The design of the dam provides for downstream flood reduction of the 100 year frequency, 6 hour duration storm. According to National Weather Service information, the statistical chance of the 100 year storm occurring at a given location is 1 percent per year. In West Virginia, the 100 year storm averages 4.5 inches of rainfall in 6 hours. Most of the 100 year storm volume is stored in the reservoir. The 100 year storm would raise the reservoir elevation equal to that of the channel spillway – but not high enough for water to flow through the channel. Generally, the pipe spillway or multiple intake structure slowly discharges the 100 year storm volume of water over several days to return the reservoir to normal elevation.
- The combination of reservoir storage and slow discharge of water through the pipe spillway results in greatly reduced flows downstream for the 100 year storm than would occur if the dam were not present.
- Rainfall greater than the 100 year storm will raise the reservoir to a higher level and cause the channel spillway to flow. Channel spillways have a much greater discharge capacity than pipe spillways. As a result, flow through the channel spillway may result in a dramatic increase in the amount of water discharged to the downstream area (but always less than if the dam were not present). The channel spillway is designed to discharge (in combination with additional reservoir storage to the top of the dam) the Probable Maximum Precipitation (PMP). The National Weather Service theoretically combines meteorological conditions to estimate maximum rainfall amounts for a given location to calculate the PMP rainfall. There is no assigned return frequency for the PMP storm. In West Virginia, the PMP averages 27.5 inches of rainfall in 6 hours. By design, the PMP would raise the reservoir to the top of the dam embankment (but not overtop the embankment) with the channel spillway and pipe spillway both flowing at maximum volume. In July 1889, Rockport West Virginia received a record 19 inches of rain in 2 hours and 10 minutes – the equivalent of the PMP.
- Flood control dams are designed to significantly reduce downstream flooding for storms up to and including the 100 year storm. For storm events exceeding the 100 year storm, flood control benefit exists, but is greatly reduced. The dams are designed not to fail during the PMP storm.

b. ROLE OF OTHER DAMS IN FLOOD CONTROL:

Dams may have many different purposes such as flood control, water supply, recreation, power generation, navigation, waste disposal, irrigation, and sediment control. Most dams (except for navigation dams) provide some measure of flood control; however, the amount of flow reduction downstream is dependent upon the purpose and design of the dam. For example, flood control dams are designed to maximize storage of excess storm water with a corresponding major rise in reservoir elevation, which allows minimum spillway discharge amounts over a long period of time. The presence of the flood control dam results in greatly reduced flow in the area downstream compared to storm flow without the dam.

In contrast, a recreational dam owner often wishes to prevent large fluctuations in reservoir elevation to protect docks and facilities. To prevent significant rise of the reservoir elevation during the design storm, the dam may be designed to maximize spillway discharge with only minor rise in reservoir elevation. As a result, the flood control benefit of a recreational dam is generally much less than a dam designed solely for flood control. Where dams have multiple

purposes (i.e. water supply, hydropower, recreation, flood control), the resulting dam design may affect the flood control aspects of the structure. Figures 4-3 and 4-4 show examples of large multiple purpose dams in West Virginia.

Figure 4-3 Burnsville Dam in Braxton County, West Virginia

Figure 4-4 Bluestone Dam in Summers County, West Virginia

TABLE 4-1: FLOOD CONTROL PROGRAMS AVAILABLE IN WEST VIRGINIA

AGENCY PROGRAM	OBJECTIVES	COMMENTS
WEST VIRGINIA CONSERVATION AGENCY		
PL 566 Watershed Protection and Flood Prevention	Protecting watersheds from damage caused by erosion, floodwaters, and sediment and to conserve and develop land and water resources.	Partnered with USDA-NRCS to develop 34 water resource plans and install 180 measures. 75% federal / 25% state or local for non-structural measures.
Emergency Watershed Protection Program	Recovery from sudden impairment caused by fire, flood or other natural disaster. Safeguard lives and property.	Partnered with USDA-NRCS 75% federal / 25% state or local cost share. (NRCS pays 100% of technical assistance.)
PL 106 / 472, Small Watershed Rehabilitation Amendments of 2000	Provide technical and financial assistance to rehabilitate dams constructed under PL 534, PL 566 and Resource Conservation and Development programs.	Partners with USDA-NRCS 65% federal / 35% state or local cost share.
WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION		
Abandoned Mine Lands	Restores and rehabilitates abandoned mine areas.	It is possible that AML could reduce the possibility of dam failure related flooding in specific areas by eliminating abandoned coal mine waste impoundments.
Division of Water and Waste Management Dam Safety Program	Protection of lives and property against dam failures.	Prevention of flooding through regulated construction, renovation or removal of dams.
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION – DIVISION OF HIGHWAYS		
Bridge Construction and Repairs	Provide and maintain a highway transportation system designed to have minimal negative impact on storm water runoff and other floodplain issues.	
Highway Construction and Repairs		
WEST VIRGINIA DIVISION OF FORESTRY		

	Stewardship Program	Provides technical assistance for forest resource management planning to protect and improve the timber, wildlife, soils, water, recreation and aesthetic values of forest.	Cost share assistance available.
	Forest Fire Suppression Program	Control all forest fires and limit acres burned as to protect forest floor and habitat to reduce erosion and runoff and protect the resource.	Southern WV continues to be the highest occurrence area in the state involving 90% of the total acres burned.
	Forest Legacy Program	Protect forestland from development through conservation easements between the State and the landowner.	Voluntary program.
	Urban Forestry Program	Work with municipalities to increase green space for beautification, stormwater runoff, and air quality through tree planting projects.	Grant program available for cost-share assistance.
	Logging Sediment Control Act Program	Regulates the logging industry to reduce erosion and sedimentation into waters of the State.	Site inspections conducted randomly and through complaints.
	Clements State Tree Nursery	Produces seedlings that can be utilized for reforestation, erosion control, wildlife and riparian buffers.	More than 30 different species at various prices and packages.
WEST VIRGINIA DIVISION OF NATURAL RESOURCES PUBLIC LANDS CORPORATION			

	Right of Entry Permit	Provide legal real-estate entry to the streambed for any construction activity by obtaining a state authorized real estate right of entry permit.	**A state wide permit required for any stream bed disturbance on a stream that:** a. Flows at least 6 months per year or; b. Is named on a USGS Topographic map or; c. Is named on Division of Highways county road map or; d. Has been locally recognized and named.
WEST VIRGINIA OFFICE OF EMERGENCY SERVICES			
	Integrated Flood Observing and Warning System (IFLOWS)	Provides real time data on precipitation.	Coverage has been expanded to almost all of West Virginia. Data is provided to county warning points and to the National Weather Service.
	Community Assistance Program	Provides technical assistance to counties and municipalities participating in the NFIP.	Identify and resolve floodplain management issues with participating communities.
	Hazard Mitigation Grant Program	Reduction of flood damages by: 1) removing structures from the floodway/floodplain 2) or elevating them, or 3) floodproofing them.	Assists in acquiring, relocating or elevating structures.
	Flood Mitigation Assistance Program	Works to reduce flood damages to structures insured through the NFIP by: 1) removing them from the floodway/floodplain, 2) elevating them, or 3) floodproofing them.	Assists in acquiring, relocating or elevating structures.
FEDERAL EMERGENCY MANAGEMENT AGENCY			
	National Flood Insurance Program – Community Mitigation Planning Branch	Provides assistance to communities in managing floodplain	Provides education about developing special flood hazard areas to minimize the risk to new and existing structures.

	Hydrographic and Hydrologic Studies.	Coordinates Flood Insurance Studies and floodplain mapping.	
NATIONAL WEATHER SERVICE			
	StormReady	Provides communities with the skills and education to survive severe weather.	A voluntary program offered statewide. Very few communities have taken advantage of this program.
US ARMY CORPS OF ENGINEERS			
	Continuing Authority Program – (CAP) Section 205 - Small Flood Control Projects	**Flood control**	Nationwide program. Must be related to flood damages. Cost sharing - 65% federal / 35% state or local match for structural or nonstructural projects.
	General Investigations Program (GI Program)	Flood control, navigation, environmental restoration, hydropower, recreation or water supply.	Nationwide program. Must be related to flood damages. Cost sharing - 65% federal / 35% state or local match for structural and nonstructural projects.
	Section 22 – Planning Assistance to States	Planning studies only for Flood control, water quality, water supply, floodplain management, environmental restoration, navigation, water conservation, etc.	Nationwide program. No event necessary. 50% federal / 50% state or local match. (100% of state or local match may be in-kind services.)
	Continuing Authorities Program – Section 206 Aquatic Ecosystem Restoration	Restoration of aquatic ecosystems to enhance the productivity and diversity of aquatic habitats including wetlands.	Nationwide program Non-Federal sponsor initiated 65% Federal/35% non-Federal match
	Watershed Management, Restoration and Development	Planning and design only. Intended to restore water quality, control and remediate toxic sediments, restore degraded streams for flood control, erosion, sedimentation, protection and restoration of wetlands, nonstructural measures for flood damage reduction.	Basin specific by legislative inclusion. (Currently includes Cabin Creek Watershed). No event necessary. 50% federal / 50% state or local match.
USDA FARM SERVICE AGENCY			
	Conservation Resource Enhancement Program	Provides financial incentives to establish riparian buffer zones.	64% federal /36% state cost share.

	Emergency Conservation Program	Provides financial assistance to restore land, ponds, springs, fences and other agricultural developments impacted by disasters.	64% federal /36% state or local cost share.
	Emergency Loan Program	Financial assistance to farmers who suffered eligible physical or production losses.	3.75% loans to assist in disaster recovery.
	Other Programs.	Provides emergency assistance.	Provides feed, technical assistance, and information on an emergency basis.
US GEOLOGICAL SURVEY			
	National Streamflow Information Program	Fund gages nationwide.	This program would fund 56 stream gages in West Virginia. This program has not been funded as of December 2001.
	West Virginia River Gauge Program	Establish flows at selected points on WV streams.	A network of 107 stream gages in WV.
	Crest-State Gaging Network	Provides data for improving flood-estimating equations for drainages smaller than 100 square miles.	Equations being used now were developed from watershed drainages larger than 100 square miles.
	Reservoir Management System	Real time data on the level of water behind dams owned by partners of West Virginia Conservation Agency.	Under development.
USDA - NATURAL RESOURCES CONSERVATION SERVICE			
	PL 566 Watershed Protection and Flood Prevention	Protecting watersheds from damage caused by erosion, floodwaters, and sediment and to conserve and develop land and water resources.	Statewide NRCS has helped develop 34 water resource plans and install 180 measures. 100% federal funded for structural measures. 75% federal / 25% state or local for non-structural.
	Emergency Watershed Protection Program	Recovery from sudden impairment caused by fire, flood or other natural disaster. Safeguard lives and property.	75% federal / 25% state or local cost share. (NRCS pays 100% of technical assistance.)

	PL 106 / 472, Small Watershed Rehabilitation Amendments of 2000	Provide technical and financial assistance to rehabilitate dams constructed under PL 534, PL 566 and Resource Conservation and Development programs.	65% federal / 35% state or local cost share.

5. Proposed Projects

This section includes future efforts, projects, and programs of each Task Force agency, department or organization. It includes a brief description of the projects or programs each agency currently proposes to address the flood-protection needs of the region in accordance with their mission, roles, and authorities.

a. State Agencies

West Virginia Department of Environmental Protection

The West Virginia Department of Environmental Protection has three proposals that will help reduce the risk of flood damages:

1. Improve identification of deficient dams.
2. Require owners of all high-hazard dams to implement an approved Monitoring and Emergency Action Plan (EAP) coordinated with local offices of emergency services.
3. Upgrade to proper safety standards or remove all deficient dams in order to prevent flooding due to dam failure.

West Virginia University Extension Service

Extension Disaster Education Network. Recently, the WVU Extension Service signed a Cooperative Agreement to become an active partner of the Extension Disaster Education Network (EDEN). EDEN is a national extension organization committed to interstate collaboration in disaster education. In the months ahead, the Extension Service will undertake the following activities:

1. Develop Memoranda of Agreements (MOAs) with the West Virginia Office of Emergency Services, the American Red Cross, and other agencies and organizations active in disaster preparedness, response, recovery, and mitigation.
2. Develop an expanded program capability within the WVU Extension Service to respond to disaster events on a more systematic and comprehensive basis.
3. Develop and conduct training programs.
4. Facilitate the sharing of materials and technical expertise across state lines.

The West Virginia Flood Recovery Special Needs Project. In response to the summer of 2001 flooding events in West Virginia, West Virginia University Extension Service applied for and received a $93,971 grant from the USDA Extension Service entitled *West Virginia Flood Recovery Special Needs Project.* With funding available from this grant, the University is pursuing the following objectives to strengthen the capacity of the WVU Extension Service to respond to future natural disasters on a more systematic and comprehensive basis:

Objective 1: To investigate the structure and function of disaster-recovery programming capabilities in other state Extension Services and to begin to network with these programs via the EDEN national network.

Objective 2: To develop a proposal to be submitted to the WVU Leadership Team for the establishment of a new Disaster Response and Recovery Extension Program.

Objective 3: To develop and pilot test a new volunteer-based, rapid-response educational program capability to provide timely and factual information to victims of natural disasters.

Objective 4: To develop and pilot test a new Swift-water Rescue Training Program for volunteer fire departments and other search and rescue agencies.

Objective 5: To develop and pilot test a new training and technical assistance program for flood-impacted communities that focuses on the rebuilding of their water and sewage infrastructure. This new program will include training and technical assistance extended to flood-impacted homeowners who have private septic systems and/or water wells.

Objective 6: To assist the State Disaster Recovery Board in the development and implementation of plans and proposals to rebuild local communities impacted by the flood. This includes assuming a lead role in helping to secure community and citizen involvement in this planning and development effort.

Objective 7: To promote and support the placement of university students from a variety of disciplines in service-learning field experiences in communities impacted by flooding.

Objective 8: To conduct Community Design Team site visits in several communities impacted by the flood event. The intent is to assist local citizens to identify opportunities for rebuilding their homes and communities outside of the floodplain.

b. Federal Agencies

Federal Emergency Management Agency

Section 322: Mitigation Planning – Disaster Mitigation Assistance Act of 2000.

The new 322 Mitigation Planning initiative requires that local governments develop and submit mitigation plans to the State/FEMA for review and approval. The revised act authorizes up to 7 percent of HMGP funds for local planning purposes and increases HMGP funds from 15 to 20 percent for states that meet enhanced planning criteria.

A State Mitigation Plan is required as a condition of the State receiving the minimum HMGP funding.

U.S. Army Corps of Engineers

U.S. Army Corps of Engineers
Huntington, Pittsburgh and Baltimore Districts

Currently the Corps of Engineers is involved in a number of flood protection projects throughout the State. Current project involvement ranges from initial basin-wide, countywide or community-level planning to more detailed design and construction activities. A complete listing of the existing and planned flood protection projects is shown in Section 4 of this report.

Flood protection projects in the planning phase are located within the communities of Milton, Marlinton, Phillippi, and Belington. Flood protection studies are also scheduled for Parsons and Rowlesburg. The planning studies in Philippi and Belington in the Tygart Valley River Basin and Parsons and Rowlesburg in the Cheat River Basin are being conducted under Section 581 of Public Law 104-303. The Section 581 authority allows for design and construction of structural and non-structural flood protection measures in the Cheat and Tygart Valley River Basins at a level of protection sufficient to prevent any future losses from flooding such as occurred in January 1996, but no less than the 100-year level of protection without regard to the benefit/cost ratio. The ability to pay provisions included in Section 103(m) of Public Law 99-662 allow for a reduced local cost share, which can be as low as 5%.

More comprehensive planning studies are recently completed or underway in Mercer County, Greenbrier River Basin, New River Basin and the Little Kanawha River Basin. The purpose of these studies is to identify flooding problems, formulate feasible protection alternatives and recommend economically justified protection projects. The planning studies also identify opportunities for cooperative efforts with Federal and State resource agencies to restore damaged terrestrial and aquatic ecosystems. The proposed Mercer County flood-warning system component is a direct spin-off of the current Mercer County planning studies.

Several local protection projects have moved into the design/construction phase of development including a Section 205 small flood protection CAP project in Huntington (Krouts Creek), a channel modification project (Island Creek near Logan), and ongoing county-wide nonstructural flood damage reduction projects in Mingo, Wayne and McDowell counties. These nonstructural projects consist of floodproofing or elevating structures above a design flood level for eligible structures and permanent removal of other structures from the floodplain (see Appendix L-Flood Damage Reduction Strategy). In addition, schools and other public buildings in those counties are being protected by ring walls, ring levees or through relocation to flood-safe sites. The countywide nonstructural projects are being implemented under the authorization of Section 202 of Public Law 96-367.

As outlined in Chapter IV of this plan, the Corps of Engineers has a number of flood-damage reduction programs available that can be applied in West Virginia. Those programs include:

- Section 205 – Small Flood Control Projects under the Continuing Authorities Program (CAP),
- Section 22 – Planning Assistance to States (PAS), and
- General Investigations Program (GI Program) for flood control, water supply and environmental restoration.

Under the GI and CAP programs, the Corps could investigate, evaluate and recommend alternatives for flood damage reduction within the State. The Section 22 PAS program is restricted to comprehensive planning studies only (no project construction recommendations permitted) for water resources problems such as reducing flood damages.

Under either the Section 205 CAP or GI programs, the initial $100K reconnaissance study is conducted at full-Federal expense. Any additional studies to determine project feasibility are subject to cost sharing at a 50%-50% rate with a non-Federal sponsor. The maximum annual Federal limit for planning studies funding under the PAS program is $500K per state (requires 50%-50% cost sharing with the State).

A feasible solution identified under the Section 205 program can be designed and constructed without additional Congressional action provided that a non-Federal cost sharing sponsor could be identified. The Federal funding limit for each Section 205 project is $7 million with a cost sharing rate of 65% Federal and 35% non-Federal. Under the GI program, additional Congressional authorization would be required following the feasibility study phase to design and construct flood protection projects. Again, a non-federal cost sharing sponsor must be identified to provide cost sharing funds (65% Federal and 35% non-Federal) for design and construction and to provide 100% of the costs for operation and maintenance (O&M) of the project.

The State of West Virginia could provide the financial support for a project otherwise operated and maintained by a county or municipal entity. Under any of the available Corps programs full compliance under the National Environmental Policy Act (NEPA) is required and recommended projects must be economically justified unless otherwise exempt by legislation.

Under the CAP and GI programs, the Corps could evaluate both structural and non-structural measures to reduce flood damages in the State. Structural measures may include retention structures on tributary streams or main stem rivers, channel modifications, river diversions, floodwalls and levees. Nonstructural measures include floodproofing (wet and dry), permanent floodplain evacuation, elevation of structures, floodplain zoning, ring walls or ring levees and flood warning/emergency evacuation systems.

In an effort to maintain the centers of government (county seats) and commerce centers in the State, more densely developed communities could be protected in-place through

structural measures. These measures would have to be economically justified and documented through the NEPA process. Scattered, low-density residential and commercial development, occurring along the stream between incorporated areas within the counties, could be protected through nonstructural measures. Projects can address single municipal areas or be applied to countywide areas.

Initiation of flood damage investigations under the CAP, PAS or GI programs is the responsibility of a non-Federal sponsor. Under the PAS program, the State, a county or a municipal government are acceptable non-Federal sponsors and may initiate the planning effort through a letter of intent. Overall program and project priorities are coordinated through a State point of contact.

Under the CAP program, a county, municipal government or the State may act as a sponsor and may initiate the program by a letter of intent. General Investigation (GI) studies (reconnaissance level) are initiated through Congressional legislation as requested by a State, county or municipal government.

6. Recommendations

The specific issues and findings that relate to these recommendations can be found in Chapter 2 of the report. More detailed discussion of these topics and recommendations can be found in the accompanying appendices. Although many of the recommendations can be implemented through Federal and State agencies' programs, the realization of this Plan will be through the dedicated work of the counties, municipalities, watershed associations and floodplain residents. Without their support, this Plan will not be successful. The recommendations are numbered for identification purposes only and does not suggest or imply a priority of actions.

a. Floodplain Management. The Task Force recommends the following actions:

1. The Task Force recommends that the WV Insurance Commission require all insurance agents selling property insurance in West Virginia either offer flood insurance or maintain a referral list of agents who do offer flood insurance in their community. One such referral mechanism is the LEADS program operated by FEMA. By calling a toll-free number (1-800-720-1093) the caller can obtain contact information for three agents offering flood insurance in any given zip code area.

2. In addition, the Task Force recommends that the Insurance Commission address this problem by requiring all insurance agents to:

a. Obtain a signature on a statement that acknowledges that the purchaser is aware that flood insurance is not included with their standard policy; and,
b. Obtain a separate signature stating that the client has declined purchase of a separate policy to cover flood damages if they decline to purchase such a policy.

3. Increase staff in West Virginia's Office of Emergency Services to support local floodplain managers statewide. Adequate support to the 55 counties and 248 municipalities requires additional human resources.
This increase in staff would include:

a. A staff member to handle training and education of State agencies and regional floodplain technical specialists,

b. A staff member to handle disbursement of grant funds and to coordinate regional meetings of floodplain managers that will focus on training and peer support for county and local floodplain managers,
c. Staff members to provide technical support to local government units and State agency projects throughout the State.

4. Allocate one million dollars annually as the "Flood Loss Reduction Fund." This fund would provide:

a. Non-Federal cost share to match Federal funds for flood damage reduction projects (structural or non-structural).
b. Stand alone funds for State initiated flood damage reduction projects.
c. Grants to improve local floodplain management.

5. FEMA and WVOES should meet FEMA's stated goal of conducting a Community Assistance Visit in every community once every 5 years to ensure that the floodplain ordinances are being properly implemented and enforced. This would require them to conduct approximately 72 Community Assistance Visits each year in West Virginia.

6. The State should provide monetary incentives to encourage communities to participate in FEMA's Community Rating System (CRS) program. http://www.fema.gov/nfip/crs.htm The State should further promote the CRS by coordinating activities too extensive for every community to do on their own.

7. Require all participating communities to adopt and enforce improved floodplain ordinances or to enter into enforcement compacts with adjacent local governments. It is also recommended that cities be required to adopt surrounding floodplain maps at some stage in the annexation process.

8. Require all new floodplain ordinances to prohibit storage of floatable materials in the floodway and establish a program to identify and either remove, stabilize, or anchor floatable structures and materials in the floodplain.

9. Require all propane and fuel-oil dealers to ensure that all LPG and propane tanks over 30 pounds in size and all fuel-oil tanks located within the regulated floodplain or within 50 feet of a perennial stream to be anchored to a fixed structure to resist expected flood waters and impact from debris.

10. To improve enforcement of floodplain management ordinances by requiring every county and municipality to file their floodplain ordinance with the West Virginia Office of Emergency Services within 30 days of enactment.

11. Require that all participating communities have a certified floodplain manager (CFM) on staff or on retainer by 2008. Where fiscal restraints limit a county or municipal government from complying with this requirement, counties and municipalities should enter into cooperative agreements that allow sharing the costs for a regional floodplain manager.

12. All relevant Federal and State agencies should assist in the establishment of a West Virginia Floodplain Management Association in coordination with the Association of State Floodplain Managers, Inc. (ASFPM). The State should encourage participation and membership in the Association of State Floodplain Managers by paying membership dues for one floodplain manager in each county.

13. Require Real Estate Agents to determine location of structures by latitude and longitude, city-style street address, or Tax Parcel number and whether the structure is within the regulated floodplain before the structure is listed for sale. The agent must notify potential purchasers of the location and whether the structure is within the regulated floodplain prior to execution of a purchase agreement.

Figure 6-1. Inadequately Secured Manufactured Home Following A Flood

14. Require that all structure renovation valued at $10,000 or more, and all new structures obtain a permit document from the appropriate city or county floodplain manager legally certifying whether their site is in or out of the floodplain. All permits identifying sites as being in or out of the floodplain should allow for on site inspection of construction activities. Construction, installation, or renovation of a structure within the floodplain without a permit would be punishable by a fine of not less than $5,000 and removal of the structure. A copy of this permit must be provided to the utility company before the utility is connected. All utility companies must receive and keep a copy of the approved permit prior to connecting utility. Should no permit be obtained prior to construction, the builder, homeowner, utility company, and property owner shall be held liable. Where local communities have adopted combined building code and floodplain ordinance enforcement and permitting, the local code enforcement office may provide such certification if he or she holds the CFM designation and appropriate CABO and/or ICBO certification through the local permitting processes.

15. Require that the builder, homeowner, mobile-home installer, or property owner provide a copy of a certification signed and sealed by a WV Registered Professional Engineer, confirming that the manufactured home is properly installed (including anchoring) to the utility company before the utility is connected. Require all utility companies to receive and keep a copy of this certification. If a certification is unavailable, the manufactured home must be inspected and a certificate signed and sealed by a WV Registered Professional Engineer. This document confirms that the manufactured home has been properly installed before any utility can be connected.

16. The Task Force recommends that a program be established to identify "gap" structures, (structures that affect the flow characteristics of a stream, such as bridges, retaining walls, culverts etc., constructed during the gap between the time the watershed was studied and the Flood Insurance Rate Map (FIRM) was published) and report them to WVOES so the appropriate watersheds can be moved to a higher priority for restudy.

17. Require all surveyors and professional engineers to include the floodplain boundaries, when applicable, as delineated on the FIRM on registered plat maps with the latitude, longitude, and elevation of a reference point.

18. The Governor should issue an Executive Order and the Legislature should issue a resolution that supports floodplain management and recognizes the natural and beneficial role of the floodplain in providing ecological and economic benefits to the State.

19. Discourage development within the floodplain through:

a. Relocation assistance to property owners in the floodway.
b. Floodplain ordinances to forbid future development in floodways.
c. Legislation to prohibit installation of new infrastructure in floodway unless there is no other alternative.

20. Deny all financial assistance to local governments and public institutions that construct new buildings or enter into new leases in buildings located in the regulated floodplain.

21. If a regional or State agency is providing floodplain management assistance to a local government, that local government must consult with the regional or State agency providing assistance on all proposed variances from the floodplain ordinances.

22. Require all new public structures or significant improvements to existing public structures within the regulated floodplain to be constructed in a flood-resistant manner.

23. Initiate a program to relocate all critical facilities, such as government administration buildings, hospitals, jails, and water and sewer treatment plants out of the floodway.

24. Require all State agencies to prepare a 10-year plan to eliminate, relocate or renovate structures and facilities within the regulated floodplain that are not constructed in a flood resistant manner.

25. The Task Force also recommends that the appropriate state agencies develop location standards that prohibit locating floatable materials within the regulated floodplain at the following types of facilities:

a. Solid Waste non-disposal facilities,
b. Solid Waste disposal facilities,
c. Hazardous Waste treatment, storage and disposal facilities,
d. Natural Gas facilities, and
e. Underground storage tank facilities.

26. Enable the WV Public Land Corporation through legislative enactment and increased staffing to enforce current permitting requirements for in-stream construction or channel alteration.

27. Enable the WV Public Land Corporation to develop and enforce a legal contract requiring permit applicants to agree to maintain a specified minimum hydraulic carrying capacity of the structure being installed.

28. The Task Force recommends that guidelines for the disposal of removed stream obstructions and debris be developed through a joint effort of the Federal and State agencies on the Task Force.

29. The Task Force recommends a consistent policy be established for addressing the following issues:

a. Areas outside the State's boundaries that affect flooding events within West Virginia.
b. Islands with residences or industry located entirely within the floodplain.
c. County seats located within the floodway.
d. Recreational areas in floodplain.
e. Ponds and dams removed or altered and the subsequent planned or inadvertent reduction of flood protection.

30. The Task Force recommends that every county identify and prepare relocation areas for use in the event of a disaster. These areas should be provided with water and sewage service. In the interim, these areas should be developed as parks, athletic fields or similar recreational use.

31. Amend § 7-1-3 of the West Virginia State Code as follows:

a. Not restrict local governments to the minimum floodplain standards established in the NFIP

b. To require all new development to obtain a permit at least to the floodplain determination stage. This permit process would require the developer to obtain documents delineating the site location relative to the floodplain.

c. To mandate that communities must have language in their floodplain management ordinance that requires a buffer zone equal to twice the width of the stream from the top of the bank of all perennial streams **without a delineated floodway**.

b. Flood Warning System. The Task Force recommends the following actions:

1. Improve the flood warning system in incremental steps over a 5-year period by:

   a. Adding ALERT and GOES transmission equipment at 118 stream gages.
   b. Install an additional 60 rain gages,
   c. Install an additional 28 stream gages with ALERT and GOES communications,
   d. Install an additional 9 radio repeaters for the ALERT communication system.

   These improvements would require $2,183,000 capital expenditure for the new equipment and installation.

2. It is also recommended that all gages be provided with modern communications equipment to reduce the lag time in reporting to one hour or less. This would cost an estimated $656,800 over the next five years in addition to the $2,183,000 itemized above. It is recommended that every gage have two methods of communicating the data collected to the inquiring parties.

3. Provide adequate funds and staffing for the West Virginia Office of Emergency Services to ensure adequate operations and maintenance of the expanded IFLOWS gages and system.

4. Improve the dissemination of flood warnings and other disaster warnings by mandating the rebroadcast of warnings on all fire, police, and emergency medical-service frequencies. Individuals and businesses with radio scanners will receive these warnings in a more timely and reliable fashion.

5. In an effort to reduce vandalism of rain gages it is recommended that priority be given to locating rain gages with cellular telephone towers where possible. It would also be possible to establish communications with these gages via the cellular telephone network to eliminate the dependence upon land lines for communication.

6. Improve the flood warning system by providing each county warning point one computer and the appropriate software dedicated to the Storm Watch Program. This can

be accomplished over a 3-year period through Federal grants from the National Weather Service.

7. Encourage local communities to participate in the StormReady program conducted by the National Weather Service.

8. Improve the maintenance of historical data by providing funding for archiving of data from rain and stream gages on a statewide level.

9. Improve the flood warning system by installing three Specific Area Message Encoding (S.A.M.E.) radio transmitters to broadcast disaster warnings throughout the State. This would cost approximately $90,000 for the transmitters. This will assist local communities in participating in StormReady. This technology (S.A.M.E.) can also be used to disseminate information on hazardous-materials (HAZMAT) incidents, terrorist activities, and other disasters.

10. Improve dissemination of disaster warnings by requiring all public facilities receiving State funds to purchase and use S.A.M.E. receivers to receive warnings of disasters that apply to their local area. These receivers cost between $40 and $90 each. This will assist local communities in participating in StormReady.

11. Improve dissemination of disaster warnings by encouraging the public to purchase and use S.A.M.E. receivers to receive warnings of disasters that apply to their local area. These receivers cost between $40 and $90 each.

12. That the WV Department of Environmental Protection, Division of Water and Waste Management Dam Safety Program be provided additional staff, resources and funding from the general fund specifically targeted to provide improved capability for Monitoring and Emergency Action Plans (EAP) technical review, approval and exercise. Improve the dam-related EAPs through public education and enhanced capability to review new and updated plans in coordination with local emergency services offices. Perform tabletop and field exercises of existing EAPs.

13. It is recommended that the Department of Transportation be funded to design and install signage similar to the “Bridge Freezes Before Road” sign to identify State highways that are frequently blocked by high water.

14. It is recommended that the WV Office of Emergency Services establish procedures for the review and updating of existing county emergency evacuation plans related to flooding.

c. Floodplain Mapping. The Task Force recommends the following actions:

1. Encourage FEMA and dedicate sufficient funds to re-map all watersheds in the State using a modern suite of mapping technology that will:

a. Create enhanced elevation and terrain data, as well as more detailed hydrographic networks to improve flow models and flood risk assessment.

b. Accurately identify the channel shape.

c. Eliminate all "Approximate A" zones by conducting detailed studies to delineate more accurate and realistic flood-prone areas.

d. Delineate floodplains in previously unmapped areas.

e. Upgrade the quality of floodplain maps statewide with priority given to heavily populated floodplain areas, areas of repetitive losses, areas with high levels of flood damages and areas with insufficient mapping as identified by the Map Needs Update Support System (MNUSS).

2. The Task Force recommends that West Virginia initiate a program to develop DFIRMs for all counties to replace the Q3 and paper maps for use in planning and regulation.

3. The Task Force recommends that West Virginia initiate a program to provide hardware, software and training in the use of Geographic Information Systems (GIS) and DFIRMs to all West Virginia jurisdictions in the National Flood Insurance Program.

4. That FEMA provide funds for the Corps of Engineers to populate the MNUSS database as has occurred in other states such as Virginia and Pennsylvania.

5. The Task Force further recommends that WVOES be provided the staff and resources to coordinate maintenance of floodplain maps in West Virginia.

6. All State and Federal agencies should adopt current FEMA guidelines for floodplain mapping, in defined project areas, that is consistent with the Federal Emergency Management Agency's document "Draft Guidelines and Specifications for Flood Hazard Mapping Partners."

7. Appropriate state agencies, local governmental units and Regional Planning and Development councils should assist in the mapping process by becoming Cooperating Technical Partners (CTP) in Flood Hazard Mapping.

8. Fund Regional Planning Councils (RPC's) or Economic Development Authorities (EDA's) to re-evaluate flood hazards in non-participating communities. Many communities were not originally mapped under the NFIP due to a lack of growth potential or low frequencies of flooding. Many of these same communities are now confronted with development issues in their floodplains through new growth or annexations of county development. The RPC's or EDA's could assist any non-participating community interested in joining the NFIP. This item has been completed since initiation of the Task Force study.

9. All hydraulic studies conducted by or through Federal and State agencies within the State for the purposes of identifying, enhancing or developing floodplain areas should be required to delineate a floodway zone (in accordance with procedures used in the NFIP) with the study.

10. The Task Force recommends that State agencies, local governmental units and Regional Planning and Development councils assist in the mapping process by becoming

Cooperating Technical Partners (CTP) in Flood Hazard Mapping. The Task Force also recommends that West Virginia investigate the possibility of becoming a Cooperating Technical State with FEMA in developing new flood studies and new DFIRMs.

11. Delineate inundation areas resulting from sunny-day and heavy rainfall dam failures on Flood Insurance Rate Maps and other floodplain maps as appropriate for planning purposes.

12. Promote the collection of accurate latitude, longitude, and elevation data on all repetitive-loss sites, flood control facilities, and significant flood damage sites.

13. Initiate a new "off-budget" State instrumentality (such as the West Virginia State Mapping Board) to develop and maintain digital mapping statewide for flood and other disaster planning. The program should be implemented and operated in cooperation with Federal partners (FEMA, USGS, USACE, and EPA) and State agencies with hydrologic-mapping expertise or regulatory responsibilities.

d. Flood Damage Assessment. The Task Force recommends the following actions:

1. Designate a single agency within State government as a point of contact or clearinghouse where a flood data repository could be established. This agency would be mandated to manage all flood data including an inventory of at-risk structures, repetitive-loss data, flood control project data, and other databases. This data should include information on losses sustained by residences, businesses, farms/agricultural losses, roadways, railroads, and other types of losses. WVOES would be the appropriate place for such a database assuming that adequate staffing and funding could be provided. The Watershed Resource Center, or any of the many universities or colleges in the State are alternative locations for a repository.

2. Develop flood and flood damage data with latitude, longitude, and elevation data so that both counties and watersheds can be used as the geographic basis for planning.

3. Update existing damage assessment data for 11-digit Hydrologic Unit Catalog (HUC) code watersheds for use as a planning tool. The U. S. Army Corps of Engineers and the Natural Resources Conservation Service should collaborate to develop flood damage data along all rivers within the State. Individually authorized protection projects will still have to develop damage estimates for their own cost-benefit analyses. Copies of this project specific data will be provided to the clearinghouse discussed above.

4. Encourage local jurisdictions to obtain the repetitive-loss data from WVOES and determine latitude, longitude, and elevation figures for each repetitive-loss structure in their jurisdiction so this data can be included in a GIS database for use by local, State, and Federal agencies.

5. Develop a chart that identifies specific Federal and State offices where flooding information or assistance may be obtained. This chart should be available in printed and web-based versions.

6. Conduct a study of the expected mortality from flooding at different recurrence levels.

7. Appropriate the necessary funds to the West Virginia State Medical Examiner's Office to purchase, equip and staff a portable morgue for use in mass casualty disasters.

e. Building Codes, Permitting and Enforcement. The Task Force recommends the following actions:

1. The Task Force recommends that the State should adopt all six separate sections of the "2000 International Building Code" for use in the regulated floodplain. Developed by the International Code Council in 1999, this updated code covers residential building, plumbing, mechanical, fuel-gas, and private sewage-disposal requirements and meets minimum flood-resistant design standards of the NFIP. This code would replace the existing Building Officials and Code Administrators (BOCA) and the Council Of American Building Officials (CABO) codes included by reference in 87CSR4 (State Building Code).

2. The State should mandate that all counties adopt and enforce the international codes within 5 years after legislative adoption. At a minimum these codes should apply to new construction within the floodplain and to significant improvements to existing structures within the floodplain.

3. The West Virginia Development Office should prepare and disseminate to counties and municipalities a model sub-division regulation that contains a requirement that every residential, commercial or industrial lot include a portion of developable land that is out of the floodway for construction of a structure.

4. The State should expand the Division of Labor's Manufactured Housing Section enforcement unit to a total of 11 field enforcement people with appropriate supervisory and support staff. An alternative recommendation would be to eliminate the Manufactured Housing Section and combine it with the new Building Codes Division.

5. The Department of Labor should require all appropriate staff to become conversant with floodplain management issues and incorporate the use of Flood Insurance Rate Maps in inspection procedures.

6. That the appropriate Corps of Engineer District offices and State offices involved in the issuance of regulatory permits in West Virginia waters develop and deploy a public information and awareness program for local officials and private landowners.

f. Environmental Impacts of Flooding. The Task Force recommends the following actions:

1. That the Governor's Office issue an Executive Order recognizing the beneficial attributes of the State's floodplains. That order also should declare the designated floodway zones within the State to be off-limits to development unless the local floodplain jurisdiction receives documentation from a WV Registered Professional Engineer showing that such development will not increase the Base Flood Elevation and has been designed and will be constructed to an engineering standard that will sustain the water depths and velocities associated with the floodway location. That order also should encourage Federal agencies operating in West Virginia to evaluate all proposed or financially subsidized projects in accordance with Federal Executive Order 11988.

2. The Task Force recommends that State legislation be enacted that will empower local floodplain management officials to prohibit placement or storage of floatable material within floodways that does not include suitable anchoring. Administration and enforcement of these regulations would be through county and municipal floodplain managers using the enforcement powers contained in the floodplain management ordinances.

3. That a "Stream Summit" be convened in 2005. The purpose of this summit would be to coordinate the various stream quality designation programs used by the Federal and State agencies working in the State. Many of the anticipated participating agencies are current members of the Task Force that identified a range of definitions of "stream quality" during the preparation of the Statewide Plan. The long-term goal of the summit and subsequent meetings would be to agree on a standard classification of stream quality in the State that could guide future planning and project development.

4. That a study be conducted to identify, document and preserve stable streams. This study would be a collaborative effort between WVDEP, WVDNR, WVCA, NRCS and USACE. The results of the study would provide a foundation for legislative statewide protection of stable streams. Although the existence of stream channel stability does not lessen the potential for over-bank flooding, stable streams are capable of accommodating high flows without excessive erosion or bank displacement. Such streams provide a base condition for future stream rehabilitation and restoration activities in each region of the State.

5. That a "Wetlands Summit" be convened in 2005. The purposes of this summit would be to: (1) identify those Federal, State, regional and local agencies having a mission or purpose to identify, protect and restore riverine-related wetlands, (2) assess the relative condition of the State's riverine wetlands including threats to existing wetlands, (3) identify those areas within the State where riverine wetlands restoration or creation would be most effective (such as, non-productive agricultural lands within the floodplains, abandoned mine lands or abandoned industrial lands, conservation easements set aside for wetland development), and (4) identify potential sources of funding for wetlands protection and restoration.

7. That State guidelines for emergency removal of stream debris be developed that would guide emergency response agencies and contractors during these removal operations. Such guidelines could be developed through a collaborative effort of the Task Force member agencies. These guidelines would ensure that in-stream debris removal

following a flood event would not result in excessive, long-term environmental damage to the stream or river affected. The guidelines would increase awareness of the need for permits for in-stream work and ensure that debris disposal does not further inhibit floodwaters. Included within these guidelines would be information on the location of stable streams and high quality streams (when available) and a series of best management practices to guide response agencies and their contractors.

g. Stream Crossings and Access Roads. The Task Force recommends the following actions:

1. That voluntary guidelines or Best Management Practices (BMP) for the sizing, installation, and maintenance of culverts, drainage structures and stream/river crossings be developed by the Task Force. Municipalities and individuals installing steam crossings should install one with a diameter or cross section at least as large as the closest appropriate downstream Division of Highways crossing unless an alternative size is provided by a professional engineering study that would ensure that these facilities would carry the stream capacity during a 10-year storm event without contributing to flood damages.

Figure 6-2. Roadway under Interstate 77 blocked by high water during a major flood event

2. That guidelines or BMPs for installation and maintenance of stream crossings for the 10-year storm event without causing additional upstream flooding be developed and enforced. Appropriate sizing for culverts and bridge openings must consider the potential for future development in the watershed. Where such development potential exists, culverts and bridge cross sections should be enlarged to handle anticipated runoff. Establish a program, including a permitting process, within a State agency to control the design, installation, and maintenance of private and public non-highway drainage structures.

3. That the State create a technical assistance program that includes funding and resources for a State agency to provide assistance in the design, installation, and maintenance of public and private stream crossings.

4. That $100,000 annually be provided to the WV Division of Highways from the general fund for a study of abandoned stream crossings (public or private road or railroad bridges or culverts) to ascertain ownership of said facilities, and provide recommendations for condemnation and removal if deemed necessary to reduce flood damages.

5. That regulations and/or best management practices including minimum criteria for construction and closure or abandonment of access roads be developed and applied consistently to all industries throughout West Virginia.

h. Dredging. The Task Force recommends the following actions:

1. That regulatory permit requests for dredging operations in the State **as a means of reducing flood damages** be approved only where documentation demonstrates that flooding will be mitigated, environmental impacts are not excessive, and where annual maintenance is assured through executed agreements. This should not hinder permitted channel modifications that are designed and maintained to reduce flood elevations of high frequency floods (low level), stream restoration, or restoration of aquatic environments. Nor should this hinder efforts by any Federal or State agency to address major flood events through an authorized and designed channel modification or a snagging and clearing operation where that activity is proven through engineering documentation to be an effective and cost efficient method for reducing flood heights and where annual maintenance is assured through local agreements.

2. That the State provide funding for State stream restoration programs to match existing Federal programs and that regulations for preservation of stable streams be developed through a collaborative effort of the WVDEP, WVCA and WVDNR. Candidate streams for restoration will be identified by the agencies participating in the recommended “Stream Summit”.

3. The Task Force recommends that guidelines for the disposal of removed stream obstructions and debris be developed through a joint effort of the Federal and State agencies on the Task Force.

i. Resource Extraction. The Task Force recommends the following actions:

AGRICULTURE

1. It is recommended that the WV Department of Agriculture, the WV Conservation Agency, and the USDA – Natural Resources Conservation Service review existing BMPs and expand the number of agricultural facilities adhering to them.

FORESTRY OPERATIONS

1. The Task Force recommends that the State Attorney General's office evaluate the current agency authorities to determine which agency(s) has been empowered to regulate the location of sawmills, sawn-log storage areas, load-out areas and consolidation yards within designated regulatory floodway zones. Should no State or county agency currently be so empowered, the Legislature should authorize and fund an appropriate agency to regulate the location of these facilities in the regulatory floodway. Such regulatory authority should be vested in an agency that is not directly involved with harvesting timber resources within the State. Timber harvesting companies and contractors should be required by the regulation to coordinate the location of these temporary timber storage and milling facilities with local municipal or county floodplain managers prior to construction.

2. That the organizational structure of the WV DOF be realigned to prioritize as urgent the inspection of each logging job during and at the end of each operation and reemphasize the need for a reduction in the number and severity of wildfires.

3. That the WV DOF develop BMPs for the restoration of areas that have been severely burned by wildfire to prevent erosion.

4. That the WV DOF and the WV Department of Environmental Protection, Office of Environmental Enforcement determine the need for a Memorandum of Understanding to clearly define each organizations responsibility and improve enforcement efficiency.

5. That the WV DOF improve quality control of inspections by publishing an annual report of logging operations and inspections.

6. That the WV DOF continue to provide training and technical assistance to loggers in regard to BMPs.

7. That the WV DOF establish a toll free message center so loggers can easily and rapidly notify the WV DOF when they are completing a logging operation or are forced to move due to adverse weather, equipment problems and/or any other reason.

8. That the WV DOF prepare educational material on the effects of wildfires and repetitive wildfires on soils and the resulting increase in runoff and flood damages for presentation to high school students, landowners, public officials, floodplain managers and the public.

9. That the WV DOF investigate possibilities for economic uses for slash, logging waste and less desirable wood to prevent logging waste from being left in and along streams.

10. That the WV DOF be provided the resources and authorization to employ additional employees including: Forest Hydrologist, Wildfire Specialists and Foresters to address timber management and field enforcement of BMP's.

11. The Task Force supports continuing development of new regional hydrological models specifically for forested areas by the USFS.

MINES AND QUARRIES

1. That all recommendation of the Flood Advisory Technical Team (FATT) study relating to mines be implemented.

2. That the Department of Environmental Protection develop and enforce regulations which meet the minimum standards detailed in the Stream Crossings And Access Roads appendix of this plan.

OIL AND GAS

1. That the Department of Environmental Protection develop and enforce regulations which meet the minimum standards detailed in the Stream Crossings And Access Roads appendix of this plan.

j. Storm Water Management

1. It is recommended that all counties in West Virginia implement a storm water ordinance to control the quantity and quality of storm water and to guide the development and implementation of a storm water management plan. These local ordinances must be at least as strict as State regulations. Local jurisdictions must provide for enforcement of their own ordinances.

2. It is recommended that a State agency inspect storm water facilities and serve as a back up for local inspection and enforcement of regulations on design, installation, operation and maintenance of these facilities. In the event no suitable State agency is found to provide the technical assistance and enforcement support needed, it is recommended that the regional watershed flood protection authorities based on the eight digit watershed basins be given this responsibility. Details on these groups are provided above.

3. It is recommended that all storm water conveyances (ditches, culverts, piping etc) be sized no smaller than the nearest appropriate downstream Department of Transportation storm water conveyance unless hydraulic/hydrology studies indicate otherwise. It is further recommended that the Department of Transportation be allocated funding to provide technical assistance on determining the appropriate size to persons installing storm water conveyances.

4. It is recommended that any development of greater than 3 acres during any 5-year period must provide storm water management plan that addresses the total run off to the entire catchment.

5. That additional resources in staff and funds be provided to the Division of Forestry to address wildfires. Due to rugged terrain and limited access into some areas, wildfires are a serious threat to the forest resources. These forested lands absorb tremendous quantities of rainfall that would otherwise reach the State's streams and rivers. Forests

devastated by wildfires do not have the capability to absorb rainfall and therefore increased runoff and erosion occurs.

6. It is recommended that any storm water detention facility discharging to a cold-water trout stream be designed to detain water no more than 12 hours. In addition the pond should be designed so that it discharges from the bottom, cooler portion of the pond. Detention facilities discharging into warm water streams should be designed to detain storm water at least 24 hours.

7. It is recommended that the Department of Transportation design signage similar to the "Bridge Freezes Before Road" sign to identify roads that are frequently blocked by storm water.

8. The Task Force recommends that any county with karst topography develop specific ordinances to protect the karst topography and groundwater supply from the effects of excessive stormwater.

k. Education. The Task Fore recommends the following actions:

1. Encourage State, county, and municipal officials involved in floodplain management, community planning, building inspection, emergency services, or enforcement of land use planning to take the Federal Emergency Management Agency Independent Study Courses related to flooding, flood mitigation, and floodplain management.

2. WVOES should present at least one Federal Emergency Management Agency field course specifically addressing flooding each year in West Virginia.

3. WVOES should develop and present at least 1 state-specific workshop each year that is related to flooding in West Virginia. Topics could include:

a. Local floodplain ordinances
b. Relevant sections of the West Virginia State Code
c. Flood Insurance Rate Maps, Digital Flood Insurance Rate Maps, Q3, GIS data and other data sources used to update flood maps
d. Updating flood maps
e. Land-use management
f. Stormwater management
g. Flood damages
h. Floodplain management
i. Floodplain protection
j. Potential impact of flooding in their region
k. Factors contributing to flooding (floatable debris in the floodway, constricted floodways, undersized or poorly constructed stream crossings)
l. Perils of building in the floodplain
m. Flood proofing
n. Flood-resistant construction techniques
o. Reducing flood-insurance premiums

p. Concepts of stable streams.
q. Benefit-cost analysis of flood damage reduction
r. Elevation certificates.
s. Dam Safety Monitoring and Emergency Action Plans
t. Natural Stream Restoration and the inter-relationship of stream morphology, land use, channel encroachment, dredging, stormwater/ erosion control, stable streams, and flooding.

4. The Task Force in conjunction with the National Flood Insurance Program Coordinator should develop and conduct an annual conference/seminar on floodplain management in West Virginia for all floodplain managers, public officials, and other interested parties to encourage training and develop peer support. If the West Virginia Floodplain Managers Association becomes a reality, the Association could take over this responsibility.

5. The Insurance Commission should provide incentives for insurance agents to be educated about the National Flood Insurance Program (NFIP). Ten to twenty agents should be randomly checked each year to ensure that they are offering flood insurance to businesses and residents or providing appropriate referrals; and to determine if flood policies are being rated properly.

6. The State should encourage participation in the annual seminars by providing this training at no cost and reimbursing qualifying jurisdictions for a portion of the salary of trained and nationally certified floodplain managers and certified building inspectors. Total reimbursement would be limited to $10,000 to qualifying jurisdictions for training and permits reimbursement. (The total estimated cost statewide is $550,000).

7. Encourage participation in floodplain management training activities by providing certification or continuing-education credits for courses and workshops. Attendees should include: (a) State, county, and municipal government, (b) insurance companies, (c) financial institutions, (d) real estate companies, (e) utility companies, (f) watershed associations, (g) professional land surveyors, (h) professional engineers, (i) floodplain managers, (j) public officials, (k) elected officials, (l) building inspectors, (m) community planners, and (n) other interested parties.

8. Encourage educational outlets in West Virginia (Vo-tech, Community Colleges, publicly owned colleges and universities) to develop classes and curriculums that address floodplain and flood issues. Floodplain management and flooding should be addressed during appropriate sessions of the current curriculum.

9. Brochures should be prepared and distributed on flood proofing methods, flood-resistant construction techniques, and strategies for reducing flood-insurance premiums to all National Flood Insurance Program policyholders in WV.

10. A brochure on the values and concepts of protecting stable streams should be prepared and distributed.

11. The Vocational Technical schools should incorporate training on retrofitting floodplain structures and other flood mitigation techniques in all construction-related courses. Individuals receiving such training should be encouraged by counties to work with communities and individuals immediately after a flood event to "build back smarter" and in a sustainable manner.

Figure 6-3. Task Force Flood Display presented at West Virginia State Capitol

12. All surveying classes (college, university, vocational, and high school levels) should include a session on the completion of elevation certificates, their importance in floodplain management, and a general outline of the floodplain permitting process.

13. To provide the public with a readily visible indication of the Base Flood Elevation (BFE) (elevation of the 100-year frequency flood), surveying classes should prepare projects that require students to survey the BFE and indicate this elevation on utility poles and/or street signposts, where practical, within a community. These would be general guides and wouldn't be legal reference points for determining flood-insurance premiums.

14. The WVDOH should establish or reestablish elevation reference marks on all bridges.

15. The Department of Motor Vehicles should identify the dangers of flooded roadways through all high school drivers' education classes and through the license testing process.

16. WVOES should make training in maps and map reading available to all Federal, State, local and volunteer personnel involved in flooding in West Virginia on a regular basis.

l. Strategy To Reduce Damages To Existing Flood Prone Structures And Facilities. The Task Force recommends the following actions:

1. Through a collaborative effort, the USACE and NRCS work jointly with the WVCA and other Task Force member agencies to assess the State's major watersheds. The purpose of this assessment would be to determine whether there are any opportunities to construct additional upstream flood storage/retention facilities in the watersheds that would reduce downstream flood damages, potentially provide a reliable source of potable water for communities within the region and provide improvements in downstream water quality and flow. Several of the watersheds shown on the statewide watershed map (see Figure 1-5) have existing storage facilities (see Appendix L) operating for flood control, low-flow augmentation and water supply. Previous studies conducted for the watersheds by various Federal and State agencies would form the basis for these studies.

This assessment could be funded in part through the USACE Section 22 Planning Assistance to States program for State/regional flood protection studies. Full consideration of the anticipated environmental effects of these potential storage facilities would be coordinated with the WVDNR, WVDEP and USFWS during the assessment. Those potential storage projects generating substantial flood protection benefits would be proposed for more detailed study through existing or new Congressional authorities. More detailed feasibility evaluations would be initiated only after firm commitments from eligible and financially capable non-Federal sponsors.

2. Through a collaborative effort of the USACE and NRCS work jointly with WVCA and other Task Force member agencies to conduct watershed specific assessments that determine whether existing municipalities and major unincorporated commercial/industrial centers within the State need to be protected in place (floodwalls, levees, channel modifications, relocations) to preserve the commercial, service and employment base that now supports the surrounding county population. These protected centers also can serve as relocation sites for commercial and residential development acquired from the floodway (see item 3 below). Existing data from previous protection studies for these communities can form the basis for this assessment. The recommendations of these watershed assessments would form the basis for funding requests to pursue specific protection projects at critical municipal centers.

The watershed assessments may be conducted through programs such as the Section 22 PAS and PL 83-566 Watershed Protection and Flood Prevention Act. Full consideration of the environmental effects of these potential structures would be coordinated with the WVDNR, WVDEP and USFWS during the assessment.

3. A voluntary program of permanent floodway acquisition should be establsihed to address the inventory of existing structures in the regulatory floodway. These structures and their associated facilities are subject to frequent and severe flooding and impact damages by floating debris. During flood events, these structures can become floatable debris blocking stream crossings and battering other downstream floodplain development. These structures can also serve as point sources of stream pollution. The

floodway acquisition program would be initiated in the non-municipal areas to avoid interference with possible structural protection of incorporated cities, towns, villages and communities and commercial centers discussed in item 2 above. The program would be voluntary in nature and relocation benefits and services would be provided to assist families to secure flood-safe replacement housing. Feasible commercial and industrial relocations would be assisted through Federal and State economic development grant and loan programs. Federal, State and local government offices and facilities would be relocated to flood-safe sites.

The Section 202 Nonstructural flood Damage Reduction program, being implemented in the Tug Fork Valley since 1985, has acquired several hundred floodway structures in West Virginia and Kentucky. This action has resulted in an overall reduction in flood damages and a reduction in the 100-year frequency flood profile in project areas. In conjunction with this program, three replacement housing sites were constructed to accommodate relocated families. In some cases, commercial structures were acquired in the floodway relocated within communities protected by local protection projects (floodwalls). WVOES projects administered through FEMA's Hazard Mitigation Grant Program have also successfully acquired floodway structures throughout the State.

The proposed floodway acquisition program could be best administered through FEMA (Pre-Disaster Mitigation Program) in cooperation with WVOES. The WVHDF and WVDO could support this effort through identification and funding of replacement housing and commercial relocation sites. The success of the floodway acquisition program would be partially contingent upon the ability to secure decent, safe and sanitary replacement housing outside of the floodplain. Equally important would be a site development process for commercial relocations from the floodplain.

4. A voluntary program of nonstructural protection should be developed for structures located in the flood fringe areas of the State that cannot be protected by structural floodwalls, upstream retention, or channel modifications. Nonstructural protection would include floodproofing, replacement on-site or permanent acquisition depending upon the height of flooding at the structure, the structure type and building condition and comparative option costs.

The Section 202 Nonstructural flood Damage Reduction program being implemented in the Tug Fork Valley since 1985 has floodproofed several hundred flood fringe structures in West Virginia and Kentucky. This action has resulted in an overall reduction in flood damages and an improvement in housing quality throughout the basin. The proposed program would not be initiated until the assessments in (1) and (2) above are completed and the floodway acquisition program has been initiated in a watershed. This nonstructural program would be best administered through the USACE, NRCS, WVCA and WVOES.

Appendix A — Floodplain Management

As evidenced by the flood damages resulting from the summer of 2001 and other historical floods, floodplain management is ineffective in much of West Virginia. While every county and municipality in the National Flood Insurance Program has enacted a floodplain management ordinance, enforcement of the ordinances has not been a priority for many of them. Likewise, the State has not officially acknowledged the importance of floodplain management in reducing flood damages.

In the Federal Emergency Management Agency's (FEMA) 2003 Budget submittal, the agency rated the National Flood Insurance Program as "moderately effective" and went on to state that it processed flood damage claims quickly; however many at-risk homes and businesses remained un- insured.

After flood events, numerous homeowners stated that they were unable to purchase flood insurance because their insurance agent does not sell flood insurance policies. The Task Force recommends that the WV Insurance Commission require all insurance agents selling property insurance in West Virginia either offer flood insurance or maintain a referral list of agents who do offer flood insurance in their community. One such referral mechanism is the LEADS program operated by FEMA. By calling a toll-free number (1-800-720-1093) the caller can obtain contact information for three agents offering flood insurance in any given zip code area.

In addition, the Task Force recommends that the Insurance Commission address this problem by requiring all insurance agents to:

- Obtain a signature on a statement that acknowledges that the purchaser is aware that flood insurance is not included with their standard policy; and,
- Obtain a separate signature stating that the client has declined purchase of a separate policy to cover flood damages if they decline to purchase such a policy.

The Insurance Commission should provide incentives for insurance agents to be educated about the National Flood Insurance Program (NFIP). Ten to twenty agents should be randomly checked each year to ensure that they are offering flood insurance to businesses and residents or providing appropriate referrals; and to determine if flood policies are being rated properly. While participation in the National Flood Insurance Program is

voluntary, sanctions on mortgage credit and economic development program funding effectively require local participation. Local governments must acknowledge ownership of their floodplain management ordinance and that its requirements provide sensible protection for the community. Local government needs to reaffirm its support for the concepts of responsible floodplain management.

The National Flood Insurance Program (NFIP) is a voluntary program based upon a formal agreement between local communities and FEMA. If the community agrees to enforce certain regulations in the 100-year floodplain, then subsidized flood insurance will be available for eligible structures and facilities within the community. This program encourages property owners to buy flood insurance as an alternative to disaster assistance to meet the rising costs of repairing damage caused by floods. Flood insurance isn't included in the standard business or homeowner insurance policy. Many agents and few purchasers are aware that flood insurance under the NFIP, can be purchased for the value of the dwelling (not just the amount of the mortgage) or that additional coverage can be purchased for the contents. Renters are generally unaware that they can purchase flood insurance just for the contents. All residents in West Virginia's floodplains, and all insurance agents licensed in West Virginia should become better informed concerning the NFIP and its availability.

If a community with identified flood hazard areas chooses not to participate:

- Flood insurance will no longer be available.
- There will be no Federal loans or grants for structures in identified flood hazard areas
- No Federal disaster assistance may be provided to repair or replace structures in identified flood hazard areas for any flood related damage.
- Lenders must notify the buyer or lessee that the property is in a flood hazard area and must notify the buyer that the buyer is not eligible for disaster relief in a flood related declared disaster.
- Actuarial rates go into effect regardless of a community's status in the program. Insurance premiums on non-compliant construction may prove prohibitive and affect future property salability and values.

The local governing body may be open to liability because their action denies the ability of its citizens to purchase flood insurance, and it does not take positive steps to reduce the exposure of life and property in the face of authoritative scientific and technical data. In FEMA's 2003 Budget submittal, the agency has outlined proposals to improve the financial situation of the NFIP. The proposals that would affect West Virginia include:

- Reducing the percentage of policyholders who pay only a portion of the cost of their
- premiums. (FEMA is prohibited from charging the full premium for properties built
- before a community adopted NFIP building standards. Properties built after a community
- adopts NFIP building standards must pay the full actuarial rates and requires that the new
- construction comply with floodplain management guidelines. Many pre-FIRM (Flood
- Insurance Rate Maps) structures are unwisely located, repeatedly flooded, and account

- for a significant portion of flood insurance claims).
- Phase out flood insurance subsidies of second homes and vacation properties
- Require that mortgage borrowers insure the full replacement value of their properties
- Eliminate State taxation of flood- insurance policies.

One additional action that could be proposed would be to ensure that actuarial rates go into effect regardless of a community's status in the program. (Insurance premiums on noncompliant construction may prove prohibitive and affect future property salability and values.)To participate in the National Flood Insurance Program, communities must adopt a floodplain management ordinance that requires the community to determine if construction, development, or fill is within the regulated floodplain and issue or deny a permit for all such activity within the regulated floodplain. This provides the basis for a local floodplain management program and will identify the area at risk from flooding, reduce the impacts of flooding in the community, and allow responsible floodplain development.

In West Virginia, the 55 counties and 248 of the municipalities participate in the NFIP. (See Table A-1 at the end of this appendix). These jurisdictions have agreed to adopt and enforce floodplain ordinances. While all of these jurisdictions are required to meet the same minimum standards, each jurisdiction may interpret them differently. Few counties or municipalities have the staffing, technical expertise, or resources to properly manage floodplains. The State government in West Virginia has never officially endorsed floodplain management as a priority. The WV Office of Emergency Services (WVOES) has been designated by the Governor as the coordinating agency for the NFIP. WVOES offers education and technical support for floodplain management. To improve professional management of the floodplains, the Task Force recommends that all relevant State agencies participate with the local floodplain managers in the establishment of a West Virginia Floodplain Management Association in cooperation with the Association of State Floodplain Managers, Inc. (ASFPM). The State should encourage participation and membership in the Association of State Floodplain Managers by paying membership dues for one floodplain manager in each county. Table A-1 provides the name and contact information for all county floodplain managers in the State. To determine the floodplain managers for a municipality, contact the floodplain manager for the appropriate county.

The Task Force recommends that all counties and participating municipalities have a certified floodplain manager (CFM) on staff or under contract by 2008. It would be acceptable for participants to join together to employ one certified floodplain manager. All counties and participating municipalities should adopt and enforce improved floodplain ordinances or enter into enforcement agreements with adjacent local governments. When municipalities annex areas, they do not always prepare new maps to include the newly annexed floodplain. Sometimes these annexed floodplains are not properly managed because the city is unaware it is a floodplain, the city did not adopt the county map, or the city is simply ignorant of the need to manage the area. It is recommended that cities be required to adopt surrounding floodplain maps at some stage in the annexation process.

Many local jurisdictions would like to participate in the hazard mitigation programs offered by Federal agencies but lack the funds for the required local match. To provide these funds the Task Force recommends that the State allocate a minimum of one million dollars s each year be allocated as the "Flood Loss Reduction Fund." This fund would provide:

- Cost-sharing to match Federal funds for flood damage reduction projects (structural or non-structural)
- A stand-alone fund for State flood damage reduction projects
- Grants to improve local floodplain management.

The Task Force recommends that every participating county and municipality be required to file its floodplain ordinance with WVOES within 30 days of passage to improve oversight of floodplain management ordinances. Some structures that affect the flow characteristics of a stream, such as bridges, retaining walls, culverts etc., were constructed during the gap between the time the watershed was studied and the Flood Insurance Rate Map (FIRM) was published. These "gap" structures provide ample reason for restudying a watershed. The Task Force recommends that a program be established to identify these "gap" structures and report them to WVOES so the appropriate watersheds can be moved to a higher priority for restudy.

The Task Force recommends that Federal, State and local agencies and all participating communities should discourage development within the floodplain by:

- Providing relocation assistance to remove businesses and residents currently located in the regulated **floodway**, the area adjacent to the stream with the deepest floodwater and greatest velocity,
- Floodplain ordinances to forbid future development in floodways.
- Modifying legislation to prohibit infrastructure development in regulated floodway,
- Requiring all new public structures or significant improvements to existing public structures within the regulated floodplain to be constructed in a flood-resistant manner, and
- Requiring Real Estate Agents to determine the location of structures and property listed for sale relative to the floodplain. This information should be provided to potential purchasers before execution of a purchase agreement.

The Task Force recommends that the State initiate a program to relocate all critical facilities, such as government administration buildings, hospitals, jails, and water and sewer treatment plants out of the floodway.

If a local government is receiving assistance on floodplain management from any regional or State agency, the Task Force recommends that the State require local governments to consult with the agency providing floodplain management assistance on all proposed variances from the floodplain ordinances.

The Task Force recommends that all licensed surveyors and professional engineers should be required to include the floodplain boundaries and elevation, where applicable, on deed plats with the latitude and longitude of a reference point. Where this

documentation isn't applicable, a statement to that effect should be placed on the deed plat. Licensed surveyors and professional engineers should also provide the appropriate floodplain manager with a copy of all elevation certificates.

Floatable material tends to accumulate on the floodplains and become floating debris during a flood. This potential debris is disguised as outbuildings, lumber, tires, woody debris, logs, plastic containers, propane and gas tanks and containers, manufactured homes, vehicles, solid waste, and hazardous materials. This debris causes additional damage during flood events by blocking culverts or catching on bridges to form temporary dams. When these dams break loose, the surge of water sweeps away everything in front of it until it catches on the next obstruction and repeats the cycle.

Floodplain ordinances should be amended to prohibit storage of floatable material in the floodway. Figures A-1 and A-2 show two common items that float and can cause stream blockages. Some materials reside at private floodplain residences, but the greatest concentrations of potential floatable debris is at commercial and industrial sites where they may be stored to support production, maintenance, replacement, or sales activities. During a flood event, this material, from whatever location, becomes a significant source of floatable debris. Storage of hazardous materials in the floodplain is already regulated through the WVDEP's hazardous materials programs. However, non-hazardous materials stored in the floodplain are largely unregulated in the State, and remain a hazard to thousands of residents.

Neither county nor municipal floodplain ordinances provide adequate regulatory enforcement powers in many cases to enable floodplain managers to control or reduce the existence of floatable debris. Other than WVDEP's Pollution Prevention Open Dump Cleanup Program (PPOD), there is little assistance in cleaning up floodplains and stream banks in the watersheds. The Task Force recommends that greater emphasis be placed on control of the storage of floatable materials and waste materials (liquids and solids) within floodplains. This oversight and control of floodplain materials storage could be deployed by WVDEP, WVDNR, and/or local floodplain managers.

Figure A- 3: Woody debris in stream channel.

Regulations do exist for anchoring manufactured housing through the NFIP and the Manufactured Housing Section of the WV Division of Labor. The Task Force recommendsthat the State establish a program to identify and either remove, stabilize, or anchor floatable structures and materials in the floodplain. This program could be deployed through the county and municipal floodplain managers. In addition, WVDEP's Pollution Prevention Open Dump Cleanup Program (PPOD) should receive additional funding to promote watershed clean-up days in West Virginia. This program has removed thousands of tons of solid waste from stream banks and other areas throughout the State. The Task Force recommends that every person or business (i.e. Contractor, property owner, homeowner, dealer or installer) involved in the placement, substantial improvement, construction, or installation of any manufactured housing unit in the floodplain should be required to provide a copy of a certification signed and sealed by a WV Registered

Figure A-1: Unsecured manufactured home

Figure A-2: Unsecured propane tank

Professional Engineer, confirming that the manufactured home is properly installed (including anchoring) to the electric-power utility company before the power is connected.

All electric companies should be required to have a copy of the certification on file prior to connecting the power and keep a copy of the certification on file for a minimum of 5 years. If no certification is obtained prior to construction or installation, the builder, manufactured housing dealer or installer, homeowner, and property owner shall be held jointly liable. Methods do exist for anchoring various types of petroleum, propane gas, and gasoline tanks in the floodplain, but there are no State regulations requiring that anchoring to occur. The Task Force recommends that all propane and home-fuel-oil dealers be required to ensure that all LPG and propane tanks which hold more than 40 pounds in size and fuel-oil tanks that are located within the regulated floodplain or within 50 feet of a perennial stream are properly situated and anchored to resist expected flood waters and impact from debris before they can re-fill them.

The Task Force also recommends that the appropriate State agencies develop location standards that prohibit locating floatable materials within the regulated floodplain at the following types of facilities:

- Solid Waste non-disposal facilities,
- Solid Waste disposal facilities,
- Hazardous Waste treatment, storage and disposal facilities,

Natural Gas facilities, and

- Underground storage tank facilities.

Agencies and individuals frequently do not consider the long-range effects of their actions during emergency operations to remove stream blockages and debris following a flood event. Often, their actions harm the stream channel and riparian environment and can actually increase the impacts of later flood events. In some instances, stable streams (discussed above) are modified during debris removal operations. Figure A-3 shows the type of woody debris accumulation that requires removal from stream channels.

The Task Force recommends that guidelines for the removal of stream obstructions and debris be developed through a joint effort of the Federal and State agencies on the Task Force. The purpose of these guidelines would be to ensure that stream debris removal crews, supervisors, and their sponsoring agencies (FEMA, NRCS, USACE, National Guard, WVCA, and others) are all aware of the environmental impacts that can occur from these operations, and the regulatory permits required by everyone during flood recovery work. At a minimum, information on locations of stable streams and high quality streams in the flooded area, and best management practices for in-stream work, would be included in the guidelines.

The Task Force recommends that the floodplain management staff in the West Virginia Office of Emergency Services be increased to support local floodplain managers. At a minimum, this should include 18 additional positions:

- 1 position to conduct training and education of State agencies and regional- floodplain technical specialists (as outlined in Appendix K-Education),
- 1 position to manage disbursement of grants funds and to coordinate regional meetings of Floodplain Managers that will focus on training and peer support for County and Local Floodplain Managers,
- 16 positions to coordinate the Community Rating System program, facilitate new studies and re- mapping of flood hazard areas, provide technical support to local government units and State agency projects throughout the State.

This increase in staffing could be accomplished by increasing the State's share of Community Assistance Program (CAP) funds from the Federal government. These funds pay for 75 percent of the expense of personnel working directly on NFIP issues. CAP funds are generated by a surcharge on every flood insurance policy. The Flood Insurance Administration could increase this surcharge, thereby generating more CAP funds to pay for State staff.

Few other State agencies are aware of floodplain-management and mitigation techniques or their implications. All investments of State funds should support practices that minimize the adverse effects of construction, development, and fill on the regulated floodplain. The Governor should issue an Executive Order and the Legislature should issue a resolution in support of floodplain management and recognizing the natural and beneficial role of the floodplain in providing ecological and economic benefits to the State. The Legislative Resolution should deny all financial assistance to local governments and public institutions that construct noncompliant buildings or enter into new leases in noncompliant buildings located in the regulated floodplain. The Legislative Resolution should also require all State agencies to prepare a 10-year plan to eliminate non-compliant State facilities within the regulated floodplain.

FEMA and WVOES may jointly conduct Community Assistance Visits (CAV) with participating communities. These are oversight inspections of the implementation and enforcement of floodplain ordinances. Communities can be placed on probation or suspended from the NFIP based on the results of these visits. Only fourteen (14) CAVs were conducted in West Virginia between 2000 and 2002. FEMA and WVOES should work together to meet FEMA's stated goal of conducting a Community Assistance Visit in every community once every 5 years to ensure that the floodplain ordinances are being properly implemented and enforced. This would require approximately 72 Community Assistance Visits each year in West Virginia. FEMA also operates a Community Rating System that allows residents to receive a discount on their flood insurance premiums based on community-wide actions. Most communities don't have the resources to conduct the activities required by this program. The State should assist local jurisdictions by assuming responsibility for some of these activities. These activities should reduce the cost of flood insurance and increase the number of policies issued. The State should provide monetary incentives to encourage communities to participate in FEMA's

Community Rating System program. Legislation should be changed to allow counties to conduct activities that exceed the minimum required to participate in the NFIP. This would allow them to participate in the Community Rating System. More information about the CRS program can be found at www.fema.gov.

The Community Rating System activities fall under the following four categories:

- Public Information
- Flood-Damage Reduction
- Mapping Regulations
- Flood Preparedness

Some issues only affect selected areas within West Virginia. While these issues need to be addressed on an individual basis where they occur, the Task Force recommends a consistent policy be established for addressing them. These issues include:

- Areas outside the State's boundaries that affect flooding events within West Virginia include:
    - Virginia and North Carolina portions of the New River basin,
    - Virginia and Kentucky portions of the Tug Fork / Big Sandy River basin,
    - Ohio and Pennsylvania portions of the Ohio River basin (Wheeling Creek and other tributaries that cross West Virginia as well as those entirely within other states),
    - Pennsylvania portions of the Cheat River basin,
    - Maryland and Pennsylvania portions of the Potomac River basin, and
    - Virginia portions of the Shenandoah River basin.

- Islands with residences or industry located entirely within the floodplain include:
    - Blaine Island in the Kanawha River (Industrial),
    - Brown Island in the Ohio River (Industrial),
    - Wheeling Island in the Ohio River (Residential and Commercial),
    - Willow Island in the Kanawha River (Industrial), and
- Islands used for camping and other industry.

- County seats located within the floodway.

- Recreational areas in floodplain including:
    - Private campgrounds,
    - Federal, State and local campgrounds,
    - Secondary homes, and
    - Recreational vehicle storage in floodplains.

- Ponds and dams removed or altered and the subsequent planned or inadvertent reduction of flood protection. The Dam Safety Program within the Department of Environmental Protection's Division of Water and Waste Management can provide a list of such structures within the State.

The Task Force also recommends that every county identify and prepare relocation areas for use in the event of a disaster. These areas should be provided with adequate water and sewage service for the number of residences proposed. In the interim, these areas should be developed as parks, athletic fields or similar recreational use.

Watershed Flood Protection Authorities. The recommendations of the Task Force to enact stormwater runoff controls in all watersheds, tighten enforcement of floodplain management ordinances, control floatable debris and wastes stored in the floodplain and protect certain stream environments present a daunting task. The inability of governmental agencies and departments to maintain current database information on floodplain development and violations indicates the potential problems associated with deploying new requirements and responsibilities. Regardless of the Federal or State agency given these new responsibilities, identifying sufficient staff and funds to manage these programs would be difficult. Without some process of oversight or a strong grassroots involvement, the recommendations presented in this document would be fruitless.

In an effort to alleviate some of this administrative burden, the Task Force recommends that the State establish watershed flood protection authorities. These authorities would coordinate floodplain protection and management issues for one or more of the major river basins. The authorities would function similar to the existing solid-waste authorities. These individual authorities would be provided information, assistance, and direction through the Task Force. This program would be coordinated with the existing Watershed Association programs administered by WVDEP. The duties of the watershed authorities would include:

- Coordinating with State and Federal agencies during flood-damage-reduction planning
- Coordinating stream identification, designation, and protection
- Coordinating stream ecosystem and wetland restoration projects
- Coordinating information generated during planning for flood-protection projects
- Assisting with the issuance of Public Lands and Landowner Stream Access permits.
- Coordinating the development of comprehensive watershed plans.

Finally, it's recommended that the West Virginia State Code be amended as follows:

(a) §7-1-3v. Floodplain and mudslide area management; legislative findings; power and authority; enforcement; provisions cumulative.

> (a) The Legislature hereby finds and declares that it is imperative that municipalities and counties in this state be fully authorized and empowered to take all action necessary to comply with the requirements of the National Flood Insurance Act of 1968 (Public Law91-152), as amended by the Congress of the United States through the fifteenth day of February, one thousand nine hundred seventy-five 2001; that municipalities presently are vested with all statutory power and authority necessary in this regard; and that the purpose of this section is to authorize and empower the several counties of this state to comply with such requirements.

(b) As used in this section:

(1) "Act" means the National Flood Insurance Act of 1968 (Public Law 91-152), as amended by the Congress of the United States through the fifteenth day of February, one thousand nine hundred seventy-five 2001; and

(2) "Specified area or areas" means the area or areas specified under such act as a floodplain or mudslide area or areas within which control over construction and improvements must be exercised in order to comply with such act.

(c) To the extent and only to the extent necessary to comply with the eligibility requirements of and otherwise fully and in all respects to comply with the requirements of such act, the county commission of each county is hereby authorized and empowered to (i) adopt, administer and enforce building codes for a specified area or areas within such county, which building codes may establish different requirements for different specified areas; (ii) require and issue building permits for all proposed construction or other improvements in such county: Provided, That nothing contained in this subdivision (ii) shall authorize a county commission to refuse to issue a building permit for any proposed construction or other improvement outside of a specified area or areas within such county; (iii) conduct inspections of construction and other improvements in a specified area or areas within such county and (iv) otherwise take such action and impose such requirements regarding land use and control measures in a specified area or areas within such county as shall be necessary under such act: Provided, That no such building code adopted by a county commission shall apply within nor any authority hereinabove granted exercised by a county commission within the corporate limits of any municipality which has taken appropriate action to comply with such act, unless and until such municipality so provides by ordinance. Any such building code adopted by a county commission or municipality and any other requirements imposed by a county commission or municipality under the provisions of this subsection (c) may be enforced by injunctive action in the circuit court of the county.

(d) The county commission, in formally adopting a floodplain ordinance may designate an enforcement agency which shall consist of the following:

(i) The county assessor (or other technically qualified county employee) shall determine whether proposed development will occur in a specified area by using information collected in accordance with subsection (c) (ii) above and/or section 11-3-3a and 7-1-3p of the State Code.

(ii) The president of the county commission, the president of the planning commission, the county administrator, or his or her designee, is to be appointed county floodplain manager, and guide all development determined to be within the specified area in accordance with the ordinance requirements. The county floodplain manager must be complete training specific to floodplain management through the NFIP within two months of being appointed.

(iii) The director of the county office of emergency services shall be responsible for providing information and assistance to the floodplain manager after a flooding event.

(iv) The county surveyor and/or county engineer, if the commission chooses to hire one (or other technically qualified county employee), shall provide field inspections

of permitted development and technical assistance as requested by the floodplain manager.

(v) The prosecuting attorney shall serve as an ex officio member of the enforcement agency and the county officer charged with processing injunctions.

(vi) The county sheriff shall serve as an ex officio member of the enforcement agency and the county officer charged with enforcing the orders of the county commission under this section.

(vii) The members of this agency, along with their staff, are jointly responsible for assuring that any new development observed has been properly permitted. The power and authority conferred upon county commissions in this section is supplemental to and not in derogation of any power and authority heretofore or hereafter conferred by law upon county commissions.

(e) Nothing in this or any other act shall prohibit any county commission or municipal government from enacting rules or regulations that exceed the requirements established by section (a).

TABLE A-1. COUNTY FLOODPLAIN MANAGERS					
County	Name	Address	City	St	Zip
Barbour	Chuck Foley	8 North Main St	Philippi	WV	26416
Berkeley	Harry Carter	119 West King St	Martinsburg	WV	25401
Boone	Greg Lay	PO Box 253	Danville	WV	25053
Braxton	Fred Thompson	HC 69, Box 48	Frametown	WV	26623
Brooke	Phyllis Sisinni	632 Main St	Wellsburg	WV	26070
Cabell	Connie Gray	750 5th Ave	Huntington	WV	25701
Calhoun	Richard Kirby	PO Box 230	Grantsville	WV	26145
Clay	Suzanne Legg	PO Box 310	Clay	WV	25043
Doddridge	Lewis Knight	118 East Court St	West Union	WV	26456
Fayette	Tim Richardson	PO Box 307	Fayetteville	WV	25840
Gilmer	Reta Kight	10 Howard St	Glenville	WV	26351
Grant	Robert Livingston	PO Box 608	Petersburg	WV	26847
Greenbrier	Drema Cyrus	200 North Court St	Lewisburg	WV	24901
Hampshire	Shelley Kile	PO Box 883	Romney	WV	26757
Hancock	Joe Alongi	PO Box 455	New Cumberland	WV	26047
Hardy	Paul Lewis	204 Washington Ave	Moorefield	WV	26836
Harrison	Richard McElroy	301 West Main St	Clarksburg	WV	26301
Jackson	Robert Bibbee	PO Box 800	Ripley	WV	25271
Jefferson	Paul Raco	104 East Washington St	Charles Town	WV	25414
Kanawha	Danny Haught	407 Virginia St East	Charleston	WV	25301
Lewis	Shelia Lewis	PO Box 466	Weston	WV	26452
Lincoln	Steve McComas	PO Box 497	Hamlin	WV	25523
Logan	Mark Sefton	28 1/2 Main St	Logan	WV	25601
Marion	Kevin McLung	200 Jackson St	Fairmont	WV	26554
Marshall	Tom Hart	PO Drawer B	Moundsville	WV	26041
Mason	John Bryant	PO Box 247	Point Pleasant	WV	25550
McDowell	Norman Clark	PO Box 1508	Welch	WV	24801
Mercer	Nelson Short	1501 West Main St	Princeton	WV	24740
Mineral	Jason Simmons	150 Armstrong St	Keyser	WV	26726
Mingo	Bill Davis	PO Box 1197	Williamson	WV	25661
Monongalia	Ronald Kyle	74 Vandervort Dr.	Morgantown	WV	26505
Monroe	Randall Williams	PO Box 350	Union	WV	24983
Morgan	Alma Gorse	PO Box 28	Berkely Springs	WV	25411
Nicholas	David King	700 Main St	Summersville	WV	26651
Ohio	John Tagg	City/County Bldg.	Wheeling	WV	26003
Pendleton	Carolyn Sponaugle	PO Box 937	Franklin	WV	26807
Pleasants	Tina Butcher	301 Court Lane	St Marys	WV	26170

TABLE A-1. COUNTY FLOODPLAIN MANAGERS					
County	Name	Address	City	St	Zip
Pocahontas	Donald McNeil	900C 10th Ave	Marlinton	WV	24954
Preston	Gregory Cain	103 1/2 West Main St	Kingwood	WV	26537
Putnam	Sandy Mellert	3389 Winfield Road	Winfield	WV	25213
Raleigh	Clayton Terry	116 1/2 North Heber St	Beckley	WV	25801
Randolph	Bill Swecker	120 South Randolph Ave	Elkins	WV	26241
Ritchie	Gayford Hoover	115 East Main St	Harrisville	WV	26362
Roane	Rob Miller	205 East Main St	Spencer	WV	25276
Summers	David Dent	PO Box 97	Hinton	WV	25951
Taylor	Ronnie Helmondoll	214 West Main St	Grafton	WV	26354
Tucker	W. Tuesing	215 First St Suite #3	Parsons	WV	26287
Tyler	Chuck Shephard	PO Box 238	Middlebourne	WV	26149
Upshur	Greg Harris	38 West Main St	Buckhannon	WV	26201
Wayne	Randy Fry	PO Box 248	Wayne	WV	25570
Webster	Don McCourt	112 Bell St	Webster Springs	WV	26288
Wetzel	Edgar Sapp	PO Box 156	New Martinsville	WV	26155
Wirt	Debbie Hennen	PO Box 548	Elizabeth	WV	26143
Wood	Keith Litton	1 Court Square	Parkersburg	WV	26101
Wyoming	Dean Meadows	PO Box 568	Pineville	WV	24874

APPENDIX B:
FLOOD WARNING SYSTEM

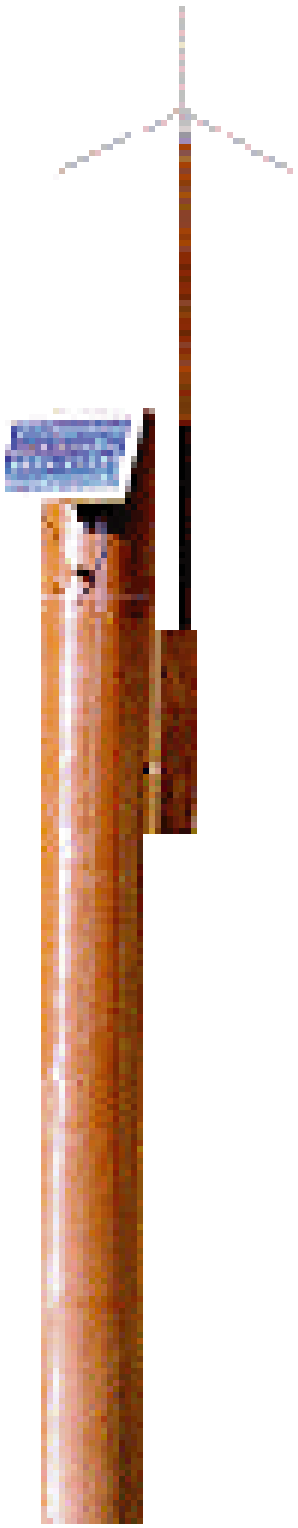
THE WEST VIRGINIA FLOOD WARNING SYSTEM

Flood Watches and Flood Warnings in West Virginia are issued by the National Weather Service (NWS) based on information obtained from rain and stream gauges scattered around the state and local weather radar systems.

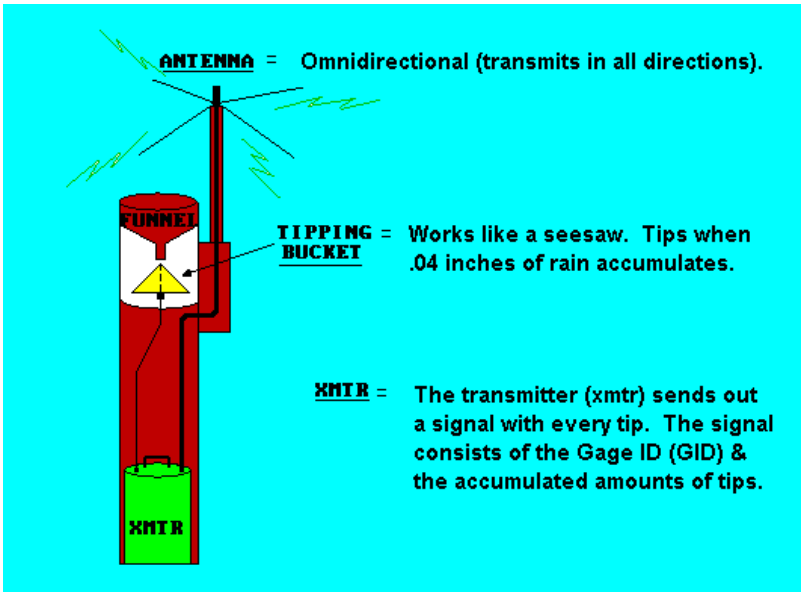
RAIN GAUGES

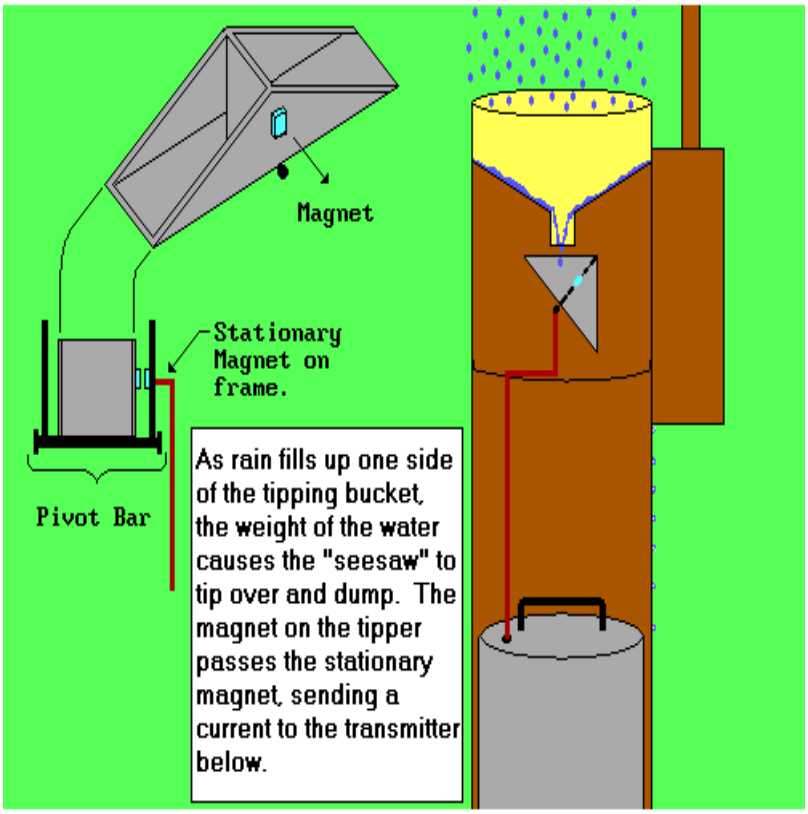
The concept of the Integrated Flood Observing and Warning System (IFLOWS) has expanded since the creation of the National Flash Flood Program Development Plan in 1978. The goals of the IFLOWS Program are to reduce the loss of life from flash floods, reduce property damage, and reduce disruption of commerce and human activities. The National Weather Service (NWS) began a joint effort with selected states in the Appalachian Region of the United States to develop a flash flood warning system to improve flood warning capabilities in that Region.

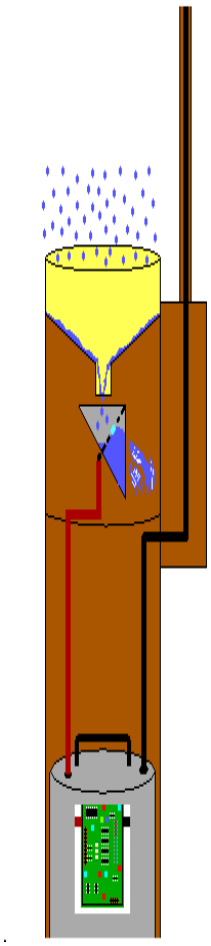
The rain gauge portion of the IFLOWS network, which covers 47 counties in West Virginia, is maintained by the WV Office of Emergency Services (WVOES). These gages report rain and stream data via radio transmission to various mountain top receivers and repeaters throughout the state. These receivers and repeaters then relay the information to the Office of Emergency Services (OES) and the NWS computers in Charleston. The information is then processed and transmitted to various Federal, State and County agencies via Internet and Microwave from the OES computers. The NWS computer is the primary source of IFLOWS information to other NWS offices and the primary backup to the OES computers.



An external view of a typical rain gauge is to the left. A solar panel provides power to the sensors and transmitters concealed by the shell. These images and more information can be found at www.afws.net.



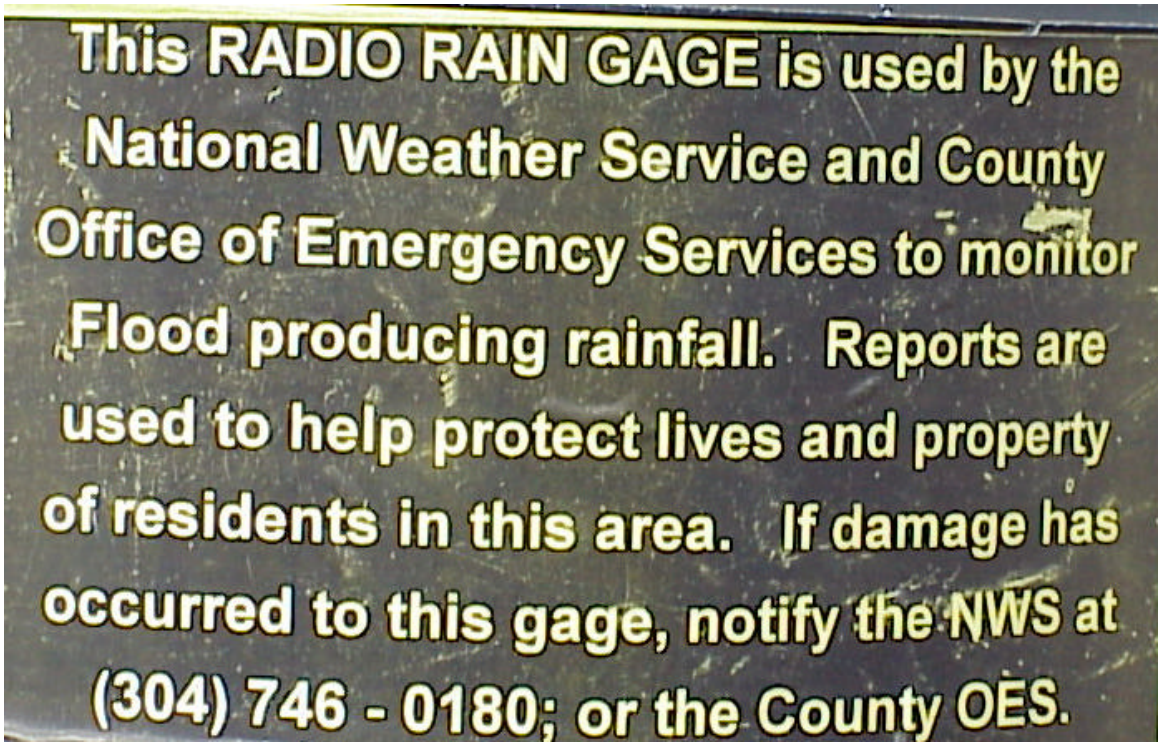




The current from the tipping bucket causes the transmitter to send a message out through the antenna. This coded message consists of a gage ID and a counter value corresponding to each tip of the bucket.

This coded message (raw rain gage data) is processed by the IFLOWS software and stored in the IFLOWS database, which can be displayed by the user.

While most counties have some rain gauges and a few have numerous gauges, all counties do not have a sufficient number of them and some are not installed in the most advantageous location. The locations of rain gauges change on a regular basis due to efforts to improve the system and as a result of vandalism. WVOES has established a policy of relocating any rain gauge destroyed by vandalism twice within one year.



Some rain gauges are installed with stream gauges. While this simplifies the operation and maintenance, it is not always the best meteorological location for the rain gauge. It is an established fact that there are different patterns of rainfall on mountaintops and streamsides.

STREAM GAUGES

Before 1930, neither floods nor stream flow in West Virginia were systematically documented. Since then, data on flooding has been collected as part of the statewide stream-gauging network supported by State and Federal funds. The United States Geological Survey office (USGS), the Army Corps of Engineers (USACE), or the West Virginia Office of Emergency Services, may own stream gauges in West Virginia. Most stream gauges are maintained in cooperation with the USGS.

Some stream gauges transmit their data over the ALERT communication system. Data from other stream gauges can only be accessed via satellites, telephone modems or by physically visiting the site and reading the data off of charts. It may take four hours to four days to obtain data from gauges that are not part of the ALERT communication system.

Delays in receipt of information or geographic gaps in the system can delay identification of conditions that contribute to flooding. Gauges that do not transmit over the ALERT system can delay the information. Malfunctioning or vandalized gauges or areas where gauges were never installed may cause geographic gaps. In addition it must be recognized that, regardless of the number of gauges, it is always possible for a storm system to "park" between gauges and not be identified as a major storm.

Once the National Weather Service recognizes conditions that contribute to flooding, they disseminate a Flood Watch or Flood Warning via various networks and the appropriate county warning points. Unless someone at the warning point receives, understands and disseminates the Flood Watch or Flood Warning to their specific county or counties, it is as ineffective as shouting fire in an empty theater.

IMPROVEMENTS TO THE STATEWIDE FLOOD WARNING SYSTEM

e. Adding ALERT and GOES transmission equipment at 118 stream gages.
f. Install an additional 60 rain gages,
g. Install an additional 28 stream gages with ALERT and GOES communications,
h. Install an additional 9 radio repeaters for the ALERT communication system.

These statewide recommendations would require $2,183,000 the purchase and installation of the new equipment and an increase in the annual allocation of state funds for operations and maintenance to a total of $851,000 in the fifth year.

RATING TABLES

A rating table is a table of stage verses flow. Rating tables are constructed by site survey and analysis work. An example of a rating table is provided below.

River forecast models used by the National Weather Service are driven by the amount of water flowing past the gauge location measured as cubic feet per second (cfs) of flow not stage or river height. The rating table is used to convert data for input into the model. The rating table along with other factors such as rainfall, runoff, unit hydrographs and soil conditions enable the National Weather Service to determine the height and time of a river's crest at that point.

TABLE B-1: SAMPLE RATING TABLE
DISCHARGE (100 Cubic Feet per Second)
TENTHS OF FEET

		.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
S - A C F	0	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	1	1.0	1.1	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.2
	2	2.3	2.5	2.6	2.7	2.9	3.1	3.3	3.5	3.8	4.0
	3	4.2	4.5	4.7	5.0	5.3	5.7	6.0	6.4	6.8	7.2
	4	7.6	8.0	8.4	8.8	9.1	9.3	9.8	10.2	10.7	11.0
	5	11.4	11.8	12.2	12.6	13.0	13.4	13.8	14.2	14.7	15.2

I	6	15.7	16.2	16.6	17.0	17.4	18.2	18.6	19.0	20.2	20.6
	7	21.1	21.6	22.1	22.5	22.9	23.3	23.6	23.9	24.2	24.5
F	8	24.9	25.4	25.8	26.2	26.6	27.0	27.5	28.0	28.4	28.8
E	9	29.2	29.5	29.8	30.2	30.4	30.6	30.8	31.0	31.2	31.4
E	10	31.6	31.8	32.0	32.2	32.4	32.6	32.8	33.0	33.2	33.3
T											

Each river point must have a rating table to allow forecasting.

Gauges that only provide the stage are needed to quickly determine the change in stream conditions on small streams or at headwater points. Due to the rapid rise and fall of water levels at these locations, they do not necessarily need to have ratings calculated for them. The National Weather Service can use the stage to determine whether or not to issue a warning based on:

- rate of rise,
- caution or warning stage,
- rainfall and soil conditions, and
- other factors.

After a review of the stream gauges in the state it was determined that only one existing stream gauge needs a rating table developed. It is recommended that funds ($7,000) be allocated for developing this rating table. This amount is included in the total for operations and maintenance listed in the statewide amount above.

Details of the existing gauge networks and the proposed changes to them are provided in two tables at the end of this appendix. Table B-2 is a compilation of both rain and stream gauges statewide.

OPERATIONS AND MAINTENANCE OF THE FLOOD WARNING SYSTEM

There is limited routine maintenance of the IFLOWS system at this time. Rain gauges are serviced once per year and when the state knows the gauge is inoperative. After a careful analysis of the operations and maintenance (O & M) of the existing flood warning system and the proposed additions, it has been determined that existing funding for routine preventive O & M is inadequate.

West Virginia should allocate $851,000 annually for O & M of the statewide flood warning system. This will match $810,500 in federal and other funds for a total of $1,661,500 for O & M of the 319 rain gauges and 144 stream gauges necessary for an effective flood warning system in West Virginia.

PUBLIC NOTIFICATION OF FLOOD WARNINGS

For a flood warning to be effective it must be received and understood by the local agencies and the residents of the

impacted area. There are three systems designed to assist in this process. The Storm Watch system is a software package that conveys information to local warning points. The StormReady program, operated by the National Weather Service, is designed to improve the weather related knowledge and skills of local officials.

In addition the National Weather Service and The WV OES jointly maintain a web page showing all fifteen minute data on the rain and stream gauges using the ALERT system. Finally, the US Geological Survey has established a web page showing all of the stream gauges they maintain in West Virginia and recent stream levels. (http://water.usgs.gov/wv/nwis/current/?type=flow)

In addition, the Specific Area Message Encoding (S.A.M.E.) system operated by the National Weather Service allows residents to receive warnings for just their own county via radio. Most S.A.M.E. radio receivers can be programmed to receive information for up to fifteen (15) different counties. Use of S.A.M.E. radios encourages residents to keep the radios turned on for local warnings and eliminates warnings for distant areas.

STORM WATCH SOFTWARE

One computer dedicated to the Storm Watch system should be located in every county warning point statewide. The Storm Watch system is similar to IFLOWS software but has significant differences. Storm Watch is more graphic and requires users to interact with the software to silence alarms and react to warnings.

Computers dedicated to the Storm Watch Program are sized so that only the Storm Watch software will run on them. This prevents their being used for other activities which would interfere with operation of the warning system. Appropriate funds should be designated for the purchase and distribution of these computers and training of warning point personnel in use of the software. Each computer would cost approximately $600. This project has been started and approximately one half of the funding was obtained through a grant, the balance of the funding could be covered with the O & M funds that have been requested.

STORMREADY

The StormReady program is conducted by the National Weather Service and gives communities the skills and education to survive severe weather. StormReady helps communities strengthen their local hazardous weather operations. StormReady communities are better prepared to save lives and reduce property damage by better planning, education and awareness.

We encourage all local communities to participate in the StormReady program conducted by the National Weather Service. Communities become StormReady by:

- Establishing a 24-hour warning point and an emergency operations center.
- Having more than one way to receive severe weather warnings and forecasts.

- Having more than one way to notify the public of severe weather warnings and forecasts.
- Creating a system to monitor local weather conditions.
- Promoting the importance of public readiness through community seminars.
- Developing a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

To assist local communities in becoming StormReady we recommend the regional and statewide flood warning system be improved by installing three Specific Area Message Encoding (S.A.M.E.) radio transmitters to broadcast disaster warnings. This would cost approximately $90,000 for purchase and installation of the transmitters. WV OES would maintain these as part of the ALERT system. Funds from the proposed O & M funding could be matched with federal grants to complete this project.

Local communities could improve reception disaster warnings by requiring all public facilities to purchase and use S.A.M.E. radios to receive warnings of disasters that apply to their local area. These receivers cost between $40 and $90 each. While this study is concentrating on flood related disasters, S.A.M.E. radios are part of the Emergency Alert System and are used to notify residents of other emergencies such as road closings, water restrictions, chemical leaks, and terrorist incidents. Occasionally, grants and matching funds are available to help defray the costs of these radio receivers. We encourage all local facilities to purchase and use these radios in all public buildings.

Private individuals can improve their reception of disaster warnings by purchasing and using S.A.M.E. radios to receive warnings of disasters that apply to their local area. We encourage all residents to obtain and use these radios.

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

NOTES:

Gage Name indicates location of gage
Changes indicates what will be done to the gage
Service Desired is what type of information will be required after all modifications are complete
Capital Costs are the cost to make the modifications
O&M Costs are for annual maintenance
WV State funds are what the state will contribute towards the maintaining of each gage
Other funds are what is required for O&M from other sources

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Barbour	Elk Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Barbour	Azzen Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Barbour	Tygart River at Belington	Stream	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Barbour	Middle Fork River at Audra	Combined	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Barbour	Buckhannon River at Hall	Stream	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Barbour	Pleasure Valley	Rain	Existing - no modification	Rain		$1,000	$1,000	
Barbour	Sand Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Barbour	Tygart Valley River at Philippi	Stream	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Barbour	Glade Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Berkeley	Round Top	Rain	Existing - no modification	Rain		$1,000	$1,000	
Berkeley	Opequon Creek near Martinsburg	Stream	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Berkeley	Sleepy Creek East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Boone	Piney Knob Tower	Rain	Existing - no modification	Rain		$1,000	$1,000	
Boone	Elk Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Boone	Williams Hill	Rain	Existing - no modification	Rain		$1,000	$1,000	
Boone	Ballard Fork	Rain	Existing - no modification	Rain		$1,000	$1,000	
Boone	Little Coal River at Danville	Stream	add new Gage	Discharge	$25,000	$14,000	$8,000	$6,000
Boone	Rock Creek near Danville	Stream	Add stream Gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Boone	Big Coal River at Ashford	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Boone	Between Little Coal River and Spruce Fork	Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Braxton	Bug Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Braxton	Dingy South East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Braxton	Elk River at Sutton	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Braxton	Flatwoods North	Rain	Existing - no modification	Rain		$1,000	$1,000	
Braxton	Little Kanawha River near Wildcat	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Braxton	Lake Lane	Rain	Existing - no modification	Rain		$1,000	$1,000	
Braxton		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Braxton	Elk River near Frametown	Stream	Add ALERT	Stage	$10,000	$6,000	$1,000	$5,000
Braxton	Granny Creek at Sutton	Stream	Add stream Gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Braxton	Little Kanawha River below Burnsville Dam	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Braxton	Little Kanawha River at Burnsville	Stream	Add ALERT/GOES	stage	$10,000	$6,000	$1,000	$5,000
Brooke		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Brooke		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Brooke	Ohio River at Wellsburg	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Brooke	Buffalo Creek at Bethany	Stream	Add stream Gage with ALERT	Discharge	$25,000	$14,000	$8,000	$6,000
Cabell	Salt Rock	Rain	Existing - no modification	Rain		$1,000	$1,000	
Cabell		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Cabell		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Cabell	Mud River near Milton	Stream	Add stream Gage with ALERT/GOES	Discharge	$25,000	$14,000	$8,000	$6,000
Cabell	Fourpole Creek near Huntington	Combined	Add stream Gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Cabell - Lawrence, OH	Ohio River at Huntington	Stream	Add ALERT	Stage	$10,000	$6,000	$1,000	$5,000
Calhoun	Beech Fork	Rain	Existing - no modification	Rain		$1,000	$1,000	
Calhoun	Walnut West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Calhoun	Sand Ridge North East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Calhoun	Mt. Zion West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Calhoun	North of Mt. Zion	Rain	Add New Rain	Rain	$7,000	$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	Ridge		Gage					
Calhoun	Rocksdale	Rain	Add Repeater	Rain	$10,000			
Calhoun	West Fork Little Kanawha River at Rocksdale	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Calhoun	Little Kanawha River at Grantsville	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Clay		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Clay		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Clay		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Clay		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Clay		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Clay	Elk River at Clay	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Doddridge	Zinna South	Rain	Existing - no modification	Rain		$1,000	$1,000	
Doddridge	West Union 3 South	Rain	Existing - no modification	Rain		$1,000	$1,000	
Doddridge	Doak South West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Doddridge			Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Doddridge			Add New Rain Gage	Rain	$7,000	$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Doddridge	Buck Run near Leopold	Stream	Add stream Gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Fayette	Mann Lookout Tower	Rain	Existing - no modification	Rain		$1,000	$1,000	
Fayette	Lick Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Fayette	Gauley Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Fayette	New River at Thurmond	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$1,000	$13,000
Fayette	Wolf Creek near Fayetteville	Stream	Add stream Gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Fayette	Kanawha River at Kanawha Falls	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$1,000	$13,000
Gilmer	Cedarville North East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Gilmer	Normantown North East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Gilmer	Canfield Cemetery	Rain	Existing - no modification	Rain		$1,000	$1,000	
Gilmer	Little Kanawha River at Glenville	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Gilmer	Newberne South East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Gilmer	Spurgeon South West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Gilmer		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Grant	Cave Mountain	Rain	Existing - no	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
			modification					
Grant	North Fork South Branch Potomac River at Cabins	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Grant	Red Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Grant	Huck	Rain	Existing - no modification	Rain		$1,000	$1,000	
Grant	Pigeon Roost Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Grant	Walker Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Grant	Knobly	Rain	Existing - no modification	Rain		$1,000	$1,000	
Grant	Mt. Storm	Rain	Existing - no modification	Rain		$1,000	$1,000	
Grant	Stony River near Mount Storm	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Grant	South Branch Potomac River near Petersburg	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Grant – Garrett, MD	North Branch Potomac River at Steyer	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$1,000	$13,000
Greenbrier	Brushy Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Greenbrier	Greenbrier River at Alderson	Combined	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Greenbrier	Meadow Bluff	Rain	Existing - no modification	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Greenbrier	Alvon 3 North North West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Greenbrier	Blue Bend	Rain	Existing - no modification	Rain		$1,000	$1,000	
Greenbrier	Rucker Gap	Rain	Existing - no modification	Rain		$1,000	$1,000	
Greenbrier	Mikes Knob Tower	Rain	Existing - no modification	Rain		$1,000	$1,000	
Greenbrier	Greenbrier River at Renick	Stream	upgrade	Stage	$6,000	$6,000	$6,000	
Greenbrier	Anthony Creek at Blue Bend	Stream	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Greenbrier	Greenbrier River at Ronceverte	Stream	upgrade	Stage	$6,000	$6,000	$6,000	
Hampshire	Delray South East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hampshire	Thrasher Knob South East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hampshire	Little Cacapon Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hampshire	Slate Lick Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hampshire	Points	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hampshire	Greenwood Hollow	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hampshire	Little Cacapon River at Frenchburg	Stream	Add stream Gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Hampshire	South Branch Potomac River	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$1,000	$13,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	near Springfield							
Hampshire	Cacapon River near Capon Bridge	Stream	Add stream Gage with ALERT/GOES	Discharge	$25,000	$14,000	$8,000	$6,000
Hancock	Chester		Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Hancock	Weirton		Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Hancock			Add Repeater	Rain	$10,000			
Hancock	Ohio River at New Cumberland	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Hardy	Bald Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hardy	South Fork Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hardy	Elkhorn Rock	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hardy	Devils Hole	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hardy	South Branch Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hardy	South Fork South Branch Potomac River near Moorefield	Combined	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Hardy	High Rocks	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hardy	Squirrel Gap	Rain	Existing - no modification	Rain		$1,000	$1,000	
Hardy	South Branch Potomac River	Combined	upgrade	stage	$10,000	$6,000	$6,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	near Moorefield							
Hardy	Defiance	Rain	Existing - no modification	Rain		$1,000	$1,000	
Harrison	Johnstown	Rain	Existing - no modification	Rain		$1,000	$1,000	
Harrison	Big Issac West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Harrison	West Fork River near Mount Clare	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Harrison	Lake Floyd North	Rain	Existing - no modification	Rain		$1,000	$1,000	
Harrison	Clarksburg Airport	Rain	Existing - no modification	Rain		$1,000	$1,000	
Harrison	Brown	Rain	Existing - no modification	Rain		$1,000	$1,000	
Harrison	West Fork River at Enterprise	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Jackson	Foster Chapel	Rain	Existing - no modification	Rain		$1,000	$1,000	
Jackson	Drift Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Jackson	Mill Creek 13		Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Jackson			Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Jackson			Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Jefferson	Summit Point North North West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Jefferson	Shenandoah	Stream	Add	Discharge	$10,000	$14,000	$1,000	$13,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	River at Millville		ALERT/GOES					
Jefferson	Bardane North East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Jefferson			Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Jefferson			Add Repeater	Rain	$10,000			
Jefferson - Frederick, MD	Potomac River at Point of Rocks	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$1,000	$13,000
Kanawha	Slaughter Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Kanawha	RLX Weather	Rain	Existing - no modification	Rain		$1,000	$1,000	
Kanawha	Polly Hollow	Rain	Existing - no modification	Rain		$1,000	$1,000	
Kanawha	Hunt	Rain	Existing - no modification	Rain		$1,000	$1,000	
Kanawha	Mt Desert Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Kanawha	Coal River at Tornado	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Kanawha	Latuna	Rain	Existing - no modification	Rain		$1,000	$1,000	
Kanawha	Kanawha River at Charleston (Lock Six)	Stream	Add ALERT/GOES	Discharge	$10,000	$17,000	$10,000	$7,000
Kanawha	Elk River at Queen Shoals	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Kanawha	Aaron's Fork	Rain	Existing - no modification	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Kanawha	Little Blue Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Kanawha	Pocatalico River at Sissonville	Stream	add new Gage	Discharge	$25,000	$14,000	$8,000	$6,000
Kanawha	Leatherwood Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Kanawha	Kanawha River at South Side Bridge	Combined	upgrade	Stage	$20,000	$6,000	$6,000	
Lewis	Bee Knob South	Rain	Existing - no modification	Rain		$1,000	$1,000	
Lewis	Vandalia South	Rain	Existing - no modification	Rain		$1,000	$1,000	
Lewis	Oak Grove Church	Rain	Existing - no modification	Rain		$1,000	$1,000	
Lewis	Camden South West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Lewis	Churchville West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Lewis			Add Repeater	Rain	$10,000			
Lewis	West Fork River at Walkersville	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Lewis	West Fork River at Butcherville	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Lewis	Weston	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Lincoln	Hager Cemetery	Rain	Existing - no modification	Rain		$1,000	$1,000	
Lincoln	Buck Knob Tower	Rain	Existing - no modification	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Lincoln	Flowers Cemetery	Rain	Existing - no modification	Rain		$1,000	$1,000	
Lincoln			Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Lincoln			Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Lincoln	Guyandotte River at Branchland	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Logan	Cow Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Logan	Holden 22	Rain	Existing - no modification	Rain		$1,000	$1,000	
Logan	Lorado	Rain	Existing - no modification	Rain		$1,000	$1,000	
Logan	Stone Coal	Rain	Existing - no modification	Rain		$1,000	$1,000	
Logan	Lomi	Rain	Existing - no modification	Rain		$1,000	$1,000	
Logan	Boardinghouse Hollow	Rain	Existing - no modification	Rain		$1,000	$1,000	
Logan	Dark Hollow	Rain	Existing - no modification	Rain		$1,000	$1,000	
Logan	Guyandotte River at Man	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Logan	Guyandotte River at Logan	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Logan	Spruce Fork at Sharples	Stream	Project Gage - State will need to provide replacement	Stage	$20,000	$6,000	$6,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
			equipment					
Logan	Island Creek	Stream	Add stream gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Marion	Glady Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Marion	Tygart Valley River at Colfax	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Marion	Buffalo Creek at Barrackville	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Marion	Mannington South West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Marion	Metz 2 North West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Marion	Fairview South West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Marshall	Belton South West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Marshall	Lynn Camp North	Rain	Existing - no modification	Rain		$1,000	$1,000	
Marshall	Rock Lick	Rain	Existing - no modification	Rain		$1,000	$1,000	
Marshall	Dallas	Rain	Existing - no modification	Rain		$1,000	$1,000	
Marshall	Moundsville	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Marshall	Grave Creek at Glen Easton	Stream	Add stream Gage with ALERT	Discharge	$25,000	$14,000	$8,000	$6,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Marshall	Fish Creek at Lynn Camp	Stream	Add stream Gage with ALERT	Discharge	$25,000	$14,000	$8,000	$6,000
Mason	Hambrick Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mason	Ohio River at Point Pleasant	Stream	Add ALERT/GOES	Stage	$20,000	$6,000	$1,000	$5,000
Mason		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Mason		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Mason		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Mason		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Mason		Rain	Add Repeater	Rain	$10,000			
Mason	RC Byrd Lock and Dam	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Mason	Pomeroy Bridge	Stream	Add stream gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
McDowell	Sandlick Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
McDowell	Jenkin Jones	Rain	Existing - no modification	Rain		$1,000	$1,000	
McDowell	Big Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
McDowell	Jackson Flats	Rain	Existing - no modification	Rain		$1,000	$1,000	
McDowell	Olga #2 Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
McDowell	Dry Fork at Beartown (Bradshaw)	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
McDowell	Mudhole Branch	Rain	Existing - no modification	Rain		$1,000	$1,000	
McDowell	Olga #3 Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
McDowell	Tug Fork at Welch	Combined	Existing - no modification	Discharge		$14,000	$8,000	$6,000
McDowell	Mitchem Cemetery	Rain	Existing - no modification	Rain		$1,000	$1,000	
McDowell	Tug Fork at Litmar	Stream	upgrade	Discharge	$25,000	$14,000	$8,000	$6,000
McDowell	Iaeger	Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Mercer	Stony Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mercer	Payne Branch near Oakvale	Stream	Add stream Gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Mercer		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Mercer	Bluestone River at Spanishburg	Stream	Add stream Gage with ALERT/GOES	Discharge	$25,000	$14,000	$8,000	$6,000
Mercer		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Mercer		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Mercer - Virginia	New River at Glen Lynn, VA	Stream	Add ALERT	Discharge	$10,000	$14,000	$1,000	$13,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Mineral	Hilkey Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mineral	Pinnacle Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mineral	Fountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mineral	North Branch Potomac River at Luke	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$1,000	$13,000
Mineral	Knobly Tunnel	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mineral	Patterson Creek near Headsville	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Mingo	Righthand East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mingo	Big Muncey	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mingo	Horsepen Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mingo	Sharon Heights	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mingo	Buffalo Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mingo	Sandy Gap	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mingo	Millstone	Rain	Existing - no modification	Rain		$1,000	$1,000	
Mingo	Guyandotte River below R D Bailey Dam	Stream	Add ALERT	Stage	$10,000	$6,000	$6,000	
Mingo	Tug Fork at	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	Williamson							
Mingo	Tug Fork at Kermit	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Mingo - Kentucky	Tug Fork at Matewan	Stream	upgrade	Stage	$6,000	$6,000	$6,000	
Monongalia	Strawn Lake	Rain	Existing - no modification	Rain		$1,000	$1,000	
Monongalia	Deckers Creek at Morgantown	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Monongalia	Pleasant Hill Cemetery	Rain	Existing - no modification	Rain		$1,000	$1,000	
Monongalia	Crossroads South West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Monongalia	Dents Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Monongalia	Jakes Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Monongalia	Monongahela River at Opekiska Lock and Dam	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Monongalia	Monongahela River at Morgantown Lock and Dam	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Monroe		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Monroe		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Monroe		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Monroe		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Monroe		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Morgan	Luttrel	Rain	Existing - no modification	Rain		$1,000	$1,000	
Morgan	Cacapon	Rain	Existing - no modification	Rain		$1,000	$1,000	
Morgan	Cacapon River near Great Cacapon	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Morgan	Hospital	Rain	Existing - no modification	Rain		$1,000	$1,000	
Morgan - Allegany MD	Potomac River at Paw Paw	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$1,000	$13,000
Morgan - Washington, MD	Potomac River at Hancock	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$1,000	$13,000
Nicholas	Poe North	Rain	Existing - no modification	Rain		$1,000	$1,000	
Nicholas	Fenwick 2 North East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Nicholas	Beach Fork Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Nicholas	Muddlety Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Nicholas	Birch River North	Rain	Existing - no modification	Rain		$1,000	$1,000	
Nicholas	Meadow River near Mt Lookout	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Nicholas	Gauley River below Summersville Dam	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Nicholas	Gauley River above Belva	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Nicholas	Gauley River near Craigsville	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Nicholas	Cranberry River near Richwood	Stream	Add ALERT/GOES	Discharge	$6,000	$14,000	$8,000	$6,000
Ohio	Wheeling Creek at Elm Grove	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Ohio	Valley Grove 3 South East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Ohio	Oglebay East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Ohio			Add Repeater	Rain	$10,000			
Ohio	Wheeling	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$6,000	$1,000	$5,000
Pendleton	White Horn Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Flesher Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Cave	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Shenandoah Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Riverton 1 North	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Kile Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Pendleton	Mitchell Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Dickerson Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Fisher Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Cow Knob Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Spruce Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Bennett Gap	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Middle Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendleton	Onego	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pendelton	South Branch Potomac River at Brandywine	Combined	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Pendleton	South Branch Potomac River at Franklin	Combined	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Pleasants		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Pleasants	Willow Island	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Pocahontas	Calvin Price State Forest	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Brushy Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Sugar Tree	Rain	Existing - no	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	Bench		modification					
Pocahontas	Minnehaha	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Black Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Jacobs Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Buckeye 1 SW	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Paddy Knob 2 West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Edray 3 North East	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Woodrow	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Mace	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Sharps Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Durbin 1 W	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Thornwood 4 North West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Pocahontas	Greenbrier River at Buckeye	Combined	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Pocahontas	Greenbrier River at Durbin	Stream	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Pocahontas	Greenbrier River at Cloverlick	Stream	upgrade	Stage	$6,000	$6,000	$6,000	
Pocahontas	Knapps Creek	Stream	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	near Minnehaha Springs							
Preston	Mount Sarah	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Stemple Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Eby	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Mountain View	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Howesville	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Caddell Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Afton	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Mountain Dale	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Glade Farms	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Big Sandy Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Preston	Cheat River at Highway 50 near Rowlesburg	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Preston	Big Sandy Creek at Rockville	Stream	Add ALERT	Discharge	$10,000	$14,000	$8,000	$6,000
Preston	Cheat River at Albright	Stream	Add ALERT	Stage	$6,000	$6,000	$1,000	$5,000
Putnam	Martin Run	Rain	Existing - no modification	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Putnam	Clear Fork	Rain	Existing - no modification	Rain		$1,000	$1,000	
Putnam	Cross Creek Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Putnam	Jim Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Putnam			Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Putnam	Hurricane Creek at Hurricane	Stream	Add ALERT/GOES	Discharge	$6,000	$14,000	$1,000	$13,000
Raleigh	Huff Knob Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Raleigh	Tams Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Raleigh	Spruce Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Raleigh		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Raleigh	Clear Fork at Whitesville	Stream	Add ALERT/GOES	Discharge	$6,000	$14,000	$8,000	$6,000
Randolph	Elk Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Ware Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Shavers Fork at Cheat Bridge	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Randolph	Parting Springs	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Fort Millroy	Rain	Existing - no modification	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Randolph	Hamilton Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Whitmeadow Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Blue Rock	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Gatewood Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Sugar Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Files Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Three Forks	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Laurel Fork	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Tygart Valley River near Dailey	Stream	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Randolph	Shavers Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Rich Mountain Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Haines Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Dry Fork at Job	Combined	upgrade	Stage	$6,000	$6,000	$6,000	
Randolph	Pumpkin Town	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Glady Fork at Evenwood	Combined	upgrade	Stage	$6,000	$6,000	$6,000	
Randolph	Shavers Fork Below Bowden	Combined	upgrade	Stage	$6,000	$14,000	$8,000	$6,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Randolph	Tygart Valley River near Elkins	Stream	upgrade	Stage	$10,000	$6,000	$1,000	$5,000
Randolph	Flatbrush Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Randolph	Tygart Valley River at Valley Head	Combined	upgrade	Stage	$6,000	$6,000	$6,000	
Randolph	Tygart Valley River at Mill Creek	Combined	upgrade	Stage	$6,000	$6,000	$6,000	
Randolph	Shavers Fork at Bemis	Combined	upgrade	Stage	$6,000	$6,000	$6,000	
Ritchie		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Ritchie		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Ritchie		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Ritchie		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Ritchie		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Ritchie			Add Repeater	Rain	$10,000			
Roane	Walton VFD	Rain	Existing - no modification	Rain		$1,000	$1,000	
Roane	Spencer	Rain	Existing - no modification	Rain		$1,000	$1,000	
Roane		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Roane		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Roane		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Roane			Add Repeater	Rain	$10,000			
Summers	Pipestem Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Summers	Ellison Ridge North	Rain	Existing - no modification	Rain		$1,000	$1,000	
Summers	Keeney Knob Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Summers		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Summers		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Summers	Bluestone River near Pipestem	Stream	Add ALERT	Discharge	$10,000	$14,000	$8,000	$6,000
Summers	Greenbrier River at Hilldale	Combined	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Summers	New River at Hinton	Stream	Add ALERT	Stage	$10,000	$6,000	$6,000	
Taylor	Three Fork Creek near Grafton	Stream	Add ALERT	Discharge	$10,000	$14,000	$8,000	$6,000
Taylor	Laurel Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Taylor		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Taylor		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Taylor	Tygart Valley River below dam near Grafton	Stream	Add ALERT	Stage	$10,000	$6,000	$1,000	$5,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Tucker	Dry Fork at Gladwin	Combined	upgrade	Stage	$6,000	$6,000	$6,000	
Tucker	Yokum Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tucker	Mozark Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tucker	Dry Fork at Hendricks	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Tucker	Olson Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tucker	Cheat River near Parsons	Combined	upgrade	Discharge	$6,000	$14,000	$8,000	$6,000
Tucker	Blackwater River at Davis	Combined	upgrade	Discharge	$10,000	$14,000	$8,000	$6,000
Tucker	Davis Radio Tower	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tucker	Clover Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tucker	Beaver Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tucker	Forty Three	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tucker	White Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tyler	Wilber Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tyler	Bearsville	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tyler	Alvy	Rain	Existing - no modification	Rain		$1,000	$1,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Tyler	Starkey Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Tyler	Buffalo Run near Little	Stream	Add stream Gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Tyler	Middle Island Creek above Middlebourne	Combined	Add stream Gage with ALERT/GOES	Discharge	$25,000	$14,000	$8,000	$6,000
Upshur	Pleasant Dale	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	Hemlock	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	Heaston Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	French Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	Beaver Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	Ellamore Radio Tower	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	Spruce Fork	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	Kesling Mill	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	Turkey Run	Rain	Existing - no modification	Rain		$1,000	$1,000	
Upshur	Sand Run at Buckhannon	Stream	Add ALERT	Discharge	$10,000	$14,000	$8,000	$6,000
Upshur	Buckhannon River at Alton	Stream	upgrade	Stage	$6,000	$6,000	$6,000	
Upshur	Buckhannon	Stream	upgrade	Stage	$6,000	$6,000	$6,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	River at Ellamore							
Upshur	Middle Fork River at Adolph	Stream	upgrade	Stage	$6,000	$6,000	$6,000	
Upshur	Buckhannon River at Buckhannon	Stream	upgrade	Stage	$6,000	$6,000	$1,000	$5,000
Wayne	Tick Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Wayne	Mill Creek	Rain	Existing - no modification	Rain		$1,000	$1,000	
Wayne		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wayne		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wayne		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wayne	East Fork Twelvepole Creek near Dunlow	Stream	Add ALERT/GOES	Stage	$10,000	$14,000	$8,000	$6,000
Wayne	East Fork Twelvepole Creek below East Lynn Dam	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$6,000	
Wayne	Twelvepole Creek below Wayne	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Wayne	Beech Fork below Beech Fork Dam	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Wayne	East Fork of Twelvepole Creek above dam at Dunlow	Stream	Add stream Gage with ALERT/GOES	Discharge	$25,000	$14,000	$8,000	$6,000
Webster	Cranberry River Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Webster	Cowen West	Rain	Existing - no modification	Rain		$1,000	$1,000	
Webster	Spring Ridge	Rain	Existing - no modification	Rain		$1,000	$1,000	
Webster	Red Oak Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Webster	Point Mountain Lookout	Rain	Existing - no modification	Rain		$1,000	$1,000	
Webster	Hodam Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Webster	Holly Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Webster			Add Repeater	Rain	$10,000			
Webster	Gauley River at Camden-on-Gauley	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Webster	Williams River at Dyer	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Webster	Elk River below Webster Springs	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Wetzel	Hannibal Lock and Dam	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Wirt	Little Kanawha River at Palestine	Combined	Add ALERT	Discharge	$10,000	$14,000	$8,000	$6,000

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
Wirt	Little Kanawha At Creston	Combined	Add combined Gage with ALERT	Rain/Stage	$27,000	$6,000	$6,000	
Wirt		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wirt		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wirt		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wood		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wood		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wood		Rain	Add New Rain Gage	Rain	$7,000	$1,000	$1,000	
Wood	Belleville	Stream	Add ALERT to Corps' Gage	Stage	$10,000	$1,000	$1,000	
Wood - Washington OH	Ohio River near Marietta,OH	Stream	Add ALERT/GOES	Stage	$10,000	$6,000	$1,000	$5,000
Wyoming	Basin Rain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Wyoming	Burning Rock	Rain	Existing - no modification	Rain		$1,000	$1,000	
Wyoming	Polk Mountain	Rain	Existing - no modification	Rain		$1,000	$1,000	
Wyoming	Ivy Knob	Rain	Existing - no modification	Rain		$1,000	$1,000	
Wyoming	Guyandotte River at Pineville	Combined	upgrade	Discharge	$25,000	$14,000	$8,000	$6,000
Wyoming	Guyandotte	Stream	Add	Stage	$10,000	$6,000	$6,000	

Table B-2: Rain And Stream Gauges For All Of West Virginia With Proposed Changes

COUNTY	GAGE NAME	GAGE TYPE	CHANGES	SERVICE DESIRED	CAPITAL COSTS	COST OF O&M	WV STATE FUNDS	OTHER FUNDING
	River near Baileysville		ALERT/GOES					
Wyoming	Clear Fork at Clear Fork	Stream	Add ALERT/GOES	Discharge	$10,000	$14,000	$8,000	$6,000
Wyoming	Glen Fork above Oceana	Stream	Add stream gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
Wyoming	Guyandotte River at Mullens	Stream	Add stream gage with ALERT/GOES	Stage	$20,000	$6,000	$6,000	
			Totals		**$2,183,000**	**$ 1,771,000**	**$1,093,000**	**$ 678,000**

APPENDIX C:
FLOODPLAIN MAPPING

In 2001, the Institute for Business & Home Safety issued a report titled *The Ten Most Wanted* detailing the ten actions most likely to realize the greatest reduction in loss from natural disasters in the shortest time for a given investment. Their top item for flooding reads: "The highest priority should be given to improving maps of the flood plain and developing land use ordinances to avoid construction in flood-prone locations." It is important to note that this recommendation includes two actions. The best flood maps in the world will not prevent losses without the political will to curtail continued construction in the floodplain.

The first flood maps were paper Flood Hazard Boundary Maps (FHBM) and Flood Insurance Rate Maps. Flood Hazard Boundary Maps showed the boundary of the floodplain using approximate methods. Flood Insurance Rate Maps (FIRM) replaced these FHBMs. A FIRM includes a Flood Insurance Study with flood elevations and other hazard information needed to protect new construction from flood damage.
Flood insurance rates for "pre-FIRM" structures, those built before the FIRM was published, are subsidized. The rates for "post FIRM" structures are based on how well protected they are from the mapped hazard. The national and local flood plain ordinances and insurance program depends on the accuracy of the flood maps.

The National Flood Insurance Program (NFIP) began mapping West Virginia's floodplains during the late 1970's. In fact, only 49 of the 268 participating communities (municipalities and counties) joined the NFIP before 1980. Many of the maps used today are based on studies conducted over twenty years ago. Table C-1 shows the dates of floodplain maps by decades. Many of the recently revised maps may have resulted from a new flood control structure in the area, a revision to one section of the panel, or from a restudy of the area. Revisions based on a complete restudy are rare. Revisions that did not result from a complete restudy do not take into account development during the years since the first study. In addition to other problems, many of these older maps identified "Approximate A Zones" with no base flood elevation or precise flood plain

delineation. Many existing floodplain maps lack sufficient detail to easily and accurately locate affected property.

TABLE C - 1: JURISDICTIONS MAPPED BY DECADES

TABLE C - 1: JURISDICTIONS MAPPED BY DECADES	
DECADE	JURISDICTIONS
1970s	21
1980s	147
1990s	84
2000s	8

One hundred sixty eight jurisdictions in West Virginia had their existing FIRMs developed before 1990. Table C – 2, at the end of this appendix, lists the participating communities in West Virginia and the dates of the most recent revisions to their FIRMs. Small watersheds and headwaters areas (generally one square mile or less) have never been mapped in a systematic fashion. This limits the potential for use in hydrologic modeling programs. Some unmapped areas have experienced growth in residential and commercial construction. This new construction has been sited without the benefit of a known base flood elevation. All jurisdictions should consider using a total development condition for hydrologic modeling when developing floodplain maps for small watershed areas.

Through FEMA's Map Modernization Initiative, many maps in West Virginia will be improved and converted to Digital Flood Insurance Rate Maps (DFIRM) (See Map Concersion Schedule Table C-3). DFIRMs consist of all the data required to create the hard copy FIRM. The digital format allows flood maps to be incorporated into the community's mapping system and tied into other geographic information systems. However, the simple conversion of a paper FIRM to a digital format does not improve the engineering quality of the map and usually does not include development occurring after the original map was published, even though the DFIRM has a more recent published date. One additional problem with DFIRM maps has become evident. Some jurisdictions in West Virginia do not have the technological capabilities to take advantage of them. Switching from a paper map to a digital map, if the jurisdiction does not have the necessary hardware, software and people trained to use them, is a waste of scarce resources.

The Task Force recommends that Development of DFIRMS should consist of value-added mapping, not a simple conversion of a paper map to a digital file (DFIRM). All new DFIRMs should include a delineation of the floodway and eliminate approximate A zones.

The Task Force also recommends that West Virginia initiate a program to provide hardware, software and training in the use of Geographic Information Systems (GIS) and DFIRMs to all West Virginia jurisdictions in the National Flood Insurance Program.

In addition the Task Force recommends that FEMA to dedicate sufficient funds to re-map all watersheds in the State using a modern suite of mapping technology that will:

- Create enhanced elevation and terrain data, as well as more detailed hydrographic networks to improve flow models and flood risk assessment.
- Accurately identify the channel shape.
- Eliminate all "Approximate A" zones by conducting detailed studies to delineate more accurate and realistic flood-prone areas.
- Delineate floodplains in previously unmapped areas.
- Upgrade the quality of floodplain maps statewide with priority given to heavily populated floodplain areas, areas of repetitive losses, areas with high levels of flood damages and areas with insufficient mapping as identified by the Map Needs Update Support System (MNUSS).

In addition, the Task Force recommends that all hydraulic studies conducted by or through Federal and State agencies within the State for the purposes of identifying, enhancing or developing floodplain areas should be required to delineate a floodway zone (in accordance with procedures used in the NFIP) with the study.

Some structures affecting stream hydraulics (bridges, culverts, retaining walls, fill, etc.) were built after the data for Flood Insurance Rate Maps were collected and before the maps were published. Such "gap" structures may affect the delineation of the floodway and floodplain and should be cause for a restudy of the area. No existing program or process identifies these gap structures and initiates a restudy of the area. The Task Force recommends a partnership with the network of volunteer watershed associations be formed to identify gap structures throughout West Virginia.

There are many reasons in addition to gap structures to revise and update a FIRM. These include:

- To correct non- flood related features such as a change in a jurisdictions boundary.
- To include better ground elevation data.
- To reflect changes in ground elevations in the floodplain.
- To revise flood data.
- To submit new flood data.
- To reflect a flood control project.

The need for map revisions is tracked by the Mapping Needs Update Support System (MNUSS). MNUSS is maintained by FEMA but is based on data provided by the states. The existing staff at WVOES is inadequate to collect and input data for MNUSS that identifies flood hazard areas needing restudy. The Task Force recommends that FEMA provide funds for the Corps of Engineers to populate the MNUSS database as has occurred in other states such as Virginia and Pennsylvania.

The Task Force further recommends that WVOES be provided the staff and resources to

coordinate maintenance of floodplain maps in West Virginia. Jurisdictions experiencing greatest growth should be prepared first. Jurisdictions with older maps should be prepared next. No jurisdiction should have a FIRM more than five years old.
Mapping in flood prone areas of West Virginia is generally inadequate to support disaster planning prior to a flood event, to determine evacuation routing and emergency response procedures during an event, and to direct recovery mitigation efforts after an event. To be useful maps need data on elevation (both floodplain and runoff catchments), property ownership (parcels, structures), infrastructure (roads, utilities), and hydrology (stream networks, watersheds), and historic flood zones.

Currently there is no integrated, comprehensive Geographic Information System (GIS) employed to systematically collect, analyze and model flood event data and parameters. Both diachronic (as they change over time) and synchronic (as they exist at a particular point in time) analysis of flood events should be a required capability of a statewide flood management system.

The production and availability of geographic information and maps relating to flood events is not well coordinated between Federal, State, and county/local agencies. Existing GIS data (e.g., DOQQs, parcel maps, County E-911 roads, etc.) may not be known or readily accessible to emergency responders during the course of a flood. During recent flooding, it was reported that some responders used road maps from gas stations or convenience stores to locate themselves because they did not have knowledge of or access to better maps at the scene.

The Task Force recommends that WVOES make training in maps and map reading available to all Federal, State, local and volunteer personnel involved in flooding in West Virginia on a regular basis.

Existing floodplain maps do not delineate potential flooding caused by failure of existing dams under either sunny day or heavy rainfall failure conditions. Dam failure inundation maps do exist for some Federal structures and selected State regulated dams.
Other data, such as: high erosion areas ands soils, landslide areas, karst areas, mine ponds, mine blow-out data, mine subsidence areas, etc., is also available that would be beneficial on a FIRM or in a GIS layer compatible with the FIRM.

Other data has never been systematically collected or made available such as: public and private culverts and stream crossings, highways bridges, railroad bridges, and abandoned bridges and pilings. In addition, small watersheds and headwater areas (generally one square mile or less) have not been mapped in a systematic fashion, thus limiting the potential for input into hydrologic modeling routines.

Identifying and locating repetitive loss structures on floodplain maps is difficult at best. Some agencies (FEMA, WVOES, US Small Business Administration) have some data on repetitive loss structures that may or may not have accurate location information. In addition, different agencies compile information differently. For instance, the Small Business Administration collects data on businesses and individuals who apply for loans

from them. FEMA on the other hand only collects data on structures insured by the National Flood Insurance Program.

The Task Force recommends that a program to identify, locate or develop desired map information related to flooding be initiated by the West Virginia GIS Coordinator. This information should be made available to all State, Federal and local agencies on digital layers for use in disaster planning.

In the past both State and Federal agencies have spent scarce resources to develop digital maps of the same regions. While the West Virginia Geographic Information System Coordinator has seen a reduction in these uncoordinated efforts, communication and coordination between agencies still needs improvement. Three basic items would result in additional improvements in this area:

- All agencies preparing maps or map data include elevation data for all structures.
- All new elevation data developed for West Virginia State and local agencies should be acquired using LIDAR or a similar modern imaging technique.
- All agencies preparing maps or map data notify the West Virginia Geographic Information System Coordinator prior to initiating the program.

If necessary, a new "off-budget" State instrumentality (such as the West Virginia State Mapping Board) should be initiated to develop and maintain digital mapping statewide for flood and other disaster planning. The program should be implemented and operated in cooperation with Federal partners and State agencies with hydrologic-mapping expertise or regulatory responsibilities such as the Department of Environmental Protection, Department of Transportation, Division of Natural Resources, Geological and Economic Survey, Geographic Information System Coordinator Office, and Geographic Information System Technical Center, or regional, county, and local offices (E-911 Centers), and/or non-governmental watershed organizations such as Canaan Valley Institute.

One of the key objectives of the FEMA modernization plan is to increase local involvement in, and ownership of, the flood mapping process. To meet this objective, FEMA developed and implemented the Cooperating Technical Partners (CTP) initiative. It is envisioned that the initiative and this guidance will evolve as technologies and the capabilities of FEMA's Partners grow. More information on the CTP program can be found at: www.fema.gov/mit/tsd/CTP_main.htm

In addition, the State could become a Cooperating Technical State (CTS) with FEMA. This would involve a long-range State project with one agency in charge. It would involve the State collecting data and conducting studies for development of new DFIRMs. If the actual flood studies were contracted out to consultants, many State agencies could manage the program.

One problem with this is the cost to FEMA to hold public meetings and respond to comments and suggestions before the studies are accepted. Unless the necessary funds

are allocated to West Virginia studies by FEMA, West Virginia might wind up with lots of data and no final product to show for it. These studies would generate better data than is currently available. Floodplain ordinances allow for use of best available data for use in regulatory activities but best available data cannot be used to require or calculate the premium rate of flood insurance.

All State and Federal agencies should adopt current FEMA guidelines for floodplain mapping, in defined project areas, that is consistent with the Federal Emergency Management Agency's document "Draft Guidelines and Specifications for Flood Hazard Mapping Partners."

The Task Force recommends that State agencies, local governmental units and Regional Planning and Development councils assist in the mapping process by becoming Cooperating Technical Partners (CTP) in Flood Hazard Mapping.

The Task Force recommends that West Virginia investigate the possibility of becoming a Cooperating Technical State with FEMA in developing new flood studies and new DFIRMs. This investigation should be conducted by WVOES and the WV GIS Coordinator.

Currently there are limited sources of funding available for flood mapping. FEMA has four programs with funding that is available to update flood maps. These include:

- Post Disaster Funding (This program reviews areas where flooding exceeded the expectations given by the study.),
- Cooperating Technical Partners Fund,
- Map Modernization Fund, and
- Limited Map Maintenance Program (This program redraws maps based on Letters of Map Change, Letters of Map Amendment and Letters of Map Revisions.)

The Economic Development Authority has funneled some funds through the Regional Planning and Development Councils to convert paper FIRMs to Digital Flood Insurance Rate Maps. The Task Force recommends that WV GIS Coordinator, the WV Development Office, the Regional Planning and Development Councils and WVOES investigate obtaining additional funding to continue this effort.

The Statewide Addressing and Mapping Board may have some in kind assistance available to assist in adding 911 addresses to floodplain maps or as a digital layer for use with DFIRMs. The Task Force recommends that the WV GIS Coordinator and WVOES coordinate this effort.

TABLE C – 2: PARTICIPATING COMMUNITIES IN WEST VIRGINIA AND EFFECTIVE DATE OF CURRENT FLOOD INSURANCE RATE MAP				
CID	COMMUNITY NAME	COUNTY	DATE OF ENTRY [Emergency or Regular]	CURRENT EFFECTIVE MAP (Reflects date of revision to at least one panel)
540001	Barbour County*	Barbour	07/01/87	07/01/87
540002	Belington	Barbour	08/01/79	8/1/1979
540003	Junior	Barbour	04/17/87	04/17/87
540004	Philippi	Barbour	09/04/86	9/4/1986
540282	Berkeley County*	Berkeley	08/04/88	11/20/1998
540006	Martinsburg	Berkeley	12/18/79	7/16/1997
540007	Boone County*	Boone	04/16/91	9/6/1996
540230	Danville	Boone	04/16/91	9/6/1996
540008	Madison	Boone	04/16/91	9/6/1996
540235	Sylvester	Boone	04/16/91	9/6/1996
540229	Whitesville	Boone	04/14/91	9/6/1996
540009	Braxton County*	Braxton	03/18/91	3/18/1991
540010	Burnsville	Braxton	09/10/84	3/18/1991
540235	Flatwoods	Braxton	09/29/78	No Flood Hazard Area
540237	Gassaway	Braxton	09/10/84	3/18/1991
540236	Sutton	Braxton	09/10/84	3/18/1991
540012	Bethany	Brooke	09/28/79	09/28/79
540011	Brooke County*	Brooke	12/15/83	9/28/1990
540013	Follansbee	Brooke	09/30/82	2/15/1984
540015	Wellsburg	Brooke	11/17/82	11/17/1982
540014	Weirton	Brooke Hancock	09/28/79	9/14/1990
540017	Barboursville	Cabell	06/03/88	6/3/1988
540016	Cabell County*	Cabell	09/30/87	9/30/1987
540019	Milton	Cabell	09/30/87	9/30/1987
540018	Huntington	Cabell Wayne	08/17/81	1/17/1990
540020	Calhoun County*	Calhoun	03/18/91	3/18/1991
540021	Grantsville	Calhoun	03/18/91	3/18/1991
540023	Clay	Clay	03/18/91	3/18/1991
540022	Clay County*	Clay	03/18/91	3/18/1991
540024	Doddridge County*	Doddridge	03/18/91	3/18/1991

TABLE C – 2: PARTICIPATING COMMUNITIES IN WEST VIRGINIA AND EFFECTIVE DATE OF CURRENT FLOOD INSURANCE RATE MAP				
CID	COMMUNITY NAME	COUNTY	DATE OF ENTRY [Emergency or Regular]	CURRENT EFFECTIVE MAP (Reflects date of revision to at least one panel)
540025	West Union	Doddridge	03/18/91	3/18/1991
540027	Ansted	Fayette	10/30/81	10/30/81
540026	Fayette County*	Fayette	03/04/88	3/4/1988
540294	Gauley Bridge	Fayette	09/18/91	9/18/1991
540029	Meadow Bridge	Fayette	01/02/91	10/16/1991
540280	Mount Hope	Fayette	08/10/79	08/10/79
540031	Oak Hill	Fayette	01/18/80	01/18/80
540032	Pax	Fayette	08/10/79	3/16/1988
540033	Smithers	Fayette	04/15/82	4/15/1982
540029	Montgomery	Fayette Kanawha	06/01/82	6/1/1982
540035	Gilmer County*	Gilmer	04/16/91	4/16/1991
540036	Glenville	Gilmer	04/16/91	4/16/1991
540037	Sand Fork (Layopolis)	Gilmer	04/16/91	4/16/1991
540240	Bayard	Grant	08/10/79	08/10/79
540038	Grant County*	Grant	08/01/87	5/4/2000
540039	Petersburg	Grant	06/18/87	5/4/2000
540040	Greenbrier County*	Greenbrier	01/15/88	9/18/1991
540281	Lewisburg	Greenbrier	09/29/78	No Flood Hazard Area
540244	Quinwood	Greenbrier	02/27/81	02/27/81
540229	Rainelle	Greenbrier	11/19/87	11/19/1987
540243B	Renick (Falling Springs)	Greenbrier	09/24/84	09/24/84
540043	Ronceverte	Greenbrier	05/17/90	5/17/1990
540044B	Rupert	Greenbrier	08/24/84	08/24/84
540045	White Sulphur Springs	Greenbrier	08/01/78	4/15/1992
540041	Alderson	Greenbrier Monroe	09/27/91	9/27/1991
540046	Capon Bridge	Hampshire	04/01/88	04/01/88
540226	Hampshire County*	Hampshire	08/01/87	08/01/87
540276	Romney	Hampshire	06/15/88	06/15/88
540048	Chester	Hancock	12/01/82	12/1/1982

TABLE C – 2: PARTICIPATING COMMUNITIES IN WEST VIRGINIA AND EFFECTIVE DATE OF CURRENT FLOOD INSURANCE RATE MAP				
CID	COMMUNITY NAME	COUNTY	DATE OF ENTRY [Emergency or Regular]	CURRENT EFFECTIVE MAP (Reflects date of revision to at least one panel)
540047	Hancock County*	Hancock	06/15/84	6/3/1991
540049	New Cumberland	Hancock	05/15/80	5/15/1980
540051	Hardy County*	Hardy	06/19/85	1/19/2001
540052	Moorefield	Hardy	07/01/87	1/19/2001
540245A	Wardensville	Hardy	08/01/87	08/01/87
540054	Anmoore	Harrison	09/03/80	9/3/1980
540055	Bridgeport	Harrison	03/04/88	3/4/1988
540056	Clarksburg	Harrison	02/15/78	3/16/1992
540053	Harrison County*	Harrison	07/04/88	7/2/1992
540057	Lost Creek	Harrison	03/04/88	3/4/1988
540058	Lumberport	Harrison	03/04/88	3/4/1988
540059	Nutter Fort	Harrison	09/17/80	9/17/1980
540242B	Salem	Harrison	12/04/85	12/04/85
540060	Shinnston	Harrison	03/16/88	2/5/1992
540061	Stonewood	Harrison	09/05/79	9/5/1979
540062	West Milford	Harrison	04/01/88	04/01/88
540063	Jackson County*	Jackson	05/01/85	8/23/2000
540241	Ravenswood	Jackson	03/18/91	3/18/1991
540064	Ripley	Jackson	09/01/77	8/23/2000
540066	Charles Town	Jefferson	12/04/79	9/30/1992
540067	Harpers Ferry	Jefferson	08/24/84	08/24/84
540065	Jefferson County*	Jefferson	10/15/80	1/6/1999
540068	Ranson	Jefferson	06/15/79	1/20/1993
540069	Shepherdstown	Jefferson	03/18/80	3/18/1980
540071	Belle	Kanawha	04/15/82	4/15/1982
540072	Cedar Grove	Kanawha	06/01/82	6/1/1982
540073	Charleston	Kanawha	06/15/83	4/3/1985
540074	Chesapeake	Kanawha	06/01/82	6/1/1982
540075	Clendenin	Kanawha	07/16/84	7/16/1984
540076	Dunbar	Kanawha	06/01/82	4/3/1985
540077	East Bank	Kanawha	06/01/82	6/1/1982
540078	Glasgow	Kanawha	06/15/82	6/15/1982

TABLE C – 2: PARTICIPATING COMMUNITIES IN WEST VIRGINIA AND EFFECTIVE DATE OF CURRENT FLOOD INSURANCE RATE MAP				
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540279	Handley	Kanawha	07/05/84	7/5/1984
540070	Kanawha County*	Kanawha	03/18/85	11/6/1991
540079	Marmet	Kanawha	04/15/82	4/3/1985
540081	Nitro	Kanawha	04/15/82	4/15/1982
540082	Pratt	Kanawha	05/01/84	5/1/1984
540223	South Charleston	Kanawha	06/15/82	4/3/1985
540083	St. Albans	Kanawha	06/15/82	6/15/1982
540086	Jane Lew	Lewis	09/24/84	09/24/84
540085	Lewis County*	Lewis	07/01/87	8/18/1992
540087	Weston	Lewis	04/15/82	8/18/1992
540089	Hamlin	Lincoln	09/04/87	9/4/1987
540088	Lincoln County*	Lincoln	09/18/87	8/19/1991
540090	West Hamlin	Lincoln	09/04/87	9/4/1987
540092	Chapmanville	Logan	08/27/71	11/16/1983
545535	Logan	Logan	07/16/71	11/5/1982
545536	Logan County*	Logan	04/07/72	5/18/2000
545537	Man	Logan	09/10/71	2/18/1983
540095	Mitchell Heights	Logan	08/13/71	12/3/1982
545539	West Logan	Logan	06/02/72	11/12/1982
540098	Barrackville	Marion	03/16/88	3/16/1988
540099	Fairmont	Marion	07/02/87	10/18/1995
540100	Fairview	Marion	03/16/88	3/16/1988
540101	Farmington	Marion	03/16/88	3/16/1988
540102	Grant Town	Marion	03/04/88	3/4/1988
540103	Mannington	Marion	11/19/86	11/19/1986
540097	Marion County*	Marion	07/04/88	10/18/1995
540104	Monongah	Marion	03/16/88	3/16/1988
540105	Rivesville	Marion	03/16/88	9/20/1995
540106	Worthington	Marion	03/16/88	3/16/1988
540108	Benwood	Marshall	05/01/80	5/1/1980
540287	Cameron	Marshall	09/04/86	9/4/1986
540109	Glen Dale	Marshall	04/01/80	9/30/1983

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540107	Marshall County*	Marshall	04/17/84	2/19/1992
540110	McMechen	Marshall	04/15/80	9/30/1983
540111	Moundsville	Marshall	05/15/80	9/30/1983
540247	Hartford	Mason	02/15/78	2/15/1978
540251	Henderson	Mason	05/15/78	5/15/1978
540113	Leon	Mason	08/15/78	8/15/1978
540248	Mason	Mason	02/15/78	2/15/1978
540112	Mason County*	Mason	01/02/80	1/2/1980
540249	New Haven	Mason	07/03/78	7/3/1978
540250	Point Pleasant	Mason	05/15/78	5/15/1978
540115	Anawalt	McDowell	02/01/85	2/1/1985
540291	Bradshaw	McDowell	10/15/2001	
540116	Davy	McDowell	09/28/84	9/28/1984
540117	Gary	McDowell	02/01/85	2/1/1985
540118	Iaeger	McDowell	09/28/84	9/28/1984
540119	Keystone	McDowell	02/01/85	2/1/1985
540120	Kimball	McDowell	02/01/85	2/1/1985
540114	McDowell County*	McDowell	09/18/86	9/18/1986
540121	Northfork	McDowell	04/03/85	4/3/1985
540122	War	McDowell	09/28/84	9/28/1984
540123	Welch	McDowell	09/01/83	9/1/1983
540285	Bluefield	Mercer	05/26/78	No Flood Hazard Area
540125	Bramwell	Mercer	12/01/83	12/1/1983
540126	Matoaka	Mercer	12/15/83	12/15/1983
540124	Mercer County*	Mercer	02/01/85	2/1/1985
540127	Oakvale	Mercer	12/15/83	12/15/1983
540128	Princeton	Mercer	02/01/84	2/1/1984
540130	Keyser	Mineral	09/27/91	9/27/1991
540129	Mineral County*	Mineral	09/27/91	10/20/1999
540131	Piedmont	Mineral	09/27/91	9/27/1991
540134	Delbarton	Mingo	03/15/77	11/1/1985
540135	Gilbert	Mingo	05/02/77	11/15/1985

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CID	COMMUNITY NAME	COUNTY	DATE OF ENTRY [Emergency or Regular]	CURRENT EFFECTIVE MAP (Reflects date of revision to at least one panel)
540136	Kermit	Mingo	03/01/78	11/15/1985
545535	Matewan	Mingo	02/03/70	6/2/1999
540133	Mingo County*	Mingo	12/02/80	12/4/1984
540135	Williamson	Mingo	01/16/81	1/2/1992
540140	Blacksville	Monongalia	12/26/78	No Flood Hazard Area
540272	Granville	Monongalia	12/15/83	11/2/1995
540139	Monongalia County*	Monongalia	05/01/84	2/22/1999
540141	Morgantown	Monongalia	08/01/79	10/18/1995
540142	Osage	Monongalia	09/28/79	09/28/79
540273	Star City	Monongalia	08/01/78	10/18/1995
540274	Westover	Monongalia	08/01/78	12/19/1995
540278	Monroe County*	Monroe	01/14/83	01/14/83
540143	Peterstown	Monroe	08/01/79	8/1/1979
540005	Bath (Berkeley Springs)	Morgan	01/02/80	3/5/1996
540144	Morgan County*	Morgan	07/01/87	5/18/2000
540252	Paw Paw	Morgan	11/02/84	3/5/1996
540146	Nicholas County*	Nicholas	04/05/94	11/6/1991
540147	Richwood	Nicholas	09/27/91	9/27/1991
540148B	Summersville	Nicholas	08/24/84	08/24/84
540275	Bethlehem	Ohio	08/26/77	No Flood Hazard Area
540149	Ohio County*	Ohio	04/04/83	9/3/1992
540150	Triadelphia	Ohio	01/18/84	1/18/1984
540151	Valley Grove	Ohio	09/28/79	09/28/79
540152	Wheeling	Ohio	02/18/81	2/19/1992
540154	Franklin	Pendleton	09/01/87	8/15/1989
540153	Pendelton County*	Pendleton	07/01/87	8/15/1989
540253	Belmont	Pleasants	06/03/91	6/3/1991
540225	Pleasants County*	Pleasants	06/03/91	6/3/1991
540156	St. Mary's	Pleasants	06/03/91	6/3/1991
540158	Durbin	Pocahontas	08/24/84	10/17/1989
540159	Marlinton	Pocahontas	10/17/89	10/17/1989

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CID	COMMUNITY NAME	COUNTY	DATE OF ENTRY [Emergency or Regular]	CURRENT EFFECTIVE MAP (Reflects date of revision to at least one panel)
540283	Pocahontas County* Includes Cass	Pocahontas	10/17/89	10/17/1989
540161	Albright	Preston	08/01/87	5/2/1991
540162	Bruceton Mills	Preston	08/01/87	8/15/1990
540254	Kingwood	Preston	11/12/86	No Flood Hazard Area
540268A	Newburg	Preston	08/01/87	08/01/87
540160A	Preston County*	Preston	03/01/87	03/01/87
540269	Reedsville	Preston	08/01/87	08/01/87
540163	Rowlesburg	Preston	08/01/79	8/1/1979
540257A	Terra Alta	Preston	08/25/87	08/01/87
540165	Bancroft	Putnam	12/18/85	12/18/1985
540166	Buffalo	Putnam	12/18/85	12/18/1985
540222B	Eleanor	Putnam	02/06/84	02/06/84
540167	Hurricane	Putnam	03/04/86	3/4/1986
540168	Poca	Putnam	12/18/85	12/18/1985
540164	Putnam County*	Putnam	06/18/87	6/19/1997
540271	Winfield	Putnam	12/18/85	12/18/1985
540170	Beckley	Raleigh	11/01/84	11/1/1984
540171	Lester	Raleigh	04/01/88	04/01/88
540286	Mabscott	Raleigh	03/04/85	3/4/1985
540169	Raleigh County*	Raleigh	12/18/84	11/6/1991
540173A	Rhodell	Raleigh	09/01/87	09/01/87
540174	Sophia	Raleigh	04/16/91	4/16/1991
540267	Beverly	Randolph	12/03/91	12/3/1991
540176B	Coalton	Randolph	09/10/84	09/10/84
540177	Elkins	Randolph	04/03/87	4/3/1987
540178B	Harman	Randolph	08/24/84	08/24/84
540264A	Huttonsville	Randolph	08/24/84	08/24/84
540266A	Mill Creek	Randolph	08/24/84	08/24/84
540265B	Montrose	Randolph	09/24/84	09/24/84
540175	Randolph County*	Randolph	09/27/91	9/27/1991
540262	Auburn	Ritchie	09/24/84	09/24/84

TABLE C – 2: PARTICIPATING COMMUNITIES IN WEST VIRGINIA AND EFFECTIVE DATE OF CURRENT FLOOD INSURANCE RATE MAP				
CID	COMMUNITY NAME	COUNTY	DATE OF ENTRY [Emergency or Regular]	CURRENT EFFECTIVE MAP (Reflects date of revision to at least one panel)
540179	Cairo	Ritchie	03/18/91	3/18/1991
540180B	Ellenboro	Ritchie	08/24/84	08/24/84
540182	Pennsboro	Ritchie	09/16/88	09/16/88
540263B	Pullman	Ritchie	09/10/84	09/10/84
540224	Ritchie County*	Ritchie	01/01/91	01/01/91
540184	Reedy	Roane	12/01/78	12/1/1978
540183A	Roane County*	Roane	09/10/84	09/10/84
540185	Spencer	Roane	01/03/79	1/3/1979
540187	Hinton	Summers	08/01/79	8/1/1979
540186	Summers County*	Summers	11/05/80	11/5/1980
540189	Flemington	Taylor	12/26/78	No Flood Hazard Area
540190	Grafton	Taylor	08/01/87	08/01/87
540188	Taylor County*	Taylor	07/01/87	07/01/87
540260	Davis	Tucker	07/20/84	6/2/1992
540192	Hambleton	Tucker	07/20/84	6/2/1992
540193	Hendricks	Tucker	08/01/87	6/2/1992
540194	Parsons	Tucker	08/15/79	6/2/1992
540261	Thomas	Tucker	09/10/84	6/2/1992
540191	Tucker County*	Tucker	07/01/87	6/2/1992
540259	Friendly	Tyler	11/04/88	11/4/1988
540195	Middlebourne	Tyler	11/04/88	11/4/1988
540197	Sistersville	Tyler	11/04/88	11/4/1988
540277	Tyler County*	Tyler	11/04/88	11/4/1988
540196	Paden City	Tyler Wetzel	03/16/89	3/16/1989
540199	Buckhannon	Upshur	09/04/86	9/4/1986
540198	Upshur County*	Upshur	07/01/87	07/01/87
540232	Ceredo	Wayne	05/17/89	5/17/1989
540202	Fort Gay	Wayne	01/03/79	1/3/1979
540221	Kenova	Wayne	05/17/89	5/17/1989
540231	Wayne	Wayne	09/30/87	9/30/1987
540200	Wayne County*	Wayne	09/18/87	9/18/1987
540204	Addison	Webster	02/16/90	2/16/1990

TABLE C – 2: PARTICIPATING COMMUNITIES IN WEST VIRGINIA AND EFFECTIVE DATE OF CURRENT FLOOD INSURANCE RATE MAP				
CID	COMMUNITY NAME	COUNTY	DATE OF ENTRY [Emergency or Regular]	CURRENT EFFECTIVE MAP (Reflects date of revision to at least one panel)
	(Webster Springs)			
540205	Camden-On-Gauley	Webster	08/24/84	2/16/1990
540206	Cowen	Webster	08/24/84	2/16/1990
540203	Webster County*	Webster	02/16/90	2/16/1990
540256	Hundred	Wetzel	04/01/88	04/01/88
540255B	Littleton	Wetzel	08/24/84	08/24/84
540208	New Martinsville	Wetzel	09/02/82	9/2/1982
540210	Pine Grove	Wetzel	04/01/88	04/01/88
540258	Smithfield	Wetzel	04/01/88	04/01/88
540207	Wetzel County*	Wetzel	04/04/83	4/4/1983
540212	Elizabeth	Wirt	01/17/91	1/17/1991
540211	Wirt County*	Wirt	04/01/88	04/01/88
540214	Parkersburg	Wood	09/04/86	4/17/1989
540215	Vienna	Wood	12/18/85	12/18/1985
540216	Williamstown	Wood	10/18/83	10/18/1983
540213	Wood County*	Wood	03/04/85	1/18/1989
540218	Mullens	Wyoming	08/01/79	8/1/1979
540219	Oceana	Wyoming	10/16/79	10/16/1979
540220	Pineville	Wyoming	09/30/83	9/30/1983
540217	Wyoming County*	Wyoming	03/15/84	3/15/1984

FEMA Region III Schedule of Map Updates for West Virginia

Map Mod	County	Community	RP&DC	Contractor	Comments	Address	Zip	Phone
2001	**Monroe Co.**		I	RI	Issued 2002 All Approximate "A"	P.O. Box 350	24983	772-3083
2001	Monroe Co.	Alderson			(also in Greenbrier)			
2001	Monroe Co.	Peterstown				P.O. Box 487	24963	753-9509
2001	Monroe Co.	Union			Non-Participating NSFHA Low flood Risk			
2002	**Hampshire Co.**		VIII	MOD	Issued 2003	P.O. Box 883	26757	822-7018
2002	Hampshire Co.	Capon Bridge				PO Box 183	26711	856-3625
2002	Hampshire Co.	Romney				260 School Street	26757	822-5118
2002	**Jackson Co.**		V	MOD	Issued 2004	P.O. Box 800	25271	372-2011
2002	Jackson Co.	Ravenswood				212 Walnut St.	26164	273-2621
2002	Jackson Co.	Ripley				113 S. Church St.	25271	372-3482
2003	**Cabell Co.**		II	County PI	Prelim issued	Cabell Co. Comm. Rm 314 Court House 750 5th Ave.	25701-2072	526-9704
2003	Cabell Co.	Barboursville			Prelim issued	P.O. Box 266	25504	736-8994
2003	Cabell Co.	Huntington			Prelim issued	PO Box 1659	25717	696-4438
2003	Cabell Co.	Milton			Prelim issued	1139 Smith Street	25541	743-1825
2003	**McDowell Co.**		I	MOD/USACE	Prelim issued	P.O. Box 1508	24801	436-3421
2003	McDowell Co.	Anawalt			Prelim issued	Drawer 40	24808	383-2993
2003	McDowell Co.	Bradshaw			Prelim issued	P.O. Box 450	24817	967-7370
2003	McDowell Co.	Davy			Prelim issued	P.O. Box 243	24828	656-7145
2003	McDowell Co.	Gary			Prelim issued	P.O. Box 310	24836	448-2209
2003	McDowell Co.	Iaeger			Prelim issued	PO Box 158	24844	938-3035
2003	McDowell Co.	Keystone			Prelim issued	HC 52 Box 200	24852	862-2239
2003	McDowell Co.	Kimball			Prelim issued	PO Box 157	24853	585-7913
2003	McDowell Co.	Northfork			Prelim issued	PO Box 760	24868	862-3414
2003	McDowell Co.	War			Prelim issued	P.O.Box 1508	24801	436-3421
2003	McDowell Co.	Welch			Prelim issued	88 Howard	24801	436-3113
2002	**Mercer Co.**		I	Region I	Effective 3/2/05	1501 W. Main St.	24740	487-8335
2002	Mercer Co.	Athens			Non-Participating NSFHA Low flood Risk			
2002	Mercer Co.	Bluefield			Participating - previously unmapped annexed floodplain	PO Box 4100	24701	327-2401
2002	Mercer Co.	Bramwell			Effective 3/2/05	100 Simmons St.	24715	248-7114
2002	Mercer Co.	Matoaka			Effective 3/2/05	PO Box 528	24736	467-7311
2002	Mercer Co.	Oakvale			Effective 3/2/05	PO Box 187	24739	898-8809
2002	Mercer Co.	Princeton			Effective 3/2/05	100 Courthouse Rd.	24740	487-5026
2002	**Putnam Co.**		III	USGS	Scoped	3389 Winfield Road	25213	586-0237
2002	Putnam Co.	Bancroft			Scoped	P.O. Box 58	25011	586-1227
2002	Putnam Co.	Buffalo			Scoped	P.O. Box 307	25033	937-2041
2002	Putnam Co.	Eleanor			Scoped	P.O. Box 185	25070	586-2319
2002	Putnam Co.	Hurricane			Scoped	PO Box 1086	25526	562-2194
2002	Putnam Co.	Poca			Scoped	3389 Winfield Rd.	25213	586-0237

Map Mod	County	Community	RP&DC	Contractor	Comments	Address	Zip	Phone
2002	Putnam Co.	Winfield			Scoped	3389 Windfield Road	25213	586-0237
2002	**Raleigh Co.**		I	Region I & County	Scoped	116 1/2 N. Heber St.	25801	255-9146 255-9388
2002	Raleigh Co.	Beckley			Scoped	409 S. Kanawha St. Rm 16 P.O. Drawer A J	25802-2832	256-1757
2002	Raleigh Co.	Lester			Scoped	122 Grandison Street	25865-0052	934-6301
2002	Raleigh Co.	Mabscott			Scoped	301 Whitestick Street	25871	253-5654
2002	Raleigh Co.	Rhodell			Scoped	P.O. Box 5	25915	683-3668
2002	Raleigh Co.	Sophia			Scoped	100 East Railroad Ave.	25921	683-4456
2002	**Wyoming Co.**		I	Region I	Scoped	P.O. Box 568	24874	732-6953
2002	Wyoming Co.	Mullens			Scoped	316 Moran Ave	25882	294-7132
2002	Wyoming Co.	Oceana			Scoped	P.O. Box 190	24870	682-6231
2002	Wyoming Co.	Pineville			Scoped	Drawer 220	24874	732-6255
2003	**Berkeley Co.**	BERKELEY	IX	WVU & MOD	Scoped	119 W. King St.	25401	264-1966
2003	Berkeley Co.	Hedgesville			Non-Participating NSFHA Low flood Risk			
2003	Berkeley Co.	Martinsburg	IX		Scoped	232 North Queen Street	25402	264-2131
2003	**Jefferson Co.**		IX	WVU & MOD	Scoped	104 E. Washington St.	25414	728-3228
2003	Jefferson Co.	Bolivar			Non-Participating NSFHA Low flood Risk			
2003	Jefferson Co.	Charles Town			Scoped	101 E. Washington St. PO Box 14	25414	725-2311
2003	Jefferson Co.	Harpers Ferry			Scoped	P.O. Box 217	25425	535-2206
2003	Jefferson Co.	Ranson			Scoped	312 S. Mildred St.	25438	725-1010
2003	Jefferson Co.	Shepherdstown			Scoped	P.O. Box 248	25443	876-7187
2003	**Logan Co.**		II	USACE H	Scoped	300 Stratton Street Room 103	25601	792-8626
2003	Logan Co.	Chapmanville			Scoped	PO Box 426	25508	855-4582
2003	Logan Co.	Logan (City)			Scoped	219 Dingess Street	25601	752-4044
2003	Logan Co.	Man			Scoped	PO Box 70	25635	583-9631
2003	Logan Co.	Mitchell Heights			Scoped	115 Cedar Street	25601	752-9292
2003	Logan Co.	West Logan			Scoped	PO Box 5286	25601	752-3244
2003	**Ohio Co.**		X	USACE P	Scoped	City/County Bldg.	26003	234-3756
2003	Ohio Co.	Bethlehem			Participating - unmapped low flood risk	PO Box 6339	26003	242-4180
2003	Ohio Co.	Clearview			Non-Participating NSFHA Low flood Risk			
2003	Ohio Co.	Triadelphia			Scoped	2101 Deegan Ave	26031	547-5000
2003	Ohio Co.	Valley Grove			Scoped	P.O. Box 103	26060	547-1550
2003	Ohio Co.	West Liberty			Non-Participating - previously unmapped flood Risk			
2003	Ohio Co.	Wheeling			Scoped	1500 Chapline Street	26003	234-3601
2003	**Grant Co.**		VIII	WVU & MOD	WVU GIS Tech begun	P.O. Box 608	26847	257-4922
2003	Grant Co.	Bayard			WVU GIS Tech	P.O. Box 243	26707	693-7134

Map Mod	County	Community	RP&DC	Contractor	Comments	Address	Zip	Phone
					begun			
2003	Grant Co.	Petersburg			WVU GIS Tech begun	112 Highland Ave.	26847	257-4735
2003	**Monongalia Co.**		VI	WVU & MOD		180 Hart field Rd.	26505	291-9570
2003	Monongalia Co.	Blacksville			Participating - previously unmapped has flood risk	P.O. Box 55	26521	
2003	Monongalia Co.	Granville				Dents Run Blvd.	26147	354-7500
2003	Monongalia Co.	Morgantown				389 Spruce Street	26505	284-7412
2003	Monongalia Co.	Star City				370 Brosway Ave.	26505	599-3550
2003	Monongalia Co.	Westover				500 Dupont Road	26501	296-6860
2003	**Morgan Co.**		IX	WVU & MOD	WVU GIS Tech begun	P.O. Box 28	25411	258-8540
2003	Morgan Co.	Bath			WVU GIS Tech begun	103 Wilkes St.	25411	258-1102
2003	Morgan Co.	Paw Paw			WVU GIS Tech begun	P.O. Box 35	25434	947-7476
2004	**Barbour Co.**	BARBOUR	VII	WVU & MOD	Unincorporated areas all Approx. "A"	8 N. Main St.	26416	457-4339
2004	Barbour Co.	Belington				P.O. Box 926	26250	823-1611
2004	Barbour Co.	Junior				P.O. Box 247	26275	823-1829
2004	Barbour Co.	Philippi				PO Box 460; 108 N. Main St.	26416	457-3700
2004	**Gilmer Co.**		VII	Canaan Valley		P.O. Box 150 / 226 West Main Street	26351	462-5634
2004	Gilmer Co.	Glenville				20 N. Court Street	26351	462-8040
2004	Gilmer Co.	Sand Fork (Layopolis)				P.O. Box 88	26430	
2004	**Hardy Co.**		VIII	WVU & MOD		204 Washington Ave.	26836	538-6157
2004	Hardy Co.	Moorefield				206 Winchester Ave.	26836	538-6142
2004	Hardy Co.	Wardensville				P.O. Box 7	26851	874-3950
2004	**Harrison Co.**		VI	USACE P	Scoped	301 W. Main St.	26301	624-8690
2004	Harrison Co.	Anmoore			Scoped	PO Box 178	26323	622-7431
2004	Harrison Co.	Bridgeport			Scoped	156 Thompson Drive	26330	842-8218
2004	Harrison Co.	Clarksburg			Scoped	222 West Main Street	26301	624-1633
2004	Harrison Co.	Lost Creek			Scoped	PO Box 114	26385	745-3466
2004	Harrison Co.	Lumberport			Scoped	301 West Main Street	26301	624-8750
2004	Harrison Co.	Nutter Fort			Scoped	1415 Buckannon Pike	26301	622-7713
2004	Harrison Co.	Salem			Scoped	Rt. 2 Box 206B	26385	782-1313
2004	Harrison Co.	Shinnston			Scoped	P.O. Box 1865	26431	592-2126
2004	Harrison Co.	Stonewood			Scoped	112 Southern Ave	26301	623-2919
2004	Harrison Co.	West Milford			Scoped	P.O. Box 120	26451	745-3131
2004	**Kanawha Co.**		III	MOD	Scoped	407 Virginia St. E.	25301	357-0570
2004	Kanawha Co.	Belle			Scoped	1100 East Dupont Ave.	25015	949-3841
2004	Kanawha Co.	Cedar Grove			Scoped	PO Box 536	25039	595-1841
2004	Kanawha Co.	Charleston			Scoped	PO Box 2749	25330	348-6833
2004	Kanawha Co.	Chesapeake			Scoped	09-133 RD. Street	25315	949-1611
2004	Kanawha Co.	Clendenin			Scoped	PO Box 694	25045	548-4192

Map Mod	County	Community	RP&DC	Contractor	Comments	Address	Zip	Phone
2004	Kanawha Co.	Dunbar			Scoped	12th St. & Myers Ave. Box 216	25064	766-0217
2004	Kanawha Co.	East Bank			Scoped	PO Box 307	25067	595-1605
2004	Kanawha Co.	Glasgow			Scoped	PO Box 130	25086	595-1015
2004	Kanawha Co.	Handley			Scoped	P.O. Box 100	25102	442-5100
2004	Kanawha Co.	Jefferson			Non-Participating has mapped flood risk			
2004	Kanawha Co.	Marmet			Scoped	PO Box 15037	25365	949-2241
2004	Kanawha Co.	Nitro			Scoped	454 Blake Rd.	25143	755-0703
2004	Kanawha Co.	Pratt			Scoped	303 James Street	25162	442-4731
2004	Kanawha Co.	South Charleston			Scoped	1103 Jefferson Rd.	25309	744-5532
2004	Kanawha Co.	St. Albans			Scoped	1499 MacCorkle Ave	25177	727-2962
2004	**Lewis Co.**		VII	WVU & MOD		P.O. Box 466	26452	269-8200
2004	Lewis Co.	Jane Lew				P.O. Box 50	26378	884-7910
2004	Lewis Co.	Weston				102 W. Second Street	26452	269-2349
2004	**Lincoln Co.**		II	USACEH	Scoped	P.O. Box 497	25523	824-7990 ext 264
2004	Lincoln Co.	Hamlin			Scoped	220 Main Street	25523-1512	824-5500
2004	Lincoln Co.	West Hamlin			Scoped	P.O. Box 497	25523	824-7990 ext 264
2004	**Marion Co.**		VI	USACE P	Scoped	200 Jackson St.	26554	367-5341
2004	Marion Co.	Barrackville			Scoped	P.O. Box 26	268559	363-2649
2004	Marion Co.	Fairmont			Scoped	200 Jackson Street	26554	366-6211
2004	Marion Co.	Fairview			Scoped	Drawer 119	26570	449-1642
2004	Marion Co.	Farmington			Scoped	P.O. Box 520	26571	825-6442
2004	Marion Co.	Grant Town			Scoped	PO Box 40	26574	278-7381
2004	Marion Co.	Mannington			Scoped	206 Main Street	26582	986-2700
2004	Marion Co.	Monongah			Scoped	P.O. Box 9119	26554	534-3365
2004	Marion Co.	Pleasant Valley			Scoped	401 Kingmont, Ste #1	26554	363-2400
2004	Marion Co.	Rivesville			Scoped	142 Main St. PO Box 45	26588	278-5301
2004	Marion Co.	White Hall			Non Participating has some flood risk			
2004	Marion Co.	Worthington			Scoped	P.O. Box 265	26591	287-2238
2004	**Mineral Co.**		VIII	WVU & MOD		150 Armstrong St .	26726	788-1457
2004	Mineral Co.	Carpendale			Non-Participating NSFHA Low flood Risk			
2004	Mineral Co.	Elk Garden			Non-Participating NSFHA Low flood Risk			
2004	Mineral Co.	Keyser				111 North Davis Street	26726	788-1511
2004	Mineral Co.	Piedmont				52 Second Street	26750	355-2621
2004	Mineral Co.	Ridgeley			Non Participating has some flood risk (levee)			
2004	**Mingo Co.**		II	USACEH	Scope delayed/flood	P.O. Box 1197	25661	235-0566
2004	Mingo Co.	Delbarton			Scope delayed/flood	P.O. Box 730	25670	475-3359
2004	Mingo Co.	Gilbert			Scope delayed/flood	P. O. Box 188	25621	664-9625
2004	Mingo Co.	Kermit			Scope delayed/flood	P.O. Box 385	25674	393-3573
2004	Mingo Co.	Matewan			Scope delayed/flood	P.O. Box 306	25678	426-4092
2004	Mingo Co.	Williamson			Scope delayed/flood	P.O. Box 1517	25661	235-2073

Map Mod	County	Community	RP&DC	Contractor	Comments	Address	Zip	Phone
2004	**Pendleton Co.**		VIII	WVU & MOD		P.O. Box 937	26807	358-2563
2004	Pendleton Co.	Franklin				PO Box 483	26807	358-7525
2004	**Randolph Co.**		VII	WVU & MOD		120 S. Randolph Ave.	26241	636-0543 or 636-0343
2004	Randolph Co.	Beverly				Drawer 279	26253	636-5360
2004	Randolph Co.	Coalton				PO Box 189	25257	636-3267
2004	Randolph Co.	Elkins				401 Davis Ave	26241	673-1268
2004	Randolph Co.	Harman				PO Box 125	26270	227-4131
2004	Randolph Co.	Huttonsville				P.O. Box 81	26273	
2004	Randolph Co.	Mill Creek				PO Box 128	26280	335-4795
2004	Randolph Co.	Montrose				P.O. Box 84	26283	
2004	**Taylor Co.**		VI	WVU & MOD	Unincorporated areas all Approx. "A"	214 W. Main St.	26354	265-3303
2004	Taylor Co.	Flemington			Participating - unmapped low flood risk	PO Box 44	26347	739-2295
2004	Taylor Co.	Grafton				1 West Main Street	26354	265-1412
2004	**Tucker Co.**		VII	WVU & MOD		215 First St. Ste #3	26287	478-2866
2004	Tucker Co.	Davis				PO Box 207	26260	259-5302
2004	Tucker Co.	Hambleton				Rt #1 Box 110	25269	259-4038
2004	Tucker Co.	Hendricks				City Buildings	26271	478-2252
2004	Tucker Co.	Parsons				341 Second St.	26287	478-2311
2004	Tucker Co.	Thomas				P.O. Box 248	26292	463-4360
2004	**Upshur Co.**		VII	WVU & MOD	Unincorporated areas all Approx. "A"	38 W. Main Street	26201	473-0308
2004	Upshur Co.	Buckhannon				70 E. Main Street	26201	472-1651
2004	**Wayne Co.**		II	USACE H	Scoped	P.O. Box 248	25570	272-6426
2004	Wayne Co.	Ceredo			Scoped	P.O. Box 691	25507	453-1041
2004	Wayne Co.	Fort Gay			Scoped	3407 Wayne Street	25514	648-5246
2004	Wayne Co.	Kenova			Scoped	PO Box 268	25530	453-1571
2004	Wayne Co.	Wayne			Scoped	P.O. Box 186	25570	272-3221
2005	**Boone Co.**	BOONE	III			P.O. Box 253	25053	369-7273
2005	Boone Co.	Danville	III			PO Box 217	25053	369-7050
2005	Boone Co.	Madison	III			261 Washington Ave.	26582	369-2762
2005	Boone Co.	Sylvester	III			PO Box 10	25193	854-1930
2005	Boone Co.	Whitesville	III			PO Box 475	25209	854-2658
2005	**Marshall Co.**		X			P.O. Drawer B	26041	843-1130
2005	Marshall Co.	Benwood				430 Main Street	26031	232-4320
2005	Marshall Co.	Cameron				44 Main Street	26033	686-2366
2005	Marshall Co.	Glen Dale				400 Wheeling Ave.	26038	845-5511
2005	Marshall Co.	McMechen				47 & 9th Street	26040	232-3140
2005	Marshall Co.	Moundsville				800 Sixth Street PO Box E	26041	845-3394
2005	**Mason Co.**		II			P.O. Box 247	25550	675-9911
2005	Mason Co.	Hartford				P.O. Box 7	25247	882-2521
2005	Mason Co.	Henderson				Mason County Court House 6th Street	25550	675-9911

Map Mod	County	Community	RP&DC	Contractor	Comments	Address	Zip	Phone
2005	Mason Co.	Leon				Drawer 136	25123	485-1715
2005	Mason Co.	Mason				PO Box 438	25260	773-5200
2005	Mason Co.	New Haven				PO Box 365	25265	882-3203
2005	Mason Co.	Point Pleasant				400 Viand Street	25550	675-2360
2005	**Summers Co.**		I	Region I		P.O. Box 97	25951	466-7100
2005	Summers Co.	Hinton				P.O. Box 477	25951	466-3256
2005	**Webster Co.**		IV			112 D Bell Street	26288	847-2122
2005	Webster Co.	Addison				146 McGraw Avenue	26288	847-5411
2005	Webster Co.	Camden on Gauley				P.O. Box 300	26208	226-5613
2005	Webster Co.	Cowen				P.O. Box 446	26206	226-3101
2005	**Wetzel Co.**		X			P.O. Box 156	26155	455-8200
2005	Wetzel Co.	Hundred				P.O. Box 1100	26575	775-5131
2005	Wetzel Co.	Littleton				P.O. Box 205	26581	775-2270
2005	Wetzel Co.	New Martinsville				191 Main Street	26155	455-9120
2005	Wetzel Co.	Paden City				PO Box 211	26159	337-2295
2005	Wetzel Co.	Pine Grove				P.O. Box 286	26419	889-3351
2005	Wetzel Co.	Smithfield				PO Box 67	26437	334-2544
2005	**Wood Co.**		V			1 Court Square	26101	424-1988
2005	Wood Co.	North Hills			Non-Participating NSFHA Low flood Risk			
2005	Wood Co.	Parkersburg				PO Box 1627	26102	424-8477
2005	Wood Co.	Vienna				609 29th Street	26105	295-6081
2005	Wood Co.	Williamstown				100 W 5th Street	26187	375-7536
2006	**Fayette Co.**		IV			P.O. Box 307	25840	574-4273
2006	Fayette Co.	Ansted				P.O. Box 798	25812	658-5901
2006	Fayette Co.	Fayetteville			Participating - previously unmapped has flood risk	P.o> Box 298	25840	574-0101
2006	Fayette Co.	Gauley Bridge				PO Box 490	25085	632-2505
2006	Fayette Co.	Meadow Bridge				PO Box 27	25976	484-7492
2006	Fayette Co.	Montgomery				706 Third Ave.	25136	442-3162
2006	Fayette Co.	Mount Hope				PO Box 151	25880	877-2211
2006	Fayette Co.	Oak Hill				PO Box 1245	25901	469-9541
2006	Fayette Co.	Pax				PO Box 118	25904	877-2407
2006	Fayette Co.	Smithers			issued 2003	P.O. Box 489	25186	442-5282
2006	Fayette Co.	Thurmond			Non-Participating NSFHA Low flood Risk			
2006	**Greenbrier Co.**		IV			200 N. Court St.	24901	647-6630
2006	Greenbrier Co.	Alderson				P.O. Box 179	24910	445-2916
2006	Greenbrier Co.	Falling Springs				P.O. Box 116	24966	497-2788
2006	Greenbrier Co.	Lewisburg			Participating - unmapped low flood risk	119 West Washington Street	24901	645-2080
2006	Greenbrier Co.	Quinwood				P.O. Box 194	25981	438-6658

Map Mod	County	Community	RP&DC	Contractor	Comments	Address	Zip	Phone
2006	Greenbrier Co.	Rainelle				215 Seventh Street	25962	438-7191
2006	Greenbrier Co.	Renick				P.O. Box 116	24966	497-2788
2006	Greenbrier Co.	Ronceverte				PO Box 417	24970	647-5455
2006	Greenbrier Co.	Rupert				615 Nicholas Street	25984	392-5682
2006	Greenbrier Co.	White Sulphur Springs				34 West Main Street	24986	536-1454
2006	**Pleasants Co.**		V			301 Court Lane	26170	684-1127
2006	Pleasants Co.	Belmont				PO Box 375	26134	665-2160
2006	Pleasants Co.	St. Mary's				418 Second St.	26170	684-2401
2006	**Ritchie Co.**		V			612 E. south Street	26362	643-4634
2006	Ritchie Co.	Auburn				P.O. Box 37	26325	349-2421
2006	Ritchie Co.	Cairo				P.O. Box 162	26337	628-3843
2006	Ritchie Co.	Ellenboro				PO Box 123	26346	869-3242
2006	Ritchie Co.	Harrisville			Non Participating has some flood risk			
2006	Ritchie Co.	Pennsboro				422 Main Street	26415	659-2377
2006	Ritchie Co.	Pullman				P.O. Box 122	26421	659-3427
2006	**Tyler Co.**		V		Unincorporated areas all Approx. "A"	P.O. Box 238	26149	758-5155
2006	Tyler Co.	Friendly				P.O. Box 95	26146	
2006	Tyler Co.	Middlebourne				100 Main Street	26149	758-4771
2006	Tyler Co.	Sisterville				200 Diamond Street	26175	652-6361
2006	**Wirt Co.**		V			P.O. Box 548	26143	275-3192
2006	Wirt Co.	Elizabeth				P.O. Box 478	26143	275-3200
2007	**Braxton Co.**		VII		Unincorporated areas all Approx. "A"	HC 69, Box 48	26623	364-8160
2007	Braxton Co.	Burnsville				PO Box 305	26335	853-2605
2007	Braxton Co.	Flatwoods			Participating - previously unmapped has flood risk			
2007	Braxton Co.	Gassaway				PO Box 147	26624	364-5111
2007	Braxton Co.	Sutton				PO Box 366	26601	765-5581
2007	**Calhoun Co.**		V			P.O. Box 230	26145	354-6725
2007	Calhoun Co.	Grantsville				PO Box 146	26147	354-7500
2007	**Doddridge Co.**		VI			118 E. Court St.	26456	873-2631
2007	Doddridge Co.	West Union				P.O. Box 5	26456	873-1400
2007	**Pocahontas Co.**		IV			900C 10th Ave.	24954	653-4218
2007	Pocahontas Co.	Durbin				PO Box 37	26264	546-4955
2007	Pocahontas Co.	Hillsboro			Non-Participating NSFHA Low flood Risk			
2007	Pocahontas Co.	Marlinton				709 2nd Ave.	24954	799-4315
2007	**Preston Co.**		VI		Unincorporated areas all Approx. "A"	103 1/2 W. Main St.	26537	329-1855
2007	Preston Co.	Brandonville			Non Participating has some flood risk			
2007	Preston Co.	Bruceton Mills				P.O. Box 302	26525	
2007	Preston Co.	Kingwood			Participating - unmapped low flood risk	313 Tunnelton Street	26537	329-1225
2007	Preston Co.	Masontown			Non-Participating - previously unmapped flood Risk			

Map Mod	County	Community	RP&DC	Contractor	Comments	Address	Zip	Phone
2007	Preston Co.	Newburg				P.O. Box 40	26410	892-3341
2007	Preston Co.	Reedsville				P.O. Box 397	26547	864-3437
2007	Preston Co.	Rowlesburg				P.O. Box 458	26425	454-2441
2007	Preston Co.	Terra Alta				701-A East State Ave	26764	789-6664
2007	Preston Co.	Tunnelton			Non-Participating NSFHA Low flood Risk			
2007	**Roane Co.**		V		Unincorporated areas all Approx. "A"	205 E.Main St.	25276	927-0918
2007	Roane Co.	Reedy				P.O. Box 57	25270	927-3222
2007	Roane Co.	Spencer				207 Court St.	25676	927-1640
2008	**Brooke Co.**		XI			632 Main St.	26070	527-2353
2008	Brooke Co.	Beech Bottom			Non-Participating has mapped flood risk			
2008	Brooke Co.	Bethany				Box U	26032	829-4217
2008	Brooke Co.	Follansbee				872 Main Street	26037	527-1330
2008	Brooke Co.	Wellsburg				City Hall 70-7M Street	26070	737-2104
2008	Brooke Co.	Windsor Heights			Non-Participating NSFHA Low flood Risk			
2008	**Clay Co.**		III			P.O. Box 310	25043	649-4845
2008	Clay Co.	Clay				Court House Main Street	25043	387-4258
2008	**Hancock Co.**		XI			P.O. Box 455	26047	564-4040
2008	Hancock Co.	Chester				375 Carolina Ave	26034	387-2820
2008	Hancock Co.	New Cumberland				Jefferson St. PO Box 505	26047	564-3383
2008	Hancock Co.	Weirton				200 Municipal Plaza	26062	797-8500
2008	**Nicholas Co.**		IV			700 Main Street	26651	872-7890
2008	Nicholas Co.	Richwood				6 White Ave	26261	846-2596
2008	Nicholas Co.	Summersville				PO Box 525 400 North Broad St.	26651	872-1211

Appendix D — Flood Damage Assessment

There is no single definition of the phrase “flood-damage assessment” that is applicable to all agencies. Such a definition would be difficult to develop and may be unnecessary. Every agency collects damage data that is specific to their mission. Some agencies collect data to aid in determining the scope, severity, and size of the flood as it impacts business and residential structures. Other agencies collect data on specific types of structures (agricultural, highways ,etc.). Still other agencies collect data on the flooding impacts on the stream banks. Figures D-1, D-2, and D-3 show the types of damages for which data is collected by various agencies.

Figure D-1. Flood Damaged Vehicle

Figure D-2. Residential Flood Damages

Figure D-3. Damaged Stream Banks

Anyone attempting to locate specific information on historical floods, potential flooding, and flood damage will soon discover that agencies typically organize their data using criteria and software that differ from those of other agencies, making no attempt to relate their data to any other data. This makes it difficult for agencies to access one another's information concerning flood damage assessments, and therefore difficult to analyze the impacts of the flooding and the performance of the agencies involved.

Table D-1 shows the agencies, organizations, associations, and individuals that collect data relating to flood damage for their own mission specific purposes in West Virginia.

Table D-1
Agencies, Organizations and Associations Collecting Flood Damage Data

American Red Cross
County and Municipal Governments
Federal Emergency Management Agency
Insurance Agents
Public Utilities
Volunteer Organizations Active in Disaster
Regional Planning and Development Offices
Small Business Administration
US Army Corps of Engineers—Baltimore District
US Army Corps of Engineers—Huntington District
US Army Corps of Engineers—Pittsburgh District
USDA—Farm Service Agency
USDA—Natural Resources Conservation Service
WV Bureau for Public Health
WV Department of Agriculture
WV Department of Education
WV Department of Environmental Protection
WV Department of Health and Human Resources
WV Department of Transportation
WV Development Office
WV Division of Corrections
WV Division of Forestry
WV Division of Natural Resources
WV Housing Development Fund
WV National Guard
WV Office of Emergency Services
WV Conservation Agency
WV State Fire Marshal's Office
WV University Extension Service

No effort is ongoing to compile a definitive database of flood damage or flood protection information for all organizations in West Virginia. Furthermore, no one agency is responsible for keeping all flood damage data current. Therefore, no historical flood-damage data is compiled and available for predicting potential damage, nor can flood damage data from different flood events be compared with any confidence.

To facilitate developing comparable data for future floods, the Task Force recommends establishment of a single point of contact or clearinghouse and repository of historic data. This should be one agency, mandated to collect all flood related data including an inventory of at-risk structures, repetitive loss data, flood control project data, and other databases. This data should include information on losses sustained by residences, businesses, farms/ agricultural losses, roadways, railroads and other types of losses.

The WV Office of Emergency Services would be the logical place for such a database providing WVOES is adequately staffed with two database managers and funding to support their activities.

Two systems are used to organize flood damage and flood frequency data in West Virginia: by county and by watershed. The Corps of Engineers and the Natural Resource Conservation Service usually study flood damages on a watershed basis. Numerous watersheds in the state span several counties (see Figure 1-5), therefore flooding usually impacts more than one county at a time. When planning for flood control or flood mitigation projects, it is imperative that the entire watershed be examined to determine the effects of any project or event on flooding from the headwaters to the mouth of the watershed.

Other forms of flood damage assessments are done on a county-by-county basis since that is how Federal assistance is generally provided. The Federal Emergency Management Agency, West Virginia Office of Emergency Services, American Red Cross, and the Small Business Administration typically collect flood damage information on a county-by-county basis. County governments are also the most likely local sponsors for small-scale flood control projects. Few watershed associations have the capacity either in financial resources or in management structure to administer flood control or planning projects.

To ensure that flood information is available for watersheds and for counties, the Task Force recommends that all data including data on repetitive loss structures, be compiled with latitude, longitude, and elevation reference data. In this manner, the data can be extracted from the databases to generate Geographic Information System mapping layers for county or watershed flood protection planning.

The Natural Resource Conservation Service has developed a database of land use and damage assessment for most of the 11-digit HUC code watersheds in West Virginia.. These tables should be examined by NRCS and updated on a regular basis. The Corps of Engineers should develop similar figures for the watersheds along major rivers not covered by the NRCS.

Information on repetitive loss structures is available. However, it is impossible to locate these structures with an acceptable degree of precision. Privacy issues may prevent the information being made available to the public, but it should be available to local, State and Federal agencies involved in floodplain management, flood protection planning, and project planning. All local jurisdictions should obtain the repetitive loss data from WV OES and develop 11-digit HUC codes or latitude, longitude, and elevation figures for each repetitive loss structure in their jurisdiction. This data can then be included in a GIS database for use by local, State and Federal agencies.

Many local officials, State and Federal agencies, and the public are uncertain about whom to contact for information or assistance relating to flooding. With the constant evolution of programs, it is impossible for all agencies to stay abreast of developments in the other agencies involved in flood preparation, response, recovery, and mitigation. It's imperative that the Statewide Flood Protection Plan Task Force take steps to alleviate this by developing a chart that identifies who to contact for information or assistance on the issues related to flooding. This chart should be available in a printed version and in a web-based version for distribution to the public.

It was discovered that information on the mortality from flooding at different recurrence levels has never been examined in West Virginia or comparable areas. Nor is there a portable morgue in West Virginia for use in the event of a major disaster involving loss of life. Current plans provide for borrowing a portable morgue from Pennsylvania. The Task Force recommends that the West Virginia State Medical Examiner's Office be provided the necessary funds to purchase, equip and staff a portable morgue for use in mass casualty disasters and conduct a study of the expected mortality from flooding at different recurrence levels.

Appendix E — Building Codes, Permitting and Enforcement

A. BUILDING CODES:

The most cost effective way to reduce damages from natural disasters is to incorporate preventive measures into site planning, design and construction of buildings. For flooding, these measures can be applied to land use planning, land development ordinances, or a building code adopted and enforced at the local level. There are three national building code organizations:

BOCA – Building Officials and Code Administrators International, Inc., developed the National Building Code adopted by New England and upper Midwest states.
SBCCI – Southern Building Code Congress International, Inc. developed the Standard Building Code adopted by southern states.
ICBO – International Conference of Building Officials developed the Uniform Building Code adopted by western states.

During 1999, the three national organizations banded together to form the International Code Council (ICC). The ICC has developed a series of international building codes, including an International Residential Code (IRC), designed to lessen property damage and save lives during natural disasters, including floods. The Federal Emergency Management Agency (FEMA) and the three national councils have urged states and communities to adopt and enforce the new International Codes. The 1995 CABO Building Code will no longer be updated. There are some differences in the 1995 CABO Building Code and the new 2000 IRC that apply to one and two-family dwellings. The major differences that apply to flood protection are identified in Table E-1.

Table E-1

Differences Relating to Flooding and the 1995 Council of American Building Officials One- and Two-Family Dwelling Code and the 2000 International Building Code

1995 CABO	2000 IRC	Significant Differences
-----	R105.3	The IRC addresses the application for a permit and the information required on a permit.
-----	R106.1.3	The IRC addresses information required for buildings and structures in flood hazard areas.
113	R109	Floodplain inspection and fire-resistance-rated construction inspection have been added.
301	R301	Added requirements for floodplain construction.
301.2	Table R301.2(1)	Added Flood Hazards to this table.
-----	R301.2.4	The IRC addresses prescriptive requirements for floodplain construction.
-----	R309.5	The IRC provides a new section for garages for buildings located in flood hazard areas.
-----	R327	The IRC addresses requirements for flood-resistant construction.

Other International Codes that contain provisions for flood protection include:

- The 2000 International Plumbing Code
- The 2000 International Mechanical Code
- The 2000 International Fuel Gas Code
- The 2000 International Private Sewage- Disposal Code.

These codes are not automatically adopted along with the International Building Code and would have to be adopted individually. To have a comprehensive code system that addresses all phases of construction, the Task Force recommends that all of the International Codes listed above be adopted by West Virginia for use in the regulated floodplain.

The Task Force recommends that the West Virginia Development Office prepare and disseminate to counties and municipalities a model sub-division regulation that contains a requirement that every residential, commercial or industrial lot include a portion of developable land that is out of the floodway for construction of a structure.

The Task Force recommends that the State require that all structure renovation valued at $10,000 or more, and **all** new structures obtain a permit document from the appropriate city or county floodplain manager legally certifying whether their site is in or out of the floodplain. All permits identifying a site as being in or out of the floodplain should allow for on site inspection of construction activities. Construction, installation, or renovation of a structure within the floodplain without a permit would be punishable by a fine of not less than $5,000 and removal of the structure. A copy of this permit must be provided to the utility company before the utility is connected. All utility companies must receive and keep a copy of the approved permit before to connecting utility. If a permit is not obtained before construction, the builder, homeowner, utility company, and property

owner should all be held liable. Where local communities have adopted combined building code and floodplain ordinance enforcement and permitting, the local code enforcement office may provide such certification if he or she holds the CFM designation and appropriate CABO and/or ICBO certification through the local permitting processes.

A major threat during flooding is floating debris. A recurring problem with floating debris involves improperly anchored manufactured housing. During flood events, improperly anchored manufactured houses frequently float downstream and lodge under the next bridge or other choke point. Figure E-1 shows a manufactured home creating a blockage at a stream crossing.

Figure E-1. Manufactured Home Blocking a Stream Crossing

These blockages create temporary dams artificially raising the height of water behind them and increasing the flood damages immediately upstream of the blockage. When the blockage breaks loose, high velocity, debris-filled floodwaters rush downstream. The cycle resumes when the remnants become lodged at the next bridge or choke point. This deadly sequence was observed quite painfully during the July 2001 flood events in the southern portions of the state. Manufactured houses account for 17% of all housing units in the State according to 2000 Census data.

In West Virginia, the Division of Labor (DOL) is responsible for ensuring that manufactured homes are properly installed under 42CSR19. Section 10A.1.(a) of this regulation requires that all manufactured homes be installed in accordance with the manufacturer's instructions, and that a competent design be certified in writing by a registered professional engineer or architect or otherwise be consistent with the recommendations in the American National Standards Institute, A225.1 *Installation Standard for Manufactured Homes*. DOL has recently started inspecting some buildings for compliance with the State building code.

Since different soils require different anchors, it is unlikely that any one design will be acceptable everywhere across West Virginia. Some manufactured homes in West Virginia might be one or two feet off the ground. Others may be much higher. Due to extreme slopes, some may be only a few feet from the ground on one end and twelve to fifteen feet off the ground on the other end. These extremes in elevation require different methods of supporting and anchoring the home. Until recently, DOL had only one inspector statewide inspecting manufactured home installations. Three additional manufactured home inspectors have begun working since the July 2001 floods. Four inspectors simply cannot adequately cover the entire State.

The Task Force recommends that the Division of Labor be provided the necessary funds and be authorized to employ field inspectors with appropriate supervisory and support staff to address this issue. An alternative recommendation would be to eliminate the Manufactured Housing Section and reorganize it into the new Building Codes Division.

In addition, the Task Force recommends that the Department of Labor require appropriate staff to become conversant with floodplain management issues and incorporate the use of Flood Insurance Rate Maps in inspection procedures.

B. PERMITTING PROCESS:

The Department of the Army regulatory program is one of the oldest in the Federal Government. Its purpose is to protect and maintain the navigable capacity of the nation's waters. The legislative origins of the program are the Rivers and Harbors Acts of 1890 (superseded) and 1899 (33 U.S.C. 401, et seq.). Various sections establish permit requirements to prevent unauthorized obstruction or alteration of any navigable water of the United States. The most frequently exercised authority is contained in Section 10 (33 U.S.C. 403), which covers construction, excavation, or deposition of materials in, over, or under such waters, or any work which would affect the course, location, condition, or capacity of those waters. The authority is granted to the Secretary of the Army.

In 1972, amendments to the Federal Water Pollution Control Act added what is commonly called Section 404 authority (33 U.S.C. 1344) to the program. The Secretary of the Army, acting through the Chief of Engineers, is authorized to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into waters of the United States at specified disposal sites. Selection of such sites must be in accordance with guidelines developed by the Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army; these guidelines are known as the 404(b)(1) Guidelines. The Federal Water Pollution Control Act was further amended in 1977 and given the common name of "Clean Water Act" and was again amended in 1987 to modify criminal and civil penalty provisions and to add an administrative penalty provision.

The geographic jurisdiction of the Rivers and Harbors Act of 1899 includes all navigable waters of the United States which are defined in 33 CFR Part 329 as, "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce."

Activities requiring Section 10 permits include structures (e.g., piers, wharfs, breakwaters, bulkheads, jetties, weirs, transmission lines) and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to the navigable waters of the United States.

The Clean Water Act uses the term "navigable waters" which is defined (Section 502(7)) as "waters of the United States, including the territorial seas". Thus, Section 404 jurisdiction is defined as encompassing Section 10 waters plus their tributaries and adjacent wetlands and isolated waters where the use, degradation or destruction of such waters could affect interstate or foreign commerce.

Activities, requiring Section 404 permits are limited to discharges of dredged or fill materials into the waters of the United States. These discharges include return water from dredged material disposed of on the upland and generally any fill material (e.g., rock, sand, dirt) used to construct sites for development, roadways, erosion protection, or other uses.

Most of these permit authorities have been delegated by the Secretary of the Army to the Chief of Engineers and his authorized representatives (usually District Engineers at the Corps of Engineers districts). Section 10 authority was formally delegated on May 24, 1971, with Section 404 authority delegated on March 12, 1973. Those exercising these authorities are directed to evaluate the impact of the proposed work on the public interest

The basic form of authorization used by districts is the individual permit. Before issuing an individual permit the Corps must evaluate the individual application for each project through three steps: pre-application consultation (primarily for major projects), formal project review, and decision-making.

The Corps participates in a strong, partnership with West Virginia’s Department of Environmental Protection and Division of Natural Resources in regulating water resource developments. This is achieved with joint permit processing procedures (e.g., joint public notices and hearings), programmatic general permits founded on effective State programs, transfer of the Section 404 program in non-navigable waters, joint environmental impact statements, special area management planning, and regional conditioning of nationwide permits.

A general permit is one founded on an existing State, local or other Federal agency program and designed to avoid duplication with that program. Nationwide general permits are issued by the Chief of Engineers through the Federal Register rulemaking process. Information about nationwide general permits can be found at 33 CFR Part 330, Appendix A.

Public involvement plays a central role in the Corps' administration of its regulatory program. The major tools used to interact with the public are the public notice and public hearing. The public notice is the primary method of advising all interested parties of a

proposed activity for which a permit is sought and of soliciting comments and information necessary to evaluate the probable beneficial and detrimental impacts on the public interest. Public notices on proposed projects always contain a statement that anyone commenting may request a public hearing. Public hearings are held if comments raise substantial issues that cannot be resolved informally and the Corps decision maker determines that information from such a hearing is needed to make a decision. Public notices are used to announce hearings. The public is also informed by notice on a monthly basis of permit decisions.

Individual State permitting and water quality certification requirements provide an additional form of objective safeguard to the Corps regulatory program. Section 401 of the Clean Water Act requires State certification or waiver of certification prior to issuance of a Section 404 permit.

In addition to these requirements, the Corps' implementing regulations require that district engineers conduct additional evaluations on applications with potential for having an effect on a variety of special interests (e.g., Indian reservation lands, historic properties, endangered species, and wild and scenic rivers).

In addition to the Corps' regulatory program, the WV Division of Environmental Protection is responsible for issuing permits for discharges of stormwater from construction activities. This program is covered by the State's Water Pollution Control Act (WV Code Chapter 22 Article 11) and the Groundwater Protection Act (WV Code Chapter 22 Article 12). The purpose of the program is to provide expedited permit coverage and ensure proper management of stormwater quality discharged from construction activities.
Permits issued under this program are valid for five years and there are fees associated with the permit process. The permit must be applied for thirty days before the start of any construction (3 acres or larger) and a stormwater pollution prevention plan must be submitted that includes a BMP plan and groundwater protection plan.

All applicants must receive a Section 404 permit from the Corps of Engineers when applicable and a permit from the Public Lands Corporation of the Division of Natural Resources to work in a stream. During public workshops, it became apparent that many local officials and the public are not aware of the regulatory permitting requirements of the Federal and State agencies.

The Task Force recommends that the appropriate Corps of Engineer District offices and State offices involved in the issuance of regulatory permits in West Virginia waters under the Clean Water Act of 1970 (as amended) develop and deploy a public information and awareness program for local officials and private landowners. The purpose of the program will be to assure that Federal and State agencies, county and municipal officials, floodplain managers, building code officials, and the general public are fully aware of the requirements of the regulatory permitting process (including permissive acts under the Nationwide Permits) when conducting emergency recovery operations or normal construction within or along the State's waterways.

C. ENFORCEMENT:

Procedures for enforcing Corps permitting authorities are found at 33 CFR Part 326. Inspection and surveillance activities are carried out at the district engineer disposal. Corps of Engineers' employees are instructed on the observation and reporting of suspected unauthorized activities in waters of the United States and of violations of issued permits. The assistance of members of the public and other interested Federal, State and local agencies is encouraged.

When the district engineer becomes aware of any unauthorized activity still in progress, he must first issue a cease and desist order and then begin an investigation of the activity to ascertain facts concerning alleged violations. If the unauthorized activity has been completed, he will advise the responsible party of his discovery and begin an investigation. Following his evaluation, the district engineers may formulate recommendations on the appropriate administrative course or legal action to be taken. The district engineer's evaluation contains an initial determination of whether any significant adverse impacts are occurring which would require expeditious corrective measures to protect life, property, or a significant public resource.

Once that determination is made, such remedial measures can be administratively ordered and a decision can be made on whether legal action is necessary. In certain cases, district engineers, following the issuance of a cease and desist order, coordinate with State and Federal resource agencies in deciding what action is appropriate. Further evaluation of the violation takes into consideration voluntary compliance with a request for remedial action. A permit is not required for restoration or other remedial action.

For those cases that do not require legal action and for which complete restoration has not been ordered, the Department of the Army will accept applications for after-the- fact permits. The full public interest review is deferred during the early stages of the enforcement process. A complete public interest review is conducted only if and when the district engineer accepts an application for an after-the- fact permit.

The laws that serve as the basis for the Corps regulatory program contain several enforcement provisions that provide for criminal, civil, and administrative penalties. While the Corps is solely responsible for the initiation of appropriate legal actions pursuant to enforcement provisions relating to its Section 10 authority, the responsibility for implementing those enforcement provisions relating to Section 404 is jointly shared by the Corps and EPA. For this reason, the Corps has signed a Section 404 enforcement memorandum of agreement (MOA) with EPA to ensure that the most efficient use is made of available Federal resources. Pursuant to this MOA, the Corps generally assumes responsibility for enforcement actions with the exception of those relating to certain specified violations involving unauthorized activities.

If a legal action is instituted against the person responsible for an unauthorized activity, an application for an after-the- fact permit cannot be accepted until final disposition of all

judicial proceedings, including payment of all fees as well as completion of all work ordered by the court.

Appendix F – Environmental Impacts of Flooding

1. Floodplain Development. West Virginia is blessed with a diverse terrain of high mountains, rolling uplands, wide plateaus, and deep river valleys. This rich topographic diversity has resulted in a linear system of floodplains across the State. West Virginia has approximately 31,000 miles of rivers and streams in 32 major river watersheds. These watersheds are shown in Map F-1 below. The State's waterways are bordered by thousands of acres of floodplains: all subject to flooding.

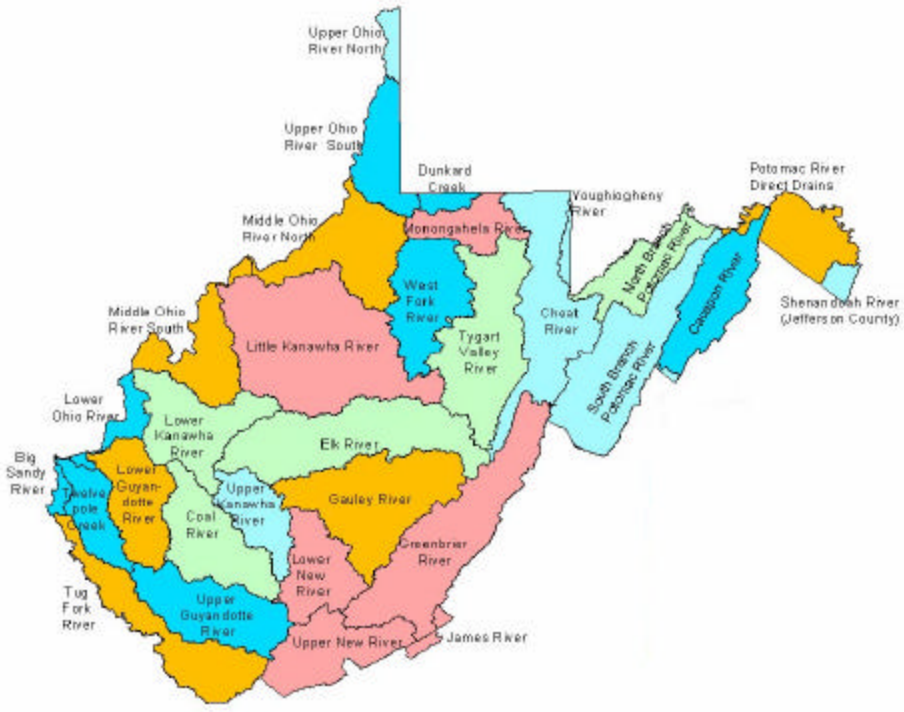


Figure F-1. Major Watersheds in West Virginia

Over thousands of years a combination of tectonic mountain building, gravity, and precipitation have created our current landscape by rivers down-cutting into plateaus, streams meandering back and forth across the land, eroding mountainsides and stream banks, and depositing sediment. Riverine floodplains in West Virginia are one part of our

natural landscape created by these natural forces. Floodplains are the corridors of land along a river that are occasionally inundated by water that overflows the river channel. Their ability to temporarily store excess runoff is a significant attribute of floodplains. The ever-changing floodplain is delineated and sculpted by a combination of climatic rainfall patterns, runoff from surrounding land, the underlying geological strata, and resulting soil associations.

Given their constant evolution through hydraulic processes, floodplains are as much a part of the waterway as the stream channel itself. The absence of overflows across the floodplain in any given year is balanced by the thousands of high-water events that created and nourished the same floodplain during the past thousands of years. The presence or absence of certain flora and fauna in the floodplain testify to the natural forces present in this corridor. The floodplain has been referred to by some as the "Kingdom of the River" and any intruders are subject to the river's recurring wrath.

The State's floodplains are an incubator and home to a wide variety of flora and fauna. Figure F- 2 shows the floodplain corridor separating the stream from cultivated fields. The diversity and total natural production of these floodplain ecosystems may be beyond our capacity for measurement. A mixture of bottomland hardwoods, riverine wetlands, riparian ecosystems, and open fields, floodplains produce a diverse pattern of vegetation. In addition to the natural productive capacity of the State's floodplains, they serve as sponges, both attenuating the severity of high flows and transferring and filtering surface water into the groundwater table.

Figure F-2. Riparian corridor within cultivated fields

2. Floodway Development. Within the floodplain is a narrower corridor consisting of the river channel and its immediate edges. This area, defined by regulatory agencies as the "floodway" is shown in Figure F-3 below. While not always naturally identifiable, the floodway zone is delineated by computer models combining stream and floodplain cross-sections and estimated (or known) water volumes.

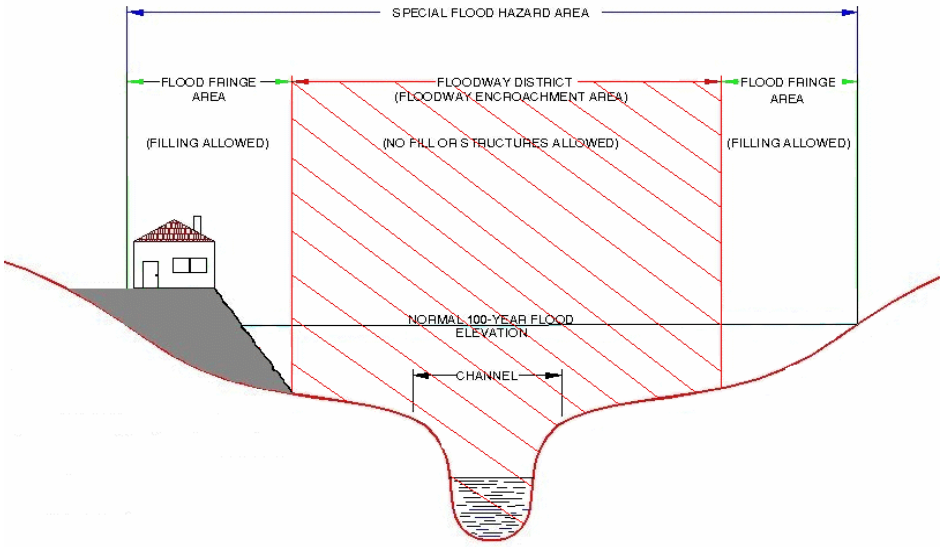


Figure F-3. Schematic showing the relationship of the floodway to the stream channel and the flood fringe area.

The floodway zone carries the greatest volume of floodwaters, is characterized by the highest velocity flows, and transports the greatest amount of sediment and debris. For this reason, during high flows, the floodway zone is the area where most destruction and flood damage occurs. The majority of water-borne sediments are deposited in the flood fringe area where floodwater velocities are reduced. Due to the volume of water that passes through the floodway zone, any constriction of this zone (through placement of structures or fill) can significantly affect both the elevation of the flow and the patterns of material deposition and scour. The floodway zone has been recognized by Federal and State legislation and agencies as a highly dangerous location for development. In areas of the State where stream gradients are steep, floodway zones can be extremely destructive to all forms of development.

In an effort to curb development within the State's floodways, the Task Force recommends that the Governor issue an executive order declaring the State's floodways to be off- limits to development unless floodplain managers receive site-specific documentation from a WV registered professional engineer, or a Federal or State agency which proves that the proposed floodway development: (1) does not result in an increase in the water surface elevation of the 100-year flood event, (2) has been designed and will be constructed to a standard that will withstand the water depths and velocities associated with the floodway location, and (3) if a Federally subsidized or constructed facility, has been evaluated according to Federal Executive Order 11988. This requirement is in accordance with current floodplain management ordinances.

3. Protection of Floodplains. West Virginia's floodplains vary in width from very narrow along upland streams to very broad along the major rivers such as the Ohio, the Kanawha or the Potomac. As indicated above, the width of the floodplain is determined

by the size of the watershed above it, the erosion characteristics of the soils and underlying rock, and the stream pattern.

Mankind's intrusion into an undisturbed watershed and its floodplain causes numerous environmental problems. Streams assume a certain channel size and shape to accommodate the runoff associated with the size of the watershed and the type of land cover present. Although the capacity of the channel is occasionally exceeded by extreme rainfall events, most storms are accommodated without significant impacts or changes to the stream channel size, shape or ecology. Forested watersheds that have been spared devastation by fire and have maintained an intact humus layer absorb enormous amounts of rainfall (as high as 70 to 90 percent). This rate of absorption results in relatively small amounts of runoff and extended times of concentration Converting forests to other land uses increases stormwater runoff and stream sedimentation and decreases time of concentration. Figure F-4 is an example of one type of land use conversion that increases both runoff and sedimentation.

Figure F-4. Land Use conversion generating runoff and sedimentation

Any significant reduction in the forest cover, for whatever purpose or type of development, reduces the capacity of the vegetation and soil to attenuate stormwater runoff volumes and slow concentration times (the time water rests on the surface where it can soak into the ground). In regions of steep terrain, runoff concentration times are already short adding to the impacts of land disturbance. Since converting forestland to other uses usually includes constructing roads, consolidating soil materials, and creationg impervious surfaces, both runoff and sedimentation are increased beyond what simple vegetation loss would produce. Roads, unless properly designed and constructed to reduce runoff and sedimentation, act as direct conduits of stormwater runoff and

sedimentation to the streams. Figure F-5 shows a steep access road that will serve as a runoff conduit during rainfall events. Roads of this sort are frequently found at mine sites, timber operations, and during construction of subdivisions and commercial facilities.

Figure F-5. Steep access road in timber removal area

Erosion of access roads dramatically increases the sediment deposition in nearby streams. Impervious surfaces and compacted soils (which essentially mimic impervious surfaces) convey nearly 100 percent of rainfall as stormwater runoff. Rapidly conveying increasing amounts of runoff into otherwise stable stream channels results in unstable stream channel geometry and damaged aquatic ecosystems. Erosion and sedimentation further modifies the stream channel and impacts the aquatic community. Repeated bank-full flows scour the bottom and sides of the channel. Figure F-6 shows bank erosion associated with high flows.

Figure F-6. Bank erosion caused by high flows

Greater flow volumes can accommodate a greater sediment load, and therefore the stream cuts into the banks and streambed to obtain the optimum load. Eventually, when the stream velocity slows, the newly acquired sediment load is deposited within the channel or on the adjacent floodplains.

In addition, construction within the floodplain often occurs without consideration for the floodplain's functions as a part of the river channel. The floodplain is a normally inactive portion of the river channel that can accommodate larger flows. It is like building one's home on the known pathway of previous landslides, lava flows, or avalanches—eventually the result is catastrophic.

These unwise intrusions lead to repetitive losses of life and property.
In addition to the basic risks associated with just living and working in the floodplain, we've exacerbated the flooding problems by filling in the floodways to the detriment of all surrounding development. We also cross the stream channel wherever and however it is most convenient without much consideration for the stream channel. While not obvious in this photograph, Figure F-7 shows an inadequately designed and constructed stream crossing. Stream-channel constrictions by structures, fill materials, bridge piers, bridge beams, culverts, and low-water bridges all contribute to flooding.

Figure F-7. Inadequately designed/ constructed stream crossing

Adding to the fact that development in the floodway and floodplain restricts flows during flood events, runoff from floodplain development is channeled directly into the stream, further increasing stormwater runoff in the watershed and increasing the potential for flash floods. In many cases, floodplain development results in the complete or partial loss of the riparian buffer zone. This buffer zone slows runoff and acts as a filter for sediment and pollutants from adjacent development. Loss of this buffer zone is an indication of the loss of riparian wetlands and tree cover necessary for maintaining cool-water temperatures that support aquatic species in the stream.

In addition to development of the floodplain for residential, commercial, and industrial uses, floodplains become storage areas for many types of building materials, timber products (sawdust, logs, and slash), storage structures, propane tanks, recreational vehicles and manufactured homes. The floodplain also becomes a convenient location for the storage of waste materials (both liquids and solids) generated by these land-use conversions. These stored materials and wastes, many of which float or are washed into the stream channel during flood events, become damaging battering rams in the current, contribute to debris dams at bridges and culverts, reduce the hydraulic efficiency of the stream channel, and after flood waters recede are randomly distributed throughout the floodplain. Figure F-8 shows the collection of debris accumulated at a railroad bridge. These floatable wastes can be hazardous to residents and disaster recovery personnel. Debris dams at bridges and other stream crossings artificially raise the flood levels and increase the flood damages to structures adjacent to the bridge. When the debris dam fails, a surge of floodwater carrying timbers, storage tanks, vehicles, houses, rock and silt is unleashed downstream causing more extensive damages.

Figure F-8. Collection of debris at a railroad bridge.

The Task Force recommends that State legislation be enacted that will empower local floodplain management officials to prohibit placement or storage of floatable material within floodways that does not include suitable anchoring. The regulations detailing the legal definition and storage of floatable debris within the 100-year frequency floodplain should be prepared by WVOES in cooperation with WVDEP and WVDNR. Administration and enforcement of these regulations would be through county and municipal floodplain managers using the enforcement powers contained in the floodplain management ordinances. State technical assistance and program oversight for these local enforcement actions would be through WVOES. Additional funding support for local

watershed “clean up” activities would assist in addressing stream corridor debris accumulation.

Perhaps the most damaging result of floodplain development is mankind’s response to losses of life and property in the floodplain. Fueled by the misery and losses of those affected by flooding, there follows a socially and politically sympathetic effort by Federal and State agencies to reduce flood damage by constructing dams, modifying stream channels, dredging streams and constructing floodwalls and levees. Figure F-9 shows the construction of a floodwall to protect dense concentrations of development.

Figure F-9. Floodwall construction to reduce damages

Although these efforts do provide relief from flood damage, their costs in terms of financial resources, ongoing maintenance, and the long-term environmental costs to the streams frequently outweigh the flood prevention benefits. More importantly, these flood protection efforts further entrench and expand floodplain development, thereby affirming mankind’s use of the floodplain as the “right” thing to do. To interrupt this development – flood – protect cycle in the floodplain, a well-coordinated comprehensive strategy for reducing floodplain development and managing the State’s floodplains needs to be developed.

Unfortunately, West Virginia’s terrain and land-ownership patterns have confined most development and transportation arteries in the State’s floodplains. The State’s economic future depends on the availability of developable land. Decisions to build in the State’s floodplains have been made by individual property owners until the advent of the National Flood Insurance Program (NFIP). Since enactment of the NFIP, these development decisions have been filtered through local interpretation of the floodplain ordinances. Sometimes that interpretation has been conducted in ignorance of the basis for the ordinances that are designed to account for the probability of future flooding.

In an effort to interrupt this damage cycle, the Task Force recommends that more emphasis (in terms of education, training, funding, and Administrative recognition) be placed upon sound floodplain management by the municipal and county governments. In a state where the majority of developable land is located within the floodplains, the state's economic and social viability is inextricably connected to our wise use of the floodplains in the state.

4. Defining Stream Quality. West Virginia's streams would be considered of the highest quality and value by most professional aquatic ecologists. Many West Virginia streams produce and support significant populations of aquatic flora and fauna that are both intrinsically and economically important to the State. Figure F-10 shows a typical high-quality stream in the State. Historically, the floodplains of many of those same high-quality streams have become home for thousands of West Virginians – a situation that is not in the best interests of either party.

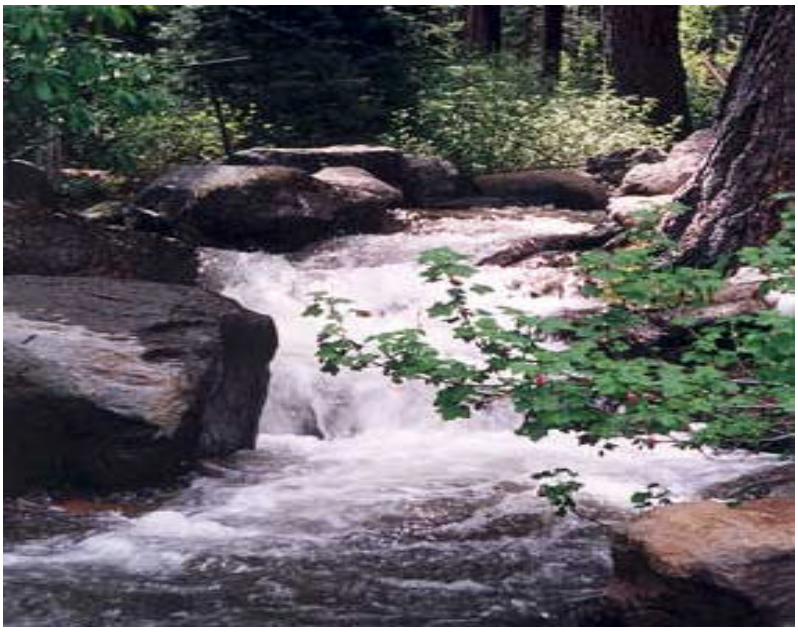


Figure F-10. High quality stream in West Virginia

During development of strategies for reducing flood damages, it became apparent that a wide range of opinions exists at both the Federal and State level concerning processes and criteria used to determine the quality of streams within West Virginia. Each agency within the Task Force uses different criteria for evaluating streams depending on the agency's missions and policy directives. The different views on stream quality and value create uncertainty in the development of various plans when incorporated into the formulation of a comprehensive strategy for flood protection. This uncertainty limits the ability of the Task Force members to propose certain flood protection measures for areas subjected to frequent flooding. This diversity of views on stream quality also limits opportunities to initiate the restoration of stream ecosystems.

To arrive at a common understanding of the procedures for determining stream quality and value, the Task Force recommends that a "Stream Summit" be convened in 2005. This summit would gather the Task Force agencies and other interested stakeholders together and, through discussion and negotiation, determine a process for combining these standards into one classification for waters of the State.

5. Identification and Protection of Stable Streams. Stable streams are defined as streams with a dimension, pattern, and profile that convey the range of flows and effectively transport the sediment produced within the watershed such that the stream neither aggrades (fills in) nor degrades (scours). Figure F-11 is an example of a stable stream condition. Stable streams are characterized by a condition of dynamic equilibrium. Sediment supply is in equilibrium with sediment transport. Slow rates of erosion on the outside of meander bends are matched by similar rates of deposition on point bars.

Figure F-11. Stable stream section showing high quality riparian vegetation

Unstable streams result from a change in any one of the variables that govern stream geomorphology. A disturbance that changes one variable starts a series of changes in other variables resulting in altered channel patterns. Stream geomorphology is therefore the result of these variables adjusting themselves to each other. One of the disturbances that can result in instability is the increase in frequency, magnitude, and duration of bank full flows that can result from development and land conversion in the watershed.

There is a close relationship between the size of a drainage area and the dimensions of the stream channel throughout regions with similar climate and physical geography. (Dunne and Leopold, 1978). A similar relationship exists between channel dimensions and the magnitude of runoff from frequent storm events. Peak discharge from a storm occurring on an interval of from one to three years produces the flow that shapes, sizes, and maintains stream channels (Leopold, Wolman, and Miller, 1964). This peak flow is called the bank-full flow. It follows that a substantial increase in frequency, magnitude, and duration of the peak discharge that generates the bank full flow will increase the stress on

stream channels with cause morphological adjustment. Thomas Hammer determined that stream channels in developing areas could enlarge ten to twenty times their cross-sectional area in a process that doesn't return to equilibrium for decades (Hammer, 1973).

Stable streams do not lessen the potential for out-of-bank flooding and damage to development along reaches of stable streams. However, stable streams are better suited to accommodating high flows within the channel without excessive erosion or stream bank failures that increase flood damages. Following the July 2001 floods in southern West Virginia, Federal and State agencies cleared flood debris and sand bars from numerous streams in the affected area. In view of the potential for subsequent flooding that may have resulted from debris and sedimentation in the stream channel, the inherent stability of the stream was not always a concern to those conducting the emergency clean-out operations.

During this same flood event, several streams escaped their channels and reestablished new flow channels. These streams were returned to an excavated, artificial channel that will require years to become stable. Among the many values of stable streams is their use as representative reaches or as archetypes for restoring or reestablishing streams disturbed during construction or through land-use changes in the watershed. Successful stream restoration within a region is more difficult without a representative, stable stream to guide the restoration efforts. Stable streams may or may not be considered high-quality streams according to the Division of Natural Resources. This adds to the confusion associated with classifying streams in West Virginia. Entire lengths or reaches of stable streams are scattered throughout the State. These stable streams need to be identified and protected to avoid future modification.

The Task Force proposes initiating a program for identifying, documenting, and recommending methods for protecting stable stream reaches throughout the State. The initial investigations would concentrate on areas recently impacted by flooding. This would be a collaborative effort of the Department of Environmental Protection, Division of Natural Resources, the Conservation Agency, Natural Resources Conservation Service, the Canaan Valley Institute and Corps of Engineers. This study and the resulting list of streams would be distributed to all Federal and State agencies involved in water resources within the State as well as to all emergency response agencies that direct stream cleanout and debris removal. Best Management Practices (BMPs) for stream cleanout would be prepared by these agencies to guide debris removal in the future.

6. Protection of Wetlands

"Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Water saturation largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetlands soils." — USEPA

Wetlands are important because of their habitat value, ability to store stormwater, ability to allow for surface water infiltration to recharge groundwater aquifers and for their ability to take up and attenuate pollutants. Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater, and flood waters. Trees, root mats, and other wetland vegetation also slow floodwaters and distribute them over the floodplain. This combined water storage and braking action attenuates flood heights and reduces erosion. Two types of wetland are predominant in West Virginia:

(1) Palustrine (those wetlands associated with streams and rivers), and
(2) Lacustrine (those wetlands associated with lakes and ponds).

Wetlands within and downstream of urban areas are particularly valuable, counteracting the increased rate and volume of surface water runoff from impervious surfaces. Preserving and restoring wetlands, along with other water retaining features, can provide some limited reduction in flood levels.

Wetlands are protected through a series of environmental laws and regulations that date back to 1969. The National Environmental Policy Act of 1969 and the Clean Water Act of 1972 were both instrumental in providing Federal protection for wetlands. Under the Clean Water Act, the U. S. Army Corps of Engineers was given the responsibility for protecting the nation's surfacewater resources including wetlands. The Natural Resources Conservation Service addresses the protection of wetlands on the nation's farmlands. In 1977, President Carter signed executive Order 11990 – Protection of Wetlands in 1977. This order required all Federal agencies to assess the potential impacts of any Federally financed development that might adversely affect wetlands. Generally, these three Federal documents represent the legal protection of wetlands in West Virginia.

Figure F-12 shows a high-mountain wetland. Although West Virginia has fewer wetlands than many states, primarily because of its rugged topography, but there are some well-known wetlands in the State. Wetland complexes in the southern mountains occur on Marsh Fork, Raleigh County; Meadow River, Greenbrier County; Meadow Creek, Fayette County; and Muddlety Creek, Nicholas County. Well-known wetlands of the high mountains include Cranberry Glades, Canaan Valley, Dolly Sods, Pine Swamp, and Cranesville Swamp. Some of the better-known wetlands in western West Virginia are located at McClintic, Green Bottom, Blennerhassett, Boaz, Williamstown, and Winfield. Two popular wetlands in the Eastern Panhandle are Altona-Piedmont Marsh and Town Marsh. Numerous other small wetlands occur throughout the State. Figure F-13 shows a lacustrine wetland.

Figure F-12. High-mountain wetland environment

Figure F-13. Wetland in a lake environment

Wetlands are known by a variety of names such as bogs, marshes, swamps, riparian (streamside), seeps, and wet meadows. Numerous wetlands occur where man-made embankments for roads and railroads impound water. Wetlands are found around the margins of lakes and farm ponds. Most wetlands are dominated by grasses, forbs, shrubs, or trees. The predominant type of wetland in the regional area is associated with streams and rivers and known as palustrine or riparian wetlands.

There are some Federal programs that can be used to restore wetlands on floodplain and/or riparian areas. Among these programs is the Corps of Engineers' Section 206 Aquatic Ecosystem Restoration program. This program provides Federal matching funds to restore aquatic ecosystems, including lakes, ponds, streams and rivers, and wetlands. Areas that, prior to development, were formerly wetlands can be restored provided that environmental benefits can be generated from the restoration. Any State agency, county or local government, or non-profit entity can serve as the non-Federal sponsor for wetland ecosystem restoration. See Chapter 4 of the main report for references to the Section 206 program.

Given the number of Federal and State programs associated with the protection, preservation, and restoration of wetlands in West Virginia, the Task Force recommends that a "Wetlands Summit" be convened in 2005. This summit would be dedicated to the following purposes:

(1) Identifying all Federal, State, and non-profit agencies and groups whose expressed mission, purpose, and/or authorities include the identification, protection, and/or restoration of wetlands,
(2) Assessing the relative health of the State's wetlands, including existing and projected threats to existing wetlands,
(3) Identifying those areas in the State (floodplains and abandoned mine lands) where wetlands restoration could be initiated; and
(4) Identifying potential sources of funding for wetland restoration, purchase of conservation easements or fee acquisition. Several existing members of the Task Force would be present at the summit, including WVDNR, WVDEP, WVCA, USACE, NRCS, CVI, WV Nature Conservancy, and USFWS.

Appendix G—Stream Crossings and Access Roads

A. Stream Crossings

Mankind has chosen to change the environment rather than changing his living patterns to adapt to the environment. One of these changes to the environment is the installation of bridges, culverts, and other stream crossings. If properly designed, constructed and maintained, these crossings do not cause a problem. Even properly designed and constructed stream crossings can become inadequate because of:

(1) Upstream development that increases the stormwater runoff entering the crossing,
(2) Sedimentation, debris accumulation, or other blockages that reduce their hydraulic efficiency.

Inadequate stream crossings restrict the flow of water and create greater flooding in upstream areas. No development activities including stream crossings or fills are allowed within the floodway if they would cause a cumulative increase in the base flood elevation of one foot or more. As a general rule of thumb, the WV Department of Transportation has established the following guidelines for stream crossings. They will generally be adequate if they are installed and maintained so that they will function properly up to these specified events:

- A 50-year storm event, affecting expressway and trunk-line highways
- A 25-year storm event, affecting other highways (*over* 200 ADT)
- A 10-year storm event, affecting other highways (*under* 200 ADT)

Exceptions to these frequencies may occur when stream records show higher discharges, if the existing highways floods more frequently than the general guidance, or when potential property damage and injuries justify the use of less frequent storm events. This applies to flooding of the roads themselves. Like any other activity, highways are not allowed to cause a cumulative increase of one foot or greater in the base flood elevation. Figure G-1 shows a properly designed and constructed stream crossing.

The Division of Highways may require anyone placing culverts or bridges or accessing a public highway to build a stormwater storage facility to ensure that there is no net increase in peak water runoff from the facility. These requirements are usually restricted to major commercial development and residential subdivisions.

Figure G-1. A properly designed and installed culvert

The Clean Water Act mandates that culverts cannot be barriers to aquatic life. Aquatic life includes fishes, mussels, crustaceans and benthic organisms (insect larvae).The culverts must be adequate in size and shape to maintain low flow conditions. The culverts should be oversized with the lowest edge of the culvert installed at or below the normal water surface so that the aquatic life listed above can travel up and down stream through them. Figure G-1 shows a properly installed culvert that does not restrict passage of aquatic species.

Individuals usually determine the size of private stream crossings based on availability, price, or ease of installation. Local jurisdictions may not have the technical expertise to ensure that culverts are properly designed, constructed and maintained. The Task Force recommends that voluntary guidelines or Best Management Practices (BMP) for the sizing, installation, and maintenance of culverts, drainage structures and stream/river crossings be developed by the Task Force. Municipalities and private individuals installing stream crossings should use one with a diameter or cross section at least as large as the closest appropriate downstream Division of Highways crossing or the crossing should be sized by a WV registered professional engineer.

In addition, guidelines or BMPs for installation and maintenance of stream crossings for the 10-year storm event without causing additional upstream flooding should be developed and enforced. Appropriate sizing for culverts and bridge openings must

consider the potential for future development in the watershed. Where such development potential exists, culverts and bridge cross sections should be enlarged to handle anticipated runoff. A program, including a permitting process, should be established within a State agency to control the design, installation, and maintenance of private and public non-highway drainage structures.

Currently the Division of Natural Resources, Public Lands Corporation signs contracts with individuals conducting in-stream construction or channel alteration. While these documents are called "permits", they are simple contracts and there is no penalty for failure to comply with the terms of them. The Task Force recommends that the WV Public Land Corporation, through legislative enactment and increased staffing, be enabled to enforce current requirements for instream construction or channel alteration.

In addition, the Task Force recommends that the WV Public Land Corporation be provided the staff and resources to develop and enforce a legal contract requiring permit applicants to agree to maintain a specified minimum hydraulic carrying capacity of the structure being installed. Unlike Department of Highway crossings, municipal and private crossings are not always well maintained. They become filled with sediment or blocked by debris and can not transport the quantity of water necessary. The owner can remove debris from private culverts under provisions of the Army Corps of Engineers nationwide permit (NWP) Number 3. These maintenance activities should be conducted during daylight hours and after consultation with the appropriate District of the Corps of Engineers, Water Resources Inspectors of the WV Department of Environmental Protection, and the WV Public Land Corporation. (See Table G-1). While there is no mandate to notify the last two agencies mentioned, it is a good practice to do so.

Future upstream development is seldom taken into consideration when determining the size of stream crossings. Converting a lawn, forest or vegetated area into a gravel parking lot triples the stormwater runoff. Converting a vegetated area into a shopping mall or other paved, roofed or impervious surface creates more than four times the amount of stormwater runoff. Until future watershed development is taken into consideration during the design of stream crossings, West Virginia will continue to be plagued by inadequately sized and poorly maintained stream crossings.

In addition to stream crossings that are used on a regular basis a number of stream crossings have been abandoned by the original users. Some abandoned railroads and roads have left the culverts, bridges, and trestles, or the piers that supported the bridges and trestles, in place. These crossings are no longer maintained or serviced. Frequently these structures, like actively used structures, catch floatable debris and form temporary dams that increase flooding and property damage. Figure G-2 shows an abandoned crossing blocking debris after a major flood event.

The Task Force recommends that funds be provided to the WV Division of Highways from the general fund for a study of abandoned stream crossings (public or private road or railroad bridges or culverts) to ascertain ownership of said facilities, and

provide recommendations for condemnation and removal if deemed necessary to reduce flood damages.

Figure G-2. Abandoned crossing acting as a debris dam after a major flood event

There may be other requirements and restrictions for stream crossings in certain waters. These include streams that may contain endangered and threatened species, wetlands, Wild and Scenic Rivers, Natural Stream Preservation Act streams, streams in the National Forest or National Recreation Area, and many others. It is imperative that any agency or individual working in a stream contact the U. S. Army Corps of Engineers prior to doing any work in the stream. Table G-1 shows a list of the agencies that should be notified for debris removal and disposal.

The Task Force recommends that the State create a technical assistance program that includes funding and resources for a State agency to provide assistance in the design, installation, and maintenance of public and private stream crossings. The WV Division of Highways may be the appropriate State agency for this program given their extensive experience in stream crossing design and construction. The program could be deployed through the various Highway District offices.

The Task Force recommends that procedures be established to provide local government with technical advice and review services prior to issuing permits for development in the floodplain and for private stream crossings. A State funding source to reimburse the State agency providing assistance for costs associated with this activity should also be established.

WV Department of Environmental Protection	
	Division of Water and Waste Management 1201 Greenbrier Street Charleston, WV 25311-1088 (304) 558-2107
	Division of Waste Management 1356 Hansford Street Charleston, WV 25301 (304) 558-5929
	Environmental Enforcement 1356 Hansford Street Charleston, WV 25301 (304) 558-2497
	Environmental Enforcement—Southwest Regional Office General Delivery Putnam Village #18 Teays, WV 25569 Phone: (304) 757-1693 Fax: (304) 757-3873
	Environmental Enforcement—Southeast Regional Office 116 Industrial Drive Oak Hill, WV 25801-8329 Telephone: (304) 465-1919 Fax: (304) 465-1524
WV Division of Natural Resources	
	Public Lands Corporation Building 3, Room 669 1900 Kanawha Boulevard, East Charleston, WV 25305-0660 (304) 558-3225
U S Army Corps of Engineers – Huntington District	
	Huntington District Regulatory Office 502 Eighth Street Huntington, WV 25701 (304) 529-5710

Table G-1

Contact Information for Debris Removal and Disposal

B. ACCESS ROADS

Access roads are constructed by a multitude of industries in West Virginia. There are logging roads, skid roads, mining roads, haul roads, prospecting roads, roads to oil and gas wells, landfill access roads, roads into and across farms, pipe or power line access roads, construction access roads, recreational roads or jeep trails used for sight seeing and all terrain vehicle pleasure riding.

Regardless of their purpose, all of these roads have one thing in common. They will, unless properly designed and constructed to reduce runoff and sedimentation, act as direct conduits of stormwater runoff and sedimentation to the streams. Figure G-3 shows a steep access road that will serve as a runoff conduit during rainfall events.

Figure G-3. Steep Access Road at Timber harvesting Operation,

For the purposes of this report, access roads are narrow unpaved trails or roads that are infrequently or temporarily used and are not constructed or maintained by a government agency as part of the public highway system. Access roads may have a dirt or gravel surface, and may be of any width.

After the 2001 floods in southern West Virginia, the Governor appointed a Flood Investigative Advisory Committee to examine the effects of mining and timber harvesting on flooding. This committee and a subordinate work group, the Flood Advisory Technical Team (FATT) issued a report which included recommendations for access roads. Although the FATT report only concerned mining and timber harvesting in a few watersheds, the portions of their report that addressed access roads is pertinent to all industries that construct, maintain or use access roads.

The Task Force recommends that regulations and/or best management practices including minimum criteria for construction and closure or abandonment of access roads be developed and applied consistently to all industries throughout West Virginia. Numerous agencies have regulations or BMPs that address access roads, but these are not uniform.

Appendix H — Dredging and Stream Channel Restoration

Mankind's intrusion into the natural environment in West Virginia began in earnest following the Civil War when extractive industries and settlement all increased dramatically. Since that beginning, our lack of understanding and appreciation for natural stream processes has resulted in ongoing activities that produce harmful impacts to the environment and eventually to us. Indiscriminate dredging of streams and rivers as a long-term solution to flooding has continued despite the harmful impacts on the aquatic/riparian environment and the limited effectiveness in reducing major flood damages.

Dredging, as perceived by the public, is the removal of sediment and streambed material in an attempt to confine all flood-flows within the reconstructed stream channel. Conversely, stream channel restoration is the removal of sediment above the level of the original streambed, along with other practices, to re-establish a stable alignment of the stream.

There are five accepted reasons to excavate a waterway channel. These activities are completed through the permit process of Section 404 of the Clean Water Act and the Division of Natural Resources, Public Land Corporation. They are:

- *To extract sand, gravel, or minerals from the streambed*. On occasion, regulatory permits are issued by the U.S. Corps of Engineers to allow removal of coal, sand and gravel from riverbeds for commercial purposes.
- *To maintain navigation*. The Corps of Engineers dredges rivers to maintain commercial navigation (i.e. Ohio River, Big Sandy River, Kanawha River, Monongahela River and Little Kanawha River).
- *To provide terminal/marina access*. River terminal and marina areas are dredged (by private companies with regulatory permits) to allow access for commercial shipping and recreation boating.

H-2

- *To restore stream habitat*. Stream habitat restoration occasionally requires removal of excessive sediment through channel excavation and, on an infrequent basis, such

excavations may be used to restore deep-water habitat in tributary embayments of larger rivers (i.e. Ohio and Kanawha rivers).

- *To increase channel capacity*. Channels are excavated in an attempt to increase channel capacity to reduce nuisance flooding.

In some cases, dredged spoil material is used to create industrial or recreational development opportunities. For example, material dredged from the mouth of Elk River in Charleston has been deposited along the Kanawha River to create the popular recreation area known as Magic Island. Dredged material has been used to raise the level of industrial property within the flood fringe area in accordance with existing floodplain management ordinances. In some cases, this filling operation is in violation of the floodplain management ordinances when deposited within the regulatory floodway.

Channel excavation, as a part of stream restoration, has been used to restore stream ecosystems when the bottom of a stream is buried with silt. Silt fills in the crevices and interstitial spaces critical to supporting populations of benthic organisms. Sub-optimal benthic populations reduce fish diversity and population. Channel excavation seeks to improve the hydraulic carrying capacity of the waterway and confine floodwaters to the channel to reduce flooding and property damage.

Un-engineered dredging of small streams also occurs. This form of dredging can reduce the heights of high frequency, low-level flooding events that have a recurrence interval of 2 to 5 years. This nuisance flooding damages structures located immediately adjacent to the waterway, inundates roadways and leaves a layer of sediment and debris in the floodplain. However, this form of dredging does very little to reduce flood damages resulting from low frequency high volume floods. In some cases, this dredging can create more damage than it corrects when spoil materials are deposited in the regulatory floodway. To maintain channel capacity, frequent maintenance is required. In addition, deepening and/or widening channels can lead to channel instability causing bank erosion.

Channel dredging should not be confused with carefully planned stream restoration and channel modifications that are designed to accomplish specific purposes such as restoration of aquatic environments. Correctly engineered, constructed and maintained channel modifications meet their designed purpose of reducing damages from major flood events (see Figure H-1). Channel modification projects constructed by the Natural Resources Conservation Service (see Appendix L) have significantly reduced flood damages to residential and commercial development.

Dredging should not be confused with removing flood debris from the streams. Removing woody materials, propane tanks, manufactured homes, trailers, and other debris piled against bridge piers, trees and accumulated within the channel is necessary to recover the hydraulic efficiency of the waterway channel. Debris removal does not

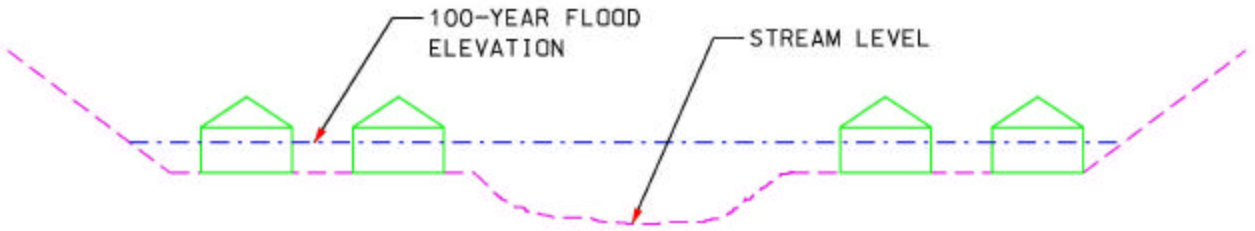
Figure H-1. Little Whitestick Creek channel modification project

normally include removing deposited sediment unless the sediment presents a major blockage at bridges that promotes additional scouring or erosion around piers and abutments. These projects are coordinated with natural resource agencies and utilize sound engineering principles and empirical data from successful channel modification and restoration projects.

River systems are highly dynamic and respond to land-use conversions in the watershed, channel modifications, floodway encroachments, structural encroachments (bridge piers), and modifications to stream bank and stream-bottom conditions. Some of these changes, which include dredging, can cause streams to become unstable and develop changes in stream flow, rates of bank and channel erosion, and sediment transport. Channel migration and bank erosion can occur as an unstable stream attempts to reach stability. The stream re-stabilization process can take several years and can result in many unforeseen changes to the channel location and flow before stabilization occurs.

The illustrations below graphically depict the effects of sedimentation and flooding on a typical small stream anywhere in the state. In-filling of the channel normally results in a dramatic increase in the elevation of subsequent floods.

Figure H-2. Effects of sediment on 100 year flood elevation



Stream Channel conditions prior to flood event.

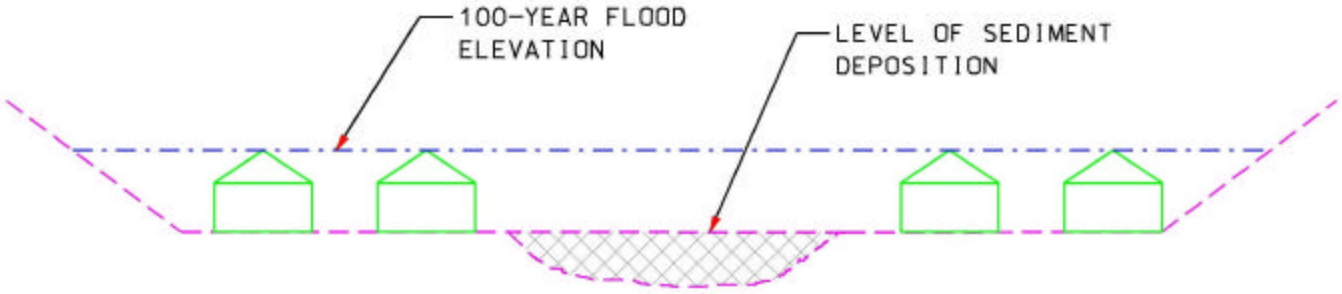
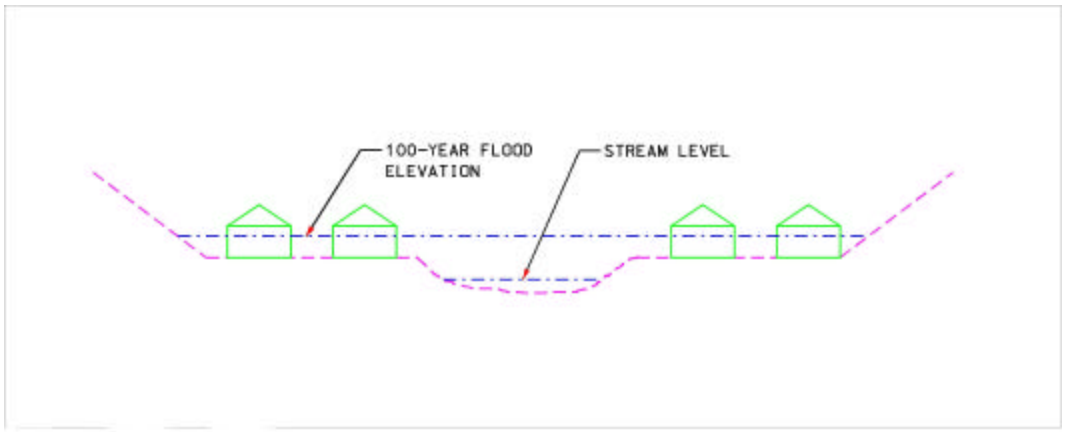
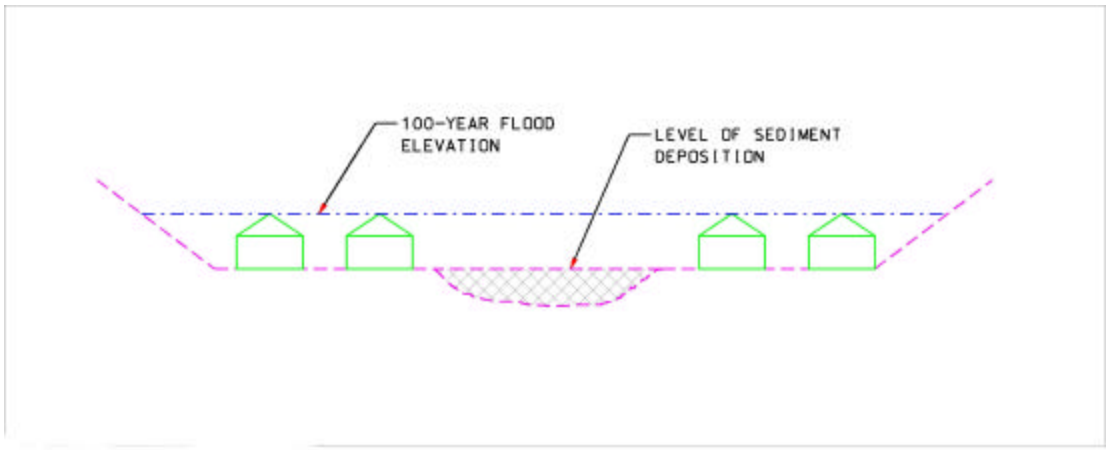


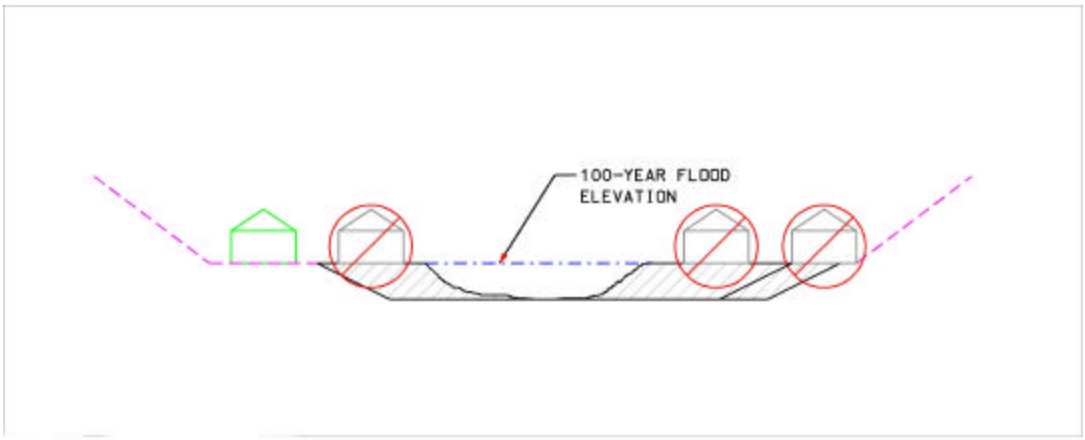
Figure H-3. Effects of Sedimentation and Stream Channel Capacity Modification on 100 Flood Elevation



Stream Channel Prior to Flooding



Stream channel filled after flooding



Stream channel after widening project

Stream channel modification project

After every flood, the Governor, legislators, and State and Federal agencies receive calls from landowners and local officials insisting that their streams and rivers be dredged as a quick solution to their flood problems. Frequently these callers fail to consider how modification of the stream channel by dredging will influence the stream hydraulic and ecological systems. Rather than calling for more stream dredging, the question should be, "Can the stream be restored or modified to a condition that will reduce the impacts of repeated flooding?" Some aspects of the complex relationships of river systems such as scour and sediment transport are poorly understood. Frequently, floodplain landowners use spoil generated by stream dredging to improve the development potential of their property. Where development has occurred and floodplains have been altered, dredging may be used to protect existing development.

Dredging to mitigate the effects of flooding is often proposed for areas where sediment and silt have reduced the carrying capacity of the stream. While localized stream dredging may increase the carrying capacity of the dredged reach for the short term, dredging may initiate erosion throughout a longer stream reach and produce excess sediment that fills recently dredged areas. Where stream dredging intrudes upon bedrock, groundwater levels can be lowered. This effect can occur adjacent to dredging operations and extend laterally to the extent of the floodplain, thereby reduce the amount of groundwater available for agricultural, industrial and residential well users as well as influencing adjacent wetlands.

Figure H-3. Dredging of a small stream

Generally speaking, simple dredging, as a long-term solution for reducing flood damages from large events, has proven to be neither effective nor cost-efficient. Each stream modification proposal must be evaluated on a case-by-case basis to determine if the flood damage benefits outweigh the costs (including damages/costs to the stream ecosystem both upstream and downstream of the dredged section).

In West Virginia, dredging is often a locally initiated operation where bulldozers, end loaders, backhoes or other excavators are used to remove deposited sediment and rock materials and reconfigure the stream into a trapezoidal channel. Spoil material removed from the streambed is often used to raise the level of adjacent floodplain property or used as construction materials. More often, dredged material is deposited on the stream banks within the floodway to act as makeshift levees (see Figure H-4). Since dredging for flood mitigation is intended to increase the carrying capacity of the stream, unconsolidated spoil material from these sites should never be deposited where it can easily reenter the stream (i.e. within the floodway). Some past stream dredging projects have unwisely used dredged material to construct levees that have limited or no flood protection capabilities and further constrict the floodway. These un-engineered levees provide a false sense of flood protection to floodplain residents.

Figure H-4. Dredged Material Used To Construct An Un-Engineered Levee

Dredging has both short and long-term effects on the natural and human environment. Some or all of the following may occur during or after dredging operations:

- increased water flows downstream and increased flooding,
- disturbance caused by vehicle and equipment access,
- destruction of stream bank and aquatic vegetation,
- disruption of the aesthetic values of the stream corridor,
- removal, release, or rearrangement of sediments,
- reduction of water quality,
- remobilization of contaminants,
- increased turbidity,
- lowered water tables,
- increased erosion and sedimentation,
- alteration of hydrology,
- alteration of hydraulics (current patterns and flow),
- increased bank instability and erosion,
- alteration of fish habitat,

- alteration of fish spawning habitat,
- alteration of benthic habitat,
- disruption or removal of benthic communities,
- reduction in height of high frequency, low- level flood events over the short term unless it is properly maintained, and
- false sense of security following dredging.

In addition to the effects at the dredge site, there will also be impacts resulting from disposal of the dredged material. These impacts will depend upon the location of disposal and the nature of the spoil (organic, inorganic, contaminated, nutrient enriched, etc.). In some major river systems (Ohio, Kanawha and Monongahela), the sediment may contain trapped contaminated materials that can be re-introduced into the water column during dredging operations. These contaminants could become a threat to aquatic organisms and humans using the river for recreation or as drinking water. Depending upon their nature, dredged contaminated material may be classified as hazardous material by USEPA and WVDEP. Proper disposal of contaminated dredged materials should be coordinated with WVDNR and WVDEP prior to dredging.

Several factors influence the magnitude of the effects of dredging:
- size of the dredging operation,
- frequency of dredging,
- stream channel size and depth,
- size of the material being dredged,
- background levels of water and sediment quality, suspended sediment, and turbidity,
- stream velocity,
- design of final contours,
- stability of channel up and downstream from the dredging operation.

Dredging for flood control is based upon the idea that sediment removal and deepening of the channel will provide a substantially larger channel capacity to allow a greater volume of water to flow downstream without causing an impact on the streamside environment. While this appears to be logical, it can easily be proven inaccurate (see Figure H-6).

The following illustration will show the shortcomings of dredging as a long-term solution to significant flood damages. Assume that a theoretical stream channel is 100 feet wide and 5 feet deep. Also, assume that the floodway for this stream extends 100 feet on each side. Finally, assume that the flood fringe zone extends 100 feet beyond the outer edge of the floodway on both sides of the stream.

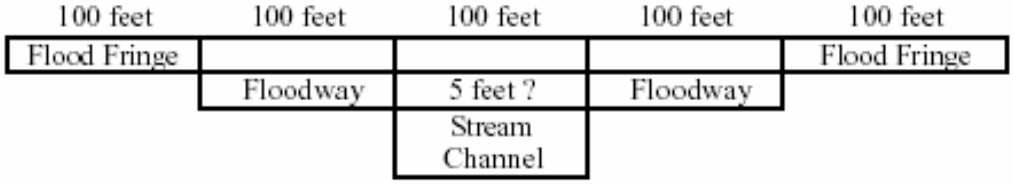


Figure H-6. Theoretical Stream Channel Dredging Operation

Normally this stream channel has 3 feet of water in it. During a 25-year flood, the stream channel is full and overflows a portion of the floodway zone. During a 50- year flood, the stream channel is full and the water extends into the flood fringe. During a 100- year flood, the stream would overflow the channel and the floodway and reach a depth of 5 feet in the entire flood fringe.

Dredging the channel to twice its current depth (no additional width) would reduce the height of water in the entire floodplain by 1 foot. To prevent water from encroaching on the flood fringe during the 100- year flood in this admittedly simplified event, it would be necessary to dredge the stream channel to a depth of 30 feet. In most West Virginia streams, this depth of dredging would require removal of bedrock material by blasting.

If we ignore the significant environmental and groundwater impacts of extensive dredging, then it is technically feasible to dredge to this depth. It would however, be extremely costly to remove bedrock. Environmental mitigation costs (both short-term and long-term impacts) and acquisition of long-term disposal areas for dredged materials would have to be included. Added would be the routine and repetitive cost of maintaining the channel to this depth. Without annual maintenance, the effectiveness of the new channel in reducing flooding would soon be lost. Realistically, dredging as a long-term solution for reducing damages from major flood events is not effective and certainly not cost efficient given other proven methods of reducing flood damages.

Stream Restoration:
An alternative to dredging and other stream modification is natural stream restoration. By examining the entire stream system and applying a broad range of natural stream restoration practices, it is possible to increase the stability of the stream and reduce the erosive effects of high flows on the channel without causing additional environmental harm. Figure H-7 shows a recently completed stream restoration project.

Figure H-7. Completed Stream Restoration Project

Natural stream restoration also has several other desirable attributes such as:
- Structural applications, such as "J" hooks, rock vanes, and root wads, can provide significant cost savings over traditional bank-armoring practices.
- Often restoration projects address the entire stream reach and not specific sites within the reach.
- The approach recognizes, accommodates, and restores the natural flow of the stream. This natural approach minimizes stream instability and reduces the likelihood of increasing damage elsewhere on the stream.
- Practices such as channel modification, realignment, and reshaping are used to recreate or restore the most stable stream form to appropriate dimension, pattern, and profile.
- The natural stream-restoration approach can contribute to the goal of reducing flood losses while preserving the natural-resource values of stream systems.

Applying the natural stream-restoration process to streams in West Virginia could result in the following benefits:
- A reduction in the magnitude of flood damage to property and infrastructure,
- A reduction in the cost of flood prevention, repair, and recovery operations,
- An improved stream system and increased stream-channel stability,
- Increased protection of both human investments and West Virginia's natural resources.

Generally speaking, use of single measures such as stream restoration or dredging to reduce damages from major flood events is not universally applicable, is not cost efficient and is only moderately effective. Flooding problems must be evaluated considering the particular circumstances of the flooding events and the location of the damaged properties to determine which measures are most appropriate.

Based on this information the Task Force recommends the following actions:

1. That requests for State or Federal regulatory permits for dredging operations as a means of reducing flood damages be approved only after documentation demonstrates that environmental impacts are not excessive and annual maintenance is assured through executed agreements. This should not hinder previously permitted channel modifications that are designed and maintained to reduce flood elevations of high frequency floods (low level), stream restoration, or restoration of aquatic environments. Nor should this hinder efforts by any Federal or State agency to address major flood events through an authorized and designed channel modification or a snagging and clearing operation where that activity is proven through engineering documentation to be an effective and cost efficient method for reducing flood heights and where annual maintenance is assured through local agreements.

2. That the State provide agency funds that serve to match existing Federal funds for stream restoration programs/projects.

3. That regulations for preservation of stable streams be developed through a collaborative effort of the WVDEP, WVCA and WVDNR. Candidate streams for restoration will be identified by the agencies participating in the recommended "2005 Stream Summit".

4. That State guidelines for emergency removal of stream debris be developed that would guide emergency response agencies and contractors during these removal operations. Such guidelines could be developed through a collaborative effort of the Task Force member agencies. These guidelines would ensure that in-stream debris removal following a flood event would not result in excessive, long-term environmental damage to the stream or river affected. The guidelines would increase awareness of the need for permits for in-stream work and ensure that debris disposal does not further inhibit floodwaters. Included within these guidelines would be information on the location of stable streams and high quality streams (when available) and a series of best management practices to guide response agencies and their contractors.

APPENDIX I - RESOURCE EXTRACTION

General : The extraction and processing of coal, minerals, aggregates, oil, gas and timber resources represents a significant segment of the State's economy. In some counties, these extractive industries represent the predominant share of the wages and employment in local communities. Taxes and revenues generated by the extractive industries provide financial resources for education, community services, and public safety and health services. Other industries closely associated with the extractive industries (i.e. transportation, processing, machinery, etc.) also provide substantial employment opportunities and tax revenues within the State.

It is a recognized fact that significant land-surface disturbances associated with resource extraction/development industries (mining, timbering, oil and gas extraction, quarrying, agriculture, etc.), like all other land disturbance activities (strip malls, industrial parks, residential subdivisions), can have a measurable effect on the volume and quality of excess stormwater runoff. The spatial extent of the land disturbance, the level of compliance with regulations and application of Best Management Practices (BMPs) by these industries determines whether or not such disturbances can have any measurable impact on lower probability floods (25 to 100 year flood frequency event) that affect large watersheds in the state. Due to the enormous volumes of stormwater runoff associated with these larger rainfall events, there are few measures that can be deployed by any single industry to affect the resulting elevation of floodwaters in the stream. See Appendix 10 for stormwater runoff impacts.

During the extensive public involvement portion of the WV Statewide Plan effort, numerous comments where received from citizens in several regions of the state regarding perceived adverse impacts to flooding and water quality from timbering and mining activities in the watersheds. Many floodplain citizens perceived that greater amounts of sediment and debris-laden stormwater were being produced from upstream areas where extensive mining and timbering operations were active. Many floodplain residents observed heavy loads of sediment, debris and sawn-logs being moved downstream or deposited (post-flood) on floodplain land or at bridge piers in their watersheds. Some citizens at the public workshops expressed serious concern that their homes and property were being placed at a greater risk of loss due to these upstream

resource extraction activities. Although no one present at the meeting was able to provide credible proof of the complicity of these activities in generating additional stormwater, debris and sediment, the public's perception was steadfast.

The flood events of May and July 2001 in the six southern counties in the state further strengthened this perception as floodplain residents expressed their displeasure at the amount of additional runoff, woody debris, logs and sediment that appeared in the streams during those events. In a series of public workshops conducted by the Corps of Engineers following the July 2001 flood events, many floodplain residents presented information concerning the amount and types of vegetative debris, sawn-logs and sediment volumes observed both during the flood event and later deposited on floodplain properties and at bridge piers. Numerous operating timbering and mining operations in the headwaters of several watersheds were identified by local residents as the primary sources of these problems. Again, although no one presented any specific evidence implicating these upstream timbering and mining activities in the flooding per say, pictures and eye-witness accounts of the resulting debris flows and post-flood cleanup indicated that land disturbances within the upper reaches of several watersheds may have contributed to the flood problems.

Members of the Task Force were aware of numerous instances within the state where sawmills, log landings, load-out areas and timbering debris (woody vegetation) had been located within the regulatory floodway zone. Since the floodway zone (by definition) experiences high-velocity, high-volume flows during flood events, much of the material located within the floodway by timber harvesting and sawmill companies becomes floatable debris further endangering development downstream. Further coordination with the Division of Forestry indicated that this State agency was not legislatively empowered to regulate the location of sawmills, timber consolidation yards and such facilities within the regulatory floodway. The Division of Forestry's regulatory authority ended when the sawn logs were removed from the permitted timbering area.

Indeed, lack of State government authority to regulate where these facilities are located should not result in that responsibility being automatically defaulted to the individual counties and municipal governments whose tax base interest in harvesting of timber may hinder effective regulation activities. Failure to regulate timber storage locations in one county may result in damages downstream in another county or municipal area during flood events. Hydrologic watersheds do not recognize political boundaries and litigation through the courts system may hinder more efficient solutions. Statewide regulation of these facilities in concert with accepted floodplain management ordinances should be the goal.

Flood Investigation Advisory Study: Following the disastrous flooding that occurred in the southern part of the State between May and July of 2001, the Governor appointed a Flood Investigation Advisory Committee (FIAC) chaired by the Secretary of the Department of Environmental Resources to examine the potential effects of mining and timbering activities on stormwater runoff during those flood events. The Executive Order outlines the duties of the committee as:

a) Assist and support the investigation of the scientific and hydrological cause for the flooding which occurred in the State in May and July 2001;
b) Assist in the determination of the effect and, if any be found, the impact on the flooding from current or past methods of coal mining and timbering practices in the affected counties and watersheds;
c) Provide assistance to the Flood Analysis Technical Team of the State Department of Environmental Protection in its mission to prepare a report for the Secretary of the Department of Environmental Protection on the cause of the floods of May and July 2001; and
d) Retain or hire such hydrological, forestry, mining, or meteorological experts as it deems necessary to assist it in reviewing any draft technical assessment prepared by the Flood Analysis Technical Team;

The FIAC organized a separate group known as the Flood Advisory Technical Team (FATT) that conducted the actual investigation and wrote the study report. The complete report can be seen at: http://www.dep.state.wv.us/item.cfm?ssid=9&ss1id=401 or contact the WVDEP.

WV Division of Forestry Study: Once the study by the FIAC group was completed and reviewed by several state and Federal agencies, it became apparent that certain of the hydrological runoff models used to determine the potential affects of timbering on stormwater runoff were more specific to conditions found at coal mining operations than those found in the forest cover where timber is being extracted. For this reason, a separate study was commissioned by the West Virginia Division of Forestry through Dr. Steven C. McCutcheon, Hydrologist and Environmental Engineer in cooperation with the Fernow Experimental Forest in Parsons, West Virginia and U.S. Forest Service.

This February 2003 study compared the hydrologic models used in the FAIC study to those models used by the Fernow Research Forest in Parsons in determining the amounts of runoff that would be generated by watersheds where timbering operations were being conducted. This study determined that the uncertainty of the model parameters used in the FIAC study could not decisively show whether timbering operations in the watersheds studied by WVDEP contributed significantly to the flooding events in the southern region of West Virginia. Subsequent review of the FATT study by the NRCS national office indicated that the NRCS runoff curve numbers used in the FATT study may not have been sufficiently robust for use in establishing state policies for forestry operations.

Based upon the findings of the McCutcheon study, it was determined that additional investigations of the hydrologic models used for calculating forest runoff due to timbering operations were needed before any connection between timbering and increased stormwater runoff could be made. Generally speaking, the uncertainty imbedded within the models due to the choice of parameter values, may have been greater than the amount of runoff affect detected by the models. A copy of the McCutcheon study can be obtained from the West Virginia Division of Forestry.

Additional Forest Hydrology Studies: In furtherance of this question regarding the involvement of timbering operations in the generation of excess stormwater in the state's watersheds, several initiatives are underway to better define the hydrologic modeling techniques that are applicable to the Appalachian forests in the state. Among those studies are:

1) A $100,000 grant to further study the three watersheds identified in the FATT study using alternative hydrologic models.

2) An ongoing study over a 3-year period to formulate new hydrologic models for Appalachian forests in conjunction with the US Forest Service and the Fernow Experimental Forest.

The purpose of these additional forest hydrology studies is to ensure that appropriate science is being applied to the public questions regarding the affects that timbering operations may have on flooding in the watersheds of the forested areas of West Virginia. The two studies mentioned above are dedicated to formulating the appropriate models that can be applied to stormwater runoff from timbered areas in the state. Currently, the data and analyses presented by the FATT study and the McCutcheon study are available for the public's information.

Recommendations for Mining and Reclamation Operations.
Based upon information provided in the various studies and input from the WVDEP Task Force members, the following issues were addressed by rule changes during the 2003 Legislative session, as follows:

1. Regulations were revised to enhance Hydrologic Reclamation Plans for all existing, pending and future permits to prohibit any increase in surface water discharge over pre-mining conditions.
2. Regulations were revised so that the post-mining drainage design of all existing and future mining permits corresponds with the permitted post-mining land configuration.
3. Regulations were revised to enhance contemporaneous reclamation requirements to further reduce surface water runoff.
4. Regulations were revised to require that each application for a permit contain a sediment retention plan to emphasize runoff control and minimize downstream sediment deposition during precipitation events.
5. Regulations were revised to require durable rock fills be limited to "bottom up or incremental lift construction" methods for enhanced runoff and sediment control.
6. Regulations were revised to require the condition of the total watershed be reviewed prior to any approved placement of excess spoil material. Conditions that should be considered include the proximity of residents, structures, etc., to excess spoil disposal structures.
7. Regulations were revised to require that valley fill designs minimize erosion within the watershed during precipitation. The permittee shall consider the total disturbance of the disposal area.

8. Regulations were revised to prohibit “wing dumping” of spoil in excess spoil disposal structures.
9. Regulations were revised to prohibit placement of windrowed material in areas that encroach upon natural drainage-ways.
10. Regulations were revised to limit areas allowed for clearing/grubbing of operations in excess spoil disposal areas.
11. Regulations were revised to maximize reforestation opportunities for all types of post mining land uses.
12. Regulations were revised to require rain gages be located on all mine sites and that monitoring and reporting schedules be developed in order to evaluate runoff response to precipitation.

RECOMMENDATIONS FOR FORESTRY OPERATIONS

Comments by the public indicated potential movement of sawn logs, woody debris and sediment from logging operations into streams during flood events. Transport of this material may have been caused in part by concentration of flow by poorly constructed logging and skid roads. In addition, location of sawmills and load-outs within the regulatory floodway and disposal of slash near streambeds also contributed material that may have increased flood damages due to blocked stream crossings and downstream impact damages. See Figures I-1 and I-2below.

Logging Road Along a Steam
(Photo from FATT Study)

Log Landing Adjacent to a Steam
(Photo from FATT Study)

While research shows the value of using BMPs and enforcing regulations in reducing impacts associated with timbering operations, close field verification and vigorous enforcement are necessary to provide the social and economic benefits associated with proper timbering methods. Research has also shown that uncontrolled forest fires result in significant stormwater runoff and sedimentation. The Division of Forestry is currently under-staffed to accomplish all of the inspection, fire-fighting, and enforcement responsibilities assigned to the Division by the State.

In view of this staffing shortfall, the Task Force recommends that the Legislature provide sufficient funding to the Division to increase staffing that would aid in: forest fire prevention and suppression, forest hydrology, and field inspection and verification of the use of existing and proposed BMPs. These additional staff would include a Forest Hydrologist, wildfire specialists, foresters and four civil enforcement officers, to implement the recommendations in this plan.

In response to comments received from the public during the workshop phase of the Statewide planning process and based in part on various studies prepared by WVDEP and the WV Division of Forestry, the following recommendations are offered to address future potential timbering impacts on flooding.

1. The Task Force recommends that the State Attorney General's office evaluate the current agency authorities to determine which agency(s) has been empowered to regulate the location of sawmills, sawn-log storage areas, load-out areas, log landings and consolidation yards within designated regulatory floodway zones. Should no State agency currently be so empowered, the Legislature should authorize and fund an appropriate agency to regulate the location of these facilities in the regulatory floodway. Such regulatory authority should be vested in an agency that is not directly involved with

harvesting timber resources within the State. Timber harvesting companies and contractors should be required by the regulation to coordinate the location of these temporary timber storage and milling facilities with local municipal or county floodplain managers prior to construction.

2. The Task Force recommends that the Division of Forestry revise BMPs to prohibit the use of lopped slash as a substitute for seeding on skid roads, require out-sloping and seeding of all roads prior to a post-operational site inspection or within sixty days of the end-date in the timber harvesting notification.

3. The Task Force recommends that the Division of Forestry revise BMPs to require a slash disposal plan be included in all timber harvesting notifications to provide for the removal of slash from roadways and landing areas. The BMPs should be revised to prohibit placement of large woody vegetation in intermittent and perennial stream channels.

4. The Task Force recommends that the Division of Forestry revise BMPs to require that the past history of uncontrolled burning in the watershed be taken into account in designing timbering operation plans to reduce runoff from these areas.

5. The Task Force recommends that the State Legislature consider providing funds for increased staffing to address forest fire prevention and suppression with the long-term goal of significantly reducing forest fires as a contributor to increased runoff and sedimentation.

6. The Task Force recommends that the Division of Forestry conduct pre-operational site inspections to review proposed timbering operation plans, sediment control practices, and BMPs to be used by operators.

7. The Task Force recommends that the Division of Forestry consider modifying the BMP's covering the construction of timber access roads and stream crossings in accordance with the recommendations provided in Appendix G (Stream Crossings and Access Roads) of this plan and in Chapter 6 (paragraph g) of the main report.

8. The Task Force recommends that the Division of Forestry develop and enforce regulations that requires the timbering industry to minimize the disturbed area at extraction sites, maximize the preservation of soils and under-story brush and trees, mandates reseeding or planting seedlings on all lands timbered, and mandates stockpiling topsoil disturbed in access road construction for use in seeding and reforestation.

9. The Task Force recommends that the Division of Forestry implement a routine inspection regime to monitor and enforce BMPs and timbering notification requirements during active operations.

10. The Task Force recommends that the Division of Forestry conduct a post-operational site inspection at the end-date of the timbering operation to insure that all BMPs and sediment control practices have been met prior to removal of equipment from the site.

11. The Task Force recommends that the Division of Forestry provide increased technical assistance to timber operators in training and field verification, specifically with regard to road construction, stream-crossing construction, log landing location, and sediment control measures.

12. The Task Force recommends that the Division of Forestry investigate alternative uses for slash, logging waste and less desirable wood to prevent logging waste from being left in and along streams.

13. The Task Force recommends that the Division of Forestry develop regulations requiring development of a plan by the landowner for use of the land after it has been timbered. This plan should include details of how the land will be protected from erosion and sedimentation including short-term and long-term seeding and mulching, and who is responsible for implementing the plan after timbering has ceased.

14. The Task Force recommends that the Division of Forestry prepare educational material on the effects of wildfires and repetitive wildfires on soils and the resulting increase in runoff and flood damages for presentation to high school students, landowners, public officials, floodplain managers and the public.

In addition to the recommendations specifically proposed for mining and timbering industries, the Task Force has specific recommendations for other resource development and extraction industries. These recommendations are provided below.

AGRICULTURE

The agricultural industry contributes to flooding and flood damages through three primary processes: 1) inappropriate construction and maintenance of access roads, 2) conversion of forested areas into pasture and cropland, 3) creation of impervious areas within the state's floodplains and regulatory floodways. The current Best Management Practices (BMPs) established for agricultural would be adequate to reduce flood damages if they were universally applied. It is recommended that the WV Department of Agriculture, the Conservation Agency, and the Natural Resources Conservation Service expand the number of cooperators who adhere to these BMPs.

MINES AND QUARRIES

Slurry impoundments and sediment control structures are necessary components of coal processing and protection of water quality in West Virginia. Coal must be washed before it is shipped to the end users (power plants, furnaces, etc.). Slurry impoundments enable coal companies to economically clean coal and dispose of the remaining refuse and slurry mixture in a stable and environmentally sound manner. Sediment control structures are necessary to maintain water quality standards of the surface runoff from mining areas. When these structures function as intended, they protect the water quality of West

Virginia's streams as the State prospers from resource development. However, when these structures are not constructed according to sound engineering practices, the results can be disastrous.

The typical slurry impoundment is built by constructing a dam of coal refuse across a hollow. This method significantly reduces the cost of constructing the retention basin. The necessary elements of a properly designed impoundment include a sound foundation (including the dam abutments), a correctly engineered outflow and overflow system and the use of appropriate materials and compaction within the dam structure itself. Should any of these elements be overlooked when either designing or constructing a structure, failure may result, especially in times of heavy rainfall events.

The following failures of slurry impoundments in the State highlight the need for diligence in their design, construction and maintenance.

On February 26, 1972, three impoundments, in series, on Middle Fork of Buffalo Creek in Logan County collapsed during heavy rain. Three coal-waste dams were located in a narrow valley about six hundred feet apart. The second was built at the upper end of the first and the third and largest impoundment was built at the upper end of the second. Days of heavy rain in the area caused the upper dam to collapse, unleashing a flood of water, rock, timbers, coal sediment into the lower dams causing them to overtop and fail. The resulting floodwaters carried houses, churches, trailers, cars, bridges, people, and trees down the valley. One hundred twenty five adults and children died on Buffalo Creek. The collapse of the dams on Buffalo Creek resulted in the greatest loss of life and greatest monetary loss of all the dam failures in West Virginia.

On July 17, 1980, a slurry cell on top of a refuse site at Philpott Coal Corporation in Raleigh County overtopped when too much slurry was inadvertently pumped into the structure. A significant amount of black water was released.

On April 8,1987, the principle spillway pipe in the Lower Big Branch impoundment at Peabody Coal Companies Montcoal No. 7 preparation plant in Raleigh County breached due to heavy snowmelt and associated ground movement. Twenty-three million gallons of black water was released into the downstream watershed.

On January 28, 1994 a 5-foot earthen berm overtopped at a slurry impoundment at Consolidated Coal Companies Arkwright Mine in Monongalia County due to ice blockage in the 4-inch discharge pipe. Some 375,000 gallons of water were released into the Town of Granville. Although no one was injured three residences directly downstream were damaged.

According to recent data, West Virginia has less than 130 coal mine impoundments. The sheer number of these impoundments in the state represents only part of the problem. The total storage of the impoundments involved in the Buffalo Creek disaster totaled less than 500 acre-feet. Many current impoundments hold more than 20,000 acre-feet of water. One acre-foot of water is equivalent to 325,851 gallons (the measurement of one acre-

foot is the amount of water that will cover one acre of flat surface one foot deep). Notably, the increased size of today's impoundments emphasizes the need for continued scrutiny and vigilance associated with their design, construction and inspection.

Due in large part to the disaster at Buffalo Creek, the West Virginia Legislature passed the Dam Safety Act of 1973. In 1977 the United States Congress specifically cited the Buffalo Creek disaster when it passed the Surface Mining Control and Reclamation Act.

In 2003, the West Virginia Department of Environmental Protection promulgated new regulations for mining, reducing the industry's contributions to stormwater runoff and downstream flooding consequences. An addition to the regulations now requires each coal company to maintain a rain gage at the actual mining site. While there is no discussion of the type of rain gage required, the proposed regulation change does provide the mining industry the opportunity to install rain gages with ALERT communications capabilities compatible with those used by the WV Office of Emergency Services. WVOES could install, operate and maintain each rain gage for five years for approximately $10,000 ($2,000 per year). Rainfall data collected at these gages would then be available for flood forecasting and could be evaluated and distributed via the internet.

Regulations passed in 2003 require a surface water runoff analysis (SWROA) to be performed on all surface mining permits. As a result, the during-mining and post-mining land conditions cannot increase peak runoff compared to the pre-mining conditions. This quantitative hydrologic analysis, based on a "no-net" increase threshold, insures that mining will not contribute to downstream flooding impacts during mining activities through complete reclamation. Although quarry operations don't have this requirement, their potential to offer significant contributions to runoff is limited by their smaller areas of impact, compared to surface mines.

The Department of Environmental Protection has existing regulations, covering both surface mining and quarrying, that presently exceed the minimum standards detailed in the Stream Crossings and Access Roads appendix of this plan. For mining operations, 38-CSR2-§4, et seq. provides detailed design requirements for haulroad construction and maintenance. For quarrying operations, 38-CSR3-§5, et seq., presents the design requirements for quarry roads.

Additional, the Task Force recommends that the Department of Environmental Protection require new mining and quarrying operations in the State to be coordinated with the local municipal or county floodplain manager in that area prior to initiating construction.

OIL AND GAS

Generally speaking, exploration and development of the oil and gas resources within the state requires a much smaller footprint than other resource extraction industries and is generally confined to particular regions where these resources are concentrated. However, numerous comments were received during the public workshop process for the statewide plan indicating that these industries have caused problems in those areas where exploration and extraction take place.

As with all other land-uses in the state, the oil and gas extraction industry contributes to increased stormwater flooding and downstream flood damages by engaging in three primary activities including: 1) inappropriate construction and maintenance of access roads (including poorly designed, constructed and maintained stream crossings), 2) conversion of forested lands into more impervious surfaces that generate additional stormwater runoff, and 3) inappropriate development within the state's floodplains and regulatory floodways.

Consequently, the Office of Oil and Gas has established an Erosion and Sediment Control Field Manual that presents standards for stream crossings. The Task Force recommends that the Department of Environmental Protection continue to implement and enforce the standards established by this manual. The Task Force also recommends that new oil and gas well exploration and drilling operations in the State be coordinated with the local municipal or county floodplain manager in that area prior to initiating construction.

APPENDIX J -- STORMWATER MANAGEMENT

When rain hits land covered with natural vegetation about 90% of the rainfall evaporates, seeps into the ground until the soil is saturated or is taken up by vegetation and exhaled (transpired) as water vapor. The remaining 10% runs off the surface into natural storage areas such as ponds and wetlands or into the natural routes to the sea such as creeks and rivers. When there is not enough capacity to contain the rainfall, excess stormwater runoff occurs.

Without its vegetated cover, land is less able to absorb stormwater. It does not matter if the natural vegetation is lost from fires, conversion to cropland, conversion to a gravel parking lot or conversion to a strip mall. The loss of natural vegetation results in increased runoff volumes, peak runoff depth, and runoff velocity. Figure J -1 shows the relative amounts of stormwater runoff associated with different land cover types and the accompanying decrease in time of concentration of the runoff flows.

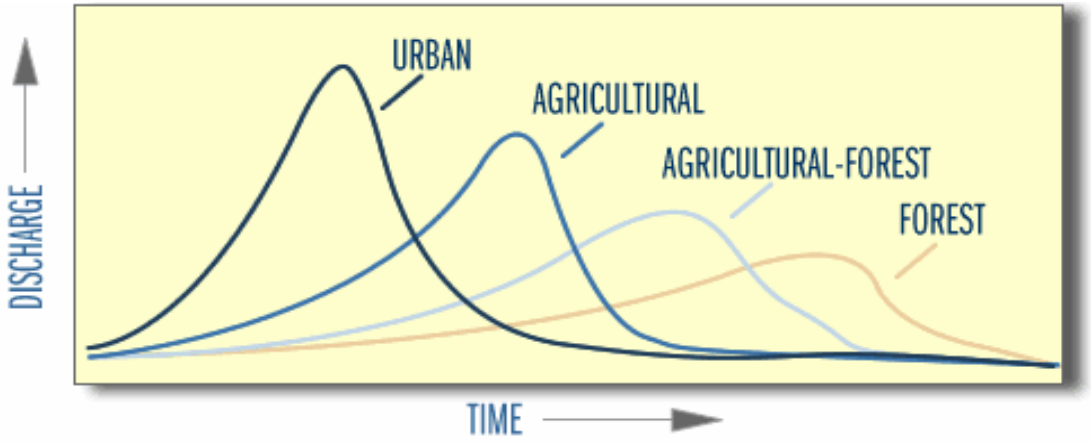


Figure J-1. Stormwater Discharges From Various Land Cover Types

When ten to twenty percent of the land is converted to an impervious surface, the amount of runoff doubles to 20%. This increase in runoff results in both residential and commercial establishments that were on the edges of historic floods, to be in the path of future floods. Buildings, which once had nuisance flooding of basements or water under the house, are now subject to deeper floods for longer periods of time. In short, uncontrolled and unregulated land use conversions can contribute to flash flooding in smaller watersheds and increase the probability of significant damages and loss of life.

Unmanaged stormwater runoff results in an immediate increase in the peak volume of run-off and a shortened period of time between the initiation of rainfall and flooding conditions. The result is larger and more frequent bank-full events that destabilize the stream geometry and ecology. In addition to increased stormwater runoff, most conversions result in temporary or long-term soil erosion. Soil erosion is a naturally recurring process. Stable streams can maintain a sediment load that is balanced to the flow volume during bank- full events and balanced for the stream gradient and soil types within the watershed.

Soil erosion may inhibit the growth of vegetation on steep slopes in the state; thus increasing erosion and decreasing opportunities for re-growth after land disturbances. Also, eroded soil eventually settles in stream channels where it reduces the channel flow capacity and expands the use of the floodplain during subsequent high- water events. It can also destabilize the stream and cause the channel to move and increase filling in and scouring of the channel. Increased sediments in the stream can severely impact the diversity and the health of the aquatic ecosystem. Examples of land use conversions within a watershed that can influence flooding through uncontrolled stormwater and sedimentation include:

Resource extraction (mining, quarrying, timbering, oil and gas wells, agriculture) -- These operations involve removal of vegetation, soil and rock excavation, construction of access roads, waste material disposal areas, debris piles and construction of storage and material shipping areas. In public meetings, mines, timber harvesting, oil and gas wells and other resource extraction operations were repeatedly blamed for increased runoff and sedimentation that contribute to flooding.

These uses do contribute to stormwater runoff and sedimentation, but not to the extent the public believes. The FATT study conducted by the West Virginia Department of Environmental Protection dated June 14, 2002 concluded that land disturbance associated with timber harvesting and mining did influence the volume of runoff in the three watersheds investigated in southern West Virginia. The percentage of additional runoff attributed to mining and logging in this study ranged from a -3% to +21% depending upon the extent of the operation and the length of time that reclamation efforts had been in place. Appendix I contains a more in-depth review of the FATT study and follow-on studies of the effects of timber harvesting and mining on stormwater runoff.

Generally, these resource extraction activities are based on an approved plan and follow best management practices (BMPs). Given proper monitoring and enforcement by State

and Federal inspectors and supervisors, the impacts to runoff volumes in a watershed would be minimal. Where these operations diverge from approved plans or ignore the best management practices or where monitoring and enforcement are not adequate, stormwater runoff can cause significant impacts to water quality and volume downstream of the operations.

Highway construction -- Highway construction, especially limited access Appalachian Corridor highways and interstate highways, is especially important. Although highway design incorporates facilities for stormwater runoff collection and retention, the largely uncontrolled commercial and residential development at interchanges creates acres of impervious surfaces generating enormous amounts of stormwater runoff. The location of highway interchanges with respect to floodplains and developable property is critical to the control of commercial and residential growth and resulting runoff. Figure J -2 shows the array of impervious surfaces that can emerge surrounding a highway interchange.

Interchanges located in the floodplain can be a problem for two reasons. First the location of the interchange can encourage commercial growth within the floodplain (an already recognized problem in floodplain management) and second, stormwater runoff generated by this commercial growth directly enters the stream with limited opportunities for attenuation or retention.

Figure J-2. Development of impervious surfaces at highway interchanges

Commercial and residential development -- Commercial and residential development can contribute substantial stormwater runoff into streams. Many commercial establishments such as banks and fast food stores have reduced parking areas due in part to drive-thru service. However, even these smaller areas of impervious land cover

contribute to the total runoff in the watershed. Malls and large shopping areas have extensive roofs and parking facilities that cover acres of land with impervious surfaces. Figure J -3 shows the extent of impervious surfaces associated with commercial mall development. Without carefully designed retention facilities, these expansive stormwater runoff generators can significantly impact local streams and watersheds.

Figure J-3. Impervious surfaces associated with commercial development

Unfortunately, residential subdivisions can also generate substantial stormwater runoff. When low-density single- family residential development occurs on larger lots with limited clearing of vegetation, stormwater runoff is a minor consequence of the development. However, where residential construction occurs as a multi-lot subdivision without carefully designed retention facilities, stormwater runoff amounts can rival that generated by commercial development. Figure J - 4 shows the types of impervious surfaces associated with residential development. The combination of land clearing, impervious roofs, streets, sidewalks, and driveways in major subdivisions can generate substantial stormwater runoff. The need for enactment of subdivision regulations and enforcement of those regulations is an essential ingredient in solving these problems.

Recreation Facilities -- Certain types of recreation facilities also generate significant stormwater runoff. More passive forms of recreation such as hiking trails, low-density tent and trailer camping, and picnicking where land clearing is kept to a minimum (to enhance the recreation experience) do not generate large amounts of stormwater runoff. However, recreation facilities that require the clearing of significant acreage for facilities, parking, and associated commercial development can generate stormwater runoff. This is especially notable in regional park facilities featuring expansive open fields for soccer, baseball, football, tennis courts, parking, and public facilities. Figure J - 5 shows the type of intensive recreation development that generates high runoff. Although golf courses can require extensive clearing of forested land, normally this construction incorporates retention on site for irrigation, and most course surfaces are dedicated to grasses and

Figure J-4. Impervious surfaces associated with residential subdivisions

other vegetation thereby reducing the stormwater impacts. Most damaging can be intensive-use recreation facilities located within the floodplain where stormwater generated by impervious surfaces is piped directly to the stream channel.

Figure J-5. Impervious surfaces associated with recreation development

Agriculture -- Agriculture can be a contributor to stormwater runoff when land is converted from forest cover to agricultural production uses. Conversion to agricultural uses on steep slopes (an exception to the rule) makes the runoff problem and the erosion associated with soil disturbance worse.

Forest Fires -- Forest fires, whether ignited by mankind or by lightening, present a serious threat to West Virginia watersheds and streams. Intense fires as shown in Figure J-6 can destroy the forest canopy, the shrub under-story, and the duff (humus layer) layer on the forest floor. Repetitive fires can bake the soil and create an impervious surface. Due to the rural nature of West Virginia, including steep slopes and vast areas of forest with limited road access, forest fires can devastate extensive areas of the watersheds.

Figure J-6. Loss of duff layer due to forest fires

Subsequent rainfall events are not absorbed into the soil as efficiently as those occurring before a fire (due to loss of the duff layer and loss of transpiration by vegetation), and the exposed soils are subject to severe erosion. The rate of erosion (tons/acre) increases dramatically following a fire event.

Although forest recovery can occur following a fire, the summer and autumn forest fire season is followed by seasons (winter and spring) of high precipitation and only moderate growth of the forest. Replacing a burned duff layer requires years of forest growth and leaf fall, while rains continue to erode exposed soils. During this period, stormwater runoff and erosion rates remain high. In many ways, fire events can be more threatening to the watersheds in terms of stormwater runoff and soil erosion than many other land-use conversions. While good development regulations and design can incorporate retention facilities into most man-made ventures, forest fires do not provide that opportunity.

For these reasons, the Task Force recommends that the Division of Forestry be provided sufficient funds and personnel to address forest fire prevention and control within the state. (See Appendix I-Resource Extraction.)

There is no simple way to separate stormwater flooding, sometimes called nuisance flooding, from more substantive flooding. In general, stormwater flooding occurs more frequently, is shallower, covers limited areas and is of short duration. Flooded basements, flooded underpasses and blocked streets are the most frequent result from stormwater flooding. Local emergency response units can usually handle stormwater flooding without assistance from the State or Federal government. The Corps of Engineers regards stormwater flooding and the systems used to convey stormwater within urban areas to be the responsibility of local government. Generally, urban watersheds of less than 1.5 square miles in size are regarded to be urban stormwater conditions rather than flood protection situations.

Storm events are rated by their duration and their statistically derived recurrence period. For instance, a 48-hour, 100- year storm would last two days and has a one percent (1/100) chance of occurring during any one year. Stormwater flooding does damage homes and businesses, some which are not within the regulated flood plain. Frequently stormwater flooding occurs on the edges of general flooding and can hinder the response to disasters by State and Federal units.

Steps taken to reduce the damages from stormwater floods will do little to reduce damages from devastating regional floods. Structures and activities designed to protect from a two to twenty-five year stormwater flood are overwhelmed by a hundred or five hundred year storm. However, it is still important that stormwater flooding be addressed. Addressing stormwater will reduce the peak flow volume and lengthen the time of concentration. This could lower the crest of a river flood by six inches to one foot. The reduced crest could reduce the geographic area impacted by a river flood. It could allow a faster response to the severely flooded areas by Federal and State response units. Finally, taking steps to control the flow of stormwater will improve water quality and allow for an increased rate of aquifer recharge.

Historically we have relied on two ways to control stormwater, increase the carrying capacity of the system that carries water away from the flooded area, and temporary or permanent storage of the excess water until the present carrying capacity can safely transport the excess volume. In the past, man has increased the carrying capacity of streams by widening and dredging them. While this may be adequate for controlling flooding from frequent minor rains, it does little to control the massive flooding from less frequent but more severe storms. In addition, dredging can cause irreparable harm to the ecosystem in and around the stream.

Constructing ponds and lakes has been the preferred method of increasing the storage of stormwater in West Virginia. Unfortunately, these attempts to control nature are not always effective and cost millions of dollars, frequently more than the value of the property they are designed to protect. Some facilities have constructed stormwater

detention basins to reduce the flows of stormwater. These basins may be wet basins (ponds or wetlands) or dry basins (enclosed swales, amphitheaters, or sports facilities). A third method of reducing the effects from stormwater has recently been added to our arsenal, source controls. This includes a series of best management practices (BMPs) that control or reduce the effects of stormwater where it first hits the ground. While source controls can be effective in reducing runoff, a mixture of source controls and structural facilities may be necessary to improve flood protection. Table J-1 provides a listing of Best Management Practices and source controls for controlling the flow of water.

TABLE J-1
BEST MANAGEMENT PRACTICES TO CONTROL FLOW VOLUME AND VELOCITY

BMP	DESCRIPTION
PUBLIC EDUCATION BMP's	
Public Participation / Education Programs	Activities where people learn about and work together to control stormwater.
SOURCE CONTROL BMPs	
Zoning restrictions to reduce population density	A reduction in population density automatically reduces the amount of impervious area.
Minimizing impervious areas	Reducing the size of the impervious areas by making roads narrower, parking lots smaller, use of porous pavement, providing green islands in the middle of paved areas, using green roofs, etc.
Cluster development with surrounding green space	Clustering development allows for shorter roads and reduced impervious areas. The remaining green space slows the run off of stormwater and allows for infiltration into ground water.
Land Use Planning and Management	A comprehensive planning process to control or prevent land uses in areas where development would contribute to flooding.
Stormwater Storage Facilities	Devices designed to retard the flow to reduce downstream flooding or reduce erosive velocities.
Storm Sewer System Cleaning	Removes sediment and allows conveyances to transport the intended flows.
Catch Basin Cleaning	Removes sediment, prevents downstream clogging and allows conveyances to transport the intended flows.
Septic Tank/Sanitary Sewer Maintenance	Reduce flow and pollutants by detection, prevention and control of the flow of sanitary waste into stormwater conveyances.
Illicit Connection Controls	Reduce flow and pollutants by detection, prevention and control of the flow of undesired material into the stormwater conveyances. This includes roof gutters directly connected to municipal storm sewers.
TREATMENT CONTROL BMPs	
Wet Detention Ponds	A small man-made lake with vegetated banks designed to capture and remove sediments and delay the downstream flow of stormwater. Some infiltration to groundwater occurs.

TABLE J-1 BEST MANAGEMENT PRACTICES TO CONTROL FLOW VOLUME AND VELOCITY	
Dry Extended Detention Basin	A basin that is usually dry between storms. It captures runoff and releases it slowly enough that most sediment settles out. Dry Detention Basins are frequently used for sporting events or amphitheaters between storms. Some infiltration to groundwater occurs.
Constructed Wetlands	A man-made basin with a significant percentage covered by wetland vegetation. Some infiltration to groundwater occurs.
Swales and Filter Strips	Channels or flat surfaces lined with vegetation that slows the flow of stormwater and allows it to infiltrate into the ground.
Stormwater Infiltration	A basin, trench, vault, permeable pavement or other system that collects runoff and discharges it into ground water. Some surface runoff may occur.
Combined Sewer Overflow Storage and Treatment	Tunnels or basins that detain combined sewer overflows and prevent them from discharging before treatment.
CHANNEL RESTORATION STABILIZATION BMPs	
Outlet Stabilization	Prevent stream bank erosion due to excessive discharge velocities.
Engineered Stream bank Stabilization Measures	Structures designed to prevent erosion by stabilizing stream banks.
Bio-engineered Stream bank Stabilization Measures	Use of live plants to prevent erosion by stabilizing stream banks.
Bio-technical Stream bank Stabilization Measures	The integrated use of structures and live plants to prevent erosion by stabilizing stream banks.
Habitat Restoration Techniques	The integrated use of structures and live plants to restore the habitat along the base of eroding streams.
Stream Obstruction Prevention and Removal	Identifying and removing items from the waterways that reduce the carrying capacity of the waterway. These items may include: trash, appliances, and woody debris. This BMP also includes preventing such items from entering the waterways by anti-liter campaigns, appliance drop off points, enforcement of the mandatory garbage disposal law and elimination of floatable material stored in the floodway.
AGRICULTURAL BMPs	

TABLE J-1 BEST MANAGEMENT PRACTICES TO CONTROL FLOW VOLUME AND VELOCITY	
Conservation Tillage	Any tillage practice that reduces the loss of moisture and soil.
Agricultural Filter Strips	Vegetated areas that slow stormwater run off and allow it to infiltrate into the soil.
Livestock Pasture Management	Reduce overgrazing of pastures to decrease erosion and sediment transport. Increased vegetation also slows stormwater runoff and allows it to infiltrate into the soil.

Many of the above Best Management Practices are directed towards reducing the impervious cover. The effects of impervious cover are directly related to the size of the watershed being addressed. A fifty-acre site with an impervious cover located on the banks of the Kanawha River will not have the same effect as a five-acre parking lot located on Knapps Creek above Marlinton.

It is not realistic to expect individual landowners or local jurisdictions to spend enough money to control flooding caused by very large, infrequent storm events. Therefore, different areas should have different levels of protection. County roads along headwater streams are frequently allowed to flood. Typically, the floodwaters here are “flashy”, quick to rise and quick to fall. Relocating the road or taking other measures to prevent it from being blocked by floodwaters would cost much more than the few hours of inconvenience of blocked road.

Major highways and interstates, on the other hand, carry vital supplies to businesses and retail establishments across the State and serve as evacuation routes for hundreds of thousands of people. These routes are located were delays may cause loss of life and millions of dollars in damages. These roads are generally constructed to avoid inundation from regional floods and therefore, do not flood during the smaller, more frequent storms.

The Task Force recommends that the Department of Transportation install signage similar to the “Bridge Freezes Before Road” sign to identify roads that are frequently blocked by stormwater. Suggestions include: “High Water May Block Road”, “Do Not Drive Through Water”, or a graphic representation with the same meaning. This topic is also addressed in Appendix G: Stream Crossings and Access Roads and Appendix B – Flood Warning System.

Historically, the control of stormwater runoff has been limited to planning, designing and implementing improvements focused on the site being developed. This level of planning is typically found in jurisdictions where a regulation requires that post-development peak runoff from a site be equal to or less than pre-development peak runoff. This allows the total volume of runoff to increase, which may still cause some flooding. This results in numerous small stormwater structures that require, but don’t usually get, routine inspection and maintenance.

Recent efforts have been expanded to include planning for entire catchments. A catchment is defined as the total area draining to the first stream intersection below the development site. This expanded level of planning allows protection for both current and future development to be achieved. It usually results in regional facilities built by some level of government. Regional facilities are more likely to attract public funding and receive the necessary inspection and maintenance.

While building and maintaining these facilities requires more planning and can be expensive, studies have shown that the net cost to the community can be one half to one third the cost of numerous small detention facilities. In addition, funding can be obtained by charging a stormwater management fee for service. These fees should be based on the area of the development in selected categories based upon the degree of imperviousness. An ancillary benefit of managing the quantity of stormwater is that it also provides an improvement in stormwater quality. Facilities intended to manage stormwater quality are sized for protection from smaller more frequent storms (See Figure J-7). Facilities intended to manage stormwater for quantity are larger and are sized for protection from larger less frequent storms. These larger facilities also provide improved stormwater quality by containing the "first flush" of stormwater. This first flush contains most of the runoff pollutants. Containment allows many of the pollutants to settle out of the water before it is released downstream. Addressing stormwater management for both flood control and water quality protects the entire environment.

Figure J-7. Stormwater retention facility

An ongoing operations and maintenance program with an annual inspection is essential to obtain to maximum benefit from stormwater management facilities. Detention ponds need periodic sediment removal, clogged outlets need to be cleared, infiltration trenches

need inspection to prevent clogging, and all facilities should be maintained in an aesthetically pleasing condition. If not, detention basins will fill with sediment, outlets may plug, and the resulting system may create more problems than if no controls existed at all. Stormwater ordinances should require a long term operations and maintenance program paid for by the developer.
Municipalities and counties in selected urbanized areas will soon be required to obtain stormwater permits under the National Pollutant Discharge Elimination System (NPDES). These urbanized areas in West Virginia are: Charleston, Huntington, Parkersburg, Morgantown, Weirton, Wheeling, and Hagerstown Maryland. Jurisdictions within these areas required to obtain a stormwater permit include: Bancroft, Barboursville, Belle, Benwood, Berkeley County, Bethlehem, Brooke County, Cabell County, Cedar Grove, Ceredo, Charleston, Chesapeake, Clearview, Dunbar, East Bank, Follansbee, Glasgow, Glen Dale, Hancock County, Huntington, Hurricane, Kanawha County, Kenova, Marmet, Marshall County, McMachen, Mineral County, Moundsville, Nitro, North Hills, Ohio County, Parkersburg, Poca, Putnam County, Ridgeley, South Charleston, Saint Albans, Triadelphia, Vienna, Wayne County, Weirton, Wheeling, and Wood County.

The NPDES stormwater permits are primarily intended to protect water quality. Meeting the requirements for these permits would also help control stormwater quantity for very little addition expenditure of time and resources.

The Task Force recommends that all counties in West Virginia implement a stormwater ordinance to control the quantity and quality of stormwater and to guide the development and implementation of a stormwater management plan. These local ordinances should be at least as strict as State regulations. Local jurisdictions must provide for enforcement of their own ordinances. A model county stormwater ordinance is included at the end of this appendix. Enforcement of stormwater management is an area frequently overlooked and under-funded. Enforcement will become increasingly important as water controls are built into the stormwater management system.

The Task Force recommends that a State agency such as the Office of Environmental Enforcement within the Department of Environmental Protection inspect stormwater facilities. This agency would serve as a back up for local inspection and enforcement of regulations on design, installation, operation and maintenance of these facilities. The agency assigned to enforce stormwater regulations should consult with the Statewide Flood Protection Task Force in drafting the regulations for presentation to the legislature.

Care should be taken to ensure any stormwater regulations comply with regulations concerning the Total Maximum Daily Load, the National Pollution Discharge Elimination System, the Clean Water Act and the Endangered Species Act, and other appropriate laws and regulations.

In the event no suitable State agency is found to provide the technical assistance and enforcement support needed, the Task Force recommends that the State organize no more than twenty regional watershed authorities based on the eight digit watershed basins to

provide technical assistance. The Task Force also recommends establishment of a State wide Watershed Council to provide technical assistance and enforcement support to the regional watershed authorities.

The Task Force recommends that all stormwater conveyances (ditches, culverts, piping etc.) be sized no smaller than the nearest appropriate downstream Department of Transportation stormwater conveyance. It is further recommended that the Department of Transportation provide technical assistance on determining the appropriate size to persons installing stormwater conveyances.

The Task Force recommends that any development of greater than 3 acres during any 5 year period must provide stormwater management plan that addresses the total run off to the entire catchment.

West Virginia has numerous cold-water naturally reproducing trout streams. Detention and subsequent release of stormwater into these streams may remove some pollutants and reduce the peak volume and velocity of the flow and still adversely impact the trout by raising the normal temperature of the waters. Therefore, the Task Force recommends that any stormwater detention facilities that discharges to a cold-water trout stream are designed to detain water no more than twelve hours. In addition, the pond should be designed so that it discharges from near the bottom, cooler portion of the pond. Detention facilities that discharge into warm water streams should be designed to detain stormwater at least twenty-four hours.

West Virginia has seventeen counties with karst topography. These include, Jefferson, Berkeley, Morgan, Hampshire, Hardy, Mineral, Grant, Pendelton, Monongalia, Preston, Tucker, Randolph, Pocahontas, Greenbrier, Summers, Monroe and Mercer. (See Figure J –8). Karst topography presents unusual challenges to managing stormwater.

Some stormwater ponds are identified as "non-discharge' because they have no surface discharge. For ponds with an impervious liner, this means the evaporation rate exceeds the rate stormwater flows into them. Ponds in karst topography may have a sub-surface discharge to caverns, large solution cavities or subterranean streams. Many people mistakenly believe this subterranean discharge solves the stormwater problem. Often flows directed into these subterranean routes resurface a few miles away to create problems for unsuspecting landowners. A large development directed stormwater from their parking lots into a pond occupying a small sinkhole. This pond has never had a surface discharge. Subsequently water has been appearing in basements and garages in a near by subdivision that is "downstream" from the sinkhole. This nuisance flooding is a result of the increased peak flows from the new development.

In addition, the increased flow increases the rate of dissolution of the walls of the subterranean conduits. The enlargement of these conduits can create new sinkholes or cause the cavern to collapse, partially or totally blocking the underground water flow. This subterranean erosion causes the collapse of buildings and streets, creating hazards for livestock and farm equipment and causing additional problems for landowners.

The Groundwater Program within the Department of Environmental Protection's Division of Water Resources requires any structure with a direct connection to ground water such as stormwater ponds, constructed wetlands, sinkholes, improved sinkholes, and infiltration trenches to obtain an Underground Injection Control Permit. All such structure should have a Groundwater Protection Plan even if it is determined that they do not require an Underground Injection Control Permit. In addition, WVDEP would like all ponds to have a semi-permeable layer that allows for some attenuation of pollutants before the stormwater becomes ground water.

The Task Force recommended that special stormwater regulations be prepared for karst areas in West Virginia.

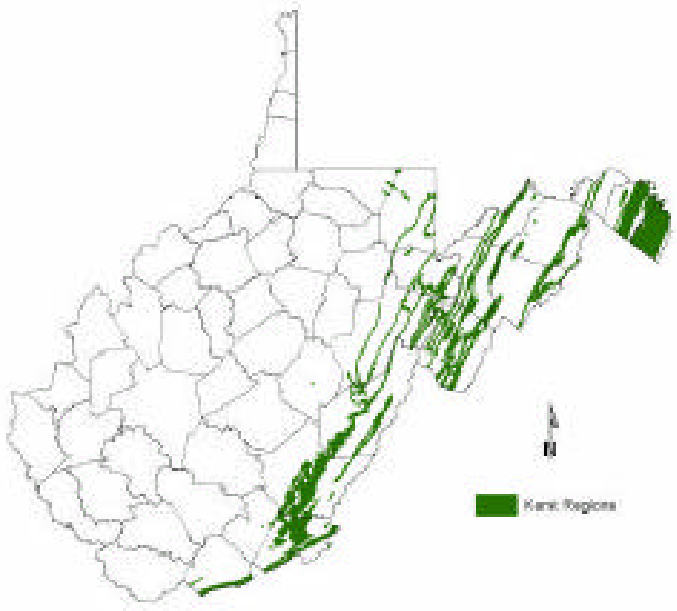


Figure J-7. Regions with Karst topography in West Virginia

Like all other areas relating to flood protection, there is insufficient education and outreach about stormwater management. The Task Force recommends convening an "Education Summit" or conference of all training officers, pubic information officers and other outreach specialists in Federal and State agencies to review the current status of education and outreach on flooding and develop methods of improving it.

The following model stormwater regulations have been compiled from regulations currently in place in some West Virginia counties.

MODEL COUNTY STORMWATER REGULATIONS

I. Title, Authority, and Purpose

A. This article shall be known as: The XXXX County Stormwater Management Ordinance.

II. Authority and Purpose

A. This ordinance is adopted by the authority of the West Virginia Code 8-24-1 to 35 seq.

B. This ordinance is adopted for the following purposes:

1. To protect and provide for the public health, safety, and general welfare of the citizens of XXXX County;
2. To mitigate the impact of increased stormwater runoff due to change in land use; and
3. To safeguard lives and property from loss by flood and erosion.

III. Applicability, Definitions, Exemptions, Waivers, and Variances

A. No person shall develop any land for residential, commercial, industrial, or institutional use without providing adequate stormwater management measures that control and manage stormwater runoff from such development, except as provided herein.

B. A stormwater management plan, signed and sealed by a professional engineer, for providing adequate stormwater management must be submitted to the county planning commission for approval prior to any development. The stormwater management plan shall include all items listed in Item 6. of these regulations.

C. **Exemptions**: The following activities are exempt from the requirement to provide Stormwater Management measures:

1. Agricultural land management activities;
2. Additions or modifications to existing single family detached residential structures; and
3. The development consists of single-family detached residences, each on a lot of two acres or greater.

D. **Waivers**: A waiver of the stormwater management ordinances may be granted for individual developments provided a written request is submitted by the applicant containing descriptions, drawings, and any other information that is necessary to evaluate the proposed development. If there are subsequent additions, extensions, or modifications to a development receiving a waiver, a separate written waiver request shall be required in accordance with the provisions of this section. A development shall be considered for a waiver if the applicant can conclusively demonstrate that:

1. The proposed development will not generate an increase in the 2-year 24- hour post-development peak discharge rate over the 2-year 24 hour predevelopment peak discharge rate; and that the development will not cause an adverse impact on the receiving wetland, watercourse, or water body; or
2. The site is completely surrounded by existing developed areas that are served by an existing network of public storm drainage systems of adequate capacity with stable outfalls to accommodate the runoff from the additional development.

E. **Variances**: A written variance from the stormwater management ordinances may be granted if there are exceptional circumstances applicable to the site such that strict

adherence to the provisions of these regulations will result in an unnecessary hardship and/or will not fulfill the intent of these requirements. The applicant shall submit a written request to the county planning commission stating the specific variances sought and reasons for the request.

IV. Stormwater Management Minimum Control Requirements:

A. Stormwater management facilities shall control post-development runoff for the 24-hour, 2 year, and 10 year frequency storms to a level equal to or less than the pre-development levels for the 24-hour, 2 year, and 10 year frequency storms, respectively, and shall pass the 24-hour 100 year frequency storm without damage to the facilities. Both the volume and rate of runoff shall be controlled.

V. Specific Design Criteria

A. Infiltration measures, where feasible, shall be preferred to detention or retention systems. Supporting documentation demonstrating that infiltration measures are not feasible must be included in the stormwater management plan.

B. Infiltration measures shall be designed in accordance with accepted engineering practices and published design criteria, and shall meet the following requirements:

1. The requirements for demonstrating that infiltration measures are feasible, or are not feasible, shall be the same as those required by the West Virginia
Department of Health for demonstrating that a site is suitable for the use of an individual on-site septic drain field, except that:

a) Infiltration (perc) tests shall be made at the elevation or depth of the proposed bottom of the stormwater management facility;

b) The number of tests shall be sufficient to show the suitability of soil over the entire area of the proposed facility;

c) Where more than one facility is proposed for a site, tests demonstrating the feasibility of each facility shall be provided;

d) Tests shall be made by a certified septic installer or other qualified professional; and

e) The minimum acceptable rate of infiltration shall be one-half inch (1/2") per hour.

2. Infiltration measures shall be:

a) Constructed with the bottoms at least three (3) feet above seasonal high water table; and

b) Located at least 25 feet and down slope from all buildings on permanent foundations.

3. Infiltration measures designed to accept runoff from commercial or industrial impervious parking areas shall:

a) Be a minimum of 100 feet from any water supply well;

b) Include an oil/water separator; and

c) Provide pretreatment for 25% of the design volume using grass filter strips or other acceptable measure.

4. The facility design shall include an overflow system designed to provide a non-erosive velocity of flow along its length and at the outfall.

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5. Infiltration measures shall not receive runoff until the entire contributory drainage area to the infiltration system is stabilized or the system is protected by satisfactory sediment control measures;

6. Sediment which has accumulated in the measure during construction shall be removed and the bottom scarified before final seeding and mulching; and
7. A certified septic installer or other qualified professional shall make postconstruction infiltration tests showing that the facilities will function as intended. The results shall be submitted in writing.
C. Retention and detention ponds shall be designed and constructed in accordance with the criteria of the US Department of Agriculture, Natural Resource Conservation Service, and shall include the following:
1. Velocity dissipation devices shall be placed at the outfall of all retention or detention structures and along the length of any outfall channel as necessary to provide a non-erosive velocity of flow from the structure to a watercourse.
2. Stormwater management design shall include an analysis of the impacts of stormwater flows downstream in the watershed. The analysis shall include hydrologic and hydraulic calculations necessary to determine the impact of the proposed development upon a dam, highway, structure, or natural point of stream flow restriction, downstream to a tributary of the following size:
a) The first downstream tributary whose drainage area equals or exceeds the contributing area to the pond; or
b) The first downstream tributary whose peak discharge exceeds the largest designed release rate of the pond.
3. The designed release rate of the structure shall be modified if any increase in flooding or stream channel erosion would result at the downstream point.
D. For the determination of pre-development peak discharge, all land uses shall be assumed to be in good hydrologic condition; and land use shall be based on the average use of the land in question for the five (5) years preceding the proposed change in the utilization of said land.
E. Where a Stormwater Management system involves redirection of some or all runoff off the site, it shall be the responsibility of the developer to obtain permission from property owners impacted by such redirection. Approval of a Stormwater Management plan does not create or affect any such rights; nor does it relieve the developer from any liability incurred due to flooding.
F. The basic design and analysis criteria, methodologies and construction specifications shall be those of the Natural Resource (Soil) Conservation Service (or equal) found in the most current edition of the following publications:
1. "Urban Hydrology for Small Watersheds", Technical Release No. 55;
2. "Natural Resource Conservation Service Engineering Field Handbook";
3. "Natural Resource Conservation Service Field Office Technical Guide Standard 378"; and
G. The methodology used to determine rainfall runoff shall be Technical Release 20 or Technical Release 55 (TR-20 or TR-55).

VI. Stormwater Management Plan

A. Review and Approval of Stormwater Management Plan
The Stormwater Management Plan and Design Report shall contain supporting computations, drawings and sufficient information describing the manner, location and type of measures by which stormwater runoff from the entire development will be

managed. The county planning commission shall review all plans and supporting information. The approved plan shall serve as the basis for all subsequent construction. Any deviations from the plan must be approved in writing.

B. Contents of the Stormwater Management Plan

The developer is responsible for submitting a Stormwater Management Plan that meets the requirements contained herein. The plan shall include sufficient information to evaluate the environmental characteristics of the affected areas, the potential impacts of the proposed development on water resources, and the effectiveness and acceptability of measures proposed for managing runoff. The minimum information submitted for a Stormwater Management plan or request for a waiver shall be as follows:

1. Design

a) USGS topographic map showing the project site.

b) Soils map showing the project site.

c) Test results showing the feasibility or lack thereof of infiltration measures.

d) Narrative describing:

(1) Existing conditions and character of the site;

(2) The nature and extent of the proposed development;

(3) The measures proposed for stormwater management;

(4) A summary of pre- and post-development runoff for the 2, 10, and 100 year frequency storms;

(5) The impact of the proposed development downstream from the site; and

(6) Organization of data and computations in the remainder of the report.

e) Computations, including:

(1) Pre- and post-development hydrology computations including curve number weighting, time of concentration and travel time, and subarea, combination and routing hydrographs for the 2, 10, and 100 year storms; and

(2) Hydraulic computations including structure sizing and performance for the 2, 10, and 100 year storms, resistance to overturning and flotation, and location and sizing of anti-seep collars, as applicable.

f) Pre- and post-development drainage maps showing existing and proposed contours, as applicable, at a scale and contour interval appropriate for the design of the development and the stormwater management facilities, and including as applicable:

(1) Extent of soils of each classification;

(2) Extent of land use of each classification;

(3) Drainage sub-areas labeled to correspond with computations;

(4) Flow paths showing each segment with length, type of flow, and slope; and

(5) Location of drainage structures and stormwater management facilities.

2. Stormwater management plans shall include, in addition to information required by the Subdivision Ordinance and/or the Commercial and Industrial Ordinance:

a) Dimensions sufficient to show location, size, depth and volume of each stormwater management facility and structure;

b) Details and specifications for each structure including (but not limited to) culverts, orifices, risers, inlet boxes, weirs, trash racks, spillways, riprap lining, and anti-seep collars;

c) Location of existing and proposed easements and/or right-of-ways required for stormwater management facilities; and
d) Other information as may be required for specific site conditions and developments.

VII. Construction, As-Built Plans, and Final Approval
A. The developer shall install and/or construct all required stormwater management facilities.
B. As-built plans showing the completed location, size, volume and structure components shall be submitted to and approved by the county planning commission prior to the final approval of a subdivision or the issuance of an occupancy permit for a commercial or industrial development.
C. As-built plans shall be based on actual field measurements and shall be prepared by a registered professional surveyor or engineer licensed in West Virginia.

VIII. Inspections
A. Construction, operation and maintenance of all Stormwater Management facilities shall be subject to inspection by any county or State regulatory authority.
Any deficiencies noted will be forwarded to the owner in writing for correction within sixty days.
B. The developer may be required to hire a West Virginia licensed professional engineer to inspect the project and provide a report to the county planning commission. The report shall contain an engineer's certification of compliance as well as any "as built" plans, supplementary inspection reports, and laboratory or field test results.
C. If the owner shall assign his rights of ownership of a Stormwater Management system to another person or entity, notice of such change of ownership must be made to the county planning commission in writing within 10 days of such assignment.
D. Prior to granting final approval to a project, the owner shall be required to enter into an "Inspection and Maintenance Agreement of Private Stormwater Management Facilities".

INSPECTION AND MAINTENANCE AGREEMENT
OF PRIVATE STORMWATER MANAGEMENT FACILITIES
THIS AGREEMENT, made this _____ day of _____, 20___, by and between hereinafter referred to as the “OWNER(S)” of the following property: and the XXXX County Planning Commission, hereinafter referred to as the "Commission."

WITNESSETH:
We, the OWNER(S), with full authority to execute deeds, mortgages, other covenants, all rights, titles, and interests in the property described above, do hereby covenant with the Commission and agree as follows:
1. THE OWNER(S) shall provide for the maintenance of the stormwater management facility to ensure that the facility is and remains in proper working condition in accordance with approved design standards, rules and regulations, and applicable laws. The OWNER(S) shall perform necessary landscaping (grass cutting, etc.) and trash removal as part of regular maintenance.

2. If necessary, the OWNER(S) shall levy regular or special assessments against all present or subsequent owners of property served by the facility to ensure that the facility is properly maintained.
3. The OWNER(S) shall grant the Commission, its agent and contractor and any State or county regulatory authority the right of entry at reasonable times and in a reasonable manner for the purpose of inspecting, operating, installing, constructing, reconstructing, maintaining, or repairing the facility.
4. Should the OWNER(S) fail to maintain the facility or correct any defects within a reasonable period of time (60 days maximum) after proper written notice by the Commission, the Commission is authorized to perform the necessary maintenance or repairs and may assess the OWNER(S) served by the facility for the cost of the work, and applicable penalties, and legal fees and court costs, if any. Said assessment shall be a lien against all properties served by the facility and may be placed on the property tax bill of said property and collected as ordinary taxes by the Commission. The OWNER(S) shall maintain perpetual access from public rights-of-way to the facility for the Commission or its agent and contractor.
5. The OWNER(S) shall indemnify and save the Commission harmless from any and all claims for damages to persons or property arising from the construction, maintenance, and use of the facility.
6. The agreement and covenants contained herein shall apply to and bind the OWNER(S) and the OWNER(S) heirs, executors, successors, and assigns, and shall bind all present and subsequent owners of the property served by the facility.
7. The COMMISSION shall record this AGREEMENT in the land records of the COUNTY.

IN WITNESS WHEREOF, the OWNER(S) and the COMMISSION executed this AGREEMENT as of this _____ day of _____, 20___.

ATTEST: FOR THE OWNER(S)

ATTEST: FOR THE COMMISSION
STATE OF COUNTY OF, TO WIT:
I hereby certify that on this _____ day of _____, 20____, before the subscribed, a Notary Public of the State of West Virginia, and for the County of _____, aforesaid personally appeared _____ for the Commission and did acknowledge the foregoing instrument to be their Act.
In testimony whereof, I have affixed my official seal,
_____ My Commission Expires: _____
NOTARY PUBLIC
SEAL:

Appendix K — Education

Public comments and workgroup discussions clearly determined that confusion prevails regarding flood protection programs. During the many meetings conducted to prepare this plan, it became evident that there is a serious lack of adequate education and training on flooding and floodplain management in West Virginia. The West Virginia Office of Emergency Services (WVOES) offers independent study, field and classroom training in floodplain management, flood mitigation, flood proofing, and similar topics for flooding and for other hazards. Most of these courses and workshops were developed by the Emergency Management Institute in Emmittsburg, Maryland. This training is free or low cost. While other training may be available to State, county and municipal officials on these topics, no one else offers such a complete range of training at such an affordable cost.

The Task Force recommends that anyone interested in floodplain management, community planning, building inspection, emergenc y services, or enforcement of land use regulations be encouraged to participate in this training. WVOES should develop and present at least one state specific flooding workshop each year in West Virginia. Topics could include:

- Local Floodplain Ordinances
- The Potential Impact of Regional Flooding
- The West Virginia State Code Factors that Contribute to Flooding
- Q3 GIS Data
- The Perils of Building in the Floodplain
- Updated Flood Maps
- Flood Proofing
- Land Use Management
- Flood-Resistant Construction Techniques
- Storm-Water Management
- Reducing Flood Insurance Premiums
- Flood Damage
- The Concepts of Stable Streams
- Floodplain Management
- Maintenance of Stream Crossings
- Floodplain Protection
- Dam Safety and Emergency Action Plans

Table K-1

Training for Floodplain Coordinators, Public Officials

And the Public, Offered by FEMA and WVOES

Number	Course Name	Time
Federal Emergency Management Agency – Emergency Management Institute - Independent Studies Courses		
IS-002	Emergency Preparedness, USA	Independent Study
IS-007	A Citizen's Guide to Public Assistance	Independent Study
IS-009	Managing Floodplain Development through the National Flood Insurance Program	Independent Study
IS-012	Property Acquisition for Local Communities	Independent Study
IS-271	Anticipating Hazardous Weather & Community Risk	
IS-279	Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings	Independent Study
IS-393	Introduction to Mitigation	Independent Study
IS-394	Mitigation for Homeowners	Independent Study
Federal Emergency Management Agency – Resident Courses available at Emergency Management Institute, Emmitsburg, Maryland		
E-202	Debris Management	28 hour
E-234	Digital Hazard Data	36 hours – 5 days
E-273	Managing Floodplain Development through the National Flood Insurance Program	36 hours – 5 days
E–278	National Flood Insurance Program / Community Rating System	36 hours – 5 days
E-279	Retrofitting Flood-Prone Residential Buildings	36 hours – 5 days
E-380	Building Consensus in Disaster Resistant Communities	36 hours – 5 days
Federal Emergency Management Agency – Non Resident Courses which may be presented by West Virginia Office of Emergency Services		
G-271	Hazardous Weather and Flood Preparedness	2 ½ days
G-278	Benefit-Cost Analysis: Entry Level Training	2 days
G-279	Retrofitting Flood-Prone Residential Buildings	2 days
G-361	Flood Fight Operations	2 ½ days
G-376	State Hazard Mitigation Planning	1 day
G-377	Regional Hazard Mitigation Planning	2 to 3 days
G–398.2	Mitigation and Recovery Exercises (Flood)	1 day

WVOES should present at least one Federal Emergency Management Agency field course directly related to flooding each year in West Virginia. Further information on FEMA courses can be found at www.fema.gov/emi**.**

The Task Force in conjunction with the National Flood Insurance Program Coordinator at WVOES should develop and conduct an annual conference/seminar on floodplain management in West Virginia for all floodplain managers, pubic officials, and other interested parties to encourage training and develop peer support. The Insurance Commission should provide incentives for insurance agents to be educated about the National Flood Insurance Program (NFIP). Ten to twenty agents should be randomly checked each year to ensure that they are offering flood insurance to businesses and residents or providing appropriate referrals; and to determine if flood policies are being rated properly. One incentive that currently exists provides for a partial reimbursement from NFIP for the cost of advertisements that include flood insurance as part of the ad. Few insurance agents are aware of this program.

The Task Force recommends that West Virginia provide free training in flood related issues to local jurisdictions. In addition, the State should reimburse counties for a portion of the salary of trained and nationally certified floodplain managers. Reimbursement would be limited to $10,000 to counties with a certified floodplain manager in charge of the program at the county level. The estimated cost statewide is $550,000.
West Virginia should encourage participation in training activities by providing continuing education credits for courses and workshops. Potential attendees would include employees of insurance companies, financial institutions, real-estate companies, utility companies, members of watershed associations, surveyors, professional engineers, floodplain managers, public officials, elected officials, building inspectors, community planners, interested parties and State, county, and municipal governments.

West Virginia should encourage educational outlets (Vo-tech, Community Colleges, publicly owned colleges and universities) to develop classes and curriculums that address floodplain and flood issues. Floodplain management and flooding should be addressed during appropriate sessions of the current curriculum.

To ensure that consistent accurate information is disseminated, brochures should be prepared and distributed to all NFIP policyholders in West Virginia on flood proofing, flood resistant construction techniques, reducing flood insurance premiums, and similar topics. To provide consistent, accurate information, a brochure on the concepts of stable streams should be prepared and distributed. The Vocational Technical schools should incorporate training on retrofitting and other mitigation rebuilding techniques in all construction courses. These personnel should be tasked to work with communities and individuals immediately after a flood event to assist them in building "smarter"

Figure K-1. Statewide Flood Protection Task Force Flood Display

and in a sustainable manner. In addition every vocational technical school should be encouraged to flood proof at least one structure within the county to demonstrate the beauty, functionality, and ability of flood-proofed structures to blend into the environment. All Surveyor classes (college, vocational, high school) should include a

session on completion of elevation certificates, their importance in floodplain management, and a general outline of the floodplain permitting process. To provide the public with a readily visible indication of the elevation of the base flood, all Surveyor classes should require students to survey the Base Flood Elevation and indicate this elevation on utility poles and/or street sign posts within a community, where appropriate. These would be general guides and would not be legal reference points for determining flood insurance premiums.

The WVDOH should establish or reestablish elevation reference marks on all bridges. The Department of Motor Vehicles should identify the dangers of flooded roadways through all high school drivers' education classes and through the license testing process. The Task Force recommends that WVOES make training in maps and map reading available to all Federal, State, local and volunteer personnel involved in flooding in West Virginia on a regular basis.

Appendix L – Strategy To Reduce Damages To Existing Flood Prone Structures And Facilities

West Virginia is confronted with significant floodplain development issues and watershed growth that pours increasing amounts of runoff into the narrow stream channels. Before enactment of the first floodplain management ordinance in the State (Matewan, 1970), thousands of structures were constructed within the 100- year frequency floodplain. Census 2000 data shows that prior to 1970 at least 430,000 residential structures were constructed in the State. Upon adoption of the Flood Insurance Rate Maps and enactment of the required floodplain management ordinances, each county and municipality in the region was burdened with floodplain structures that had been "grandfathered" into the program in their flood prone location. These structures represent a significant amount of the damageable property affected in the State.

It is estimated that there are over 110,000 flood prone structures in the regulated floodplains of West Virginia. Commercial structures are frequently concentrated in municipal areas within the floodplain, while residential structures are scattered throughout the floodplain. A significant number of critical institutional facilities, including schools, Federal and State offices, post offices, public utilities, police and fire stations, are located within the floodplain. All of these structures and facilities will continue to be damaged by flooding unless some corrective action is taken by Federal or State programs.

1. Projected Floodplain Growth:

The State of West Virginia is not anticipating significant population growth by the year 2025. Current projections show the population remaining stable between 1.8 and 1.9 million people during the next 25 years. However, some areas of the State (Berkeley, Jefferson, and Monongalia counties) have been experiencing population growth due to immigration from adjacent states (Maryland, Virginia, and Pennsylvania) and sprawl from adjacent municipal areas (Putnam County). Berkeley County's population has grown 28.7% since 1990 (highest population growth in the State). The City of Martinsburg, WV (Berkeley County) has experienced the highest population growth rate (6.4%) of all cities in West Virginia since 1990. Jefferson County also has experienced population growth (17.4%) since 1990. Both Monongalia County (8.4%) and the City of Morgantown (3.6%) experienced growth since 1990 that was associated with commercial

development along the Interstate 79 corridor. These growth rates have generated increased housing construction accompanied by commercial (retail, office and manufacturing sectors) growth along interstate corridors. Increased stormwater flooding in these municipal and county areas was an issue raised by the participants in the Martinsburg, Winfield, Clarksburg and Parkersburg workshop meetings.

The Interstate 81 and 79 corridors have become catalysts for land development. The moderate to flat topography of the I-81 corridor in Berkeley County has supported higher densities of development than is common in much of West Virginia. Proposed highways (i.e. Corridor H linking interstates 81 and 79) will bring northern Virginia and West Virginia closer together. This connection will increase the likelihood that northern and eastern regions of the State will continue to be bedroom communities and second or vacation home locations for out-of-state workers. Due to the rugged topography of this region, pressures to develop the floodplains in these areas will increase in step with continued growth.

Similar population growth patterns are evident in the Teays Valley area (between Huntington and Charleston). The Interstate 64 corridor between the two largest cities within the State has been a significant factor in this growth. According to the 2000 Census, Putnam County had the second highest population growth rate (20.4%) in the State since 1990. Putnam County, as in the case of Berkeley County, has experienced growth in new housing and commercial development as well as stormwater flooding and development pressures in the floodplain. The current upgrading of portions of I-64 to handle increased traffic is an additional consequence of growth in the corridor.

This growth (coupled with higher disposable incomes) contributes to demands for new housing, development of new commercial centers along highways and at interchanges (replacing older commercial centers in municipal areas), and upgraded and/or expanded institutional facilities (schools, hospitals, and corrections) to support population growth. These growth areas are confronted daily with floodplain development pressures and increasing construction of impervious cover in their watersheds. Stormwater flooding has been identified as a significant issue in all of the growth areas in the State (See Appendix I).

Without appropriate stormwater runoff controls and strict enforcement of existing floodplain management ordinances, these areas will experience increasing flood damages, de-stabilized stream channels, and potential losses of life. Many of the recommended actions in Section 6 are formulated to reduce damages to new floodplain construction, assist floodplain managers in administering existing ordinances and to control stormwater runoff. However, new residential and commercial growth will represent only a fraction of the damageable property already located in the State's floodplains. The inventory of pre-FIRM floodplain structures will remain subject to damages by flooding unless deliberate actions are taken to reduce their losses. The individuals and families living and working in those structures will continue to live at risk while they remain in the floodplain.

2. Inventory of Floodplain Structures:
Before enactment of floodplain management ordinances in 1970, approximately 430,000 structures were constructed within the State. Upon adoption of the Flood Insurance Rate Maps (FIRM's) and enactment of the required floodplain management ordinances, each county and municipality in the State accepted floodplain structures that had been "grandfathered" into the National Flood Insurance Program in a flood-prone condition. These structures continue to represent a significant percentage of the damageable property affected by annual floods. Unfortunately, most of the pre-FIRM structures were not built according to any recognized building code and many are not covered by flood insurance. Thousands of manufactured homes were located within the State's floodplains prior to the advent of the national flood insurance program.

A. At-risk structures: As a part of the investigations undertaken for the Statewide Flood Protection Plan, a preliminary at-risk structure identification/count was undertaken by the Pittsburgh District of the USACE in 2002. A combination of FEMA's Q3 and DFIRM floodplain data (available for 37 of the 55 counties within West Virginia) was overlaid onto aerial photographs. Individual structures were identified and classified by use categories (residential, commercial, and institutional) within the designated floodplain and regulatory floodway. The institutional classification was identified using the Geographic Names Information System (GNIS) and was obtained from the West Virginia Geographic Information System (GIS) Data Catalog. It should also be noted that the numbers listed are conservative as only areas with a FEMA-designated floodplain and/or floodway were analyzed.

Results of the thirty-seven-county analysis identified 81,054 structures located within the 100- year frequency flood zone. Shown below is the distribution of structures within the known floodplains of the thirty-seven counties:

USE	NUMBER
Residential	66,071
Commercial	14,223
Institutional	760
Total	81,054

For structures located in the designated regulatory floodway, the following results were obtained:

USE	NUMBER
Residential	3,198
Commercial	746
Institutional	27
Total	3,971

To project the number of structures that are in the remainder of the State, the census data tracts were overlaid on the mapping generated. A match was then performed to indicate

the tracts with identified structures on them and those that did not. The population base of each category is:

Total State Population	1,808,344
Population with Q3 data Available	1,155,378

This table indicates that the available floodplain information accounts for 63.89% of the State's population. To estimate the structure count for the remainder of the State, this number was factored into the known count. The results of this computation, with the total column rounded, follow:

USE	NUMBER OF KNOWN STRUCTURES	ESTIMATED REMAINDER	TOTAL
Residential	66,071	23,857	90,000
Commercial	14,223	5,136	19,400
Institutional	760	274	1,000
Total	81,054	29,267	110,400

For the regulatory floodway, this analysis yields the following (again the totals are rounded):

USE	NUMBER OF KNOWN STRUCTURES	ESTIMATED REMAINDER	TOTAL
Residential	3,198	1,155	4,400
Commercial	746	269	1,000
Institutional	27	10	40
Total	3,971	1,434	5,400

However, this number is artificially low. Only 23 of the counties with Q3 data have the detailed studies where the floodway is delineated, and then only on those streams with an at-risk population deemed large enough at the time to justify the expense of delineating a floodway. In fact, an analysis of the available Q3 data indicates that floodways represent less than 1% of the land indicated in the floodplain, where a more realistic estimate based on HEC model computations ranges from 5 to 15 percent. In order to obtain a better estimate, Kanawha County was selected as a good example of floodway/floodplain determination since that county had a relatively large amount of floodway calculated. The comparison of this data indicates:

TOTAL STRUCTURES IN KANAWHA COUNTY FLOODPLAINS	NUMBER IN FLOODWAYS	PERCENTAGE IN FLOODWAY
11,166	1,714	15.35%

This number (15.35%) is likely closer to the actual value. For purposes of the Statewide Flood Protection Plan, 10% of the total number of structures in the floodplain would likely be in the floodway. Utilizing this factor gives the final result of (with the estimated totals rounded):

USE	ESTIMATED FLOODPLAIN TOTALS	ESTIMATED FLOODWAY TOTALS
Residential	90,000	9,000
Commercial	19,400	1,940
Institutional	1,000	100
Total	110,400	11,000

The at-risk structure identification process was unable to discern units within the floodplain whose first habitable floor was above the Base Flood Elevation (BFE), but generally speaking, most units constructed before the enactment of local floodplain management ordinances did not have first floors elevated above the BFE. Most structures constructed within the floodplain after enactment of the ordinances have a first floor elevation higher than the 100- year flood. Analysis of floodplain permit actions by the counties and municipalities following enactment of their ordinances would enable discernment of elevated versus non-elevated structures. The structure count data was geo-referenced so that the data can be incorporated into a GIS database format for display and planning purposes. The accuracy of the at-risk structure count is limited by the age and quality of the aerial mapping, the number of structures whose first floor is located above the BFE (Post-NFIP construction) and the ability of the "identifiers" to discern the various types of structures by map observation.

B. Floodway structures: Those structures identified within the FEMA designated floodway are at-risk from floodwaters whose velocity is more of a threat than water depth. Floodway water velocities can exceed 10 feet per second resulting in significant dynamic forces against un-reinforced basement walls and wood frame construction. Due to the high water velocities, scouring around structures is common leading to undermining of foundations, pillars, columns and walls. This process normally results in failure of buildings, retaining walls, and bridge piers. Figure No. 1 shows the effects of high velocity floodwaters on residential construction in the floodway. These hydrodynamic forces can result in severe damages or total destruction of standard residential construction.

Generally, the floodway zone also experiences the greatest flood depths. Significant water depths (>5 feet) and velocities result in buoyancy forces that will dislodge and float most unanchored manufactured homes, vehicles, and storage tanks. Excessive water depths (>10 feet) will cause buried storage tanks, utility vaults and caskets to rise above ground and float. The floodway also carries the greatest amount of floatable debris: debris that can act as a battering ram against other structures within the floodway zone. The majority of residential structures, especially manufactured homes, suffering total destruction in flood events are located within the floodway zone. The July 2001 flooding in southern West Virginia resulted in the total loss of hundreds of floodway zone structures including many manufactured homes. Figure No. 2 shows the affects of floodwaters on manufactured housing located in the floodway. Generally, floodproofing of structures of any type is not recommended in the floodway zone due to these extremely destructive forces.

Figure L-1: Residential structure damaged in floodway.

Figure L-2: Manufactured home damaged in floodway.

C. Commercial structures: The majority of commercial structures in the State are clustered within municipal centers. These centers contain the economic, financial, legal, security, social organizations and public infrastructure upon which much of the county population depends. The municipal areas of the State that are subject to flooding represent a significant challenge to damage reduction strategies. During regional flood events, protection of these critical social and public centers is a key to recovery of the local economy and social structure of the entire county. As concentrations of employment, public services, fire and police, and retail shopping, municipal areas contain commercial and institutional structures and infrastructure that should be considered for protection in place.

Due to their size, construction methods and materials, many commercial structures can be protected using measures that are not otherwise feasible for residential structures. Commercial protection measures can include dry floodproofing methods such as waterproofing, veneer walls, ring- walls, and ring levees. These methods have been widely used throughout the nation and are effective in reducing flood damages.

Improvements in the interstate highway system in West Virginia have resulted in the creation of new commercial centers at many highway interchanges. Interchanges on Interstates 64, 70, 79, 77 and 81 have provided significant opportunities for regional malls and institutional facilities. Several of those interchanges are located within or adjacent to developable floodplain land. County and municipal officials are confronted with retail development proposals surrounding these interchanges that offer significant employment and revenue opportunities, but require variances for construction in designated floodplain areas. Without feasible site alternatives, the promise of economic growth and jobs will prevail over potential floodplain violations. Providing feasible site

development alternatives at these interchange locations would lessen the potential for unwarranted and unwise decisions to grant floodplain variances.

D. Institutional structures: A number of institutional structures including schools, Federal and State offices, post offices, public utilities, police and fire stations, and other essential services are located within the State's floodplain. These structures provide a wide array of essential social and public services to the State's population. Most of these structures and facilities are not protected by flood insurance and due to requirements for unconstrained public access; most have been constructed with first floors at ground level with little consideration for flood protection. Some of these structures and facilities are located within protected municipal areas, but many of them have been constructed outside of municipal areas in the floodplain for lack of economically feasible flood-safe sites. Many institutional facilities have been located in the floodplain subsequent to the enactment of Executive Order 11988. All of these institutional structures and facilities will continue to be damaged by flooding unless they are addressed by one or more existing Federal or State programs.

E. Industrial facilities: Many of the State's largest single industries and industrial complexes are located within floodplain areas. Due to the massive footprint of their production facilities, spatial requirements for materials storage, and need for convenient access to truck, rail and waterway access, floodplain areas are the site of choice for large industries. Major industrial complexes along the Kanawha, Ohio, Little Kanawha, Big Sandy and Monongahela rivers constructed before the advent of the NFIP are located within the 100-year floodplain and are subject to flood damages. These major sources of employment and tax revenue in the State need to be protected from flood damages. Many industrial parks constructed in the State subsequent to the NFIP have been located out of the floodplain.

3. Historical Flood Damage Reduction Practices:

Past efforts to reduce damages have been reactionary in nature and targeted at primary damage centers in the State. Following one or more damaging floods, Congressional action authorized detailed studies of flood protection works for specific damage centers. In some cases, entire watersheds or basins (Kanawha River, Potomac River, Tug Fork, Cheat River, Greenbrier River) were evaluated for comprehensive flood protection. Other Federal and State programs applied funds to the acquisition of floodplain structures damaged by flooding. These floodplain acquisition programs are effective in reducing damages, but have only been applied following flooding events and are frequently funded at a level far below the identified need.

This tactical approach to flood damage reduction has been successful in reducing damages at specific locations within the State, but many other areas (including numerous municipal areas) remain unprotected. There are approximately 248 municipalities within the State. Fifty-five of those municipalities are the government centers for the counties. Table L-3 shows a listing of the county seats in the State with comparative population statistics. Table L-4 shows the relationship of each of these government centers to their respective county and the employment base they provide to the county.

Table L-3. Counties and County Seats (Population Statistics)

Counties – County Seats	2000 Census Populations County – County Seat	Percent county seat of county population
Barbour – Philippi	15557-2870	18%
Berkeley - Martinsburg	75905-14972	20%
Boone - Madison	25535-2677	10%
Braxton - Sutton	14702-1011	**7%**
Brooke - Wellsburg	25447-2891	11%
Cabell - Huntington	96784-51475	53%
Calhoun - Grantsville	7582-565	**7%**
Clay - Clay	10330-593	**6%**
Doddridge – West Union	7403-806	11%
Fayette - Fayetteville	47579-2754	**6%**
Gilmer – Glenville	7160-1544	22%
Grant – Petersburg	11299-2423	21%
Greenbrier - Lewisburg	34453-3624	11%
Hampshire - Romney	20203-1940	10%
Hancock - New Cumberland	32667-1099	**3%**
Hardy - Moorefield	12669-2375	19%
Harrison - Clarksburg	68652-16743	24%
Jackson - Ripley	28000-3263	12%
Jefferson - Charles Town	42190-2907	**7%**
Kanawha - Charleston	200073-53421	27%
Lewis - Weston	16919-4317	26%
Lincoln - Hamlin	22108-1119	**5%**
Logan - Logan	37710-1630	**4%**
Marion - Fairmont	27329-19097	70%
Marshall - Moundsville	56598-9998	18%
Mason - Point Pleasant	35519-4637	13%
McDowell - Welch	25957-2683	10%
Mercer - Princeton	62980-6347	10%
Mineral - Keyser	27078-5303	20%
Mingo - Williamson	28253-3414	12%
Monongalia- Morgantown	81866-26809	33%
Monroe - Union	14583-548	**4%**
Morgan - Berkeley Springs	14943-663	**4%**
Nicholas – Summersville	26562-3294	12%
Ohio - Wheeling	47427-31419	66%
Pendleton - Franklin	8196-797	10%
Pleasants - St. Marys	7514-2017	27%
Pocahontas - Marlinton	9131-2017	13%
Preston - Kingwood	29334-2944	10%
Putnam – Winfield	51589-1858	**4%**

County – County Seat	2000 Census Population County – County Seat	County Seat Population as Percentage of County
Raleigh – Beckley	79220-17254	22%
Randolph – Elkins	28262-7032	25%
Ritchie - Harrisville	10343-1842	18%
Roane - Spencer	15446-2352	15%
Summers – Hinton	12999-2880	22%
Taylor - Grafton	16089-5489	34%
Tucker - Parsons	7321-1463	20%
Tyler - Middlebourne	7592-870	11%
Upshur - Buckhannon	23404-5725	24%
Wayne - Wayne	42903-1105	**3%**
Webster - Webster Springs	9719-808	**8%**
Wetzel - New Martinsville	17693-5984	34%
Wirt - Elizabeth	5873-994	17%
Wood - Parkersburg	87986-33099	38%
Wyoming - Pineville	25708-715	**3%**

Other commercial centers, although not government centers, do provide employment, commerce, financial and real estate services, police and fire services and social and public services. Municipal areas (towns and cities) are generally the center of commercial development within the counties and provide employment and both public and social services to the surrounding county population. Municipal centers also provide substantial county population with potable water and sewerage service from centralized or regional treatment facilities. In some cases, these essential public facilities are subject to flood damages or total loss. Many rural county areas, beyond the reach of municipal infrastructure systems, rely on public service districts (PSD's) for these utility services.

As a result of multiple flood events, many affected municipal areas suffer deterioration of their housing stock, losses of commercial property and recurring damages to infrastructure and population losses. Without significant capital investments, these communities begin to lose their effectiveness as commercial and service centers of the county population. Historically, these unprotected municipal areas either were not sufficiently damaged to warrant detailed flood damage studies, proposed flood protection projects were not found to be economically justifiable or a financially capable project sponsor was not identified to share the project construction costs. In some cases, environmental issues restricted the alternatives that could be considered to protect these damaged areas. Many feasible plans for protecting both municipal and county damage areas remain on office shelves today.

4. Impediments to the Implementation of Flood Damage Reduction Measures

A. Well conceived, soundly formulated and technically feasible flood protection plans have been prepared for several flood damaged areas of the State. Unfortunately, these plans were never implemented for a variety of reasons. A review of those plans shows

that there are three primary reasons that proposed flood protection plans were never implemented: 1) lack of economic justification to implement the project, 2) lack of an eligible and financially capable non-Federal sponsor to support the project, and 3) environmental compliance issues under NEPA. These three issues have prevented implementation of a variety of flood damage reduction measures throughout the State. A discussion of those three impediments and potential solutions follows.

B. Economic Justification: The Flood Control Act of 1936 (see Figure L-3) required that the benefits of any flood control project, to whomever they accrue, must exceed the costs. Since that enactment, Federal agencies formulating water resources development projects have been required to justify the economic efficiency of flood control projects.

In 1983, the Economic and Environmental Principles for Water and Related Land Resources Implementation Studies (known as the Principles and Guidelines or the P&G) were enacted by then President Reagan. The Corps of Engineers, Bureau of Land Reclamation, Tennessee Valley Authority and the Natural Resources Conservation Service must all adhere to the economic and environmental requirements of the P&G for developing and recommending flood control projects. The economic justification requirements for project feasibility were further defined in the P&G.

DECLARATION OF POLICY

Section 1. It is hereby recognized that destructive floods upon the rivers of the United States, upsetting orderly processes and causing loss of life and property, including the erosion of lands and impairing and obstructing navigation, highways, railroads, and other channels of commerce between the States, constitute a menace to national welfare; that it is the sense of Congress that flood control on navigational waters or their tributaries is a proper activity of the Federal Government in cooperation with States, their political sub-divisions and localities thereof; that investigations and improvements of rivers and other waterways, including watersheds thereof, for flood-control purposes are in the interest of the general welfare***; that the Federal Government should improve or participate in the improvement of navigable waters or their tributaries including watersheds thereof, for flood-control purposes if the benefits to whomsoever they may accrue are in excess of the estimated costs,*** and if the lives and social security of people are otherwise adversely affected.

Figure L-3: 1936 Flood Control Act Language

In all cases, unless specifically authorized otherwise (such as the case of Section 202 authority for the Tug Fork Basin and the Section 581 authority for the Cheat River Basin), the Federal agency must determine by rigorous economic analysis that the average annual benefits attributable to the project exceed the average annual costs of the project or program to justify its construction or implementation. For flood damage reduction projects or programs, project benefits are determined to be reductions in the costs of flood damages to residential, commercial, institutional, industrial, transportation

and emergency and recovery costs attributable to the construction and operation of some flood damage reduction measure or combination of measures. Those measures are described below.

Generating economic benefits in small communities in West Virginia can be a daunting task. Normally, economic analysis requires estimations of flood damages both with and without projects in place as well as considerations for streams of benefits and costs accumulated through the economic life of the project with application of appropriate interest rates. The final economic analysis results in a benefits-to-costs ratio known as the BCR. Projects with a BCR of 1:1 or greater are considered for implementation. In simplified terms, economically justified projects are generating more than 1 dollar of flood damage benefits (reductions in damage costs) for each dollar of project development and operating costs spent. The comparison of cumulative project benefits and costs over the projects economic life determines the economic feasibility of the project.

In West Virginia, as in many parts of Appalachia, there are only a handful of municipalities that contain the population density and development values that can generate sufficient flood damage benefits to justify construction of major flood protection measures. Communities such as Huntington, Parkersburg, Point Pleasant, and Moorefield have high densities of residential, commercial, industrial and institutional development that have experienced significant flooding damages over a number of years. The combination of dense development and significant, recurring flood events has resulted in economic justification of local protection projects to protect those areas.

In addition, the accumulation of significant and recurring flood damages at numerous communities within larger basins and watersheds have generated sufficient flood damage benefits to justify flood control reservoirs such as Bluestone Lake, Summersville Lake, Sutton Lake, Burnsville Lake, Tygart Lake, R.D. Bailey Lake and others in the State. Many smaller communities located within those basins and watersheds enjoy the reduction in flood damages and other benefits generated by those multi-purpose reservoirs.

Unfortunately, there are a number of small municipalities and unincorporated communities within the State that are not located downstream of those flood protection projects. These small communities do not have the concentrations of damageable property that generate sufficient flood damage benefits to justify flood protection projects of a size and scope that are effective or reliable.

Therefore, under current flood-protection justification methods and regulations, these communities must continue to endure repeated flood damages and loss of life. Procedural requirements that demand incremental economic justification of individual project components many times denies flood protection for communities through proven nonstructural measures. Other than floodplain buyout programs offered through the Hazard Mitigation Grant Program of FEMA for repetitive loss structures with flood

insurance, there are few options currently available to floodplain landowners in those communities.

Possible solutions to the technical difficulties in justifying the economic feasibility of these projects may include legislative actions negating the need for economic justification such as were obtained in the Section 202 and 581 authorities in the Tug Fork and Cheat River basins. Although legislative waivers of the benefit cost ratio economic evaluation are possible, such waivers are a rare occurrence and are frowned upon by the Executive Branch of the Federal Government and the Office of Management and Budget (OMB). Use of such economic waivers limits the ability of Federal agencies to budget funds for these projects through the normal annual project budgeting process.

Other solutions to this problem may include modification of the methodologies and procedures used in economic evaluation of Federal flood control projects. Consideration of additional benefit categories that capture improvements in social and economic factors within communities and environmental restoration enhancements could increase benefits attributable to project development and operation. Many of these secondary benefits considered external to the project and therefore not currently eligible, should be investigated for inclusion in the benefit estimation procedures.

Also, the economic evaluation of proposed flood protection projects for municipal areas located within economically depressed counties should be evaluated with consideration for the devastating economic affects that deterioration of that municipal center through flood damages has on the entire county. In West Virginia, many municipal centers function as the center of retail, wholesale, office and manufacturing commercial activities as well as the focus of financial, social, public and security services for much of the county population. Assuming that dispersal of these municipal activities and functions through market forces (reacting to flooding damages) is a normal or good result, denies the known benefits of the economic forces that originally created and shaped the municipal center.

C. Non-Federal Sponsorship: Another major impediment to implementing flood damage reduction projects and programs is the lack of adequate non-Federal sponsorship. The financial condition of many municipal and county governments in the State is marginal at best and is inextricably tied to one or two major industries in the local or regional area. As the financial condition of those industries rise and fall, the economic fortunes of the community fluctuate in lock step. These economic cycles and uncertainties limit the ability of many communities and counties to assume the capital costs or operations and maintenance (O&M) costs of certain flood protection projects. These financial limitations are most critical in situations where structural protection measures are being considered for small municipal areas.

Structural flood control projects such as dams, floodwalls, levees, channel modifications can require non-Federal capital expenditures in excess of $1 million dollars. Annual operations and maintenance (O&M) costs for these projects can exceed $50 thousand

dollars. Few counties or municipalities within the State can support these capital construction and O&M costs.

In accordance with Section 103 of the Water Resources Development Act of 1986, all flood damage reduction projects must be financially supported by a qualified non-Federal sponsor. After the passage of this Act, all non-Federal sponsors were required to financially contribute to the planning, design and construction of these projects. The costs of operation and maintenance of flood control projects constructed after the 1986 Act became the entire responsibility of the non-Federal sponsor. Tied to this financial responsibility was the requirement for the non-Federal sponsor to acquire all lands, easements, rights-of-way, and disposal areas as well as performing all relocations (utilities, roads, railroads, etc.) for the project. Although the non-Federal sponsor receives credit for such acquisitions in the total project cost, these requirements are administratively overwhelming for many small communities in the State.

In many instances, incorporated communities in the State do not have the fiscal capability to assume the cost sharing responsibilities for an effective flood damage reduction project. Likewise, many counties and the endangered unincorporated communities within them do not have sufficient fiscal resources to support an effective project either. Many formulated flood protection projects that were found effective in reducing flood damages and were determined to be economically justifiable have not been constructed because of the lack of non- Federal sponsorship. Without a qualified and financially capable sponsor, effective, economically efficient and environmentally sound projects cannot be implemented under the requirements in Section 103 of WRDA 86. Unfortunately, the costs associated with flood damages and flood protection projects continue to rise annually while the financial ability of many communities in the State to act as sponsors of those projects continues to decline. These diverging trends do not bode well for the safety and economic stability of floodplain landowners in the State under current Federal regulations and project implementation laws.

There are potential solutions to the lack of non-Federal sponsorship: a situation that has plagued several feasible flood damage reduction projects in the State. First, full use of the ability-to-pay analysis available through Section 103 (m) of WRDA 86 should be applied to all projects proposed in the State. This analysis evaluates the financial capability of the local and State government to act as capable sponsors. Using economic indices based upon income statistics of the county and state populations, the analysis determines whether the standard cost sharing rate for the non-Federal sponsor can be reduced. The lowest cost-sharing rate allowable through this analysis is five percent. Many areas within the State could qualify for a reduction in the cost sharing rate.

Second, considering the adverse affects that repeated flooding of residential and commercial property in counties and municipalities has on revenues available to the State, it may be in the best interests of the State to act as a non-Federal sponsor on behalf of municipal and county governments in flood damage reduction projects. Recently, the State (through the WV Conservation Agency) has indicated its willingness to serve as the non-Federal sponsor (financially) for flood damage reduction projects in Logan and

Cabell counties. This trend of State sponsorship provides a model for future flood damage reduction projects.

Third, non-Federal financial sponsorship for flood protection projects can be secured through local mechanisms such as the Community Improvement Assessment District (CIAD) authority provided by the State legislature. This mechanism allows counties or municipal governments to designate special assessment districts for development of infrastructure or flood protection works. Under this authority, individual properties that benefit from a particular development can be assessed a portion of the development cost through the existing real property tax system. Portions of the Section 202 nonstructural flood protection project in the Tug Fork Valley have been financed through a local CIAD.

Fourth, generally speaking, Federal funds cannot be used by a non-Federal sponsor to match other Federal funds for project construction. However, if Federal program or project funds are specifically appropriated with accompanying bill language stating that the funds are to be used as a non-Federal match for a Federal project, then those funds are eligible as a non-Federal financial funding source. This method is used sparingly due to the difficulty in securing such funding authority in Congress.

D. Environmental Impacts: The third impediment to flood protection presents a constraint to the variety of measures that can be realistically considered in formulating protection plans in the State. The same beautiful scenery of the State that draws the tourist and developer to invest within the State has become a detriment to implementation of certain measures. Proven protection measures such as reservoirs, channel modifications, and diversions have been limited in their application within the State in an effort to protect the existing quality of the State's aquatic and terrestrial ecosystems. Most of the existing flood control dams in the State were authorized and constructed prior to the Environmental Protection Agency's deployment of the National Environmental Policy Act of 1970 (NEPA) regulations. Many of the dams in the State represent not only flood protection but also reliable water supply resources for residential, commercial and industrial users and recreation opportunities.

The philosophical struggle between structural flood protection works and environmental protection was initiated by enactment of NEPA. Although irrevocable damages to the environment, especially water resources, were a growing concern before the advent of NEPA, the formal documentation and disclosure of those damages in a public forum significantly curtailed development of structural measures such as dams. National environmental groups dedicated to the protection of natural resources in the nation assumed the responsibility for protesting construction of certain structural measures in the State.

The environmental impacts of reservoir and channel modification construction and operation on aquatic and terrestrial ecosystems have been well documented through the NEPA procedures. Despite the effectiveness of structural measures in reducing flood damages, many times the scope and severity of anticipated environmental impacts are

perceived to outweigh the expected damage reduction benefits. Flood protection measures have not been implemented in several areas of the State due to concerns of anticipated environmental damages caused by structural measures.

When other, less economically efficient measures cannot be justified, those municipal areas remain subject to flood damages. Alternatives such as nonstructural floodproofing and floodplain evacuations are less effective in reducing some categories of flood damages (infrastructure and transportation uses) and are difficult to justify economically. Without groundbreaking legislative action by State Congressional leadership, nonstructural initiatives such as the Section 202 and 581 projects would not have been possible. Those areas of the State would remain subject to recurring flood damages with little hope of protection if legislative action had not been taken.

The protection of environmental ecosystems in the State is a goal that should be shared by all citizens and Federal and State agencies responsible for formulating and implementing flood protection projects. NEPA demands investigation, documentation and full disclosure of anticipated environmental impacts of flood control measures. That same rigorous analysis needs to be applied to the evaluation and disclosure of the social, financial and moral impacts on the State's population and economy due to recurring floods.

National environmental groups are frequently energized to protest, on all political levels, the construction of certain flood protection measures, but no activist group or organization lobbies against the gradual decline of communities and families due to flooding. Inability to protect municipalities and other centers of commercial activity in-place that are subjected to frequent floods will assure their eventual dissolution. Small municipalities such as Kimball and Keystone in McDowell County were nearly dissolved as much of the revenue producing property in the incorporated areas was destroyed in 2001 and 2002 flooding. Many other small communities in the State face similar realities of annual flood damages and limited protection options. County populations that rely heavily on flood-prone municipal centers for everyday life are likewise placed in jeopardy.

4. Potential Flood Damage Reduction Measures.

A. Structural measures: Flood damage reduction alternatives can be divided into two categories: structural and nonstructural. Structural measures include reservoirs, floodwalls, levees, channel modifications, and stream diversions. All of these measures are constructed to control the movement or course of the water in streams and rivers and their adjacent floodplains. There are numerous examples of structural measures throughout the State (see Table of Existing Projects).

B. Nonstructural measures: Nonstructural measures alleviate flood losses by modifying the susceptibility of land, people, and property to flood damage or by modifying the impact of flooding. Nonstructural measures include, but are not limited to flood warnings, floodproofing (wet or dry), permanent floodplain evacuation, floodplain

zoning, building codes, relocations, and ring walls or earthen dikes around individual properties. Nonstructural measures can also be used to acquire, perpetuate, restore, and enhance the natural capability of floodplains to retain excessive floodwaters, improve water quality, sustain stream flows, and provide fish and wildlife habitat. Several examples of nonstructural measures have been implemented within the State (see Table of Existing Projects).

C. Reservoirs: The State's watersheds are largely uncontrolled by upstream storage. Mainstem and tributary reservoirs are able to reduce peak flows from excess runoff in watersheds. The drainage from 3,478,854 acres out of the total 15.5 million acres within the State is controlled by these storage facilities. The remaining acres generate excess rainfall runoff that can impact downstream development. (See Table of Existing Dams and Locks and Dams).

Of the 32 major watersheds in the State, 23 have no mainstem reservoirs. Appendix L in Section 4 lists the existing reservoirs. These projects are successful in reducing damages, but their benefits only affect those structures located downstream of the dam. Mainstem reservoirs like Sutton Lake in Braxton and Webster counties, Jennings Randolph Lake in Mineral County and Tygart Lake in Taylor and Barbour counties provide a significant level of protection for structures in the floodplains immediately downstream of the dam, but that level of protection quickly deteriorates with the incidence of each uncontrolled intersecting tributary downstream of the dam. Two good examples of this phenomenon are the Bluestone and Burnsville Lake projects.

The Bluestone Lake flood control reservoir on the New River in Summers County (see Figure L-4) provides substantial flood control benefits for the communities located downstream of the dam along the New and Kanawha rivers (including Charleston. This reservoir provides flood control of the drainage from 4,565 square miles of watershed in West Virginia, Virginia and North Carolina. However, the uncontrolled Greenbrier River watershed (1,644 sq. mi.) that intersects the New River one mile downstream of Bluestone Dam can generate substantial flood damages in those same communities that are otherwise protected by Bluestone Dam.

Similarly, the Burnsville lake project in Braxton County provides substantial flood control benefits to communities within the Little Kanawha River Basin. However, an intense thunderstorm over the Sand Fork watershed located just eight river miles downstream of Burnsville caused significant flood damages to the City of Glenville in 1990. Generally speaking, reservoirs are an effective measure in reducing flood damages where their storage capacity can protect extensive floodplain development downstream and where the number of major tributaries between the dam and downstream damage centers is few.

Figure L-4. Bluestone Dam and Lake, Hinton, WV

In addition to flood control, some of these reservoir projects are operated for other purposes including water supply, low-flow augmentation, hydroelectric power generation, recreation and fish and wildlife habitat. Reliable water supplies represent one of the significant byproducts of reservoir storage in watersheds. Combining reservoirs constructed by the NRCS and the Corps of Engineers, a total of 14 reservoirs currently provide municipal and industrial water supplies for communities within the State.

In 1999, several West Virginia counties in the Potomac River basin suffered extreme drought conditions. Extreme drought conditions have also affected Mason, Ritchie, Greenbrier, Morgan, Randolph, Tucker, and Webster counties in the past 3 years. Drought conditions in the current year (2002) for 18 of the 55 counties are worse than experienced in 1999. The construction of additional flood storage reservoirs in watersheds where severe drought conditions are prevalent could address municipal and industrial water needs in those regions of the State.

D. Local Protection Projects (LLP): Local flood protection projects such as floodwalls, levees, river diversions, and channel modifications are an effective means of reducing flood damages. Floodwall and levee projects can protect concentrated residential, commercial, institutional and industrial centers from floodwaters. Several communities within the State derive their flood protection from these structural projects. The level of protection can be adjusted to meet or exceed the NFIP requirements for reductions in flood insurance costs for the protected community.

However, these projects do have some drawbacks. Construction and operation of the floodwalls and levees can require acquisition of valuable urban real estate within municipal areas. Drainage of interior stormwater within the protected community can require expensive (capital and O&M costs) pumping stations and ponding areas. In some cases, the floodwall and levee heights required to protect the community physically and visually divide and isolate neighborhoods within the community. Normally an assessment district is created within the community to fund the annual operation and maintenance costs of the floodwall or levee structure. There are numerous examples of local protection projects in the State including floodwall and levee structures at Huntington, Parkersburg, Point Pleasant, Williamson, Matewan, Moorefield, and Ceredo/Kenova, WV. Figure L-5 shows an example of the structural floodwall method of protection. Figure L-6 shows the flood protection levee project in Moorefield, WV.

Channel modification projects also can reduce flood damages for communities where concentrations of residential, commercial, institutional and industrial development can provide sufficient benefits to justify the project. The hydraulic efficiency of a stream or river can be improved substantially by reconfiguring the cross-section area and sinuosity (meandering) of the channel. Removing meanders and widening and/or deepening the channel through carefully designed excavation can provide significant improvements in the waterway's ability to handle highflow events without over bank flooding. Significant reductions in the 100-year frequency flood event can be attained through channel modifications. Unfortunately, channel modification projects can have two major drawbacks.

Figure L-5. Floodwall protection structure

Figure No. 6 Levee project at Moorefield, WV

First, most floodplain areas in the State include transportation routes (roadway and railway), utilities (sewer, water, gas, electric power, etc.) and buildings of all sizes and uses. All of these uses closely border the stream and therefore must be relocated or removed to modify the shape and direction of the stream channel. Many times, the very improvements needing flood protection must be relocated from the floodplain to construct the channel. This process dramatically reduces the economic benefits required to justify the project. The high costs of relocating railways, highways and utilities that share the floodplain with the stream further exacerbate the difficulties in economic justification of channel modification projects.

Second, in many cases, modification of a stream channel for flood control purposes requires total or partial destruction of the riparian ecosystem along one or both sides of the stream channel. In some cases, channel modifications also require excavation of the streambed as well. This excavation process can result in total or partial loss of the aquatic community in the stream and the associated riparian community as well. Recovery of these fragile ecosystems can take years without guarantee of success.

There are channel modification projects in Beckley, Montcalm, Bramwell, Elkins, Buckhannon, Spencer, Princeton, Griffithsville, Bayard, Blaine, Ridgely and Rainelle. Figure L-7 shows the channel modification project on Little Whitestick Creek in Raleigh County. This project prevented significant damages during the July 2001 flood event in that area. Together, local protection projects (floodwalls, levees, and channel modifications) can be effective in reducing flood damages, but their benefits are confined to a single facility or community while adjacent floodplain communities or individual structures remain susceptible to damages. For municipal centers such as county seats and major commercial developments that provide employment, banking, education and public

and social services to the county, local protection projects can be an effective measure for reducing damages. See Appendix H for more information on channel modification.

Figure L-7. Little Whitestick Creek channel modification project

E. Nonstructural protection measures: Nonstructural measures are generally applied to the structures, land or facilities being affected by flooding. The adjoining waterway is generally unaffected by the applied measures. These measures include floodproofing (wet or dry), permanent evacuation of the damageable structures or facilities, zoning of the floodplain land, institution of restrictive building codes, construction of ring walls or ring levees, and flood warning systems.

Floodproofing can be accomplished by raising structures (primarily residential structures) in-place on new extended foundations or by attaching veneer walls and/or applying waterproof coatings onto existing structure walls. Each of these methods prevents floodwaters from entering damageable portions of the structure. Floodwaters are allowed to occupy the lower portions of raised structures where floodwater resistant materials dominate the construction and where enclosed floodwaters offset the dynamic pressures

of moving floodwaters on the raised foundation walls. Figure L-8 shows an example of floodproofing by raising structures on extended foundations.

Figure L-8. Homes floodproofed on raised foundations

Structures with more substantial exterior wall construction can be protected by application of waterproof coatings or construction of veneer walls that prevent water penetration into the protected areas. Generally, buildings with masonry foundations (particularly commercial buildings) can be protected by these "dry" floodproofing methods. Other floodproofing methods permit floodwaters to enter the structure while flood damageable contents are raised above the flood elevation within the structure itself. All of these methods can significantly reduce flood damages when a reliable and credible flood warning system can provide sufficient warning to relocate damageable contents.

Permanent floodplain evacuations are an effective method of reducing flood damages. This method can occur through acquisition and demolition of floodplain structures or through actual physical relocation of structures from the floodplain to a flood-safe site Figure L-9 shows removal of a residential structure from the floodway. Most floodplain acquisition programs are voluntary in nature and result in clearing of the floodplain property and reduction of vacant market housing or construction of new housing in the region. Federal, State and local government structures can be relocated to flood-safe locations under these programs. Acquisition and removal of residential, commercial, institutional and industrial structures and associated facilities from the floodplain accomplishes several flood damage reduction objectives.

Figure L-9. Residential structure being relocated from floodway.

First, permanent removal of structures from the floodplain ends the potential for future damages to those structures. Second, evacuation of structures from the floodway effectively removes obstructions within this hydraulically sensitive area thus reducing the surface elevation of the Base Flood Elevation (100- year frequency flood). In affect, permanent evacuation of the floodway results in decreased flooding potential for all structures located in the adjoining flood fringe. Reducing the flood surface elevation in turn decreases costs of floodproofing structures in the flood fringe and reduces flood insurance costs for non-participating structures. Third, removing structures from the floodway reduces the potential for storage of floatable materials on that property that could add to debris dams at stream crossings. Fourth, removal of floodway structures decreases the potential sources of point and non-point water pollution. Floodplain evacuations also realize an opportunity to upgrade housing resources within the State by construction of new relocation housing in flood-safe locations.

Two relocation communities (Valley View and Mate Creek) were developed during the Section 202 nonstructural project resulting in construction of 78 new homes in that watershed. Once the structure is removed, the evacuated floodplain land can be used for floodplain compatible uses such as recreation, gardening, farming, silviculture, and wildlife habitat. In the Tug Fork Valley Section 202 nonstructural project, evacuated floodway lands were used as replacement wildlife mitigation for riparian lands lost in adjoining floodwall construction in municipal areas. This mitigation technique saved millions of dollars in project costs and increased the supply of high-quality, protected riparian habitat in the stream corridor.

The application and enforcement of zoning restrictions and special building codes to floodplain property can be effective in reducing future damages for new construction and reconstruction/rehabilitation of damaged structures. These measures in and of themselves

do not reduce the incidence of flood damages on existing structures, but they do reduce the possibility of total structure loss that was prevalent in the July 2001 floods in McDowell and Wyoming counties.

5. Proposed Strategy to Reduce Flood Damages of Pre-FIRM Structures.
A. Strategic Plan: A strategic plan does not target specific geographic locations such as named towns, cities or counties for flood protection as has been the premise for previous tactical flood protection initiatives. Being strategic in nature, the plan and its specific components addresses the flooding problems confronting the State and provides broad solutions aimed directly at the problems (not the location of the problems) themselves. The strategic plan components are dedicated to reducing losses of life and flood damages occurring in specific flood zones that are common among all watersheds and political subdivisions within the State. Recommending specific flood protection proposals for communities without full NEPA disclosure of the anticipated environmental impacts is prohibited by Federal Law. Such analysis of environmental impacts would be addressed in subsequent decision documents and action plans.

Considering the large number of structures within the floodplain (approximately 114,000) and floodway (approximately 11,000) zones in the State, any program formulated to effectively reduce damages will require a substantial investment of capital construction funds, years of implementation time (patience), sustained commitment by national, State and local political interests to the Plan, Federal, State and local staff resources, and ongoing cooperation between implementing agencies. The following proposals are based upon a sustained, multi-year effort to reduce flood damages across the State.

B. Strategic Plan Components: The proposed plan components listed below are formulated to address specific flooding and water resources problems experienced by the existing inventory of at-risk structures and the many communities located with the State's watersheds. Each of the 32 major watersheds contains specific floodplain zones (floodway and flood fringe) that are addressed by the plan components. The components are effective in each watershed because they address common problems of flooding in each location. The progression of these components assumes that the proposed statewide flood warning system (see Appendix B) would be implemented as a necessary initial component of the strategic plan providing an increment of protection against loss of life and movable property while these components are being developed.

The Task Force recommends that West Virginia implement the following components of a strategic flood damage reduction plan:

(1) Through a collaborative effort, the USACE and NRCS work jointly with the WVCA to assess the major watersheds. The purpose of this assessment would be to determine whether there are any opportunities to construct additional upstream flood storage & retention facilities in the watersheds that would attenuate flooding, reduce downstream damages, potentially provide a reliable source of potable water for communities within the region and provide improvements in downstream water quality and flow. Several of

the watersheds shown on the map have existing storage facilities operating for flood control, low- flow augmentation and water supply. Previous studies conducted for several of the watersheds by various Federal and State agencies would form the basis for these studies.

This assessment could be funded in part through the USACE Section 22 Planning Assistance to States program for State/regional flood protection studies. Full consideration of the anticipated environmental effects of these potential storage facilities would be coordinated with the WVDNR, WVDEP and USFWS during the assessment.

Those potential storage projects generating substantial flood protection benefits would be proposed for more detailed study through existing or new Congressional authorities. More detailed feasibility evaluations would be initiated only after firm commitments from eligible and financially capable non-Federal sponsors.

(2) Through a collaborative effort of the USACE, NRCS and WVCA, watershed specific assessments should be conducted to determine whether existing municipalities and major unincorporated commercial/industrial centers within the State need to be protected in place to preserve the commercial, service and employment base that now supports the surrounding county population. These protected centers also can serve as relocation sites for commercial and residential development acquired from the floodway. Existing data from previous protection studies for these communities can form the basis for this assessment. The recommendations of these watershed assessments would form the basis for funding requests to pursue specific protection projects at critical municipal centers.

The watershed assessments may be conducted through programs such as the Section 22 PAS and P.L. 83-566 Watershed Protection and Flood Prevention Act. Full consideration of the environmental effects of these potential structures would be coordinated with the WVDNR, WVDEP and USFWS during the assessment.

(3) A voluntary program of permanent acquisition should be developed to address the inventory of existing structures in the regulatory floodway. These structures and their associated facilities are subject to frequent and severe flooding and impact damages by floating debris. During flood events, these structures can become floatable debris blocking stream crossings and battering other downstream floodplain development. These structures can also serve as point-sources of stream pollution. The floodway acquisition program would be initiated in the non-municipal areas to avoid interference with possible structural protection of incorporated cities, towns, villages and communities and commercial centers discussed in (2) above. The program would be voluntary in nature and relocation benefits and services would be provided to assist families to secure flood-safe replacement housing. Feasible commercial and industrial relocations would be assisted through Federal and State economic development grant and loan programs. Federal, State and local government offices and facilities would be relocated to flood-safe sites.

The Section 202 Nonstructural flood Damage Reduction program, being implemented in the Tug Fork Valley since 1985, has acquired several hundred floodway structures in West Virginia and Kentucky. This action has resulted in an overall reduction in flood damages and a reduction in the 100-year frequency flood profile in project areas. In conjunction with this program, three replacement housing sites were constructed to accommodate relocated families. In some cases, commercial structures acquired in the floodway relocated within communities protected by local protection projects (floodwalls). WVOES projects administered through FEMA's Hazard Mitigation Grant Program have also successfully acquired floodway structures throughout the State.

The proposed floodway acquisition program could be best administered through FEMA (Pre-Disaster Mitigation Program) in cooperation with WVOES. The WVHDF and WVDO could support this effort through identification and funding of replacement housing and commercial relocation sites. The success of the floodway acquisition program would be partially contingent upon the ability to secure decent, safe and sanitary replacement housing outside of the floodplain. Equally important would be a site development process for commercial relocations from the floodplain.

(4) A voluntary program of nonstructural protection should be developed for structures located in the flood fringe areas of the State that cannot be protected by structural floodwalls, upstream retention, or channel modifications. Nonstructural protection would include floodproofing, replacement on-site or permanent acquisition depending upon the height of flooding at the structure, the structure type and building condition and comparative option costs. The Section 202 Nonstructural flood Damage Reduction program being implemented in the Tug Fork Valley since 1985 has floodproofed several hundred flood- fringe structures in West Virginia and Kentucky. This action has resulted in an overall reduction in flood damages and an improvement in housing quality throughout the basin. The proposed program would not be initiated until the assessments in (1) and (2) above are completed and the floodway acquisition program has been initiated in a watershed. This nonstructural program would be best administered through the USACE, NRCS, WVCA and WVOES.

C. Plan Costs: The costs associated with this multi-component program can be divided into the four basic project/program phases of development: 1) preparation of planning/decision documents and NEPA compliance, 2) design or engineering of proposed features if needed, 3) construction of approved projects or implementation of program elements, and 4) O&M by non-Federal sponsors of completed projects or programs. Depending upon which of many existing Federal programs are used to implement the proposed strategy, the funding needs for planning/NEPA compliance, design/engineering and construction will differ. Likewise, the cost sharing responsibilities between the Federal and non-Federal sponsor will fluctuate depending upon the program applied. Table L-5 shows the range of costs associated with these four categories for the four strategic components. These approximate costs would be applied to each of the major watersheds in the State according to the number of at-risk structures and municipal centers that are located within the watersheds.

At any one time, several of these phases could be underway for various regions within the State. Annual funding requirements would fluctuate depending upon the number of active regional projects and their phases of development.

Table L-5. Projected Plan Costs*

Strategic Component	Component Phase	Planning	Design/ Engineering	Construction/ Implementation	Annual O&M
Watershed Storage Assessment (Dams and Reservoirs)		$500K	$5.0M	$50-$100M per project	$10K-$100K
Municipal Protection Assessment (Floodwalls, Levees & Channel Modifications)		$250K	$2.0M	$40-$80M per project	$40K-80K
Floodway Property Acquisition		$100K	$500K	$50K-$100K per structure	$2K-5K
Flood Fringe Nonstructural protection (Flood proofing & acquisitions)		$250K	$750K	$50K-$100K per structure	$5K-10K

* Costs are approximated based upon costs experienced in past projects and programs. Many other components of the comprehensive strategy to reduce flood damages will have limited capital and O&M costs. Proposed regulations, legislative changes, and training and education will have relatively minimal costs compared to those displayed above. These administrative and legislative Plan components can proceed independently of the Components suggested above.

D. Plan Administration: Given the immense scope of this undertaking and the level of sustained commitment needed by many agencies and organizations involved in this program, it is recommended that the existing Task Force be retained in a more formal organization to assure coordination of the many interrelated components of this program. Coordination of the strategic program among the Task Force members could be maintained through quarterly meetings. Members of Task Force working groups may be team leaders (within their respective agencies) on projects and programs proposed in this Plan. An ongoing Task Force presence in the process would assure close coordination of the program components among the implementing agencies.

E. Plan Implementation Schedule: Through the development of the Statewide Plan, the Task Force members determined that a watershed approach to analysis of the problems, formulation of plans and plan implementation would be most appropriate for this scope of undertaking. The watershed approach to plan implementation would allow many existing Federal and State programs for flood damage reduction to be easily applied to the State. Additionally, many associated water resources development issues such as water supply, water quality improvements, stream restoration, and infrastructure can be best applied at the watershed level.

Of these watersheds, several already contain some form of flood storage through one or a series of reservoirs. The remaining uncontrolled watersheds would be assessed for potential storage facilities. Several of these watershed studies can be accomplished concurrently, if sufficient funding can be secured. Individual watershed storage studies could be completed within 12 months with the most economical projects moving forward into detailed planning, design and NEPA compliance procedures.

A total of seventeen municipalities are currently protected by local protection projects. The remaining unprotected municipal centers would be assessed for local protection projects with economically justifiable projects proceeding into design and construction. Individual municipal center protection studies could be completed within 12 months with several studies proceeding concurrently. Those projects supported by a non-Federal sponsor with economic justification could proceed into detailed planning, design and NEPA compliance procedures.

Nonstructural planning to support floodway acquisitions and flood fringe floodproofing and acquisitions can be accomplished at the watershed level. Depending upon the size of the watershed and the numbers of structures in the watershed, nonstructural studies to support implementation of these activities can be completed in 12-18 months. Implementation of nonstructural projects can be accomplished at various production levels. Since floodway acquisition and floodproofing implementation occurs on a per structure basis, a nonstructural program can proceed at whatever level of funding is provided. However, eventual completion of a nonstructural project is dependent upon sustained funding and dedication of agency resources. The existing Tug Fork nonstructural project has been progressing since 1985 with many floodway structures acquired and significant numbers of structures floodproofed during that 17-year timeframe.

FLOOD CONTROL PROJECTS IN WEST VIRGINIA		
AGENCY		
	PROJECT	**COMMENTS**
WEST VIRGINIA CONSERVATION AGENCY		
	Salem Fork	Harrison County. Partnered with USDA-NRCS. 10,500 linear feet of channel modification completed. Includes 7 dams.
	Warm Springs Run	Includes 8 dams.
	New Creek – Whites Run	Includes 9 dams
	South Fork	Pendleton County. Partnered with USDA-NRCS. 6,050 linear feet of channel modification completed. Includes 23 dams
	Patterson Creek	Grant and Mineral Counties. Partnered with USDA-NRCS. 2,110 linear feet of channel modification remaining to be built. Includes 23 dams
	Lunice Creek	Grant County. Partnered with USDA-NRCS. 4,600 linear feet of channel modification completed. Includes 3 dams
	Upper Buffalo Creek	Marion County. Partnered with USDA-NRCS. 6,760 linear feet of channel modification under construction. Includes 7 dams

	Upper Grave Creek	Marshall County and Pennsylvania. Partnered with USDA-NRCS. 19,000 linear feet of channel modification completed. Includes 7 dams
	Daves Fork-Christians Fork	Mercer County. Partnered with USDA-NRCS. 6,600 linear feet of channel modification completed. Includes 3 dams
	Saltlick Creek	Includes 5 dams
	Marlin Run	Includes 1 dams
	Bond's Creek	Ritchie County. Partnered with USDA-NRCS. 30,300 linear feet of channel modification completed. Includes 1 dams
	Brush Creek	Mercer County. Partnered with USDA-NRCS. 30,300 linear feet of channel modification completed. Includes 10 dams
	Polk Creek	Lewis County. Partnered with USDA-NRCS. 6,860 linear feet of channel modification completed. Includes 8 dams
	Harmon Creek	Includes 6 dams
	Wheeling Creek	Includes 5 dams
	Upper Deckers Creek	Preston County. Partnered with USDA-NRCS. 35,300 linear feet of channel modification completed. Includes 7 dams
	Pecks Run	Upshur County. Partnered with USDA-NRCS. 27,000 linear feet of channel modification completed.
	Blakes Creek – Armour Creek	Includes 1 dam.
	Big Ditch Run	Webster County. Partnered with USDA-NRCS. 19,300 linear feet of channel modification completed. Includes 1 dams
	Elk Twomile Creek	Includes 2 dams
	Shooks Run	Barbour County. Partnered with USDA-NRCS. 3,800 linear feet of channel modification completed.
	Pond Run	Wood County. Partnered with USDA-NRCS. 15,450 linear feet of channel modification completed. Includes 1 dam.
	Mill Creek	Includes 5 dams.
	South Branch	Includes 5 dams that have not been built.
	Lost River	Includes 2 dams under construction and 3 dams that have not been built.
	Pocatalico River	Includes 2 dams.

	Soak Creek of Piney Creek	Raleigh County. Partnered with USDA-NRCS. 14,300 linear feet of channel modification completed.
	Little Whitestick-Cranberry of Piney Creek	Raleigh County, Partnered with USDA-NRCS. 11,170 linear feet of channel modification under construction, 8,080 linear feet remaining to be built.
	North and South Mill Creek	Includes 4 dams and 2 dams that have not been built.
	Upper Mud River	Includes 1 dam.
	Howard Creek	Greenbrier County, Partnered with USDA-NRCS. 2,940 linear feet of channel modification under construction. Includes 1 dam.
	Middle Grave Creek	Marshall County. Partnered with USDA-NRCS. 4,820 linear feet of channel modification completed.
	North Fork of Hughes River	Includes 1 dam.
	Tributary of Evitts Run	Jefferson County. Partnered with USDA-NRCS. 1,900 linear feet of channel modification completed.
FEDERAL EMERGENCY MANAGEMENT AGENCY		
	Cabell, Wyoming, Raleigh, McDowell, Putnam County-wide Map Conversion and Studies.	Fully funded and underway.
	Jackson County Map Conversion and Study.	Released in January 2003.
	Mercer County, Oceana, Smithers, Reedy and White Sulphur Springs Map Conversion and Studies.	Released in 2002.
	Tug Fork River - Revised Hydrographic and Hydrologic Study	McDowell County. Revise data.
	Elkhorn Creek- Revised Hydrographic and Hydrologic Study	McDowell County. Revise data.
	Guyandotte - Revised Hydrographic and Hydrologic Study	Wyoming County. Revise data.
	Clear Fork – Oceana - Revised Hydrographic and Hydrologic Study	Wyoming County. Community suspended (Oceana was reinstated after the 2001 flood event.) Revise data.
US ARMY CORPS OF ENGINEERS		

	Elkins LPP	Channel Cutoff and Levees on Tygart Valley River
	Buckhannon LPP	Channel modification and cutoff on Buckhannon River
	Rainelle LPP	Channel Modification
	Spencer LPP	Channel Modification
	Milton LPP	Feasibility Study completed, sign PCA – Floodwall and Levee
	Griffithville / Yawkey LPP	Channel Modification
	Marlinton LPP	Feasibility Study completed, sign PCA – Floodwall and Levee
	Pocatalico River Basin Study	Basin Study completed – no economically justified projects
	Point Pleasant LPP	Combination Floodwall and Levee
	Ceredo/Kenova LPP	Combination Floodwall and Levee
	Huntington LPP	Combination Floodwall and Levee
	Parkersburg LPP	Combination Floodwall and Levee
	McDowell County Nonstructural Project	Floodproofing and permanent floodplain relocations
	Hatfield Bottom Nonstructural Project	Ringwall at High School and Floodproofing and permanent floodplain relocations
	Matewan LPP	Floodwall and Fill (Mate Creek Housing Site)
	Matewan Nonstructural Project	Floodproofing and permanent floodplain relocations
	Mingo County Nonstructural Project	Floodproofing and permanent floodplain relocations
	West Williamson LPP	Concrete Floodwall
	Williamson Central Business District LPP	Combination Floodwall and Cell / Levee
	Williamson Nonstructural Project	Floodproofing and permanent floodplain relocations
	Wayne County Nonstructural Project	Floodproofing and permanent floodplain relocations
	Island Creek LPP	Feasibility study complete, sign PCA - Channel modification
	Mullens LPP	Inactive feasibility study - no local sponsor
	Oceana LPP	Inactive feasibility study – no local sponsor
	Princeton LPP	Feasibility study underway
USDA - FARM SERVICE AGENCY		
	Emergency Conservation Program	Disaster specific allocations used to restore farmlands.
USDA - NATURAL RESOURCES CONSERVATION SERVICE		
	Salem Fork	Harrison County. Partnered with WVCA. 10,500 linear feet of channel modification completed. Includes 7 dams.
	Warm Springs Run	Partnered with WVCA. Includes 8 dams.

	New Creek – Whites Run	Partnered with WVCA. Includes 9 dams
	South Fork	Pendleton County. Partnered with WVCA. 6,050 linear feet of channel modification completed. Includes 23 dams
	Patterson Creek	Grant and Mineral Counties. Partnered with WVCA. 2,110 linear feet of channel modification remaining to be built. Includes 23 dams
	Lunice Creek	Grant County. Partnered with WVCA. 4,600 linear feet of channel modification completed. Includes 3 dams
	Upper Buffalo Creek	Marion County. Partnered with WVCA. 6,760 linear feet of channel modification under construction. Includes 7 dams
	Upper Grave Creek	Marshall County and Pennsylvania. Partnered with WVCA. 19,000 linear feet of channel modification completed. Includes 7 dams
	Daves Fork-Christians Fork	Mercer County. Partnered with WVCA. 6,600 linear feet of channel modification completed. Includes 3 dams
	Saltlick Creek	Partnered with WVCA. Includes 5 dams
	Marlin Run	Partnered with WVCA. Includes 1 dams
	Bond's Creek	Ritchie County. Partnered with WVCA. 30,300 linear feet of channel modification completed. Includes 1 dams
	Brush Creek	Mercer County. Partnered with WVCA. 30,300 linear feet of channel modification completed. Includes 10 dams
	Polk Creek	Lewis County. Partnered with WVCA. 6,860 linear feet of channel modification completed. Includes 8 dams
	Harmon Creek	Partnered with WVCA. Includes 6 dams
	Wheeling Creek	Partnered with WVCA. Includes 5 dams
	Upper Deckers Creek	Preston County. Partnered with WVCA. 35,300 linear feet of channel modification completed. Includes 7 dams
	Pecks Run	Upshur County. Partnered with WVCA. 27,000 linear feet of channel modification completed.
	Blakes Creek – Armour Creek	Kanawha County. Partnered with WVCA. Includes 1 dam.
	Big Ditch Run	Webster County. Partnered with WVCA. 19,300 linear feet of channel modification completed. Includes 1 dams
	Elk Twomile Creek	Kanawha County. Partnered with WVCA. Includes 2 dams

	Shooks Run	Barbour County. Partnered with WVCA. 3,800 linear feet of channel modification completed.
	Pond Run	Wood County. Partnered with WVCA. 15,450 linear feet of channel modification completed. Includes 1 dam.
	Mill Creek	Partnered with WVCA. Includes 5 dams.
	South Branch	Partnered with WVCA. Includes 5 dams that have not been built.
	Lost River	Partnered with WVCA. Includes 2 dams under construction and 3 dams that have not been built.
	Pocatalico River	Partnered with WVCA. Includes 2 dams.
	Soak Creek of Piney Creek	Raleigh County. Partnered with WVCA. 14,300 linear feet of channel modification completed.
	Little Whitestick-Cranberry of Piney Creek	Raleigh County, Partnered with WVCA. 11,170 linear feet of channel modification under construction, 8,080 linear feet remaining to be built.
	North and South Mill Creek	Partnered with WVCA. Includes 4 dams and 2 dams that have not been built.
	Upper Mud River	Partnered with WVCA. Includes 1 dam.
	Howard Creek	Greenbrier County, Partnered with WVCA. 2,940 linear feet of channel modification under construction. Includes 1 dam.
	Middle Grave Creek	Marshall County. Partnered with WVCA. 4,820 linear feet of channel modification completed.
	North Fork of Hughes River	Ritchie County. Partnered with WVCA. Includes 1 dam.
	Tributary of Evitts Run	Jefferson County. Partnered with WVCA. 1,900 linear feet of channel modification completed.
	Upper Marsh Fork Preliminary Investigation Report	Raleigh County. 1962
	Raleigh County Floodplain Management Study	Raleigh County. 1982 and 1985
	Upper Bluestone River Preliminary Investigation Report	Mercer County. 1966
	Dunloup Creek Local Implementation Plan	Fayette County. 1998
	Arbuckle Creek Feasibility Report	Fayette County. 1986
	Meadow Creek Preliminary Investigation Report	Fayette County. 1976

	Oceana Preliminary Investigation Study	Wyoming County. 1965
	Rockcastle Creek Preliminary Investigation Study	Wyoming County. 1964
	Mullens Preliminary Investigation Study	Wyoming County. 1965
	Request for Watershed Plan under PL - 566	Wyoming County. 2001
	Water Resources Study for Water Supply	McDowell County. 1995
US FISH AND WILDLIFE SERVICE		
	Partners for Fish and Wildlife	Technical and financial assistance to private landowners for fish and wildlife habitat restoration.

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY			
	PROJECT NAME	**COUNTY**	**STREAM LOCATION**
USDA-NRCS AND WVCA DAMS			
	Saltlick Creek 4	Braxton	Berry Fork
	Saltlick Creek 6	**Braxton**	Pickles Fork
	Saltlick Creek 7	Braxton	Spruce Fork
	Saltlick Creek 8	Braxton	Hughes Fork
	Saltlick Creek 9	Braxton	Saltlick Creek
	Harmon Creek 1	Brooke	Sappingtons Run
	Harmon Creek 13	Brooke	Brown Hollow
	Harmon Creek 14	Brooke	Alexanders Run
	Harmon Creek 2	Brooke	Tributary of Harmon Cr
	Harmon Creek 3	Brooke	Tributary of Meckling Run
	Harmon Creek 4	Brooke	Meckling Run
	Lunice Creek 10	Grant	Saltblock Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Lunice Creek 11	Grant	Tributary of North Fork
	Lunice Creek 9	Grant	North Fork Lunice Creek
	New Creek 12	Grant	Tributary of New Creek
	New Creek 14	Grant	Linton Creek
	North And South Mill Creek 16	Grant	Gum Hollow Of North Mill Creek
	North And South Mill Creek 3	Grant	Rough Run
	North And South Mill Creek 4	Grant	Tributary of South Mill Creek
	North And South Mill Creek 7	Grant	South Mill Creek
	Patterson Creek 1	Grant	Tributary of Patterson Creek
	Patterson Creek 12	Grant	Lower Thorn Run
	Patterson Creek 13	Grant	Rosser Run
	Patterson Creek 2	Grant	Tributary of Patterson Creek
	Patterson Creek 3	Grant	Upper Thorn Run
	Patterson Creek 4	Grant	Middle Fork
	Patterson Creek 41	Grant	North Fork
	Patterson Creek 49	Grant	Tributary of Patterson Creek
	Patterson Creek 6	Grant	Elklick Run
	Howard Creek 12	Greenbrier	Dry Creek
	Lost River 27	Hardy	Upper Cove Run
	Lost River 4	Hardy	Kimsey Run
	South Fork 1	Hardy	Shooks Run
	South Fork 2	Hardy	Stump Run
	South Fork 4	Hardy	Rohrbaugh Run
	South Fork 5	Hardy	Radabaugh Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Salem Fork 11	Harrison	Tributary of Jacobs Run
	Salem Fork 11a	Harrison	Tributary of Jacobs Run
	Salem Fork 12	Harrison	Tributary of Jacobs Run
	Salem Fork 13	Harrison	Tributary of Salem Fork
	Salem Fork 14	Harrison	Dark Hollow Of Jacobs Run
	Salem Fork 15	Harrison	Jacobs Run
	Salem Fork 9	Harrison	Tributary of Patterson Fork
	Mill Creek 10	Jackson	Elk Fork
	Mill Creek 13	Jackson	Tug Fork
	Mill Creek 4	Jackson	Joes Run
	Mill Creek 5	Jackson	Big Run
	Mill Creek 8	Jackson	Left Fork Of Frozencamp Creek
	Mill Creek 9	Jackson	Right Fork Of Frozencamp Creek
	Pocatalico River 28	Jackson	Middle Fork
	Blakes Creek-Armour Creek 7	Kanawha	Blakes Creek
	Elk Twomile Creek 12	Kanawha	Tributary of Elk Twomile Creek
	Elk Twomile Creek 13	Kanawha	Tributary of Elk Twomile Creek
	Elk Twomile Creek 14	Kanawha	Hunter Run
	Polk Creek 1	Lewis	Tributary of Polk Creek
	Polk Creek 13	Lewis	Sassafras Run
	Polk Creek 4	Lewis	Tributary of Polk Creek
	Polk Creek 5	Lewis	Tributary of Polk Creek
	Polk Creek 6	Lewis	Tributary of Polk Creek
	Polk Creek 7	Lewis	Dry Fork

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Polk Creek 8	Lewis	Tributary of Polk Creek
	Polk Creek 9	Lewis	Keith Fork
	Upper Mud River 2-A	Lincoln	Tug Fork
	Upper Buffalo Creek 16	Marion	Hibbs Run
	Upper Buffalo Creek 2	Marion	Huey Run
	Upper Buffalo Creek 22	Marion	Big Run
	Upper Buffalo Creek 33-A	Marion	Flat Run
	Upper Buffalo Creek 37-A	Marion	Whetstone Run
	Upper Buffalo Creek 39	Marion	Llewellyn Run Of Flat Run
	Upper Buffalo Creek 4	Marion	Owen Davy Fork
	Upper Grave Creek 1	Marshall	Tributary of Grave Creek
	Upper Grave Creek 3	Marshall	Tributary of Grave Creek
	Upper Grave Creek 4	Marshall	Tributary of Grave Creek
	Upper Grave Creek 5	Marshall	Ramp Hollow
	Upper Grave Creek 7	Marshall	Tributary of Grave Creek
	Upper Grave Creek 8	Marshall	Tributary of Grave Creek
	Upper Grave Creek 9	Marshall	Tributary of Grave Creek
	Wheeling Creek 18	Marshall	Grandstaff Run
	Wheeling Creek 23	Marshall	Turkey Run
	Wheeling Creek 25	Marshall	Wolf Run
	Wheeling Creek 3	Marshall	Dunkard Fork
	Brush Creek 10	Mercer	Tributary of South Fork
	Brush Creek 12	Mercer	Glady Fork
	Brush Creek 14	Mercer	North Fork

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Brush Creek 15	Mercer	North Fork
	Brush Creek 19a	Mercer	Middle Fork
	Brush Creek 4	Mercer	Tributary of South Fork
	Brush Creek 5	Mercer	Tributary of South Fork
	Brush Creek 6	Mercer	Tributary of South Fork
	Brush Creek 7a	Mercer	Tributary of South Fork
	Brush Creek 9	Mercer	South Fork
	Daves Fork-Christian Fork 1	Mercer	Tributary of Daves Fork
	Daves Fork-Christian Fork 2	Mercer	Tributary of Daves Fork
	Daves Fork-Christian Fork 3	Mercer	Christian Fork
	New Creek 1	Mineral	Tributary of New Creek
	New Creek 10	Mineral	Ash Spring Run
	New Creek 16	Mineral	Thunder Run
	New Creek 17	Mineral	Ash Spring Run
	New Creek 5	Mineral	Tributary of New Creek
	New Creek 7	Mineral	Tributary of New Creek
	New Creek 9	Mineral	Mill Run
	Patterson Creek 14	Mineral	Harness Run
	Patterson Creek 15	Mineral	Mikes Run
	Patterson Creek 20	Mineral	Liller Run Of Mill Creek
	Patterson Creek 21	Mineral	Mill Run
	Patterson Creek 22	Mineral	Wild Meadow Run
	Patterson Creek 24	Mineral	Tributary of Patterson Creek
	Patterson Creek 25	Mineral	Johnson Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Patterson Creek 26	Mineral	Tributary of Patterson Creek
	Patterson Creek 27	Mineral	Tributary of Patterson Creek
	Patterson Creek 28	Mineral	Cabin Run
	Patterson Creek 30	Mineral	Tributary of Cabin Run
	Patterson Creek 32	Mineral	Purgit Run
	Patterson Creek 36	Mineral	Tributary of Patterson Creek
	Patterson Creek 37	Mineral	Tributary of Patterson Creek
	Patterson Creek 38	Mineral	Hollenbeck Run
	Patterson Creek 44	Mineral	Pasture Run
	Patterson Creek 45	Mineral	Graveyard Run
	Patterson Creek 46	Mineral	Painter Run
	Patterson Creek 47	Mineral	Tributary of Patterson Creek
	Patterson Creek 48	Mineral	Pursley Run
	Patterson Creek 50	Mineral	Horseshoe Creek (Georges Run)
	Patterson Creek 52	Mineral	Mud Run
	Warm Springs Run 1	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 2	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 3	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 4	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 5	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 6	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 7	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 9	Morgan	Tributary of Warm Springs Run
	Wheeling Creek 7	Ohio	Middle Wheeling Creek

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	South Fork 10	Pendleton	Stony Run
	South Fork 11	Pendleton	Road Run
	South Fork 12	Pendleton	Detimer Run
	South Fork 13	Pendleton	Hawes Run
	South Fork 14	Pendleton	Broad Run
	South Fork 15	Pendleton	Miller Run
	South Fork 16	Pendleton	George Run
	South Fork 17	Pendleton	Little Fork
	South Fork 18	Pendleton	Stony Run
	South Fork 19	Pendleton	Brushy Fork
	South Fork 21	Pendleton	Little Rough Run
	South Fork 27	Pendleton	Dry River Hollow Of Hawes Run
	South Fork 32	Pendleton	Tributary of South Fork
	South Fork 33	Pendleton	Tributary of South Fork
	South Fork 35	Pendleton	Tributary of South Fork
	South Fork 36	Pendleton	Little Stony Run
	South Fork 37	Pendleton	Camp Run
	South Fork 6	Pendleton	Wilson Run
	South Fork 9	Pendleton	Dice Run
	Marlin Run 1	Pocahontas	Marlin Run
	Upper Deckers Creek 1	Preston	Deckers Creek
	Upper Deckers Creek 2	Preston	Laurel Run
	Upper Deckers Creek 3	Preston	Tributary of Dillan Run
	Upper Deckers Creek 4	Preston	Dillan Run

DAMS AND LOCKS IN WEST VIRGINIA			
AGENCY			
	PROJECT NAME	**COUNTY**	**STREAM LOCATION**
	Upper Deckers Creek 5	Preston	Kanes Run
	Upper Deckers Creek 6	Preston	Tributary of Deckers Creek
	Upper Deckers Creek 7	Preston	Tributary of Decker Creek
	Bonds Creek 1	Ritchie	Long Bottom
	Pullman 1	Ritchie	Tributary of Left Fork Slab Creek
	North Fork Hughes River	Ritchie	North Fork Hughes River
	Charles Fork 17	Roane	Charles Fork
	Pocatalico River 14	Roane	Silcott Fork
	Jumping Branch 1	Summers	Jumping Branch
	Big Ditch 1	Webster	Tributary of Big Ditch Run
	Pond Run 1	Wood	Pond Run
	Walker Creek Recreation Impoundment	Wood	Walker Creek
	US ARMY CORPS OF ENGINEERS DAMS		
	Beech Fork Lake and Dam	Wayne	Beech Fork of Twelvepole Creek
	Bluestone Lake and Dam	Summers	New River
	Burnsville Lake and Dam	Gilmer	Little Kanawha River
	East Lynn Lake and Dam	Wayne	Twelvepole Creek
	R. D. Bailey Lake and Dam	Wyoming	Guyandotte River
	Rowlesburg Lake and Dam	Preston	Cheat River (Not Constructed)
	Summersville Lake and Dam	Nicholas	Gauley River
	Sutton Lake and Dam	Braxton	Elk River
	Stonewall Jackson Lake and Dam	Lewis	West Fork River
	Tygart Lake and Dam	Taylor	Tygart Valley River
	Jennings Randolph Lake and Dam	Mineral	North Branch of the Potomac River

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

PROJECT NAME	COUNTY	STREAM LOCATION
US ARMY CORPS OF ENGINEERS LOCKS		
London	Kanawha	Kanawha River
Marmet	Kanawha	Kanawha River
Racine	Mason	Ohio River
Robert C. Byrd	Mason	Ohio River
Belleville	Wood	Ohio River
Winfield	Putnam	Kanawha River
Hannibal	Wetzel	Ohio River
Pike Island	Brooke	Ohio River
Willow Island	Tyler	Ohio River
New Cumberland	Hancock	Ohio River
Morgantown	Monongalia	Monongahela River
Hildebrande	Monongalia	Monongahela River
Opekiska	Monongalia	Monongahela River
ADDITIONAL DAMS SUBJECT TO REGULATION BY DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT, DAM SAFETY PROGRAM		
Belington Water Supply Dam	Barbour	Mill Creek
Teter Creek Lake Dam # 1	Barbour	Teter Creek
R. P. Smith Power Station	Berkeley	Potomac
R. Paul Smith # 3 Dam	Berkeley	Potomac River
Sleepy Creek Dam	Berkeley	Meadow Branch
Sleepy Hollow Creek Dam	Berkeley	Cherry Run
Burek Farm Pond	Brooke	North Fork of Short Creek
Castleman's Run Lake No. 1	Brooke	Castleman's Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Culloden Water Supply Dam	Cabell	Indian Fork
	Hatfield Farm Lake	Cabell	Guyandotte River
	Lake Of Eden	Cabell	Goose Run
	Lakeview Dam	Cabell	Unnamed Tributary of Tom Creek
	Melody T Ranch Lake	Cabell	Unnamed Tributary of Mud River Of Guyandotte River
	Trout Lake	Cabell	Unnamed Tributary of Guyandotte River
	Crystal Lake	Doddridge	Unnamed Tributary of Middle Island Creek
	Babcock Lake Dam	Fayette	Glade Run
	Plum Orchard Lake Dam	Fayette	Paint Creek
	Mt. Storm Lake Dam	Grant	Stony River
	Pond No. #1 Dam	Grant	Buffalo Creek
	Stony River Dam	Grant	Stony River Of Potomac River
	Boone Farms Lake Dam	Hampshire	Little Cacapon
	Ferndale Farms Recreation Lake	Hampshire	Unnamed Tributary of South Branch of Potomac River
	Wilson Big Hollow Dam	Hampshire	
	Cherry Lake Dam	Hancock	Deep Gut Run
	Thorn Bottom Farm Lake	Hardy	Trout Run
	Warden Lake	Hardy	Moore's Run
	Clarksburg Ws Dam	Harrison	Buffalo Creek
	Deegan Lake	Harrison	Davisson Run
	Harrison Power Station Sediment Pond #1	Harrison	Piggots Run
	Hinkle Lake	Harrison	Davisson Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Joyce Lake	Harrison	Unnamed Tributary of West Fork River
	Lake Floyd Dam	Harrison	West Fork River
	Lower Salem Ws	Harrison	Salem Fork
	Maple Lake	Harrison	Peddlers Run
	New Lumberport Dam	Harrison	
	Oral Lake Dam	Harrison	Spring Fed
	Shinnston Water Supply	Harrison	Robinson Run
	Upper Salem Dam	Harrison	Dog's Run
	West Milford Dam	Harrison	
	Cedar Lake Dam No.1	Jackson	Unnamed Tributary Of Mill Creek Of Ohio River
	Cedar Lake Dam No.2	Jackson	Unnamed Tributary Of Mill Creek
	Hutchinson Farm Pond	Jackson	Mill Creek
	Rollins Dam No.2	Jackson	Mill Creek
	Rollins Lake Dam No.1	Jackson	Spring Fed
	Turkey Run Lake	Jackson	Turkey Run
	Shannondale Club Ltd.	Jefferson	Furnace Run
	Anderson Dam	Kanawha	Dutch Hollow
	Blake's Creek Site No.7	Kanawha	Ritenour Lake
	Cunningham Flyash Pond	Kanawha	Dutch Hollow
	Finney Branch Embankment	Kanawha	Finney Branch
	FMC Waste Retention Basin	Kanawha	Davis Creek
	Holz Dam	Kanawha	Sugar Camp Creek
	Lake Chaweva Dam	Kanawha	Rocky Fork
	Poffenbarger Dam No.1	Kanawha	Rocky Fork

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Poffenbarger Farm Lake No. 3	Kanawha	Rocky Fork
	Scott's Run Cinder Barrier	Kanawha	Scott's Run
	Bendale Dam	Lewis	West Fork River
	Jackson Mill Dam	Lewis	Unnamed Tributary of West Fork
	Lake Riley	Lewis	Murphy Creek
	Murphy Creek Dam	Lewis	
	Right Fork Dam	Lewis	Murphy Creek
	Stonecoal Creek Dam & Reservoir	Lewis	Stonecoal Creek
	Weston Dam	Lewis	West Fork River
	Lee's Fishing Lake	Lincoln	Mahoney Creek
	Mannington Water Supply Dam	Marion	Dent's Run
	Rachel Hunting & Fishing Dam	Marion	Mods Run
	Rock Lake	Marion	Glady Creek
	Burch Run Lake No.1	Marshall	Burch Run
	Conner Run Flyash	Marshall	Conner Run
	Kaliya Ghat	Marshall	
	Mitchell Bottom Ash Ponds	Marshall	Ohio River
	AEP Project 1301 Ash Pond	Mason	Little Broad Run
	Chief Cornstalk Public Lake	Mason	Ninemile Creek
	McClintic #23 Dam	Mason	Oldtown Creek
	Anawalt Lake	McDowell	Millseat Branch
	Anawalt Lake Dam	McDowell	Millseat Branch
	Berwind Lake	McDowell	War Creek
	Twin Branch Dam No.1	McDowell	Tug Fork

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Ada Dam	Mercer	East River
	Horton Dam	Mercer	East River
	Jimmy Lewis Dam	Mercer	Bluestone River
	Laurel Creek Dam	Mercer	Laurel Creek
	New Bramwell Dam	Mercer	Unnamed Tributary of Bluestone River
	Old Bramwell Dam	Mercer	Unnamed Tributary of Bluestone River
	Lakewood Dam	Mineral	Death Valley
	Old Keyser Reservoir	Mineral	Limestone Run
	Laurel Creek Lake No.1	Mingo	Laurel Fork
	Cobun Creek Dam	Monongalia	Cobun Creek
	Crooked Run No. 3	Monongalia	Crooked Run
	Lough Lake	Monongalia	Little Indian Creek
	Lynch Lake	Monongalia	Little Indian Creek
	Paradise Lake	Monongalia	Boyd Run
	Tibbs Run Dam	Monongalia	Tibbs Run
	Wildwood Lake	Monongalia	Boyd Run
	Moncove Lake	Monroe	Devil Creek
	Cacapon Reservoir Dam	Morgan	North Fork
	Cacapon State Park Lake	Morgan	North, Middle & South Fork
	Coolfont Dam	Morgan	Cold Spring Run
	Dam C	Morgan	Potomac River
	Grasshopper Hollow Tailings Dam	Morgan	Potomac River
	Old Cacapon Power Dam	Morgan	Cacapon River
	Bear Rocks Lake No.1	Ohio	Todd Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Bear Rocks Lake No.2	Ohio	Todd Run
	Bear Rocks Lake No.3	Ohio	Todd Run
	Millcrest Farm Pond	Ohio	Hall Run
	Schenk Lake	Ohio	Waddles Run
	McElroy Run Dam	Pleasants	McElroys Run
	Lake Sam Hill	Pocahontas	Thorny Creek
	Seneca Lake	Pocahontas	Little Thorny Creek
	Watoga Lake Dam	Pocahontas	Island Lick Run
	Albright Bridge Dam	Preston	Cheat River
	Alpine Lake	Preston	Wardwell Run
	Appalachian Lake	Preston	Fike Run
	B & O Dam	Preston	Little Raccoon Creek
	Big Bear Lake	Preston	Beaver Creek
	Bruceton Mills Dam	Preston	Big Sandy Creek
	Chippewa Lake	Preston	Laurel Run
	Fairfax Pond	Preston	Kanes Creek
	Lake O' Woods Dam	Preston	Patterson Run
	Masontown Water Supply Dam	Preston	Back Run
	Terra Alta Lake	Preston	Snowy Creek
	Big Bear Lake Dam	Preston	Beaver Creek
	Bottom Ash Pond 1b	Putnam	
	Bottom Ash Ponds 1a	Putnam	
	FMC Employees Sportsman’s Club	Putnam	
	Hurricane Water Supply Reservoir	Putnam	Mill Creek

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	John Amos Flyash Dam	Putnam	Little Scary Creek
	Lake Washington	Putnam	Hurricane Creek
	Long Branch Reservoir	Putnam	Long Branch of Poplar Fk.
	Poplar Fork Dam	Putnam	Poplar Fork
	Westvaco Sportsman Club No. 2	Putnam	Unnamed Tributary of Little Hurricane Creek.
	Winfield Water Supply Dam	Putnam	Little Hurricane Creek.
	Flat Top Lake Dam	Raleigh	Beaverpond Branch
	Glade Creek Dam No. 1	Raleigh	Glade Creek
	Glade Creek Dam No. 2	Raleigh	Glade Creek
	Grandview Farm Lake	Raleigh	Packs Branch
	Lake Stephens Dam	Raleigh	Stephens Branch
	Little Beaver Dam	Raleigh	Little Beaver Creek.
	South Sand Branch	Raleigh	
	Winter Place Dam	Raleigh	Glade Creek
	Scott Lake	Randolph	Stalnaker Run
	Harrisville City Reservoir	Ritchie	Hughes River
	No. 1-West Of Cornwallis	Ritchie	Hughes River
	Pennsboro Water Supply Dam #2	Ritchie	Reservoir Run of Hughes River
	Lake Trotter	Roane	Lick Fork
	Lawsons Farm Lake	Roane	McKeown Creek
	Methodist Church Camp Lake	Roane	Spring Fed
	Miletree Run Dam No. 1	Roane	Miletree Run Creek
	Miletree Run Dam No. 2	Roane	Miletree Run Creek
	Pipestem Lake	Summers	Long Branch

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Sun Valley Lake Dam	Summers	Pipestem Creek
	Flat Run Lake	Tucker	Flat Run
	Pendleton Lake	Tucker	Pendleton Creek
	Sand Run Lake	Tucker	Unnamed Tributary of Blackwater River
	Spruce Island Lake	Tucker	Sand Run
	Thomas Dam (Concrete)	Tucker	North Fork
	Thomas Reservoir Dam	Tucker	Unnamed Tributary of North Fork
	Conaway Run Public Fishing Are	Tyler	Conaway Run
	Sludge Impoundment No. 2	Tyler	Sugar Camp Run
	Buckhannon Ws Dam	Upshur	
	Hall's Farm Pond	Upshur	Unnamed Tributary of Sand Run
	Moses Fork Fishing Lake	Wayne	Right Fork
	Big Ditch Lake No. 1	Webster	Long Glade Ditch
	Camp Caesar Dam	Webster	Upper Glade Run
	Wells Locks And Dam	Wirt	Little Kanawha
	A & O Farm Pond	Wood	Unnamed Tributary of Stillwell Creek.
	Lake Washington	Wood	Vaughts Run Of Sandy Creek
	Tennant's Farm Pond	Wood	Unnamed Tributary of Laurel Fork
	Upper Smith Dam	Wood	Unnamed Tributary of Neal Run
	Horse Creek Dam #1	Wyoming	Guyandotte River

APPENDIX M

WV DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER AND WASTE MANAGEMENT
DAM SAFETY PROGRAM

LIST OF DEFICIENT DAMS

INTRODUCTION

A deficient dam is a structure that exhibits one or more design or maintenance problems that may adversely affect the performance of the dam during a major storm, or over a period of time, resulting in a potential for loss of life or property.

The WV Department of Environmental Protection (DEP), Division of Water and Waste Management (DWWM), Dam Safety Program maintains an inventory of dams in West Virginia within the jurisdiction size of the Dam Control and Safety Act (W. Va. Code 22-14). With several exceptions, DWWM regulates dams 25 feet or more in height and capable of impounding 15 or more acre-feet of water; OR 6 feet or more in height and capable of impounding 50 or more acre-feet of water. For additional information, please refer to W. Va. Code 22-14-3(e) or 47CSR34-2.10. Information is also available at DEP's webpage: http://www.wvdep.org

The DWWM Dam Safety program inventory includes approximately 350 dams of jurisdiction size. Of the 350 jurisdictional dams, 38 dams (10.8 percent) are considered deficient at the present time.

DWWM Dam Safety offered a List of Deficient Dams in response to a request for additional analysis from the WV Legislature's Joint Committee on Government Operations, Performance Evaluation and Research Division, on June 13, 2000. The program intends to issue updated lists periodically to reflect progress in identification of deficient dams and in the evaluation criteria utilized to prioritize the list.

To prioritize the dams, Dam Safety evaluates the following factors:

- storm capacity of the dam – percent of design storm handled by the dam;
- spillway condition;
- factor of safety – structural deficiencies;
- embankment or concrete structure condition;

- reservoir volume – magnitude of loss;
- downstream population – magnitude of loss;
- proximity of downstream population to the dam; and
- highway traffic – traffic density and speed limit.

A numeric score is assigned to each dam for each factor. The scores range from 20 (worst score) to 0 (best score). The cumulative score for the above factors is used to list the dams in priority order.

NOTE: Despite our best efforts and research, Dam Safety is not able to document all of the listed factors for all of the dams. Where information is lacking for a given factor, Dam Safety assigns that factor a value of "0*." A score of "0*" ensures that no weight is given to that factor without the necessary information. A "0" score is reflected in the appropriate tables as a factor with sufficient information to have no weight.

Name of Dam	ID	Percent PMP Score (a)	Spillway Condition Score (b)	Factor of Safety Score (c)	Embank-ment Condition Score (d)	Reser-voir Volume Score (e)	Height of Dam Score (f)	Downs tream Popul-ation Score (g)	Population Proximity Score (h)	Highway Traffic Score (i)	Posted Speed Score (j)	**Cumulative Score (a)+(b)+(c)+(d)+(e)+(f)+(g)+(h)+(i)+(j)**	**Rank**
Lower Salem Dam	03314	5	7	1	4	7	7	20	10	2	1	64	**1**
Upper Salem Dam	03301	5	7	2	4	9	6	12	4	4	5	58	**2**
Lake Washington Dam	**07906**	**10**	**4**	**0***	**7**	**9**	**4**	**8**	**10**	**3**	**3**	**58**	**3**
Lough Lake Dam	06115	8	10	10	10	2	5	2	8	1	1	57	**4**
Burch Run Dam	05101	8	7	8	7	6	5	4	10	1	1	57	**5**
Deegan Lake Dam	**03322**	**10**	**4**	**6**	**4**	**5**	**5**	**10**	**6**	**3**	**3**	**56**	**6**
B & O Dam	07715	7	7	6	4	4	6	10	8	2	1	55	**7**
Charles Fork Dam	08705	1	1	0	4	10	9	20	8	2	0*	55	**8**
Hinkle Lake Dam	03328	9	7	0	4	2	4	12	10	3	3	54	**9**
Lynch Lake Dam	06116	9	10	8	8	2	5	2	8	1	1	54	**10**
Rock Lake Dam	04917	9	4	6	4	6	5	10	8	0	0	52	**11**
Bluewell # 2 Dam	05520	9	4	0	1	5	6	20	2	0	3	50	**12**
Bluewell # 1 Dam	05519	8	4	0	1	5	6	20	2	0	3	49	**13**
Old Keyser Dam	05722	6	7	0*	4	3	6	8	8	1	5	48	**14**
Upper Smith Dam	10705	10	7	0*	4	3	7	8	8	1	0*	48	**15**
Lake of Eden Dam	01102	10**	7	10	10	1	4	2	0*	4	0*	48	**16**
Scott Lake Dam	08304	3	4	6	1	3	4	6	10	3	5	45	**17**
Hurricane WS Dam	07909	8	4	10	4	3	2	4	8	0	0	43	**18**
Flat Top Lake Dam	**08101**	**8**	**1**	**0**	**1**	**10**	**7**	**8**	**6**	**0***	**1**	**43**	**19**
Berwind Lake Dam	04702	9	4	0	1	8	6	4	6	1	3	42	**20**
Long Branch Dam	08903	6	1	2	4	7	6	14	0	0	0	40	**21**
Lake Trotter Dam	08704	7	7	10	7	3	5	0	0	1	0*	40	**22**
Poffenbarger # 1 Dam	03904	9	7	0	7	2	6	4	2	3	0*	40	**23**
Buffalo Lake Dam	03305	4	0	0	0	10	7	4	10	2	3	40	**24**

Moncove Lake	06301	4	4	2	5	10	6	4	0	1	3	39	**25**
Name of Dam	ID	Percent PMP Score (a)	Spillway Condition Score (b)	Factor of Safety Score (c)	Embank-ment Condition Score (d)	Reser-voir Volume Score (e)	Height of Dam Score (f)	Downs tream Popul-ation Score (g)	Population Proximity Score (h)	Highway Traffic Score (i)	Posted Speed Score (j)	**Cumulative Score (a)+(b)+(c)+(d)+(e)+(f)+(g)+(h)+(i)+(j)**	**Rank**
Maple Lake Dam	03327	7	4	0	1	5	5	4	6	2	3	37	**26**
Hatfield Lake Dam	01105	10	4	0	1	2	5	6	8	1	0*	37	**27**
Cacapon Res Dam	06502	1	1	10	4	4	5	0*	8	1	1	35	**28**
Bear Rock # 2 Dam	06902	6	4	8	4	5	4	4	0	0*	0	35	**29**
Cherry Lake Dam	02903	0*	7	0*	4	0*	4	6	6	3	5	35	**30**
Sun Valley Dam	08904	10	10	0	4	3	2	6	0	0	0	35	**31**
Old Bramwell Dam	05524	6	4	5	5	2	4	4	0	0	0	30	**32**
Cacapon Park Dam	06503	0*	4	0*	4	0*	5	0*	8	3	5	29	**33**
Lees Fishing Dam	04301	5	0*	4	0*	1	5	2	10	0*	0*	27	**34**
Bear Rock # 1 Dam	06901	6	4	2	4	3	4	2	0	0	3	28	**35**
Bear Rock # 3 Dam	06903	6	4	2	4	2	4	2	0	0	3	28	**36**
Asbury Lake Dam	09905	0*	5	0*	0*	2	4	10	4	0*	0*	25	**37**
New Bramwell Dam	05501	5	1	0	1	2	6	4	4	0	0	23	**38**
* no information													
** based on 100 year storm													

Name of Dam	ID	Downstream Town/County	Owner
Lake of Eden Dam	01102	Barboursville/Cabell	William T. Workman
Hatfield Lake Dam	01105	Barboursville/Cabell	Raymond G. Cyrus
Cherry Lake Dam	02903	New Cumberland/Hancock	Paul Settle
Upper Salem Dam	03301	Salem/Harrison	City of Salem
Buffalo Lake Dam	03305	Clarksburg/Harrison	City of Clarksburg
Lower Salem Dam	03314	Salem/Harrison	City of Salem
Deegan Lake Dam	03322	Bridgeport/Harrison	City of Bridgeport
Maple Lake Dam	03327	Bridgeport/Harrison	Maple Lake Club
Hinkle Lake Dam	03328	Bridgeport/Harrison	City of Bridgeport
Poffenbarger # 1 Dam	03904	Cross Lanes/Kanawha	Solco, Inc.
Lees Fishing Dam	04301	Mahoney Creek/Lincoln	Oren Johnston
Berwind Lake Dam	04702	Berwind/McDowell	WVDNR Wildlife Res
Rock Lake Dam	04917	Hammond/Marion	Rock Lake Club, Inc.
Burch Run Dam	05101	Wheeling/Marshall	WVDNR Wildlife Res
New Bramwell Dam	05501	Bramwell/Mercer	City of Bramwell
Bluewell # 1 Dam	05519	Bluewell/Mercer	Bluewell PSD
Bluewell # 2 Dam	05520	Bluewell/Mercer	Bluewell PSD
Old Bramwell Dam	05524	Bramwell/Mercer	City of Bramwell
Old Keyser Dam	05722	Keyser/Mineral	City of Keyser
Lough Lake Dam	06115	Osgood/Monongalia	Robert Lough
Lynch Lake Dam	06116	Osgood/Monongalia	Elza Hunt
Moncove Lake Dam	06301	Gap Mills/Monroe	WVDNR Parks & Rec
Cacapon Res Dam	06502	Sleepy Creek/Morgan	WVDNR Parks & Rec
Cacapon Park Dam	06503	Sleepy Creek/Morgan	WVDNR Parks & Rec
Bear Rock # 1 Dam	06901	Middle Creek/Ohio	WVDNR Wildlife Res
Bear Rock # 2 Dam	06902	Middle Creek/Ohio	WVDNR Wildlife Res
Bear Rock # 3 Dam	06903	Middle Creek/Ohio	WVDNR Wildlife Res
B & O Dam	07715	Newburg/Preston	City of Newburg
Lake Washington Dam	07906	Hurricane/Putnam	O'Dell

Hurricane WS Dam	07909	Winfield/Putnam	City of Hurricane
Flat Top Lake Dam	08101	Ghent/Raleigh	Flat Top Lake Assoc, Inc.
Scott Lake Dam	08304	Beverly/Randolph	Scott Lake Corporation
Lake Trotter Dam	08704	Spencer/Roane	City of Spencer
Charles Fork Dam	08705	Spencer/Roane	City of Spencer
Long Branch Dam	08903	Pipestem/Summers	WVDNR Parks & Rec
Sun Valley Dam	08904	Pipestem/Summers	Unknown
Asbury Lake Dam	09905	Dunlow/Wayne	Garry Harper
Tennants Farm Dam	10703	Tallyho/Wood	Tim Moore
Upper Smith Dam	10705	Parkersburg/Wood	Henry Oldaker

Storm Capacity of the Dam - Percent PMP Storm Score - Column (a)

The National Dam Inspection Program (NDIP) reports conducted by the US Army Corps of Engineers from 1978 – 1982 were utilized as the best existing source of information regarding a dam's capacity to handle storms. The NDIP studied watershed runoff characteristics and spillway capacity of dams, however, the NDIP generally used storms less than those required by current regulations.

Current regulation requirements begin at the national standard of 100 percent Probable Maximum Precipitation (PMP – 27.5 inches of rain in six hours is average for West Virginia). With some provisions, high hazard potential (where loss of life is likely if the dam fails) dams are required to pass through spillways, or store in the reservoir, the PMP storm amount of water. The NDIP used 80 percent of the PMP (22 inches of rain in six hours) and, in some cases, the 100 year storm (4.5 inches of rain in six hours). As a result, the NDIP information is not accurate for current requirements, but in many cases is the best information available.

The ratio of peak inflow (flow into the reservoir) versus the maximum capacity of the spillways (flow out of the reservoir) was calculated to produce a percentage of storm water handling capability. The percentage of capability was then assigned a numeric score based upon ranges of values (see Table 1) to allow comparison. Higher numbers denote greater deficiency than lower numbers.

TABLE 1 – Percent of PMP Score for Column (a)

Percent of PMP	Numeric Score
0 – 10	10 (more deficient)
11 – 20	9
21 – 30	8
31 – 40	7
41 – 50	6
51 – 60	5
61 – 70	4
71 – 80	3
81 – 90	2
91 – 99	**1 (less deficient)**
100	**0**
No Information	0*

Spillway Condition Score – Column (b)

Spillway condition may vary depending upon:

- type of spillway (pipe, open channel, concrete chute);
- alignment problems;
- erosion in, under, or around the spillway;
- vegetation growth;
- blockage of spillways; and
- maintenance problems

The spillway condition score is assigned according to observations of the spillway, or spillways, at the dam. The inspecting engineer judges the overall condition of all spillways at the dam and assigns a condition score based upon a range of values (see Table 2) to allow comparison. Higher numbers denote greater deficiency than lower numbers.

TABLE 2 – Spillway Condition Score – Column (b)

Overall Spillway Condition	Score
Failed	10 (more deficient)
Poor	7
Adequate	4
Good	1
Excellent	0 (not deficient)
No information	0*

Slope Stability – Factor of Safety Score – Column (c)

The National Dam Inspection Program (NDIP) assumed conservative embankment strength parameters without benefit of subsurface investigation or laboratory documentation to calculate a slope stability factor of safety. The NDIP factor of safety value was assigned a numeric score based upon ranges of values (see Table 3) to allow comparison. Higher numbers denote greater deficiency than lower numbers.

TABLE 3 – Factor of Safety Score for Embankment Dams - Column (c)

Factor of Safety	Numeric Score
= 1.0	10 (more deficient)
1.0 – 1.1	8
1.11 – 1.2	6
1.21 – 1.3	4
1.31 – 1.4	2
1.41 – 1.49	1 (less deficient)
= 1.5	0

No Information	0*

TABLE 3A – Sliding Factor of Safety Score for Concrete Gravity Dams - Column (c)

Factor of Safety	Numeric Score
= 1.0	10 (more deficient)
1.01 – 1.25	8
1.26 – 1.50	6
1.51 – 2.00	4
2.01 – 2.25	3
2.26 – 2.50	2
2.51 – 2.99	1
= 3.0	0 (not deficient)
No information	0*

Condition of Embankment or Structure – Embankment Condition Score – Column (d)

The condition of the structure is an important consideration in the overall deficiency of a dam. Earthen structures may be affected by:

- seepage;
- piping (internal erosion of embankment materials);
- slipping;
- sinkholes;
- vegetation growth;
- animal burrows; and
- erosion

Concrete structures may be affected by:

- misalignment of structures or sections;
- erosion;
- cracking or spalling;
- vegetation growth;
- seepage through cracks or around abutments; and
- lack of maintenance

The embankment or structure condition score is assigned according to observations of the embankment or concrete structure at the dam. The inspecting engineer judges the overall condition of the embankment or structure of the dam and assigns a condition score based upon a range of values (see Table 4) to allow comparison. Higher numbers denote greater deficiency than lower numbers.

TABLE 4 – Embankment/Structure Condition Score – Column (d)

Overall Structure Condition	Score
Serious Problem	10 (more deficient)
Poor	7
Adequate	4
Good	1
Excellent	0 (not deficient)
No information	0*

Reservoir Volume Score – Column (e)

A dam break analysis was not attempted for the prioritization. Effects from a potential dam break were estimated using several factors. The first factor used was the maximum water storage volume of the reservoir to show the raw amount of water that could be released by dam failure. The reservoir volume was assigned a numeric score based upon ranges of values (see Table 5) to allow comparison. Higher numbers represent more damage potential than lower numbers.

TABLE 5 – Reservoir Volume for Column (e)

Max Reservoir in Acre-Feet	Numeric Score
> 700	10 (more potential damage)
601 – 700	9
501 – 600	8
401 – 500	7
301 – 400	6
201 – 300	5
101 – 200	4
51 – 100	3
26 – 50	2
15 – 25	1 (less potential damage)
No Information	0*

Height of Dam Score – Column (f)

The height of the dam determines the kinetic energy of water released by a dam failure. Assuming the reservoir is at or above the embankment crest upon failure, a score was assigned to the dam based upon the height of the dam measured from the downstream toe of the embankment at the natural bed of the stream or watercourse, vertically to the crest of the dam (excluding spillways). The score (see Table 6) begins at six feet in height (the lowest height defined as a "dam" and extends to 100 feet in height or greater. The average height of all non-coal dams is approximately 33 feet. The maximum height is 267 feet (Conner Run Dam, Marshall County).

TABLE 6 – Height of Dam for Column (f)

Dam Height in Feet	Numeric Score
> 100	10 (more consequence)
81 – 100	9
61 – 80	8
41 – 60	7
31 – 40	6
26 – 30	5
21 – 25	4
16 – 20	3
11 – 15	2
6 – 10	1 (less consequence)
No Information	0*

Downstream Population Score – Column (g)

The next factor related to potential for loss of life was an estimation of the number of people living downstream in the inundation area. Dam Safety counted the number of houses within one mile downstream from the dam at the dam crest elevation or below using available USGS maps last updated in the mid-1970's. We then assumed two-person occupancy per house and assigned a numeric score based upon the total number of people living below the dam (see Table 7) to allow comparison. Scores are weighted to emphasize human life factor. Higher numbers represent higher loss of life potential than lower numbers.

TABLE 7 – Downstream Population for Column (g)

Estimated Number of People	Numeric Score
> 80	20 (higher loss of life potential)
71 – 80	18
61 – 70	16
51 – 60	14
41 – 50	12
31 – 40	10
21 – 30	8
11 – 20	6
6 – 10	4
1 – 5	2 (lesser loss of life potential)
0	0
No Information	0*

Proximity of Population Score – Column (h)

The downstream hazard potential of each dam is determined upon the presence of dwellings, businesses, roadways, railroads, and utilities in the potential flood wave, assuming the dam fails. A flood released by a failing dam will decrease in magnitude as it progresses downstream due to gravity spreading over distance, widening of the valley, or decrease in gradient. Conversely, obstructions, curves in the stream, narrowing of the valley or a steeper gradient may cause the flood wave to deepen or gain in velocity.

The proximity of population score is assigned according to observations of the relative position of the dam to downstream dwellings, roads, or other structures. The inspecting engineer measures the overall distance from the dam to downstream structures and assigns a condition score based upon a range of values (see Table 8) to allow comparison. Higher numbers denote greater deficiency than lower numbers.

TABLE 8 – Proximity of Population for Column (h)

Distance to First Structure in Feet	Score
< 500	10 (more proximate)
501 – 1000	8
1001 – 2000	6
2001 – 3000	4
3001 – 4000	2
4001 – 5000	1 (less proximate)
> 5000	0
No information	0*

Highway Traffic Score – Column (i)

Another factor related to potential for loss of life was the possible overtopping of highways downstream due to failure of an upstream dam. If a downstream highway may overtop, a score was assigned based upon the West Virginia Division of Highways (WVDOH) Traffic Count Maps completed in 1993 using ranges of people per unit time (see Table 9). If there is no downstream highway that will be affected, the score must be zero. Higher numbers represent higher loss of life potential than lower numbers.

TABLE 9 – Highway Traffic Score for Column (i)

Traffic Count (Number of Vehicles per Day)	Numeric Score
>20,000	5 (higher loss of life potential)
10,001 – 20,000	4
5,001 – 10,000	3
1,001 – 5,000	2
101 – 1,000	1 (lesser loss of life potential)
< 100	0
No Information	0*

Posted Speed Limit Score – Column (j)

The last factor related to loss of life was the posted highway speed limit (see Table 10). According to WVDOH, cars will hydroplane when tire tread depth is exceeded by the depth of water on the road above speeds of approximately 20 miles per hour. The faster the car is traveling, the more unlikely it is that the driver will have sufficient time to react before driving into water. Assuming the presence of a downstream highway that may be overtopped, a score was assigned based upon the posted speed limit at the bridge or road fill crossing the stream below the dam. If there is no downstream highway that will be affected, the score must be zero. Higher scores reflect decreased driver reaction time.

TABLE 10 – Highway Posted Speed Limit Score for Column (j)

Posted Speed Limit (mph)	Numeric Score
> 40	5 (less reaction time)
30 – 40	3
20 – 25	1
< 15	0 (more reaction time)
No Information	0*

HISTORY OF DEFICIENT DAMS LIST

The number of deficient dams through time depends upon when counting begins. The Deficient Dams List was started in approximately 1995 using the Corps of Engineers National Dam Inspection Program (NDIP) conclusions as an initial determination. If the NDIP report determined the dam was high hazard potential, unsafe - or high hazard potential, needs additional investigation – Dam Safety placed the dam on the deficient dams list. In 1995, there were approximately 50 dams on the list. If the count had started in 1982, approximately 68 dams would have been on the list. Just after the Buffalo Creek Disaster in 1973, the list would have additionally included approximately 100 coal related dams.

Although Dam Safety did not list deficient dams prior to 1995, non-coal dams with NDIP reports that would have met the selection criteria through time are listed in Table 11. After repair or removal was completed (usually about one year after Dam Safety issued approval), the dam was removed from the list (or would have been removed, if there had been a list prior to 1995). Table 11 is organized by county location and includes the approximate date the dam would have been removed from the deficient dams list. Table 12 provides the same information sorted by removal date.

TABLE 11 – History of Deficient Dams - by County

Dam Name	ID	Town/County	Approx Removal Date	Number
Teter Creek Dam	00101	Nestorville/Barbour	01/10/02	1
Belington WS Dam	00102	Streamtown/Barbour	06/15/98	2
Sleepy Creek Dam	00301	Michaels Chapel/Berkeley	05/15/85	3
Sleepy Hollow Dam	00303	Hedgesville/Berkeley	07/17/02	4
Castleman Run Dam	00916	Bethany/Brooke	01/18/96	5
Lakeview Dam	01104	Barboursville/Cabell	12/20/90	6
Plum Orchard Dam	01902	Mossy/Fayette	11/13/91	7
Boley Lake Dam	01907	Glen Ferris/Fayette	06/25/98	8
Warden Lake Dam	03101	Wardensville/Hardy	10/18/94	9
Lake Floyd Dam	03319	Marshville/Harrison	05/03/02	10
Lake Dinty Moore Dam	03915	Mill Creek/Kanawha	03/01/93	11
Lake Chaweva Dam	03901	Cross Lanes/Kanawha	02/15/02	12
Poffenbarger #2 Dam	03916	Cross Lanes/Kanawha	9/2000	13
Mod Branch #1 Dam	04709	Hemphill/McDowell	06/14/96	14
Twin Branch #1 Dam	04711	Davy/McDowell	10/16/90	15
Rachel H&F Dam	04904	Rachel/Marion	10/20/83	16
Mannington Dam	04921	Mannington/Marion	09/30/86	17

Dam Name	ID	Town/County	Approx Removal Date	Number
Four States Dam	04930	Four States/Marion	01/07/83	18
Jimmy Lewis Dam	05521	Pinnacle/Mercer	07/16/91	19
Ada Dam	05522	Ada/Mercer	03/31/82	20
Laurel Lake Dam	05901	Canterbury/Mingo	1979	21
Watoga Dam	07501	Seebert/Pocahontas	08/17/98	22
Lake O Woods Dam	07703	Bruceton Mills/Preston	09/15/86	23
Terra Alta Lake Dam	07721	Terra Alta/Preston	06/07/99	24
Ranch Lake Estates Dam	07910	Fraziers Bottom/Putnam	3/1996	25
Pennsboro #2 Dam	08511	Pennsboro/Ritchie	08/12/80	26
Miletree #2 Dam	08703	Spencer/Roane	10/06/87	27
Thomas Reservoir Dam	09306	Thomas/Tucker	01/27/82	28
Thomas Dam	09307	Thomas/Tucker	11/2000	29
Lake Washington Dam	10701	Belleville/Wood	05/18/92	30
A & O Dam	10704	Murphytown	03/21/00	31

TABLE 12 – History of Deficient Dams - by Date Removed from List

Dam Name	ID	Town/County	Approx Removal Date	Number
Laurel Lake Dam	05901	Canterbury/Mingo	1979	1
Pennsboro #2 Dam	08511	Pennsboro/Ritchie	08/12/80	2
Thomas Reservoir Dam	09306	Thomas/Tucker	01/27/82	3
Ada Dam	05522	Ada/Mercer	03/31/82	4
Four States Dam	04930	Four States/Marion	01/07/83	5
Rachel H&F Dam	04904	Rachel/Marion	10/20/83	6
Sleepy Creek Dam	00301	Michaels Chapel/Berkeley	05/15/85	7
Lake O Woods Dam	07703	Bruceton Mills/Preston	09/15/86	8
Mannington Dam	04921	Mannington/Marion	09/30/86	9
Miletree #2 Dam	08703	Spencer/Roane	10/06/87	10
Twin Branch #1 Dam	04711	Davy/McDowell	10/16/90	11
Lakeview Dam	01104	Barboursville/Cabell	12/20/90	12
Jimmy Lewis Dam	05521	Pinnacle/Mercer	07/16/91	13
Plum Orchard Dam	01902	Mossy/Fayette	11/13/91	14
Lake Washington Dam	10701	Belleville/Wood	05/18/92	15
Lake Dinty Moore Dam	03915	Mill Creek/Kanawha	03/01/93	16

Dam Name	ID	Town/County	Approx Removal Date	Number
Warden Lake Dam	03101	Wardensville/Hardy	10/18/94	17
Castleman Run Dam	00916	Bethany/Brooke	01/18/96	18
Ranch Lake Estates Dam	07910	Fraziers Bottom/Putnam	3/1996	19
Mod Branch #1 Dam	04709	Hemphill/McDowell	06/14/96	20
Belington WS Dam	00102	Streamtown/Barbour	06/15/98	21
Boley Lake Dam	01907	Glen Ferris/Fayette	06/25/98	22
Watoga Dam	07501	Seebert/Pocahontas	08/17/98	23
Terra Alta Lake Dam	07721	Terra Alta/Preston	06/07/99	24
A & O Dam	10704	Murphytown/Wood	03/21/00	25
Poffenbarger #2 Dam	03916	Cross Lanes/Kanawha	9/2000	26
Thomas Dam	09307	Thomas/Tucker	11/2000	27
Teter Creek Dam	00101	Nestorville/Barbour	01/10/02	28
Lake Chaweva Dam	03901	Cross Lanes/Kanawha	02/15/02	29
Lake Floyd Dam	03319	Marshville/Harrison	05/03/02	30
Sleepy Hollow Dam	00303	Hedgesville/Berkeley	07/17/02	31

If you have questions regarding the List of Deficient Dams, please contact:

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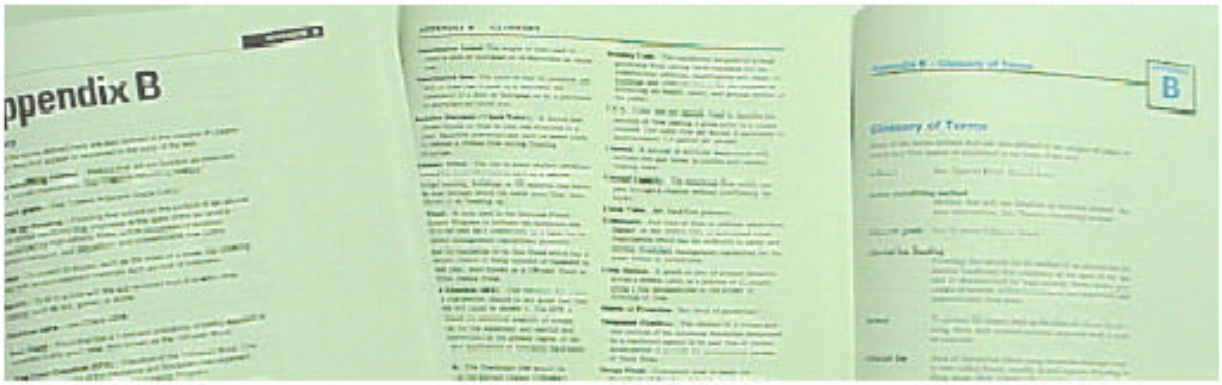

Appendix O — Glossary

100 Year Flood	a flood with a probability of occurring once during a one hundred year period. Alternatively, it is a flood with one chance out of 100 (1%) of occurring in any one year. Two 100 year floods could occur in the same year. The level of the 100 year flood is usually the Base Flood Elevation.
500 Year Flood	a flood with a probability of occurring once during a five hundred year period. Alternatively, it is a flood with one chance out of 500 (.2%) of occurring in any one year. Two 500 year floods could occur in the same year.
A	
ADT – Average Daily Traffic. Average number of cars in a 24 hour period.	
ASFPM	Association of State Floodplain Managers
Acre Foot	the capacity of a lake or reservoir is measured in acre feet. An acre foot is the equivalent of an acre of area filled to a depth of one foot. It

	contains 325,851 gallons.
B	
BFE	Base Flood Elevation. Usually the same as the level of 100 year flood.
BM	Bench Mark
Basement –	enclosed areas that have the floor level below ground level (sub grade) on all four sides.
Best Management Plan –	Methods adopted by resource users designed to mitigate harm to the environment that might result from their activities.
Biodiversity	The variety of life in an area, including the variety of genes, species, plant and animal communities, ecosystems, and processes through which individual organisms interact with one another and their environments. It is so complex, that planning and management can only address specific aspects or indicators of biodiversity such as the genetic variation in intensively managed or rare species' populations, the recovery and viability of endangered species, the conditions of special or unique biological communities, and the patterns and processes of ecological systems across large regional landscapes.
C	
CAV	Community Assistance Visits. These visits are actually inspections by FEMA to evaluate the communities adherence to NFIP regulations. CAVs frequently result in punitive action taken against the

	community. Conducting CAVs is a FEMA responsibility.
CLOMA	Conditional Letter of Map Amendment
CLOMR	Conditional Letter of Map Revision
CLOMRF	Conditional Letter of Map Revision Based on Fill
These three, CLOMA, CLOMR, and CLOMRF are all procedures established by the NFIP to amend or revise Flood Insurance Rate Maps. All three actions must be initiated by a resident or community.	
CTP	Cooperating Technical Partners (Initiative)
CFS	Cubic Feet per Second – a unit measuring the flow of a stream expressed as a rate of discharge. One cubic foot per second is equal to the discharge in a stream cross section one foot wide, one foot deep flowing with an average velocity of one foot per second. 1 cfs = 44.8 gallons per minute.
Channel Stabilization	Erosion control measures on streambanks and channels to prevent erosion and sediment production. Included are:
	a. Revegetation measures
	b. Protective fencing
	c. Structural measures
Community Rating System –	CRS – a system of rating community efforts to control flooding. The system is based on a ten point scale. For every point of

	reduction the community gets a 5% reduction on the flood insurance premiums of all policies within the community. Reductions are offered for several factors. The elementary steps to get down to an 8 don't take much effort. Getting additional reductions take more effort. The greatest value is getting the flood plain management program organized.
D	
Dam	a dam is an artificial barrier or obstruction that impounds, or will impound, water.
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DGPS	Differential Global Positioning System
DLG	Digital Line Graph
DOQ	Digital Orthophoto Quadrangle
D FIRM	Digitalized Flood Insurance Rate Map.
Design Flood	The selected flood against which a flood protective works is designed to provide protection. This is usually expressed as the probable return frequency of the flood (25 year flood, 100 year flood, etc.)
Development	any manmade change to improved or unimproved real estate, including but not limited to buildings, other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.

Diameter at breast height (dbh)	the diameter outside bark of a standing tree measured at 4.5 feet above the ground.
Discharge	an outflow of water from a pipe, conduit, stream, groundwater system or watershed.
Divide	the boundary separating watershed drainage basins.
Drainage Basin	the land area drained by a creek, stream or river. Also called a watershed. It can be identified by connecting the highest elevations between two adjacent drainage basins.
Dry Dam	A flood control dam that impounds water only during floods. The stored water is released after the potential for downstream flooding stream flow is unimpeded.has been reduced. Normal
E	
Elevation Certificates	A document prepared and signed by a professional engineer or surveyor that provides the elevation of the Lowest Floor of the structure.
Ecosystem	A geographic area where it is meaningful to address the interaction of plants, animals, ecological processes, human social systems, soils, waters, sources of energy, and the forces that guide change over time. A watershed is an example.
Endangered Species	Species listed as nationally in danger of extinction throughout all or a significant portion of their ranges by current Federal Register

	Final Rule making.
Environmental Analysis	The process associated with the preparation of an environmental assessment or environmental impact statement and the decision whether to prepare an environmental assessment or impact statement. It is an analysis of alternative actions and their predictable short term and long term environmental effects which include physical, biological, economic, and social factors and their interactions.
Expressway	Interstate or other four lane highway.
F	
FBFM	Flood Boundary and Floodway Map
FHBM	Flood Hazard Boundary Map
FIRM	Flood Insurance Rate Map
FIRM	DLG
Flood Insurance Rate Map	Digital Line Graph
FIS	Flood Insurance Study
Flash Flood	a flood that rises and falls rapidly with little or no advance warning. Flash floods usually occur as the result of intense rainfall over a relatively small area, intense rainfall over a heavy snow pack or failure of a dam.
Flood –	a condition that occurs when water overflows the natural or artificial confines of a stream or other water

	body or accumulates by drainage over low lying areas. To be considered a flood it must affect two or more properties in the community and must exceed one acre in area.
Flood Crest	the maximum stage or elevation reached by the waters of a flood at a given location.
Flood of Record .	the highest known flood level for an area
Floodplain	low lying, relatively flat areas adjacent to streams and rivers. Floodplains serve several functions including: 1) temporary storage of flood waters, 2) moderation of peak flows, 3) maintenance of water quality, 4) groundwater recharge, 5) prevention of erosion, 6) adsorption of the energy of floodwaters and 7) reduction of damage to the river channel. Floodplains are also areas where the river deposits excess sediment and debris associated with floods after a storm. In addition to the above floodplains provide habitat for wildlife, recreational opportunities (hiking, fishing, boating and, in some areas, hunting) and aesthetic benefits to the community.
Flood proofing	any combination of structural and non structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and there contents. Such actions include raising electrical connections above the Flood Protection Elevation, securing fuel tanks, elevating

	heating, ventilation and air conditioning elements above the Flood Protection Elevation, installing one way valves or traps in sewer lines or other drain lines, adding French drains and sump pumps to areas below the Flood Protection Elevation or adding a waterproof veneer to exterior walls below the Flood Protection Elevation.
Flood Protection Elevation	the base flood elevation plus one foot.
Flood	resistant materials any building product capable of withstanding direct and prolonged contact (72 hours at a minimum) with flood waters without sustaining damage beyond low cost cosmetic repair
Flood Stage	the level on a fixed river gauge at which the overflow of the natural or artificial banks of a stream begins to cause damage in any portion of the stream reach for which the gauge is used as an index.
Flood Warning	an announcement by the National Weather Service to alert the public that flooding is imminent in, or close to, the designated area or is occurring due to heavy rain or dam failure.
Flood Watch	an announcement by the National Weather Service to alert the public that flooding is a possibility in, or close to, the designated area.
Floodway	the part of the floodplain which

	must be kept clear of fill or other obstructions in order to convey the 100 year flood without an excessive increase in flood elevations. This is the area immediately adjacent to the normal channel of the river or streams. Floodways are subject to deeper flooding by higher velocity water. No new buildings or development should be allowed in the floodway. In some jurisdictions floodways are defined as an area adjacent to the stream within a distance equal to 25% of the width of the stream.
Floodway Fringe	the normal channel of the river or stream. Floodway fringes are subject to shallower flooding by slower moving waters.
Forest Land	forest use include area for crops, improved pasture, residential, or administrative areas, improved roads of any width, and adjoining road clearing and power line clearing width.
G	
GIS	Geographic Information System
GPS	Global Positioning System
Gabions	Cylindrical or rectangular wire baskets filled with earth and stones, used in fortifying stream banks, road cuts, and anywhere where soil erosion may be a problem.
Gully Control and Stabilization	Land treatment efforts to stabilize advanced gully erosion areas. Structures, grading, and revegetation may be used in combination. Structural measures

	may include check dams or gully plugs consisting of brush, log or crib, masonry, rock, concrete, gabions, or other materials.
H	
HEC	Hydrologic Engineering Center (U.S. Army Corps of Engineers)
H&H	Hydrologic and Hydraulic (Analyses)
Historic Flood	any known flood for which there is no gage record or other systematic or usable technical record.
I	
IFG Program under WVOES.	Individual Family Grant
ICC	Increased Cost of Compliance.
In Stream Flow	Used in defining the minimum flow necessary for all the uses of water. Some of those uses are fisheries, channel stability, maintenance, riparian habitat maintenance, and aesthetics.
L	
LIDAR	LIght Detection and Ranging (System)
LODR	Letter of Determination Review
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMC	VALID Letter of Map Change Revalidation (Letter)
LOMR	Letter of Map Revision
LOMRF	F Letter of Map Revision Based on

	Fill
Landowners Assisted	Individuals or groups which are provided watershed information or assistance.
Lowest Floor	the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, access to the building, or limited storage in an area other than a basement area is not considered a building's lowest floor, provided that such enclosure is not built so as to render the structure elevation design requirements of Section 60.3.
M	
MNUSS	Map Needs Update Support System
Mitigation	action that permanently reduces, alleviates or eliminates a long term risk to people, infrastructure and property from natural hazards or disasters and their effects. Long term mitigation strategies include planning, policy changes, programs, projects and other activities. Mitigation may occur at a federal, state, or local government level. Private individuals or businesses may also take mitigation efforts.
N	
NFIP	National Flood Insurance Program
NFIRA	National Flood Insurance Reform Act of 1994
NGVD29	National Geodetic Vertical Datum

	of 1929
NEMIS	National Emergency Management Information System. A computerized tracking system that replaced ADAMS, a paper tracking system, as the system for tracking emergency declarations.
Nonstructural	Flood Mitigation efforts to control the damages caused by flooding by means other than construction of physical structures. Typically this includes acquisition of property, relocation of buildings, or elevation of buildings or their contents to remove them to an area above the Flood Protection Elevation.
R	
RFIS	Flood Insurance Restudy
RMM	River Mile Marker. (See River Mile)
Recurrence Interval	The average interval of time, based on an analysis of past records, that can be expected to elapse between floods of a given magnitude. The recurrence interval is a statistical approximation and not a certain guide.
Regulated Floodplain	the portion of the floodplain identified on Flood Insurance Rate Maps as impacted by the 100 year flood. This area is also known as the Special Flood Hazard Area.
Right or Left Bank	the right or left bank as you face down stream. Also called Right or Left Descending Bank.
Riparian Area	Area which includes stream channels, lakes, and wetlands, and adjacent floodplains and

	ecosystems. They include all areas within a horizontal distance from the edge of the water system to an area where vegetation, soils, biogeochemical processes, and other conditions exist because of the influence of water.
Riprapping	Using broken rock, cobbles, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection also applies to brush or pole mattresses, or brush and stone, or other similar materials used for soil erosion control.
Riverine .	Pertaining to rivers
River Mile	The distance designation of points along a stream, usually measured from the mouth. The one exception is the Ohio River where river miles are measured from Pittsburgh Pennsylvania. (See RMM).
S	
SFHA	Special Flood Hazard Area. The portion of the floodplain impacted by the 100 year flood. It may be designated as
Severe Thunderstorm	A thunderstorm which includes hail at least ¾ inch in diameter, winds of at least 58 miles per hour or a downburst. A downburst is strong out rush of wind formed by rain cooled air. Down bursts are frequently mistaken for tornados.
Silviculture	A combination of actions whereby forests are tended, harvested, and replaced.
Spillway	A channel for an overflow of water,

	as from a reservoir.
Stream	any natural or artificial body of water moving under gravity's influence through clearly defined channels to progressively lower levels.
Structural Flood Mitigation stream.	Typically this includes dams, levees, dikes, floodwalls, wetlands and stream construction of physical structures to control damages caused by flooding. Any activity that changes the flow characteristics of the channelization or dredging.
T	
Thunderstorm	a cloud containing lightning and thunder. A typical thunderstorm is usually 15 miles in diameter and lasts for 30 minutes. Heavy rainfall from a thunderstorm may cause flash flooding.
Trunkline	Major two lane highway.
W	
Water Equalizing Vents	g grated or non rated openings into areas below the flood protection elevation that allows water pressure to equalize on both sides of a wall. One square inch of opening is required for every square foot of space below the base flood elevation.
Watershed	the land area drained by a creek, stream or river. Also called a Drainage Basin. It can be identified by connecting the highest elevations between two adjacent drainage basins.

Water table	the top of an unconfined aquifer, it indicates the level below which soil and rock are saturated with water. (See Zone of Saturation.)
West Virginia Flood Protection Plan	a document developed by a task force consisting of state and federal agencies. It is intended to assist state and local officials to plan, direct, update and implement flood protection activities.
Wetland	An area periodically or permanently saturated with water, where the presence of water is a dominant factor and produces adverse effects on all vegetation except for aquatic plant communities (included bogs, marshes, ponds, sloughs, streams, swamps, and wet meadows).
Wildlife Habitat Development	Measures to create habitat for food and cover, and for erosion control.
Woodland Grazing Control	Measures, such as fencing, which are used to exclude or control grazing to reduce or avoid damage to soil and water.
Z	
Zone of saturation	the part of a groundwater system where all of the spaces between soil and rock material are filled with water. The water found in this zone is called groundwater. (See Water table.)

APPENDIX N - Summary of Public Comments Received

COMMENTS FROM PUBLIC MEETINGS, E-MAIL, AND MAIL	FREQUENCY
Dredging - Dredge streams. (23 of the comments received were on one petition from Rowlesburg)	55
Levees & Floodwalls - Unengineered Projects - use material dredged from river to build a levee around Rowlesburg	23
Culverts - Old culverts can't handle flows from new development and other changes.	15
Debris - Debris blocks small streams and causes local flooding.	15
Mapping - Improve and update Flood Plain mapping.	15
Development - Development is causing floods.	14
Highway - DOH and Railroad bridges are too low, they catch debris and cause flooding.	12
Logging - Logging is causing floods.	10
Permitting - Streamline the permitting process and clarify permit requirements and agency authority.	10
Problem - Roads are blocked during high water.	10
Dam - Dam the Greenbrier	9
Highway - "New" construction projects are causing flooding.	8
Enforcement - require retention/detention ponds at every new development.	7
Small ponds - Need more small watershed dams and retention ponds.	7
Stormwater - Stormwater Management is needed	7
Coordination - Coordinate plan and future flood protection activities with towns and cities.	6
Coordination - Coordination and cooperation among state federal and local agencies needs to be inplace.	6
Dam - Don't Dam the Greenbrier	6
Enforcement - Enforce Flood Plain regulations	6
Buyout - Buyout sites and use them for greenspace. Buyout Marlinton	5
Debris - Plant growth in streams needs cleaned out	5
Drought - Flooding not only issue. Need help with low flows too. (Water supply)	5
Enforcement - County commissions don't want to enforce regulations. They want development.	5

COMMENTS FROM PUBLIC MEETINGS, E-MAIL, AND MAIL	FREQUENCY
Erosion and Sedimentation - Erosion is a problem. Sediment raises the stream bed and fills in spaces where macro invertebrates live.	5
Technical Assistance - We need more technical assistance from state and federal agencies. Rural areas don't have the expertise to address these problems.	5
Coordination - Address the problems on a watershed basis not by throwing money at small spots like Marlinton, Milton etc.	4
Enforcement - Stop allowing people to fill in the flood plain and dump water on someone else.	4
Training - Training and awareness for all programs and for all people needs to be improved.	4
Coordination - Coordination and cooperation or water releases from private dams (power companies) and Corps of Engineers locks and dams needs to be built into plan.	3
Coordination - Stop giving citizens the run around. Tell us who is responsible to help them? Don't tell taxpayers to do something to solve the flooding problem. Help them!	3
Enforcement - We need to quit building along the rivers.	3
Erosion and Sedimentation - Has raised stream bed to level of road.	3
Flood Insurance - Cost of NFIP Flood Insurance is too high.	3
Highway - Debris backs up behind low water bridges and causes flooding. They should be banned.	3
Logging - Clear-cutting, not just timbering, is causing flooding.	3
Money - Use National Guard to dredge streams and do stream bank work.	3
Money - We need funds appropriated not just approval of projects.	3
Money - We need funds to provide local share on projects	3
Stream Banks - More riparian zone restoration and buffer zones along stream banks not just stream restoration.	3
Stream banks - We need more bank stabilization projects.	3
Channelization - Straighten the streams to reduce erosion.	2
Coordination - Our area was studied but we never heard anymore about it.	2
Coordination - Plan projects so everyone knows about them ahead of time.	2
Debris - Prune trees to 15 or 20 feet from ground to prevent trash and debris catching on the limbs.	2
Debris - who will help pay for disposal of debris removed from streams	2
Dredging - Dredging doesn't work. The sediment just fills in back in.	2
Drinking water - Flooding has destroyed my well and FEMA won't fix it. (Sewage from septic systems or high iron).	2

COMMENTS FROM PUBLIC MEETINGS, E-MAIL, AND MAIL	FREQUENCY
Enforcement - Don't let people get assistance and Flood Insurance after they refuse a buyout.	2
Flood Warning System - Don't work for me because my floods aren't a life or death issue. It is more nuisance flooding.	2
Flood Warning System - People pay attention to flood warnings only if they have been flooded before.	2
Highway - Bridges are poorly placed and caused stream to bend where it should be straight.	2
Highway - Clean out the ditches and culverts to prevent water from flowing across road. Does DEP prevent cleaning ditches and culverts?	2
Karst - Karst areas have different problems with flooding than rest of state and should be handled differently.	2
Logging - Need more enforcement of BMP's.	2
Logging - Runoff causes sedimentation.	2
Mapping - Counties with fast developing areas should pay for their own flood plain mapping.	2
Mapping - We need a statewide listing of flood prone land.	2
Mining - Mining is causing flooding.	2
Money - Modify local powers act so a local jurisdiction does not have to meet all criteria to come up with match.	2
Money - There should be a state pool of money to pay for damages too small to be declared a disaster.	2
Money - We need funds to help replace culverts that are too small or poorly placed.	2
Money - We need money to repair or replace existing flood structures.	2
Oil and Gas - Dirt roads need enforcement of BMPs	2
Permitting - Permitting of culverts and channelization should be based on regional factors (topography, geology, etc.) which balance flood control with development.	2
Problem - Our problem is small streams coming up fast and going down fast.	2
Public Imput - Make public input on flooding issues easier.	2
Channelization - Fill in the flood plains to reduce flooding impacts.	1
Coordination - A single agency should be designated to deal with all flooding issues that has "Flood Control" as part of its name.	1
Coordination - We need a designated contact person for communities	1
Coordination - We need a designated contact person for private citizens	1
Culverts - I need an old culvert replaced on an orphan road adopted by the state. Who will do it.	1
Dam - Dams with 50 year life need rehabilitated or replaced.	1

COMMENTS FROM PUBLIC MEETINGS, E-MAIL, AND MAIL	FREQUENCY
Dam - Inspect dams more often.	1
Drought - Use green spaces for "water banking" so can draw out during low flows	1
Economic Development - Flooding damages economic development. Small businesses go under at higher rate than big business. May be related to cost of flood insurance.	1
Enforcement - Don't let industries store materials in the floodway.	1
Enforcement - Don't tell me what to do with my property! I'll listen to suggestions but not commands.	1
Enforcement - Every county should have an enforcement officer.	1
Enforcement - How do we relocate people if they don't want to go?	1
Enforcement - Improve flood plain maps so we can improve enforcement	1
Enforcement - Make new parking lots use permeable surfaces to allow water to soak in.	1
Enforcement - Require a determination of location of property in relation to flood plains on all real estate transactions.	1
Enforcement - Will zoning (Land Use Controls) help resolve flooding problems?	1
Environmental - Plan must identify areas not suitable for structures for environmental reasons.	1
Farm - Preserve small farms and protect them from large corporations	1
Farm - Provide assistance for farm erosion even when it doesn't endanger a house or structure.	1
Flood Warning System - Alarms need to set off sirens as well as radio's & Tv.	1
Flood Warning system - False alarms are a problem.	1
Flood Warning System - Improve maintenance of existing rain and stream guages.	1
Flood Warning System - Money earmarked for a warning system would be better spent on solving the problems.	1
Flood Warning System - They don't work because electricity is the first thing to go out. Next to go are the phones.	1
Flood Warning System - We need a reliable and effective warning system.	1
Flood Warning System - We need better modeling of streams.	1
Flood Warning System - We need better stream gauges.	1
Highway - DOH is putting a structure in the floodway. It will increase flooding.	1
Highway - DOH left the remains of an old bridge in the river when they replaced the bridge. It catches debris.	1

COMMENTS FROM PUBLIC MEETINGS, E-MAIL, AND MAIL	FREQUENCY
Highway - Low water bridges backs up water and lets it through slowly over a longer time. They should be encouraged.	1
Highway - Removing one bridge abutment dropped 100 year BFE almost four feet.	1
Highway - Why won't DOH leave their Right of Way to correct a problem they caused?	1
Highway - Will highway construction back up water and cause more flooding?	1
Karst - Use sinkholes in karst area as retention / detention ponds.	1
Land Rights - Can you use eminent domain to enter a creek to fix a problem?	1
Levee & Floodwalls - Open end of levee at downstream end of Moorefield	1
Levee & Floodwalls - Ponding area behind levee in Moorefield	1
Levees & Floodwalls - Unengineered Projects - Unengineered dikes are throwing water onto land on other side of river	1
Logging - Filling in streams.	1
Logging - Lots of the tops and limbs left in or near streams come from fire wood people not loggers.	1
Logging - Lots of the tops that are left in or near streams contribute to woody debris.	1
Logging - Steam crossings not built right	1
Money - Provide a tax break for people who move their house out of the flood plain.	1
Money - We need funding to help with local match between disasters	1
Money - We need funds from state to allow Watershed Associations to help mitigate damages, create wetlands, and do other watershed projects.	1
Money - Will money be diverted from other things to go to this plan?	1
Oil and Gas - lines and wells need protection during high water.	1
Permitting - County Commissions and DNR should not be in permitting process.	1
Plan - Will this be a true statewide plan?	1
Priority - Educating our children is the only thing that should have a higher priority than flooding.	1
Problem - Corps of Engineers let person change stream. This caused my flooding.	1
Problem - Four wheelers are causing erosion on dam sites.	1
Problem - Our flooding is more stormwater related than floodplain related	1
Small ponds - Raise the height on farm ponds so they hold more water	1

COMMENTS FROM PUBLIC MEETINGS, E-MAIL, AND MAIL	FREQUENCY
and let it out over time.	
Small ponds - We need to increase the land holding water by using beaver ponds, farm ponds, wetlands, and anything else.	1
Stream banks - Improve streambank management	1
Stream banks - Stream work above my property is causing me to flood.	1
Unengineered Projects - My neighbor built a floodwall that throws more water onto me.	1
Wildlife - Who can remove beaver dams?	1
TOTAL NUMBER OF COMMENTS MADE. ONE PERSON MAY BE REPRESENTED MORE THAN ONCE.	431

Appendix P Contact Information

Conservation Districts

Capitol Conservation District
418 Goff Mountain Road, Suite 102
Cross Lanes, WV 25313
Phone: (304) 759-0736
Fax: (304) 776-5326

Eastern Panhandle Conservation District
151 Aikens Center, Ste. 1
Martinsburg, WV 25401-6711
Phone: (304) 263-4376
Fax: (304) 263-4986

Elk Conservation District
801 State Street
Gassaway, WV 26624
Phone: (304) 364-5105
Fax: (304) 364-5434

Greenbrier Valley Conservation District
717 North Jefferson Street
Lewisburg, WV 24901
Phone: (304) 645- 6173
Fax: (304) 645-4755

Guyan Conservation District
2631 Fifth Street Road
Huntington, WV 25701
Phone: (304) 528-5718
Fax: (304) 697-4164

Little Kanawha Conservation District
91 Boyles Lane
Parkersburg, WV 26104
Phone: (304) 422-9088
Fax: (304) 422-9086

Monongahela Conservation District
201 Scott Avenue
Morgantown, WV 26508
Phone: (304) 296-0081
Fax: (304) 285-3151

Northern Panhandle Conservation District
132 Peters Run Road
Wheeling, WV 26003
Phone: (304) 243-5694
Fax: (304) 242-7039

Potomac Valley Conservation District
500 East Main Street
Romney, WV 26757-1836
Phone: (304) 822-5174
Fax: (304) 822-3728

Southern Conservation District
463 Ragland Road
Beckely, WV 25801
Phone: (304) 253-0261
Fax: (304) 253-0238

Tygarts Valley Conservation District
Route 4, Box 501
Philippi, WV 26416
Phone: (304) 457-3026

Fax: (304) 457-4131

Upper Ohio Conservation District
10 Pleasant View Lane
Sistersville, WV 26175-9104
Phone: (304) 758-2512
Fax: (304) 758-4303

West Fork Conservation District
Route 2, Box 204-E
Mt. Clare, WV 26408
Phone: (304) 627-2160
Fax: (304) 624-5976

Western Conservation District
224-C First Street
Point Pleasant, WV 25550
Phone: (304) 675-3054
Fax: (304) 675-3054

Regional Planning Councils

Region I Planning & Development Council
1330 Mercer Street
P. O. Box 1442
Princeton, WV 24740-1442
PHONE: (304) 431-7225
FAX: (304) 431-7235

Region II Planning and Development Council
1221 Sixth Avenue
P. O. Box 939
Huntington, WV 25712-0939
PHONE: (304) 529-3357
FAX: (304) 529-7229

Region III Planning and Development Council
315 D Street
South Charleston, WV 25303
PHONE: (304) 744-4285
FAX: (304) 744-2534

Region IV Planning & Development Council
500 B Main Street
Summersville, WV 26651
PHONE: (304) 872-4970
FAX: (304) 872-1012

Region V Planning and Development Council
531 Market Street
P.O. Box 247
Parkersburg, WV 26101
PHONE: (304) 422-4993
FAX: (304) 422-4998

Region VI Planning and Development Council
7003 Mountain Park Drive
White Hall, WV 26554
PHONE: (304) 366-5693
FAX: (304) 367-0804

Region VII Planning and Development Council
4 West Main Street
Buckhannon, WV 26201
PHONE: (304) 472-6564
FAX: (304) 472-6590

Region VIII Planning and Development Council
8 Airport Road, Grant County Industrial Park
P. O. 849
Petersburg, WV 26847-0849
PHONE: (304) 257-2448
FAX: (304) 257-4958

Region IX Planning and Development Council
121 West King Street
Martinsburg, WV 25401
PHONE: (304) 263-1743
FAX: (304) 263-7156

Region X Planning and Development Council
105 Bridge Street Plaza
P. O. Box 2086
Wheeling, WV 26003-2086
PHONE: (304) 242-1800
FAX: (304) 242-2437

Region XI Planning and Development Council
124 North Fourth Street
Steubenville, OH 43952
PHONE: (740) 282-3685
FAX: (740) 282-1821

Canaan Valley Institute
P. O. Box 673
Davis, WV 26260
PHONE: (304) 866-4739
FAX: (304) 866-4759

The Honorable Robert C. Byrd
U.S. Senate
311 Hart Senate Office Building
Washington, DC 20510
PHONE: (202) 224-0042
FAX: (202) 224-9613

Senator Byrd's State Office
300 East Virginia Street
Suite 2630
Charleston, WV 25301-2523
PHONE: (304) 342-5855
FAX: (304) 343-7144

U.S. Army Corps of Engineers
USAED Baltimore
10 South Howard Street
Baltimore, MD 21201
PHONE: (410) 962-7608

U.S. Army Corps of Engineers
USAED Huntington
502 8th Street
Huntington, WV 25701
PHONE: (304)-399-5636

U.S. Army Corps of Engineers
USAED Pittsburgh
1000 Liberty Ave
Pittsburgh, PA 15222-4186
PHONE: (412)-395-7502

United States Department of Agriculture
West Virginia Farm Service Agency
John Rader, State Executive Director
PHONE: 304-284-4800
FAX: 304-284-4821
Email Beth.Hoh@wv.usda.gov

United States Department of Agriculture
Forest Service
180 Canfield Street
Morgantown, WV 26505-3101
PHONE: (304) 285-1508

US Department Of Agriculture
Natural Resources Conservation Service
75 High Street Room 301
Morgantown, WV 26505
PHONE: (304) 284-7540

Department of Commerce (DOC)
Economic Development Administration
Disaster Recovery Coordinator, EDA
Herbert C. Hoover Building
Room 7327
Washington, DC 20230
PHONE: (202) 482-2659

US Department Of Comme rce -
National Oceanographic And Atmospheric Administration
National Weather Service
400 Parkway Road
Charleston, WV 25309
PHONE: (304)-746-0180

US Department Of Interior -
Fish And Wildlife Service

US Fish and Wildlife Service
694 Beverly Pike
Elkins, WV 26241
PHONE: 304-636-6586
FAX: 304-636-7824

US Department Of The Interior -
Geological Survey
US Geological Survey
Water Resources Division
11 Dunbar Street
Charleston, WV 25301
PHONE: (304) 347-5130

US Department Of The Interior
National Park Service
P.O. Box 246
Glen Jean, WV 25846
(304) 465-0508

US Department Of Transportation
Federal Highway Administration
700 Washington Street East
Geary Plaza
Suite 200
Charleston, WV 25301
PHONE: (304) 347-5928

US Environmental Protection Agency
Region 3
1650 Arch Street
Philadelphia, PA 19103-2029
PHONE: (800) 438-2474
FAX: (215) 814-5000
http://www.epa.gov/region03

Federal Emergency Management Agency
FEMA Region III
One Independence Mall, Sixth Floor
615 Chestnut Street
Philadelphia, PA 19106-4404
PHONE: (215) 931-5614
http://www.fema.gov

West Virginia Beekeeper's Association
c/o John Campbell, Secretary/Treasurer
West Virginia Beekeeper's Association
102 First Street
Parsons, WV 26287
PHONE: (304) 478-3675

West Virginia Board of Examiners of Land Surveyors
P. O. Box 925
Fayetteville, WV, 25840
(304) 574-2980

West Virginia Conservation Agency
1900 Kanawha Boulevard East
Charleston, WV, 25305-0193
PHONE: (304) 558-2204
FAX: (304) 340-4839
http://www.wvca.us

West Virginia Department of Environmental Protection
601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

West Virginia Department of Environmental Protection
Division of Water and Waste Management
601 57th Street SE
Charleston, WV 25304
(304)-926-0440
http://www.wvdep.org

WV Development Office
Building 6, Room 525
1900 Kanawha Boulevard East
Charleston, WV 25305-0311
PHONE: (304) 558-0352
FAX: (304) 558-1189

West Virginia Division of Forestry
Guthrie Center Building 13
1900 Kanawha Boulevard East
Charleston, WV 25305-0180
PHONE: (304) 558-2788

West Virginia Division of Highways
Building 5, Room 109
1900 Kanawha Boulevard East
Charleston, WV 25305-0403
PHONE: (304) 558-3505

West Virginia Division of Labor
Building 6, Room B749
1900 Kanawha Boulevard East
Charleston, WV 25305
PHONE: (304) 558-7890
Fax: (304) 558-3797

West Virginia Division of Natural Resources
Building 3, Room 669
1900 Kanawha Boulevard East
Charleston, WV 25305-0660
PHONE: (304) 558-2754

West Virginia Division of Natural Resources
Wildlife Resources Section
Elkins Operations Center
P. O. Box 67
Elkins, WV 26241
PHONE: (304) 637-0245
FAX: (304) 637-0250

West Virginia Farm Bureau
1 Red Rock Road
Buckhannon, WV 26201
PHONE: (304) 472-2080
FAX: (304) 472-6554

West Virginia Geological and Economic Survey
Mont Chateau Research Center
P. O. Box 879
Morgantown, WV 26507
(304) 294-5331

WV Housing Development Fund
814 Virginia Street East
Charleston, WV 25301
PHONE: (304) 345-6475 ext. 317
FAX: (304) 340-9996

West Virginia Insurance Commission
1112 Smith Street
P. O. Box 50540
Charleston, WV 25305-0540
PHONE: (304) 558-3345

West Virginia Office of Emergency Services
Capitol Complex
Building 1, Room EB-80
1900 Kanawha Boulevard East
Charleston, WV 25305-0360
PHONE: (304) 558-5380

West Virginia Real Estate Commission
1033 Quarrier Street
Suite 400
Charleston, WV 25301-2315
PHONE: (304) 558-3555
FAX: (304) 558-6442

West Virginia Rivers Coalition
787 Twin Oaks Drive
Bridgeport, WV 26330
PHONE: (304) 842-2779

West Virginia State Board of Professional Engineers
608 Union Building
Charleston, WV 25301-2104
PHONE: (304) 558-3554

West Virginia State GIS Coordinator
West Virginia Geological & Economic Survey
1124 Smith Street STE 201A
P. O. Box 11928
Charleston, WV 25339
PHONE: (304) 558-4218
FAX: (304) 558-4963

West Virginia University
Cooperative Extension Service
Room 704 Knapp Hall
P.O. Box 6031
West Virginia University
Morgantown, WV 26506
PHONE: (304) 293-6967 ext 3427

PARTICIPATING AGENCIES AND ORGANIZATIONS

Canaan Valley Institute

Federal Emergency Management Agency—Region III

Kanawha County Planning Office

National Weather Service

Trout Unlimited

U. S. Army Corps of Engineers—Baltimore District

U. S. Army Corps of Engineers—Huntington District

U. S. Army Corps of Engineers—Pittsburgh District

U. S. Department of Agriculture—Farm Service Agency

U. S. Department of Agriculture—Natural Resources Conservation Service

U. S. Fish and Wildlife Service

U. S. Geological Survey

West Virginia Association of Conservation Districts

West Virginia Conservation Agency

West Virginia Department of Agriculture

West Virginia Department of Transportation

West Virginia Development Office

West Virginia Department of Environmental Protection

West Virginia Division of Forestry

West Virginia Division of Natural Resources

West Virginia Farm Bureau

West Virginia Housing Development Fund

West Virginia Office of Emergency Services

West Virginia Regional Planning and Development Offices

West Virginia Rivers Coalition

West Virginia University Extension Service