



FLOODING/STORMWATER RELATED PROGRAMS IN PENNSYLVANIA

Data, Models, Products, Applicability

A White Paper by the Stormwater Subcommittee
of the
Floodplain Mapping and Technical Committee
of the
Pennsylvania Association of Floodplain Managers

FINAL 1-15-2016

Authors:

Paul DeBarry, NTM Engineering, Inc.
Benjamin J. Ehrhart, LandStudies, Inc.
Eric Jespersen
Gary Milbrand, York Township
Nate Miller, Summit Township
Jeff Scholly, PACD
Cleighton Smith, Bergmann Associates
Kerry Wilson, CFM, Consultant
Christine Worley, URS Inc.

Reviewers:

David Gilbert, GeoDecisions
Eric Jespersen
Ben Pratt, SRBC
Kerry Wilson, CFM, Consultant
Christine Worley, URS, Inc.

Additional Committee Members:

Kim Dunn, Dewberry
Dr. Robert Traver, Villanova University
Nicole Wooten, Wyoming Co. Planning Commission

TABLE OF CONTENTS

	<u>Page</u>
I. Executive Summary	4
II. Background Information	4
III. Programs Related To Flooding and/or Stormwater.....	5
A. The National Flood Insurance Program (NFIP)	5
B. PA Act 166 – Floodplain Management Act	12
C. PaDEP Act 167	17
D. Act 68 of 2013.....	22
E. Act 123 of 2014.....	22
F. PennDOT Bridges and Culverts.....	23
G. NPDES/MS4.....	24
H. State Water Plan	26
I. Chesapeake Bay Program	29
J. USACE.....	32
K. Susquehanna River Basin Commission	34
L. DCNR (River Conservation Plans)	35
M. Pennsylvania Fish and Boat Commission (PaFBC).....	37
N. Local Projects (tax or infrastructure).....	37
O. Pennsylvania Dam Safety & Encroachment Act (Act 325 of 1978)	39
P. Hazard Mitigation Planning	42
IV. Sub-Committee’s Analysis.....	45
V. Recommendations.....	46
VI. Conclusions.....	46
VII. References.....	47

APPENDICES

Appendix A: MatrixTo be completed at a later date

LIST OF FIGURES

	<u>Page</u>
Figure I. FEMA Regions:	8
Figure II. Pennsylvania Municipalities	14
Figure III. Approved Act 167 Stormwater Management Plans.....	21
Figure IV. Pennsylvania Bridges and PennDOT Districts.....	23
Figure V. MS4 municipalities / 2010 Urbanized Areas	25
Figure VI. Regional Committees.....	27
Figure VII. Chesapeake Bay Watershed.....	30
Figure VIII. US Army Corps of Engineers Districts.....	33

Figure IX. Susquehanna River Basin	35
Figure X. DCNR Rivers Conservation Program.....	36

Integration of Stormwater with Floodplain Management

I. EXECUTIVE SUMMARY

Flooding and stormwater, in the past, had been thought of as two separate regulatory programs. This is evidenced by Pennsylvania's Act 166, the Flood Plain Management Act, and Act 167, The Storm Water Management Act. As a result, various water-related programs had been developed throughout the Commonwealth independently of each other, with many of the same goals, wants, needs and data not coordinated. However, through the years, Floodplain Managers have learned that proper stormwater management can help reduce flooding, and that the two disciplines are truly integrated through integrated water resource management. This white paper reviews the background, jurisdiction and legal authority of the various programs in the State of Pennsylvania; their goals, geographic extent of the program, data required, models utilized, final products, applicability to other programs and their current status and budget as well as recommendations for corrective measures that are supported by the PA Floodplain Managers. The goal is to helpfully guide the future of these and new programs, to coordinate policy, efforts, data, procedures, and products, and to save valuable funds and resources.

II. BACKGROUND INFORMATION

A. Introduction

Floodplain managers have found their understanding of the causes of flooding have changed over recently years. . It starts as a raindrop and could eventually end up as a torrential river floodwater. In between it could take many paths; captured in tree canopies and evaporated right away, infiltrated, used for water supply, irrigation, hydropower, etc. Flooding is often thought of as the end result of a large precipitation event, unaffected by the local management of the surface runoff of this precipitation, or stormwater, on its way to the river. In the past, the control of flooding was thought of through structural solutions, i.e. dikes, levees, dams, channels, etc. Experience has shown us instead that management of floodwater requires a holistic approach, taking into account not only its quantity, location, and quality, but also characteristics of the land; land use, soils, slope, etc. Mitigating all but the most extreme floodwaters can be achieved through management of stormwater runoff from the land surface, and often by mimicking the natural processes found in larger floodplains. Therefore, stormwater and floodwaters are truly integrated, and management of stormwater can aid in floodplain management.

B. Goals

PAFPM formed subcommittees to document the status and understanding of stormwater controls and regulations as they may affect flooding in Pennsylvania. The goal of the stormwater subcommittee is to gather and disseminate materials that link stormwater to flooding. The intent is to show standards for modeling that can be applied to support flood mapping.

Franklin Kury is a well know legislator and author on stormwater in Pennsylvania. In his 2011 book entitled “Clean Politics, Clean Streams”, Franklin Kury relates the legislative history of two important laws from the 1970’s – the Flood Plain Management Act (Act 166) and Storm Water Management Act (Act 167). Interestingly, these two Acts were originally debated and matured together as a single law throughout the two legislative sessions following Tropical Storm Agnes in 1972. Ultimately, the separation into separate laws during the third session was largely a tactic to aid passage, rather than a valid technical separation of stormwater management from floodplain management.

This subcommittee considers the split of Acts 166 and 167 to have separated water quality considerations from water quantity, despite the assumption that minor floods bring a huge flush of sediment and major floods yield mass quantities of biological and chemical pollutants. Additionally, we think it normal that development in or near floodplains are more of a stormwater management challenge than a diminution of our natural flood resilience.

Our approach in this white paper was to identify a variety of state and Federal water related programs and then dissected the programs by reviewing each according to legal authority/jurisdiction, geographic coverage, data required, technical analysis models utilized, products produced, applicability to other programs, budget status and strengths and weaknesses. This document sets the stage for the assumption that there is a direct link between stormwater and the floodplain. Section III below contains descriptions of many of the programs related to stormwater and floodplain management extant in the Commonwealth today.

III. PROGRAMS RELATED TO FLOODING AND/OR STORMWATER

A. The National Flood Insurance Program (NFIP)

1. Official Name and Legal Authority

The National Flood Insurance Program Act of 1968, as amended by The Flood Disaster Protection Act of the 1973, The Flood Insurance Reform Act of 1994 and The Homeowners Flood Insurance Affordability Act of 2014,et.al . 44 Code of Federal Regulations (CFR), Sec.59-60, as revised.

2. Background

In 1968, the United States Congress created the National Flood Insurance Program (NFIP) to help homeowners, renters, business owners and others obtain flood insurance. In exchange for subsidized flood insurance, municipalities where these property owners are located, must adopt and enforce floodplain management regulations. The local regulations are applicable to all new development and major improvements to structures in FEMA identified flood hazard areas.

The Federal Program can be described as two (2) programs in one (1):

- a) A Community Development Program requiring the administering of local land use/development regulations and construction codes, i.e., collectively known as floodplain management regulations, to protect the health and safety of the community in identified floodplain areas and
- b) An Economic Development Program providing for affordable flood insurance, homeowners, renters, business owners and others to help protect property owners from economic loss from flood damage.

In short, the Federal program is designed so that property owners cannot have the flood insurance benefit without the applicability of floodplain management regulations.

FEMA staff members frequently describe the NFIP as a three-legged stool. In this description of the Program, the stool legs include the flood insurance leg, the floodplain or hazard area mapping leg, and the floodplain management regulation leg.

It must be noted that the NFIP was legislated primarily because the huge investment in structural projects such as flood controls dams, flood walls and levees, channelization of streams, etc., to protect property owners from flooding was not reducing flood damage costs significantly and/or effectively.

The National Flood Insurance Program/NFIP Act has been amended several times by Congress since its passage in 1968. The most recent laws, the Biggert-Waters Flood Insurance Reform Act of 2012 and Homeowners Flood Insurance Affordability Act of 2014, collectively are and will continue to have an impact on both flood insurance policyholders and the communities/municipalities they reside in both the near future and over the long term.

Commonly referred to as BW -12 and GW -14, the Acts, among other things, provide for the gradual transition of the flood insurance policy rates from a subsidized rate to an actuarial rate basis. The enactment of these two laws happened because of the concern at the national level about the financial viability of the NFIP. There has been a huge drain on the flood insurance financial system from the large number insurance claims paid out as a result of the major flood disasters that have occurred over the last decade and a half.

For flood insurance policyholders, the impact most likely can be either a negative or positive one depending on the individual circumstances of each policyholder relative to the existence of a basement and/or the presence of an elevation certificate, etc. This change applies to both residential and non-residential structures.

In PA, there are many river towns that have numerous residential and non-residential properties located in FEMA identified floodplains that were constructed prior to 1978. It appears that some policyholders will not be able to afford flood insurance because of the high actuarial rates to be charged for all flood coverage over the next four or five years. These policyholders may be forced to default on their mortgages because of the high premiums for federally required flood insurance. Consequently, they probably would walk away from the property leaving real estate taxes unpaid and structures to deteriorate.

River Towns' Main Street businesses in identified floodplains would be similarly affected. Most municipalities, counties and school districts in PA rely on heavily on these tax revenues to fund their services. Depending upon the number of defaults or foreclosures that occur in these places/municipalities, the financial viability of many of these communities will be threatened.

The full impact of the NFIP changes on PA communities must be further evaluated at this point to give communities and their flood policyholders adequately detailed information to make informed mitigation decisions. Otherwise, mitigation decisions will be based more on emotion than on fact and reasoning. This type of decision-making would negatively impact the social viability as well as the financial viability of these communities/municipalities and their citizens.

More detail on the laws themselves can be found in the following:

<https://www.fema.gov/flood-insurance-reform>

[http://www.floods.org/ace-files/documentlibrary/2012 NFIP Reform/FEMA HFIAA 04-2015Changes FactSheet.pdf](http://www.floods.org/ace-files/documentlibrary/2012%20NFIP%20Reform/FEMA%20HFIAA%2004-2015Changes%20FactSheet.pdf)

[http://www.floods.org/ace-files/documentlibrary/2012 NFIP Reform/HFIAA Analysis ASFPM 4-17-14 Final.pdf](http://www.floods.org/ace-files/documentlibrary/2012%20NFIP%20Reform/HFIAA%20Analysis%20ASFPM%204-17-14%20Final.pdf)

3. Jurisdiction (agency)

The NFIP is under the jurisdiction of FEMA which is located within the Federal/US Department of Homeland Security (DHS). FEMA interfaces with both public and private sectors in overseeing the implementation of the many facets of the Program and will be more fully described under the Products sub-heading. In PA, the PA Department of Community and Economic Development has been designated the official State

Coordinating Agency to coordinate all floodplain management aspects of the Program in the state.

4. Geography

FEMA administers the program via its D.C. headquarters with the direct assistance of ten (10) Regional Offices located throughout the USA. Pennsylvania is covered by its Region 3 Office as shown in the attached map. Relative to NFIP eligibility and local compliance, the attached map of the Commonwealth and its 2500 +municipalities shows the large number of communities within the Commonwealth Some 2462 NFIP participating municipalities are actually participating in the program within PA with 38 additional municipalities having a flood hazard area but not participating in the NFIP.

<http://www.fema.gov/cis/PA.html>

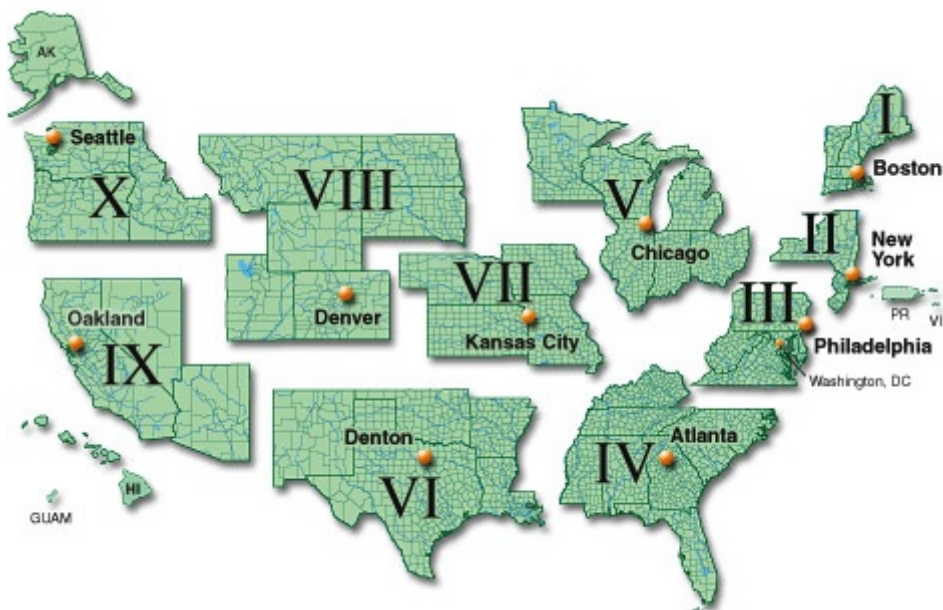


Figure I. FEMA Regions

5. Data Required

Both hydrologic and hydraulic data are required in order for FEMA to provide, maintain and update Flood Insurance Studies (FISs) and Flood Insurance Rate Maps (FIRMs). FEMA obtains the data from a variety of sources both public and private. Public agencies such as the Corps of Engineers (COE), the US Geological Survey (USGS), River Basin Commissions (DRBC, SRBC), PA DEP, and others are primary sources for hydrologic data. Frequently, FEMA directly contracts with private engineering firms to develop and/or update the necessary data these studies and maps require. The aforementioned public agencies and Commissions, State or Regional agencies and universities can also secure some FEMA funding through FEMA's Cooperating Technical Partners (CTP) Program to do FIS/FIRM.

<http://www.fema.gov/cooperating-technical-partners-program/cooperating-technical-partners-program>

Digital base mapping (aerials and LIDAR) for PA was developed through a variety of funding sources and public-private partnerships. This effort involved USGS, DCNR, PEMA and its Regional Homeland Security Task Forces, various County GIS and Planning Commission/Department offices, a private industry group, and numerous GIS specialty firms among others.

6. Models

FIS/FIRMs

FEMA's latest nationwide mapping initiative is called Risk Mapping, Assessment and Planning (Risk MAP) and has developed a multi-year plan to continue FIS/FIRM modernization. The overall purpose is to increase public awareness of flood risk that should lead to action that reduces risk to life and property.

<http://www.fema.gov/risk-mapping-assessment-planning>

FEMA has established an overall policy for flood risk analysis and the development of FIS/FIRMs which is located at the following specific FEMA website:

<http://www.fema.gov/guidelines-and-standards-flood-risk-analysis-and-mapping>

Additionally, FEMA has established minimum requirements for the development of both the hydrologic and hydraulic information necessary for the preparation of more accurate FISs/FIRMs. HEC-SSP 1.1, SWMM and PEAKFQ 2.4 are hydrologic models that are acceptable to the FEMA flood risk analysis process used in FIS development. TR-20/55 usually requires special approval from FEMA R3 to be used in PA.

<http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/hydrologic-models-meeting-minimum-requirement#1>

It should be noted that hydrologic models for Act 167 Stormwater Management compliance are based on future hydrologic conditions as opposed to existing hydrologic conditions as is the case with FEMA FISs/FIRMs.

HEC-RAS is the hydraulic model most frequently used in the preparation in FEMA FIS/FIRM work in PA.

<http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/numerical-models-meeting-minimum-requirement-0#1>

Insurance

FEMA has developed standard operating procedures and forms that provide guidance for the Private Insurance Industry, et.al to handle the flood insurance sales, marketing, and the adjusting of claims. A good website for more info on flood insurance is:

www.floodsmart.gov

The official Flood Insurance Manual can be found at the following FEMA website:

<http://www.fema.gov/flood-insurance-manual>

Floodplain Management Regulations

Local compliance with FEMA's minimum floodplain management regulations requires the enactment and enforcement of local codes and ordinances. PA DCED has developed Models or Suggested Ordinance Provisions that comply with FEMA required Floodplain Management Regulations which can be found on the PA DCED website:

http://www.newpa.com/webfm_send/1807

<http://www.tcrpc-pa.org/Documents/DCED%20FEMA%20Model%20D.pdf>

<http://www.nfrmp.us/state/docs/Pennsylvania/TheOrdinance.pdf>

Title12Ch113 PA FPM DCED

<http://www.pacode.com/secure/data/012/012toc.html>

7. Products

FIS/FIRMs

FEMA has a Product Catalog located on it digital Map Service Center website:

<https://msc.fema.gov/webapp/wcs/stores/servlet/StoreCatalogDisplay?storeId=10001&catalogId=10001&langId=-1&userType=G>

Both paper and digital FIS and FIRMs can be obtained from this source. These products are organized alphabetically by State and then within each state, the Counties are also listed alphabetically. Their respective municipalities can be found within the key of the selected County FIRM. Other RiskMap products can be located in the catalog as well. FEMA allows property owners to request FIRM revisions by submitting a Letter of Map Amendment (LOMA) or Conditional Letter of Map Revision (CLOMR), etc.

Insurance

Effective flood insurance policies in PA are identified on FEMA's Flood Insurance e-database but access is limited due to the Privacy Act restrictions.

The Flood Insurance Manual is also located on the above Product Catalog website. Relative to the actual sale of flood insurance policies and the handling of flood related claims, it should be indicated that private insurance companies, brokers, and licensed insurance agents and adjusters, among others, are directly involved with the insured.

Floodplain Management Regulations

Municipalities use FIS/FIRMs as the basis to implement their floodplain management regulation requirements required by FEMA and PA Act 166. The end products here are the adoption of an amended zoning ordinance, amended subdivision regulations, amended building code, and/or amended Floodplain management ordinance.

Enforcement is documented via the local development permitting system which is associated with the above identified ordinances and/or denied permitting records which are maintained by each municipality for future FEMA and/or DCED review.

8. Applicability to Other Programs

The NFIP requires all proposed development to be reviewed to determine if all other permits required by Federal and/or state law have been obtained. The list of other permits can be quite extensive depending upon the type or nature of the proposed development. This local review process includes Sec.404 of the Water Pollution Control

Act of 1972; The PA Clean Stream Act and The PA Code Title 25, Chs102, 105 and 106 gives PA DEP permitting jurisdiction in erosion and sedimentation control and various floodplain development permitting issues; Act 166, The PA Floodplain Management Act and the PA Code Title12, Ch113 gives DCED an expanded role in floodplain management.

The local review also covers Act 167, The PA Stormwater Management Act and The National Pollution Discharge Elimination System (NPDES) program established by the EPA and delegated to the states. DEP and County Conservation Districts have municipal oversight in the local review of development permit requests relative to activities connected with the separation of Municipal Storm Sewer Systems (MS4 discharges) and stormwater discharges from new development. Specific FEMA floodplain management regulations in 44CFR60.3 (a) address minimal consideration of stormwater and proper drainage in new development.

9. Status (budget)

The FEMA annual budget has at least ten major line items that include Pre- Disaster Mitigation Assistance, the National Flood Insurance Fund, Salaries and Administration, the Disaster Relief Fund and Flood Hazard Mapping and Risk Analysis, plus at least five (5) other line items that relate to flooding and risk assessment.

Flood Hazard Mapping and Risk Analysis had about an 11% cut in 2013 which reduced the mapping line item to about \$82.0 M. In 2014, there was a 12.5% cut in that line item from the year before. Overall, the rescission process undertaken late last year had a major reduction impact on FEMA's budget. Further research will be conducted in the near future to obtain more detailed and current FEMA Budget info.

10.Strengths/Weaknesses

Strengths

A Program strength is that the recent FIRM updates allow for much more accurate interface between floodplain boundaries and areas proposed for development. Another strength, the FloodSmart.gov website, has improved the promotion of flood insurance and the importance of family flood safety. Flood insurance is also required for federally insured mortgages that finance the purchase of flood prone residential and commercial property.

A very important strength within the NFIP is a special component called the Community Rating System (CRS) which encourages municipalities to develop a comprehensive Floodplain Management Program. CRS is an incentive based program that offers flood insurance rate discounts up to 45%. These discounts are based on the awarding of points for the completion of local floodplain management projects within four (4) major categories. These activities are certified by an insurance industry risk management company, Insurance Servicing Office/Organization (ISO), initially to qualify and then on a periodic basis once every five years.

Weaknesses

One program weakness is that the lack of adequate funding in the past has delayed FEMA FIS data updates. A second program weakness is that many municipalities do not have qualified personnel implementing the program. This is due to the lack of base level training being made available consistently on the local level. Coupled with this is the frequent turnover of local personnel associated with the local permitting system. A third program weakness is that locally available data is often not used or referenced because FEMA does not often officially identify floodplains in smaller watershed floodplains. Yet, another weakness is that FEMA floodplain regulations often become the maximum standard (minimums) for local regulations adopted and the No Adverse Impact concept which encourages stronger local floodplain management regulations promoted by the Association of State Floodplain Managers (ASFPM) is ignored. Provisions should have been included that would have directed the Commonwealth to develop standards that were more appropriate for PA municipalities such as a stronger Floodway requirement that could have been coordinated with surrounding states some of whom do have stronger standards.

B. PA Act 166 – Floodplain Management Act

Note: Act 166 works in conjunction with the above Flood Insurance program.

1. Official Name and Legal Authority

The Pennsylvania Flood Plain Management Act of 1978, P. L. 851, No.166 (32 P. S. § § 679.101—679.601).

<http://www.legis.state.pa.us/CFDOCS/LEGIS/LI/uconsCheck.cfm?txtType=HTM&yr=1978&sessInd=0&smthLwInd=0&act=0166.&CFID=185655039&CFTOKEN=95198604>

2. Background

The Pennsylvania (PA) General Assembly gave serious consideration to the passage of a comprehensive floodplain and stormwater management legislation during the early 1970s. Efforts to do so intensified after the Commonwealth witnessed the terrible destruction and disruption caused by Tropical Storms Agnes in 1972 and Eloise in 1975. But, it was not until the fall of 1978 when two major PA laws, Act 166 and Act 167, were finally enacted by the PA legislature that dealt with these important issues. Without the legal separation of these two issues, there would not have been either law enacted. The resultant separation was intentional as it became part of a compromise with local government associations, home builders association, and environmentalists. DCA/DCED was brought into the law to minimize the threat of over regulation by PA DEP. There are special floodplain/stormwater coordination provisions in Act 167.

The intent of the Act 166 is multi-faceted with the overriding goal of preserving and restoring the Commonwealth streams and floodplains. The Act generally seeks to accomplish this goal in a variety of ways: 1) Encouraging proper planning and development in floodplains which are consistent with sound land use practices; 2) Preventing and eliminating urban and rural blight caused by flooding; 3) Assisting

municipalities in qualifying for/maintaining compliance under the NFIP program; 4) Incentivizing local administration and management of floodplains 5) Minimizing the expenditure of public and private funds for flood control projects and flood recovery efforts; and 6) Authorizing a comprehensive and coordinated program for floodplain management.

Specifically, however, the Act requires PA municipalities having FEMA identified flood hazard areas to participate in the NFIP (failure to do so results in these municipalities losing State funding until compliance is achieved). Also, municipalities are required to comply with additional standards for a few designated high risk land uses and the production/storage of hazardous materials. In this regard, the floodplain management standards and requirements of the NFIP and the Act are minimal only. The Act further states there are no provisions that limit the powers of a municipality from adopting more restrictive codes, ordinances and regulations concerning the management of its flood-prone areas. Since a good floodplain management program involves more than simply meeting the minimum Federal and State requirements, PA municipalities are encouraged to adopt stronger floodplain management regulations.

The Act identified additional powers and duties for both the Department of Community and Economic Development (DCED) and The Department of Environmental Protection (PA DEP) relative to the Act. DCED for instance has established regulations for a reimbursement program to municipalities and counties for floodplain management compliance costs. PA DEP on the other hand was given exclusive jurisdiction over certain floodplain activities (i.e. Obstructions) such as highways, flood control projects, public utilities, county and municipally-owned structures, buildings, etc. PaDEP was also given overlapping jurisdiction with municipalities in FEMA floodways and certain top-of-bank situations.

3. Jurisdiction (agency)

DCED, PA DEP and municipalities have individual duties and responsibilities under the Act that support as well as complement each other.

4. Geography

DCED administers its program responsibilities from its headquarters in Harrisburg. The agency has used third party contractor(s) to assist municipalities in local ordinance and administration/enforcement compliance. Relative to NFIP eligibility and local compliance, Figure II of the Commonwealth and its 2500 + municipalities shows the large number of communities within the Commonwealth. Some 2462 municipalities are actually participating in the program within Pennsylvania with 38 additional municipalities having a flood hazard area but not participating in the NFIP.

<http://www.fema.gov/cis/PA.html>

PA DEP administers its program permit responsibilities through its six (6) Regional Offices located throughout PA. Program policy and regulations related to these responsibilities are developed and promulgated via PA DEP headquarters.

www.depweb.state.pa.gov/regionaloffices

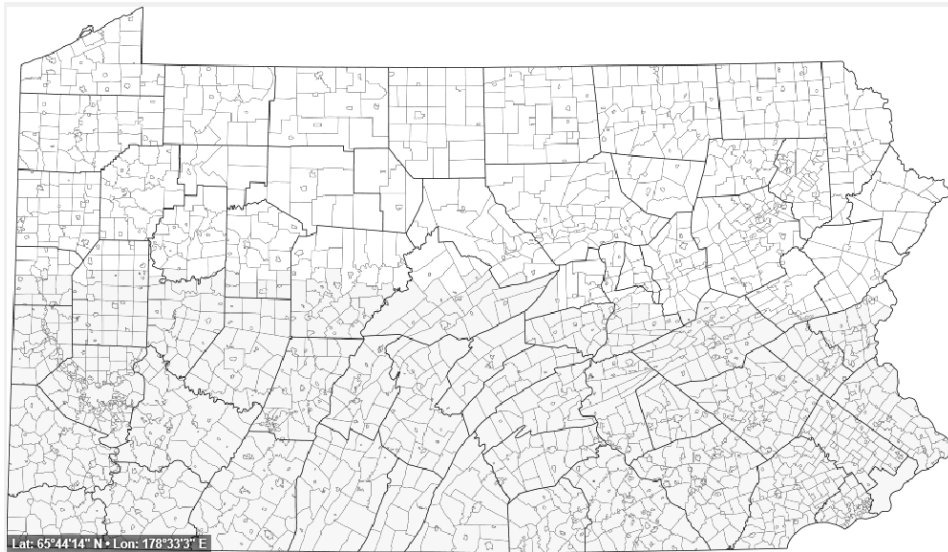


Figure II. Pennsylvania Municipalities

5. Data Required

The latest FEMA Flood Insurance Studies (FISs) and Flood Insurance Rate Maps (FIRMs) must be referenced as a minimum delineation in local floodplain management regulations for municipalities to maintain compliance under both the NFIP and Act 166. <http://www.pacode.com/secure/data/012/chapter113/s113.4.html>

6. Models

Local Compliance with DCED and FEMA's minimum floodplain management regulations require the enactment and enforcement of local codes and ordinances. DCED has developed Models or Suggested Ordinance Provisions that comply with DCED and FEMA required Floodplain Management Regulations which can be found on the DCED website:

http://www.newpa.com/webfm_send/1807

<http://www.tcrpc-pa.org/Documents/DCED%20FEMA%20Model%20D.pdf>

<http://www.nfrmp.us/state/docs/Pennsylvania/TheOrdinance.pdf>

7. Products

Municipalities use FEMA FIS/FIRMs as the basis to implement their floodplain management regulation requirements required by FEMA and PA Act 166. The end products here are the adoption of amended zoning ordinances, amended subdivision regulations, amended building codes, and/or amended Floodplain management ordinances. Enforcement is documented via the local permitting system which is associated with the above identified ordinances and/or denied permitting records which are maintained by each municipality for future FEMA and/or DCED review.

8. Applicability to Other Programs

Local compliance with FEMA's minimum floodplain management regulations requires the enactment and enforcement of local codes and ordinances. In those ordinances, the NFIP requires all proposed development to be reviewed to determine if permits required by Federal and/or State law have been obtained. The list of other permits can be quite extensive depending upon the type or nature of the proposed development. This local review process includes Sec. 404 of the Water Pollution Control Act of 1972; The PA Clean Streams Act, The Dam Safety and Obstructions Act and The PA Code Title 25, Chs.102, 105 and 106 also give PADEP permitting jurisdiction in erosion and sedimentation control and various floodplain development permitting issues; Act 166, The PA Floodplain Management Act, regulations in the PA Code Title 12, Ch.113 gives DCED an expanded role in floodplain management. According to DCED grant regulations, Title 12, § 141.152 and 309, (Floodplains), grantee communities which reside in flood prone areas will be required to adopt and implement an appropriate floodplain ordinance, if one does not exist, to bring the community into compliance with the Flood Plain Management Act.

The online legal references for this Section are as follows:

The PA Code, Title 12, Ch. 113.

<http://www.pacode.com/secure/data/012/chapter113/chap113toc.html>

The PA Code, Title 25, Ch.102

<http://www.pacod/e.com/secure/data/025/chapter102/chap102toc.html>

Act 167 the Storm Water Management Act

<http://www.legis.state.pa.us/cfdocs/Legis/LI/uconsCheck.cfm?txtType=HTM&yr=1978&sessInd=0&smthLwInd=0&act=0167>

Act 325 - Dam Safety and Obstructions Act

<http://www.legis.state.pa.us/WU01/LI/LI/US/HTM/1978/0/0325..HTM>

The PA Code, Title 25, Ch. 105

<http://www.pacode.com/secure/data/025/chapter105/chap105toc.html>

The PA Code, Title 25, Ch. 106

<http://www.pacode.com/secure/data/025/chapter106/chap106toc.html>

The local review also covers Act 167, The PA Stormwater Management Act and The National Pollution Discharge Elimination System (NPDES) program established by the US Environmental Protection Agency (EPA) and delegated to the states. DEP and County Conservation Districts have municipal oversight in the local review of development permit requests relative to activities connected with the separation of Municipal Storm Sewer Systems (MS4) discharges and stormwater discharges from new development. Specific FEMA floodplain management regulations in 44CFR60.3 (a) address minimal considerations of stormwater and proper drainage in new development.

Stormwater Contacts:

DEP Bureau of Conservation and Restoration: (717)772-5661 or

www.depweb.state.pa.gov (Click on both Stormwater Management and Regional Offices)

EPA Region 3, NPDES Permits Branch: (215) 814-5000 or www.3public@epa.gov

Other programs and regulations or laws that are impacted by Act 166 also include but are not limited to the following:

Executive Order 1978-4 - FloodPlain Management (Requires all agencies among other things to evaluate publicly owned buildings, structures and new construction for compliance w/ NFIP & Act 166 regulations. Designation of DCED as the official state coordinating agency for the NFIP)

<http://www.pabulletin.com/secure/data/vol35/35-15/653.html>

<http://www.pacode.com/secure/data/004/chapter1/s1.233.html>

Act 247, The PA Municipalities Planning Code, as amended (Statewide Planning and Zoning Enabling Legislation)

http://www.legis.state.pa.us/cfdocs/legis/CH/PUBLIC/word_search_acts.cfm?keyword=PLANNING&searchType=exact

44 Code of Federal Regulations (CFR), Sec.59-60 (FEMA NFIP Floodplain Management Regulations)

<http://www.gpo.gov/fdsys/pkg/CFR-2011-title44-vol1/pdf/CFR-2011-title44-vol1-sec60-3.pdf>

The Uniform Construction Act, Act 45 of 1999

<http://www.portal.state.pa.us/portal/server.pt?open=514&objID=552999&mode=2#1101>

The Oil and Gas Act,

http://www.depweb.state.pa.us/portal/server.pt/community/oil_gas/6003

http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/WebEx/Act_13_Session2_03April2012.pdf

9. Status (budget)

Pennsylvanians do not have specific State or Federal funding levels for the offices responsible for managing Act 166 activities.

10. Strengths/Weaknesses

Strengths

A primary strength of Act 166 is the mandate for NFIP participation of flood prone municipalities. Consequently, municipalities must use the recent FIRM updates that provide for much more accurate interface between floodplain boundaries and areas proposed for development.

Participating communities of the NFIP have the option to participate in the Community Rating System (CRS). This option encourages municipalities to develop a comprehensive Floodplain Management Program. CRS is also an incentive based program that offers flood insurance rate discounts up to 45%. These discounts are based on the awarding of points for the completion of a wide variety local floodplain management projects within four (4) major categories. These activities are certified by

an insurance industry risk management company, Insurance Servicing Office/Organization (ISO), initially to qualify and then on a periodic basis once every five years. This provides an excellent baseline for DCED to define and to encourage the development of a “Comprehensive Floodplain Management program” locally and statewide.

Weaknesses

Act 166 has lacked adequate Commonwealth funding in the past which has delayed reimbursement of municipalities for their eligible ordinance adoption, administration and enforcement costs provided for under the Act. Additionally, the Act relies on local government to administer and enforce floodplain regulations. Many municipalities do not have qualified personnel to implement the program. This is due in part to the lack of base level training being made available consistently on the local level. Coupled with this is the often frequent turnover of local personnel associated with the local permitting system.

A third weakness of Act 166 is that FEMA floodplain regulations often become minimums and the concepts of No Adverse Impact, promoted by the Association of State Floodplain Managers (ASFPM), which encourage stronger local floodplain management regulations are ignored. Also, locally available floodplain data for smaller watersheds is often not used or referenced because FEMA does not typically identify floodplains in these smaller watersheds or sub-watersheds.

A critical weakness is the lack of Commonwealth funding for adequate DCED staffing to provide essential technical assistance on all aspects of floodplain management regulations. Currently there are only two (2) staff members to cover the entire Commonwealth which is well below the benchmark for adequate staffing of state coordinating agencies. DCED at one point in time had eight (8) staff members in headquarters with one supporting staff member from each of its six regional offices. Finally, the role of the county in floodplain management has not consistently been emphasized.

C. PADEP Act 167

1. Official Name and Legal Authority

The Pennsylvania Storm Water Management Act of 1978 (more commonly known as Act 167) provides the legislative basis for stormwater management.

2. Background

Act 167 requires Pennsylvania counties to prepare and adopt stormwater management plans (SMPs) for each watershed located in the county, as designated by the Pennsylvania Department of Environmental Protection (PADEP). It also requires municipalities to implement a stormwater management ordinance, limiting stormwater runoff from new development and redevelopment. This SMP details the analyses that were performed in order to fulfill the requirements of Act 167.

The main objective of the SMP is to control stormwater runoff on a watershed-wide basis rather than on a site-by-site basis, taking into account how development and land cover in one part of the watershed will affect stormwater runoff in all other parts of the watershed. Consistent with Act 167, the SMP seeks to achieve the following:

1. Preserve and restore the flood-carrying capacity of watershed streams.
2. Reduce erosion and sedimentation.
3. Preserve natural stormwater runoff regimes and the natural course, current and cross sections of streams.
4. Protect and conserve ground water and ground water recharge areas.

The SMP seeks to address serious water quality problems. Through implementation of the stormwater improvements recommended in the SMP, the implemented actions will simultaneously reduce flooding, erosion and sedimentation, and improve water quality.

Within two (2) years following the promulgation of guidelines by the Department, counties were required to prepare and adopt a SMP for each watershed in the county. Plans were required to be updated every 5 years. The Stormwater Guidelines were completed by PADEP in May 14, 1985. The first SMPs were begun in 1985 and were completed on a watershed basis, with multiple counties participating if the watershed overlapped counties. The plans focused on the flooding aspect of stormwater management and included detailed hydrologic modeling with the development of release rates and/or management districts which applied different management criteria for various portions in the watershed. Beginning in the late 1990's, the SMPs began looking at the water quality aspect of stormwater runoff, with standards and criteria being developed for infiltration and water quality volume requirements.

Starting in approximately 2008, Act 167 plans were completed on a county-wide basis. The new approach de-emphasized the modeling aspect of the SMP and concentrated on location of problems areas and proposed solutions, county-specific resources and issues, and established a model ordinance for municipalities to adopt. No funding is currently available to correct stormwater problem areas other than PENNVEST loans. As of February 2014, 28 county-wide SMPs have been completed and approved by PADEP.

3. Jurisdiction (agency)

PADEP administers SMP's and previously provided 75% of the funding to develop the Plan. Within six months of the adoption of the SMP by the Counties and approval by PADEP, each municipality is required to adopt or amend ordinances and regulations, including zoning, subdivision and development, building codes, and erosion and sedimentation ordinances, as are necessary to regulate development within the municipality in a manner consistent with the SMP. If a municipality lies in more than one watershed, the applicable criteria and standards should be identified for the different watersheds. The Act requires the county to review and, when necessary, revise such plans at least every five years. These ordinances must regulate development within the municipality in a manner consistent with the SMP and the provisions of the Act.

Developers are required to manage the quantity, velocity, and direction of resulting stormwater runoff in a manner that adequately protects health and property from possible injury. They must implement control measures that are consistent with the provisions of the SMP and the Act. The Act also authorizes for civil remedies for those aggrieved by inadequate management of accelerated stormwater runoff.

The SMP is prepared in consultation with municipalities located in the watershed, working through a Watershed Planning Advisory Committee (WPAC) comprised of municipal officials and other interested parties.

4. Geography

The geography of the program is all watersheds within the State of Pennsylvania; however, some watersheds extend beyond the Pennsylvania border. In these cases, the hydrologic impact of the watersheds outside the border had to be considered, however, the standards and criteria were only applicable within the border.

5. Data Required

Some SMPs offer a unique approach to the Act 167 planning process that incorporates watershed scale hydrologic modeling and alternative stormwater improvements to reduce runoff and improve water quality. Typical data collected, most of which is in GIS format, includes information on:

1. Comprehensive land use plans.
2. Existing municipal ordinances.
3. Soils.
4. Geology.
5. Topographic and other readily available mapping.
6. Aerial photographs.
7. Land use/land cover.
8. Future land use/land cover.
9. Previously completed engineering and planning studies.
10. Stormwater-related problem areas.
11. Existing and proposed flood control projects.
12. Existing and proposed stormwater control facilities.
13. A listing of existing and proposed stormwater collection and control facilities, including a designation of those areas to be served by stormwater collection and control facilities within a 10-year period, an estimate of the design capacity and costs of such facilities, a schedule and the proposed methods of financing the development, construction, and operation of such facilities, and an identification of the existing or proposed institutional arrangements to implement and operate the facilities, where this information is readily available.
14. Significant water obstructions.
15. Stream flow and rain gauge data and other water quality information.
16. FEMA FIS floodplain information.

6. Models

GIS (mostly ESRI software products) is a large part of the planning process for development of Act 167 Plans (SMP's). The GIS data is not only used to develop maps to observe problem areas, trends and patterns, but to develop the parameters required for hydrologic modeling. The watershed is subdivided into many smaller subwatersheds for analysis. Hydrologic models, previously the Penn State Runoff Model (PSRM) and more recently the US Army Corps of Engineers HEC-HMS model are calibrated and flows are determined at bridges, culverts and FEMA study areas. Various intermediate software may be used for hydrologic processing or calibration such as GeoHMS, WMS, PeakFQ and StreamStats.

7. Products

An analysis is conducted on identifying opportunities for retrofitting existing stormwater facilities and finding locations for new Best Management Practices, or BMPs, in areas that are not currently served by stormwater facilities. Riparian stream buffer restoration is recommended as an opportunity to address the goal of preserving and restoring flood-carrying capacity of streams. The use of stormwater BMPs as the preferred means to achieve improved water quality; groundwater recharge and retention; streambank protection; and volume control is strongly endorsed by ADEP. The implementation of these retrofits and new BMPs in conjunction with regulation of new development and redevelopment through new stormwater ordinances will reduce stormwater problems. The SMP lays the framework for municipalities to construct stormwater improvements over a ten-year period. The various improvements are assigned a priority according to their cost-effectiveness and capture potential, and municipalities can use this ranking as a basis for funding projects.

The SMP presents criteria and standards for new development and redevelopment which is incorporated into a model stormwater management ordinance. The SMP provides technical standards and criteria applicable throughout the watershed for the management of stormwater runoff from road construction, new land development, and redevelopment sites.

8. Applicability to Other Programs

Since January 2005, the standards advanced as part of an approved Act 167 SMP are considered to be consistent with or equivalent to the standards in Chapter 102. There are cases where the volume control standards in Chapter 102 are more stringent than those in an Act 167; in these cases, the Chapter 102 water standards supersede the Act 167 standards. The peak rate standards in Act 167 SMPs, include those approved before January 2005, supersede the Chapter 102 peak rate standards. Data collected for Act 167 Plans, particularly GIS data is usable for DCED Rivers Conservation Plans, PennDOT bridge design, FEMA hydrology, etc. For municipalities that have regulated [MS4s](#), compliance with NPDES permits may be achieved by enacting and implementing an ordinance(s) from an applicable Act 167 stormwater management plan if that plan was approved by DEP in 2005 or later.

9. Status (budget)

The status of the approved watershed plans as of February 2014 is shown in Figure III. The best source to retrieve an adopted SMP would be the County Planning Commissions or Conservation Districts. The link to the PaDEP Act 167 website is:

http://www.portal.state.pa.us/portal/server.pt/community/act_167_information/21378

Currently, Act 167 is unfunded.

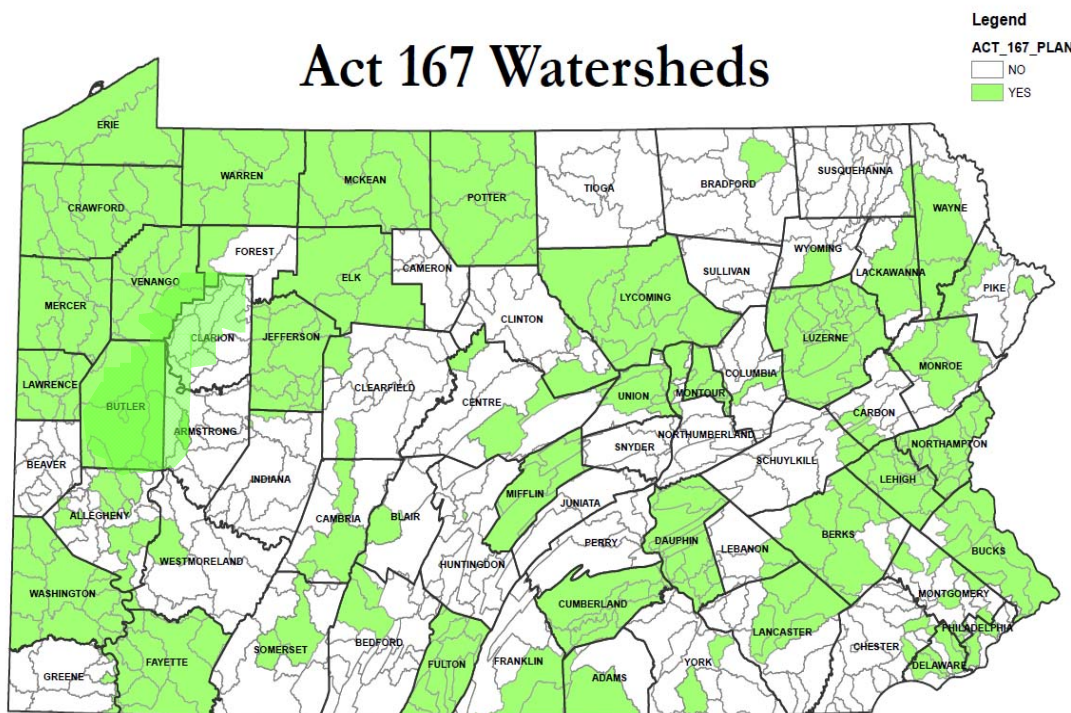


Figure III. Approved Act 167 Stormwater Management Plans

10. Strengths/Weaknesses

Strengths

The strength of the program is that it provides a planned management of watershed to minimize future flooding, promote infiltration and stream baseflow augmentation, improve water quality, and prevents streambank erosion. It also provides a wealth of information on obstructions and problem areas for various other programs such as PennDOT bridge replacement, FEMA studies, and municipal NPDES/MS4 inventory and compliance.

Weaknesses

The weaknesses and threats to this program is that it is currently unfunded and complete coverage is not finished. The opportunity lies in the latest water law (Act 68 of 2013) that was passed which allows municipal authorities to charge stormwater fees to fund similar projects.

D. Act 68 of 2013

Act 68 of 2013 amends Title 53 (Municipalities Generally) of the Pennsylvania Consolidated Statutes, in municipal authorities, further providing for purposes and powers. i.e., The PA Muni Authorities Act. The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Section 5607(a) of Title 53 of the Pennsylvania Consolidated Statutes is amended by adding a paragraph to read:

Scope of projects permitted.--Every authority incorporated under this chapter shall be a body corporate and politic and shall be for the purposes of financing working capital; acquiring, holding, constructing, financing, improving, maintaining and operating, owning or leasing, either in the capacity of lessor or lessee, projects of the following kind and character and providing financing for insurance reserves:

Storm water planning, management and implementation as defined in the articles of incorporation by the governing body. Authorities already operating storm water controls as part of a combined sewer system, sanitary sewer system or flood control project may continue to operate those projects.

A

Act 68 of 2013 amended the purposes and powers of Municipal Authorities to include stormwater planning, management and implementation.

E. Act 123 of 2014

Act 123 of 2014 amends Amending Title 53 (Municipalities Generally) of the Pennsylvania Consolidated Statutes, in municipal authorities, further providing for purposes and powers. Section 5607(d) of Title 53 of the Pennsylvania Consolidated Statutes is amended by adding a paragraph to read:

Every authority may exercise all powers necessary or convenient for the carrying out of the purposes set forth in this section, including, but without limiting the generality of the foregoing, the following rights and powers:

In the case of an authority that performs storm water planning, management and implementation, reasonable and uniform rates may be based in whole or in part on property characteristics, which may include installation and maintenance of best management practices approved and inspected by the authority. Act 123 of 2014 would allow property owners to reduce their stormwater rates and charges by implementing and maintaining stormwater best management practices that address their own contributions to the problems caused by stormwater runoff.

F. PennDOT Bridges and Culverts

1. Official Name and Legal Authority

There is no official name to this program, but all new bridges or bridge replacements need a hydrologic and hydraulic analysis performed of the waterway opening to insure the public's safety.

2. Background

With 25,000 state owned bridges, Pennsylvania has the third-largest number of bridges in the nation, but we lead the nation in the number of bridges classified as "structurally deficient." The average age of bridges on the state system is over 50 years old. When a bridge needs to be modified or replaced, a hydrologic and hydraulic analysis is required to determine the waterway opening size (hydraulic capacity).

3. Jurisdiction

The program is administered by PennDOT.

4. Geography

Over 5,000 bridges within the State of Pennsylvania are included in the program. The bridges are coded into a GIS and have numerous attributes including scour critical bridges (4 classes), number of spans, surface type, owner (PennDOT, DCNR, Turnpike, local), maintenance responsibility, last inspection date among many others (Figure IV).

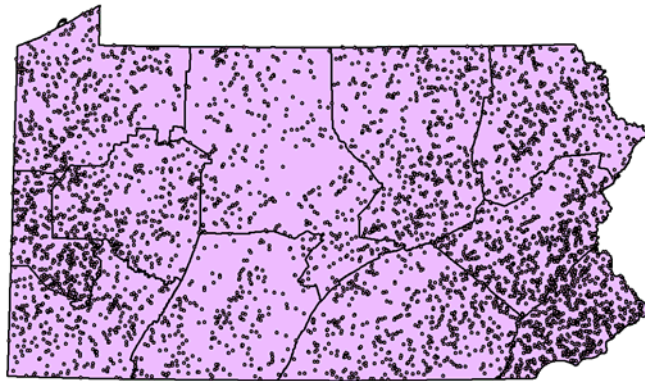


Figure IV. Pennsylvania Bridges and PennDOT Districts

5. Data Required

To analyze a bridge, first a hydrologic analysis is required. A hydrologic analysis includes looking at the watershed that drains to the bridges, its land use, soils, percent carbonate, mean elevation, slope or other physical features that affect runoff depending on the methodology, and predicting the flows to the bridge. Rainfall data is also required for some methods. Oftentimes a statistical analysis of stream gage data is performed. Data required for the hydraulic modeling includes photographs of the bridges, stream channels, overbanks, upstream and downstream structures, surveyed stream cross sections and profiles, Manning roughness coefficients, LiDAR topography, and detailed dimensions of the bridge or culverts.

6. Models

PennDOT has a “toolbox” of accepted hydrologic methods which includes HEC-1, HEC-HMS, WMS, WinTR-55, WinTR-20, EFH-2, PeakFQ, NFF, and NSS. Accepted hydraulic models include HEC-2, HEC-GeoRAS, HEC-RAS, HY-8 and WSPRO.

7. Products

Products of the hydrologic analysis include peak flows for several design events. The hydraulic analysis products are water surface profiles and/or backwater calculations along with tables of existing versus proposed conditions. Both the results of the hydrologic and hydraulic (H&H) analyses are included in an H&H report. The reports oftentimes include a scour analysis, risk assessment, and an analysis of temporary (during construction) conditions.

8. Applicability to Other Programs

The same hydrologic analysis required for bridges is required for Act 167 and FEMA FIS work. Act 167 flows are required to be compared in the report. The water surface profiles are the same as what is developed for FEMA FIS's. The water surface profile results must be compared to FEMA detailed studies and be consistent with the requirement of the National Flood Insurance Program.

9. Status (budget)

With the passage of the State transportation bill in November, 2013, bridge replacement and improvement projects are secure for the foreseeable future. However, even with passage of the bill, there aren't enough funds to fix all deficient bridges.

G. NPDES/MS4

1. Official Name and Legal Authority

Two distinct National Pollution Discharge Elimination System (NPDES) programs regulate stormwater discharges, with authority from the Federal Clean Water act. The PAG-02 regulates stormwater discharges associated with construction activities, and the PAG-13 regulates Municipal Separate Storm Sewer System (MS4) discharges.

2. Jurisdiction (agency)

The NPDES program is a federal permit system under the jurisdiction of the EPA. The administration of the programs has been delegated to Pennsylvania via the PAG-02 and PAG-13 permits. In turn, some County Conservation Districts have entered into a delegation agreement with PaDEP to administer the PAG-02 program in conjunction with Erosion and Sediment Control Plan (E&S Plan) reviews.

3. Geography

The PAG-02 applies to most earth disturbance activities greater than one (1) acre. The PAG-13 program applies to Municipalities, or other public entities that own and operate a separate storm sewer system within an urbanized area, as defined by the 2010 census data and shown in Figure V.

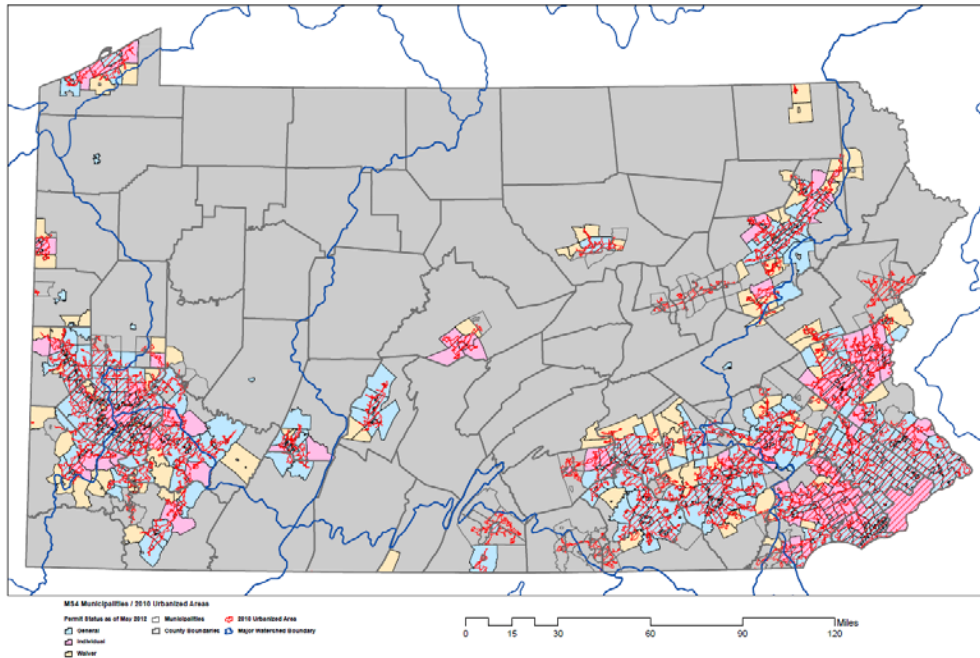


Figure V. MS4 municipalities / 2010 Urbanized Areas

4. Data Required

The PAG-02 requires a Post Construction Stormwater Management Plan (PCSM Plan) including detailed site plans and stormwater management calculations meeting minimum standards for peak discharge rate, runoff volume, and water quality treatment. Preparations of these plans and calculations requires a detailed boundary and topographic survey, existing land use and soils data, and identification of sensitive site resources such as wetlands, streams, floodplains, steep slopes, natural drainage ways, and woodlands.

The PAG-13 requires mapping of stormwater management facilities including storm sewers, outfall locations, and other stormwater management facilities owned by the permittee. Established TMDLs, stream impairments (303d listing), and known point and non-point pollutant sources are also critical data needs in developing an effective MS4 program.

5. Models

Standard hydrology and hydraulics models such as TR-20/TR-55 or SWMM are typically used in the development of a PCSM Plan.

A variety of pollutant loading models apply to the PAG-13 program. The Chesapeake Bay Program Watershed Model was used to establish the Chesapeake Bay TMDL and

load reduction targets, while the Penn State ArcView Generalized Watershed Loading Function model (AVGWLF; for sediment and nutrient loading) and the EPA's Loading Simulation Program in C++ (LSPC; for pathogen loading) have typically been used to establish local TMDLs. CAST, MapShed, and LSCP can be used for watershed-based planning to meet established TMDLs or demonstrate load reductions, while models such as WinSLAMM and SWMM can be used to calculate load reductions on a site specific or sub-watershed basis.

6. Products

The major products required by the PAG-02 program are an E&S Plan, PCSM Plan, and an Operations and Maintenance Plan defining the required ongoing management of the stormwater BMPs. A restrictive covenant (deed restriction) is also required to protect the planned BMPs in perpetuity.

PAG-13 requires a detailed plan to implement the six Minimum Control Measures (MCMs) described in the permit and regular reports to document compliance.

Stormwater facilities and outfall mapping is a required component of this documentation. In addition, a TMDL plan is required to document how progress will be made towards meeting any established TMDLs. Similarly, a Chesapeake Bay Pollution Reduction Plan (CBPRP) is required for MS4 permittees located in the Chesapeake Bay Watershed to document how progress will be made towards meeting established load reduction targets. Finally, a plan is required to address any stream impairment for a 303d listed stream.

7. Applicability to Other Programs

PAG-02 requirements include meeting applicable Act 167 plan requirements as well as Erosion and Sediment Control Regulations under 25 PA Code §102. PAG-13 requirements are intended to be consistent with Chesapeake Bay Program goals, and require enforcement of PAG-02 requirements.

8. Status (budget)

The PAG-02 and PAG-13 programs are supported by an application fee structure that was recently updated by DEP. Compliance with MS4 permit requirements is an increasing cost for municipalities, especially with regard to newer permit requirements to address established TMDLs and known stream impairments.

H. State Water Plan

1. Official Name and Legal Authority

The Department of Environmental Protection (PaDEP) website reports, "The Water Resources Planning Act, No. 220, signed into law on December 16, 2002, established a Statewide Water Resources Committee and six Regional Water Resources Committees that guided DEP since 2003."

2. Background

The first State Water Inventory was ordered by the Legislature in 1913 and focused on public water supply, wastewater treatment, and the value of the water resource

generally. The next concerted effort ran from 1975 to 1983 and was both a state-driven action and part of a national reaction to water quality issues and general concerns about environmental quality; that work set the program guidance for the next 20 years and ceded some autonomy to EPA. Act 220 of 2002 authorized the current State Water Planning activities and directs updates every five (5) years.

3. Jurisdiction (agency)

The State Water Plan situates in the PaDEP, Office of Water Management, Bureau of Conservation and Restoration. There is also an undefined relationship with the Bureau of Interstate Waters Office, also within the Office of Water Management within PaDEP.

4. Geography

Act 220 created six (6) Regional Committees, guided by a Statewide Committee. The map below shows the regional divisions.



Figure VI. Regional Committees

5. Data Required

Act 220 of 2002 addresses data requirements as follows:

Section 3117 (titled "Statewide Data System") states that "the Department shall establish and maintain a statewide system to gather, process, and distribute information on the availability, distribution, quality, and use of water resources of this Commonwealth."

Section 3104 (2) authorizes "cooperative agreements for... coordinated collection and maintenance of data regarding water resources..."

The specifics of database elements or limits to what might be collected are not defined in the legislation. The language of Act 220 does however always cite stormwater and floodplain management together, leading one to expect that information about stormwater systems should be integrated for water planning when technology allows for mapping at appropriate scales.

6. GIS Models

State Water Planning utilized data as created and managed in each active regulatory program within DEP and other agencies which were consulted in the plan creation; six

(6) regions are named in Act 220 and regional study groups may have consulted slightly different sets of data providers. Generally, PaDEP has aggregated program data to the National Hydrographic Data model (NHD) of USGS, compiled at a scale of 1:24000, which is reasonably uniform and complete nationally, and is the technical base for State Water Planning. *Both the scale of the data and the NHD data model itself are of limited utility in representing stormwater systems.*

7. Products

State Water Planning activities under Act 220 were instrumental in understanding the differences in data holdings among program areas and connecting them through use of the NHD as base map. The development of USGS StreamStats is reported to have been made possible by the data compilation for Act 220. A *Pennsylvania Water Atlas* was created from the data compiled, and illustrates clearly the regional differences in water needs and trends, as well as the richness and complexity of the resource statewide.

The DEP website contains links to reports and the Water Atlas, as last updated in November 2012:

<http://www.pawaterplan.dep.state.pa.us/statewaterplan/docroot/default.aspx>

8. Applicability to Other Programs

The State Water Plan could encompass any and all programs related to PA Water Resources. The regulatory complexity that developed over the past 100 years is in itself a result of the complex and inter-related nature of all water programs in the Commonwealth.

9. Status (budget)

State Water Planning is essentially unfunded at the present time and the 5-Year Plan Update required in 2013 has not been completed. Technical capabilities at PaDEP are depleted by recent budget cuts.

10. Strengths and weaknesses

Strengths

- Pennsylvania is blessed with abundant water.
- We have 100-years of practice, experience and records to base new plans upon
- Academic and professional expertise in the Commonwealth are more than adequate for any activity required
- The people involved in the 2003-2008 efforts uniformly felt that their efforts were valuable
- The reports of the 2003-2008 Plan are excellent summaries of current status.

Weaknesses

- The State Water Planning efforts have not engaged the general public despite the health and economic necessity of water to their everyday lives.
- Mapping of the water resource has not kept pace and is now inferior to the rest of the state base map, and is incompatible with today's mapping and monitoring technologies.
- Regulatory programs evolved when mapping and modeling could not adequately represent the entire resource, thus programs now segment the resource in unnatural ways.
- No entity in the state is making State Water Planning a priority.

The same elements that are threats and weaknesses can be turned into opportunities.

I. Chesapeake Bay Program

1. Official Name and Legal Authority

The Chesapeake Bay Program is a regional partnership comprised of federal and state agencies, local governments, non-profit organizations and academic institutions. This partnership leads and directs Chesapeake Bay restoration and protection efforts. In December 2010, the Environmental Protection Agency (EPA) established the Chesapeake Bay Total Maximum Daily Load (TMDL). The Bay TMDL is a comprehensive "pollution diet" that sets limits on the amount of nitrogen, phosphorus, and sediments that are allowed to flow into the bay each year. Also as part of the bay cleanup process, each of the seven Bay watershed jurisdictions (Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and the District of Columbia) are developing Watershed Implementation Plans (WIPs) plans to help reduce these pollutants over time.

2. Background

The Chesapeake Bay is the largest estuary in the United States and over 150 major creeks, streams and rivers drain into the Chesapeake Bay Watershed. The Chesapeake Bay Watershed includes parts of six states: Delaware, Maryland, New York, Pennsylvania, Virginia and West Virginia, and the entire District of Columbia. In total, the Bay and its tidal tributaries have 11,684 miles of shoreline and 4,480 square miles of surface area. There are more than 17 million people who live within the Chesapeake Bay Watershed and it supports more than 2,700 species of plants and animals. It is because of these amazing facts that the Chesapeake Bay Program Partnership was first formed in 1983 when the Governors of Maryland, Virginia, Pennsylvania, the Mayor of the District of Columbia, the Chair of the Chesapeake Bay Commission and the Administrator of the Environmental Protection Agency signed the first Chesapeake Bay Agreement. For over 30 years, this regional partnership has been the nation's premier estuarine restoration effort, engaging in scientific investigation, coordinating plans, and implementing policies among the states, the District of Columbia and the federal government.

3. Jurisdiction (agency)

US EPA

4. Geography

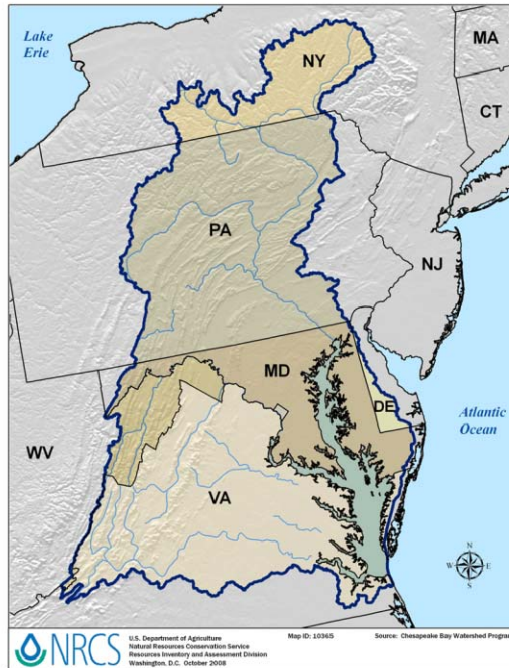


Figure VII. Chesapeake Bay Watershed

5. Data Required

- Land Cover
- Land Use
- Hydrography
- Wetlands
- Roads, Railroads and Power lines
- Protected Lands
- Rare Species Locations
- Watershed Boundaries
- Acid Mine Drainage
- Eco-regions
- Vegetation
- Potential Habitat Distribution
- Soil Types
- Elevation, Aspect and Slope
- Forest Fragmentation Metrics
- Hydrogeomorphic Regions
- Fertilizer Applications
- Floodplains
- Imperviousness
- Water Quality
- Drinking Water Supplies
- Precipitation
- Human Population (Census)
- Property Ownership
- Historic Timber Harvests
- Resource-Based Economic Data
- Farm Animal Populations
- Septic System Prevalence & Locations
- National Register Historic Districts and Sites
- Wastewater Plant Discharges

6. Models

Chesapeake Bay Program partners, along with a suite of other stakeholders, utilize a collection of computer models that are extremely sophisticated and vastly respected throughout the world. The models that are used to achieve the goals set forth by the Bay Program provide a comprehensive view of the Chesapeake ecosystem from the depths of the Bay to the upper reaches of the watershed.

The Watershed Model incorporates information about land use/land change, farm animal populations and fertilizer applications, wastewater plant discharges and septic systems, air deposition, weather, and numerous other variables to estimate the amount of nutrients and sediment reaching the Bay and where the pollutants originate. The Hydrologic Sub-Model uses rainfall, evaporation, and meteorological data to calculate runoff and sub-surface flows for all land uses. Surface and sub-surface flow data ultimately drives the Non-Point Source Sub-Model, which simulates the soil erosion and pollutant loads process from land to rivers.

The Estuary Model utilizes the pollution load data generated by the Watershed Model to examine their effects on water quality within the Chesapeake Bay. The Water Quality Sub-Model calculates the Bay's biological, chemical and physical dynamics, and the Hydrodynamic Sub-Model simulates the mixing of waters in the Bay and its tidal tributaries.

The Scenario Builder uses computer simulations to extrapolate past, present, and future scenarios within the Chesapeake Bay watershed to explore potential impacts of management actions and to evaluate alternative management possibilities. Scenario Builder produces data inputs for the Watershed Model based upon a wide variety of management actions and land uses.

7. Products

In 1983 the first Chesapeake Watershed Agreement was signed and the Chesapeake Bay Program was born. The Bay program has since produced more than 500 publications and 18 policy memorandums. In 2010 the EPA established the landmark Chesapeake Bay TMDL to put the Bay on a federal "pollution diet", and each of the seven Bay jurisdictions have developed Watershed Implementation Plans to lay out detailed steps that each jurisdiction will take to reach their respective pollution reductions by the year 2025. The Bay program produces the Watershed, Estuary, Scenario Builder, Airshed and Land Change Models that numerous entities can utilize to help advance Bay conservation. The Chesapeake Bay program also produces a vast library of maps and maintains a data hub where their geographic data can be accessed by the general public.

8. Applicability to Other Programs

The Chesapeake Bay Program is very large and interacts with numerous local, state and federal programs. In Pennsylvania the Chesapeake Bay program has heavy influences on the National Pollutant Discharge Elimination System (NPDES) Program and the Municipal Separate Storm Sewer System (MS4) Program. The TMDLs that have been

implemented in Pennsylvania are a direct result of the TMDLs implemented by the EPA for the Chesapeake Bay Watershed.

9. Status (budget)

Through an annual appropriation from Congress, the EPA funding for the Chesapeake Bay Program Office has ranged from about \$20 million annually in the 1990s to roughly \$50 million in recent years. More than 50 percent of this funding is provided annually to states, local governments, NGOs, and academic institutions through various grant programs. Between the years of 2008 and 2011 the six Bay watershed states and the District of Columbia spent approximately \$2.4 billion to support their restoration efforts and meet their pledged milestone Bay restoration measures. The Chesapeake Bay Trust fund is funded through motor fuel tax and rental car tax in the state of Maryland. Since 2008 this Trust Fund has allocated more than \$38.4 million for projects to reduce polluted runoff within the Bay watershed. In 2008 the Farm Bill established the Chesapeake Bay Watershed Initiative (CBWI), which dedicated \$188 million for conservation practices in the Bay region.

10. Resources

<http://www.chesapeakebay.net/>

<http://www.cbf.org/>

<http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/programs/initiatives/?cid=stelprdb1047323>

<http://www.epa.gov/chesapeakebaytmdl/>

J. USACE

1. Official Name and Legal Authority

The United States Army Corps of Engineers (USACE) is a Federal agency under the Department of Defense that is involved with public works, including the design, construction and management of dams, levees, canals, and other flood control structures. The USACE provides design and construction of flood protection systems through various federal mandates. The Flood Control Act of 1936 made flood control a Federal policy and officially recognized the Corps as the major Federal flood control agency. The USACE also provides environmental regulation and performs ecosystem restoration projects. The USACE evaluates and issues permits for construction activities that occur in the Nation's navigable waters and wetlands. The two primary acts of Congress that grant the USACE authority to regulate and issue permits are Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act.

2. Geography

The USACE conducts public works throughout the nation. The 404 permits apply to all navigable waters and wetlands in the nation. The following USACE regulatory districts fall into Pennsylvania: Buffalo, Pittsburgh, Baltimore, and Philadelphia as shown in Figure VIII.



Figure VIII. US Army Corps of Engineers Districts

3. Data Required

For flood control projects, the USACE requires terrain data, such as digital elevation models (DEMs) and LiDAR, and hydrology and hydraulic analysis in order to properly design adequate flood protection. The USACE collects specific watershed data to perform hydrologic analysis, such as soils, land use, and imperviousness. The USACE conducts or collects surveys of stream channels, reservoirs, bridges, culverts, and dams to perform hydraulic analyses. For wetland 404 permits, an application form, adjacent property owners list, project description, legible drawings, assessment of alternatives, and mitigation plans are required.

4. Models

The USACE uses and develops various hydrologic and hydraulic models, including HEC-RAS and HEC-HMS, and many others developed by the USACE's Hydrologic Engineering Center (HEC). The USACE also develops water quality models (CE-QUAL, etc.).

5. Products

The USACE produces floodplain studies, levee and dam inventory and accreditation studies, hydrology, hydraulic and water quality models. They issue wetland permits and permits for construction and dredging in the Nation's navigable waters.

6. Applicability to Other Programs

The USACE works closely with FEMA on Flood Insurance Studies to develop hydrologic and hydraulic analysis, and develop non-regulatory products. The USACE works with PennDOT and other Local Projects to issue permits for activities such as road crossings in navigable waters or wetlands. The Silver Jackets Program, led by the USACE, encourages the USACE to work and share knowledge with other Federal Agencies on flood management.

7. Status (budget)

The USACE FY14 Operations and Maintenance (O&M) total budget is \$2.588 billion, and \$4.826 billion in total gross discretionary funding. From the USACE's *Engineer Update*

regarding the President's Fiscal 2014 Budget for the USACE: \$41 million from the O&M budget is designated for the Levee Safety Initiative to help ensure that Federal levees are safe. This initiative includes funding for ongoing work on the National Levee Inventory Program. The FY14 Regulatory Program is funded at \$200 million. With these funds, USACE will improve protection of the nation's waters and wetlands and provide greater efficiency of permit processing. The Investigations account also includes \$12 million to enhance the Army's efforts in conjunction with state floodplain management authorities to provide floodplain management services and interagency coordination to improve state and local capabilities to develop effective flood risks management solutions to flood and storm damages. This includes \$2 million to support the continued development of interagency teams known as Silver Jackets to provide unified Federal assistance in implementing flood risk management solutions.

8. Strengths/Weaknesses

The Silver Jackets program is one USACE strength that can be utilized to improve coordination with FEMA, NOAA, and other Federal agencies to improve floodplain management. This program might also be leveraged to involve the EPA and provide the opportunity to tie stormwater and floodplain management more closely together. For example, it could be a Silver Jackets initiative to try to better share watershed data collected for Watershed Implementation Plans required by NPDES regulations and watershed studies prepared by FEMA for flood insurance studies.

K. Susquehanna River Basin Commission

1. Official Name and Legal Authority

The Susquehanna River Basin Commission is a Federal-Interstate Compact Commission formed by agreement of the States of New York and Maryland, the Commonwealth of Pennsylvania, and the Federal government. Authority is granted to the Commission by the Susquehanna River Basin Compact, which was signed into law on December 24, 1970. The Compact provides the mechanism to guide the conservation, development, and administration of the water resources of the vast river basin.

2. Jurisdiction (agency)

The Susquehanna River is the nation's sixteenth largest river and is the largest river lying entirely in the United States that flows into the Atlantic Ocean. The Susquehanna and its hundreds of tributaries drain 27,510 square miles, an area nearly the size of South Carolina, spread over parts of the states of New York, Pennsylvania, and Maryland.

The river meanders 444 miles from its origin at Otsego Lake near Cooperstown, N.Y., until it empties into the Chesapeake Bay at Havre de Grace, MD. The Susquehanna contributes one-half of the freshwater flow to the Bay.

The Commission has jurisdiction over the entire Susquehanna River watershed as shown in Figure IX.

3. Geography

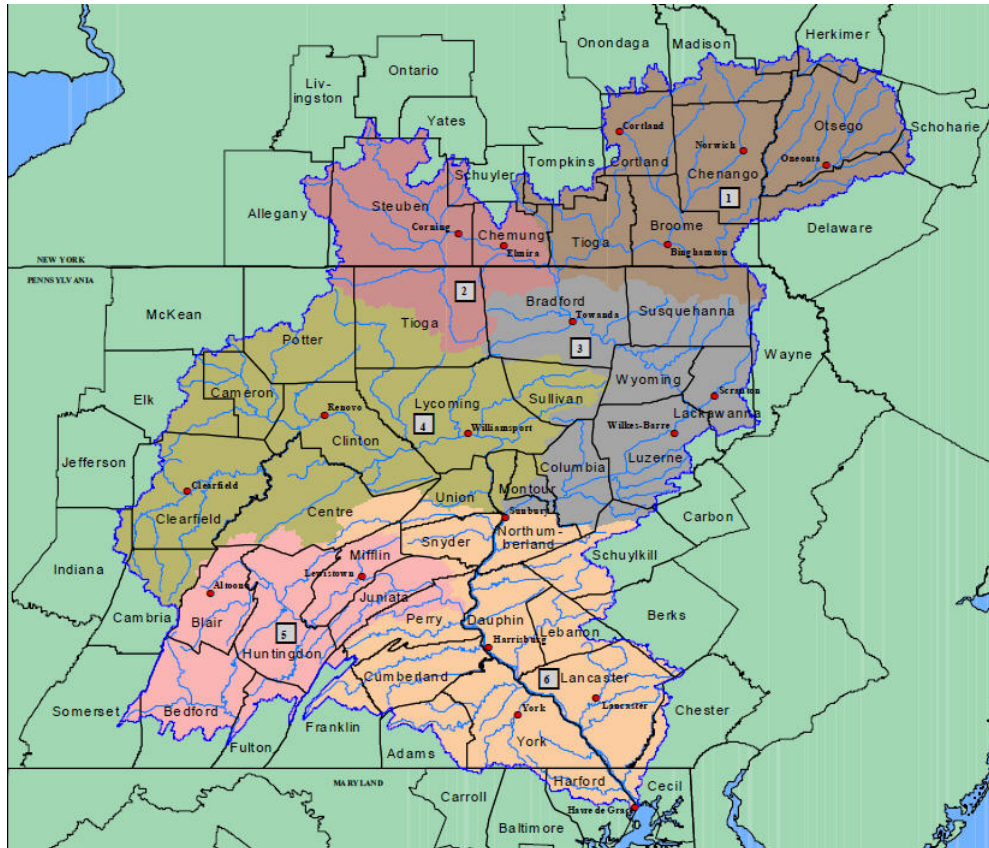


Figure IX. Susquehanna River Basin

L. DCNR (River Conservation Plans)

1. Official Name and Legal Authority

Pa. Rivers Conservation Program

2. Background

The Pa. Rivers Conservation Program has been developed to conserve and enhance river resources through preparation and accomplishment of locally initiated plans. The program provides technical and financial assistance to municipalities and river support groups to carry out planning, implementation, acquisition, and development activities. A registry is established to recognize local river conservation efforts.

3. Jurisdiction (agency)

PA Department of Conservation and Natural Resources (DCNR)

4. Data Required

Typical data collected, most of which is in GIS format, includes information on:

- Comprehensive land use plans.
- Soils.
- Geology.
- Topographic and other readily available mapping.
- Aerial photographs.
- Land use/land cover.
- Future land use/land cover.
- Stormwater-related problem areas.
- Stream flow and rain gauge data and other water quality information.
- FEMA FIS floodplain information.
- Recreational opportunities.
- Constraints.

5. Geography

The program is administered statewide. Approved Plan is shown in Figure X.

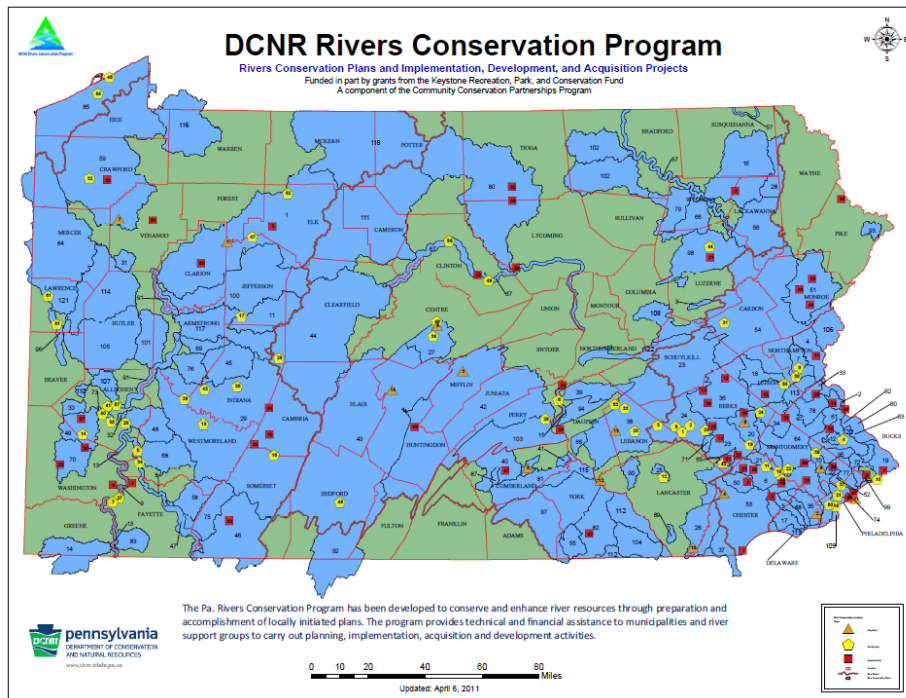


Figure X. DCNR Rivers Conservation Program

6. Models

GIS data is required for the analysis as described above, however, hydrologic/hydraulic modeling are not required for the program.

7. Products

The purpose of this program is to develop a Rivers Conservation Plan (RCP) identifying significant natural, recreational, and cultural resources. Issues, concerns and threats to river resources, and values are determined locally as part of planning, as well as recommending methods to conserve, enhance, and restore Pennsylvania's many streams and rivers.

8. Applicability to Other Programs

Much of the same data collected for the maps produced for the RCP as described above is required for the Act 167 Plans.

9. Status (budget)

The Keystone Recreation, Park and Conservation Fund Act of 1993; A component of the Community Conservation Partnership Program, administered by the Bureau of Recreation and Conservation provides development, implementation, and acquisition grants for the program. Any municipality and appropriate organization (river support groups having 501 (c)(3) are eligible to apply for grants. Such groups must be established under Pennsylvania law, authorized to do business in the Commonwealth, and Registered with the Commonwealth's Bureau of charitable organizations. River conservation must be one of the group's primary purposes. Funds provided by DCNR may not exceed 50 percent of the approved project cost. A local share must be provided either through direct payment (cash) or in-kind services.

10. Strengths/Weaknesses

The program strength is its continued success, mostly attributable to stable funding. Opportunities, including projects, can include but are not limited to greenways, rails to trails, riparian buffers, water trails, and wildlife areas. Threats and/or weaknesses would only occur if funding ceased.

M. Pennsylvania Fish and Boat Commission (PaFBC)

The mission of the Pennsylvania Fish and Boat Commission is to protect, conserve, and enhance the Commonwealth's aquatic resources and provide fishing and boating opportunities. The PaFBC collects data through a GIS format on many facets of water such as approved trout waters, access points, special regulation steam, etc. and distributes the data via the Pa Spatial Data Access (PASDA) platform. Of all the data they collect, it appears that only the information on run-of-the-river dams may affect flooding.

N. Local Projects (tax or infrastructure)

1. Official Name and Legal Authority

Each municipality has its own official name. Municipalities receive their legal authority through the Pennsylvania Municipalities Planning Code, Act of 1968, P.L. 805, No. 247 as reenacted and amended. The Pennsylvania Flood Plain Management Act of 1978 P.L. 151, No, 166 32 P.S. §679.101 et seq., set forth municipal responsibilities. Section 201(a) states, "Each municipality which is notified by the United States Department of Housing and Urban Development that has been identified as having an area or areas

which are subject to flooding shall participate in the National Flood Insurance Program.” Section 202 states, “Each municipality which is notified by the United States Department of Housing and Urban Development that has been identified as having an area or areas which are subject to flooding, shall adopt such flood plain management regulations, and amendments thereto, as are necessary to comply with the requirements of the National Flood Insurance Program within six months after a flood plain map is approved or promulgated for the municipality by the United States Department of Housing and Urban Development.” Most municipalities adopt flood plain management ordinances consistent with the “suggested ordinance” prepared and distributed by the Pennsylvania Department of Community and Economic Development.

2. Background

In 1968, Congress created the National Flood Insurance Program (NFIP) to help homeowners, renters, and business owners obtain flood insurance. The Commonwealth of Pennsylvania requires municipalities to participate in the NFIP.

3. Jurisdiction (agency)

Each municipality’s jurisdiction is within its physical boundaries.

4. Geography

Each municipality’s geography is within its physical boundaries.

5. Data Required

The Federal Emergency Management Agency (FEMA) provides, maintains, and updates Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs) used by municipalities in implementing their floodplain management programs. FIRMs are available in both paper or digital formats. FEMA allows property owners to request FIRM revisions by submitting a Letter of Map Amendment (LOMA) or Letter of Map Revision Based on Fill (LOMR-F).

6. Models

Most municipalities use FEMA FIRMs, FISs, LOMAs and LOMR-Fs to implement their floodplain management program. While some municipalities have GIS and a few larger municipalities, like Philadelphia, may have models for stormwater management, most municipalities do not employ models to implement their daily floodplain management program.

7. Products

The municipalities’ product is interfacing FEMA FIRMs, Studies, LOMAs, and LOMR-Fs to check development requests against regulated floodplains.

8. Applicability to Other Programs

Each municipality’s floodplain management ordinance may be applicable to its Zoning Ordinance, its Subdivision and Land Development Ordinance, its Stormwater Management Ordinance, etc.

9. Strengths/Weaknesses

Strengths

Each municipality may decide whether to/or not to establish a budget item for floodplain management. A program strength is the recent FIRM updates which allow much more accurate interface between floodplain boundaries and areas proposed for development.

Weaknesses

One program weakness is that funding delays FEMA data updates. A second program weakness is that many municipalities do not have qualified personnel implementing the program, owing to the lack of base level training available locally. A third program weakness is that locally available data is often of a different time period than the FIRMs.

0. Pennsylvania Dam Safety & Encroachment Act (Act 325 of 1978)

1. Official Name and Legal Authority

The Pennsylvania [Dam Safety & Encroachments Act \(Act 325 of 1978\) \(PDF\)](#) and the Amendment for "High-Hazard Dam" Act 325 provides for the regulation of dams and reservoirs, water obstructions and encroachments in the Commonwealth, in order to protect the health, safety and welfare of the people and property.

2. Background

In 1913, following devastating dam collapses in Johnstown in 1889 and Austin, Potter County in 1911, Pennsylvania enacted the first known dam safety legislation in America, providing for the regulation of dams and other water obstructions. The current law, Pennsylvania's Dam Safety and Encroachments Act (Act 325 of 1978), stems from the 1977 Johnstown flood disaster in which very heavy rains caused flooding and dam failures that killed 85 people.

3. Jurisdiction (agency)

The PADEP Division of Dam Safety provides for the regulation and safety of dams and reservoirs throughout the Commonwealth in order to protect the health, safety and welfare of its citizens and their property.

This division is required to assure proper planning, design review, construction review, maintenance monitoring and supervision of dams and reservoirs. This requirement is mandated by the Dam Safety and Encroachments Act, as amended, and the Pennsylvania Code. The division directs and coordinates field investigations with regional offices on authorized projects during construction; provides program guidance and coordination to regional program staff in the periodic inspection of all existing dams to determine their condition and safety; and directs, coordinates and develops policies and technical standards in the area of dam safety for the Department.

Today, the Department of Environmental Protection's (DEP) Dam Safety Program oversees approximately 3,360 dams and reservoirs throughout the state in order to protect the health, safety and welfare of citizens and properties downstream. The program is recognized as a national leader and has served as a model for other states.

4. Geography

DEP inventories and regulates all dams that meet or exceed any one of the following criteria:

- Impound water from a drainage area of greater than 100 acres;
- Have a maximum potential water depth greater than 15 feet or
- Have a maximum potential storage capacity of 50 acre-feet or greater.

DEP gives particular attention to dams that could threaten the lives of Pennsylvania's citizens. DEP has created a classification for these structures called "high hazard dams." This designation does not suggest the dam is in danger of failing; it indicates that should the dam fail, homes, businesses, schools, hospitals and assisted-living care facilities, or important infrastructure would be at risk.

5. Data Required

Some dams are required to have developed Emergency Action Plans (EAPs). To develop an EAP, a hydrologic and hydraulic computer model is set up and a dam break is simulated, resulting in the inundated area downstream of the dam. In order to perform this, the following data is required:

17. Soils.
18. Geology.
19. Topographic and other readily available mapping.
20. Aerial photographs.
21. Land use/land cover.
22. Previously completed engineering and planning studies.
23. Downstream bridge dimensions.
24. Significant water obstructions.
25. Downstream structures
26. Stream cross sections
27. Dimensions, height, width, material, spillway measurements of the dams.
28. Stream flow and rain gauge data and other water quality information.
29. 100-year, ½ probable maximum flood (PMF) or PMF rainfall.
30. FEMA FIS floodplain information.
31. Roadway access to the dam and below the dam
32. Emergency services and personnel locations
33. Emergency shelter locations

6. Models

GIS (mostly ESRI software products) is a large part of the planning process for development of dam break analyses. The GIS data is not only used to develop maps to observe inundation areas, but to develop the parameters required for hydrologic modeling. Hydrologic models such as the US Army Corps of Engineers HEC-1, HEC-HMS or more recently the HEC-RAS model are typically utilized. Many older studies were performed utilizing the NWS Dam Break model (DAMBRK). Various intermediate software may be used for hydrologic processing or calibration such as GeoHMS, WMS, PeakFQ and StreamStats.

7. Products

The Dam Inspection Program produces an Annual Dam Safety Inspection report which reports on the condition of the dam and recommended maintenance items.

An Emergency Action Plan (EAP) is a formal document that identifies potential emergency conditions at a dam and specifies preplanned actions to be followed in response to a dam hazard emergency, which are designed to minimize property damage and prevent loss of life. The EAP describes procedures and information to assist the dam owner in surveillance of developing conditions and issuing timely notification of an emergency situation to responsible emergency management authorities. It also contains inundation maps that show the emergency management authorities the critical areas for action in the event of a dam hazard emergency. It should also include an inundation map with emergency evacuation routes and shelter locations.

8. Applicability to Other Programs

The development of the dam break model includes some of the same data as Act 167 plans, River Conservation Plans, FEMA and other floodplain mapping, and bridge work.

9. Status (budget)

There is no statewide budget to perform the above work. Individual dam owners are responsible to hire an engineer to perform the above tasks.

10. Strengths/Weaknesses

Strengths

The strength of the program is that it provides a planned management of the dams within the State minimize failure and flooding.

Weaknesses

There is no State funding to assist dam owners, although Skytop Lodge, a private entity was able to secure \$200,000 in State Local Share Account (LSA) funds to rehabilitate the dam and eliminate the public safety threat in case of a failure.

P. Hazard Mitigation Planning

1. Official Name and Legal Authority

Hazard Mitigation Planning (HMP) Program and/or Pre-Disaster Mitigation Program(PDM)

Legal authority for these programs stem from Federal and state legislation including but not limited to the Pre-Disaster Mitigation Assistance Act of 2000, The PA Emergency Management Act of 1978, The PA Municipalities Planning Code as amended, The PA Flood Plain Management Act, and the respective municipal codes.

2. Jurisdiction (agency)

The Pennsylvania Emergency Management Agency (PEMA) has primary jurisdiction for approval of all County and local/municipal Hazard mitigation plans and projects with Federal oversight provided by FEMA.

3. Background

Mitigation is another way to say "relieve" or "alleviate". The general idea is to make a dangerous situation less risky. In emergency management, hazards are natural, man-made or technological disasters. Hazard mitigation means reducing, eliminating, redirecting, or avoiding the effects of those hazards. The standard definition of hazard mitigation that is often used by FEMA and PEMA is:

Any cost-effective action taken to eliminate or reduce the long-term risk to life and property from natural and technological hazards.

Planning has always played an important role in making communities safer places to live. Local zoning and subdivision plans, comprehensive plans, building codes and floodplain ordinances are all familiar community efforts aimed at that common goal. Hazard mitigation planning (HMP) is an extension of that effort that aims at identifying hazards and risks in our communities and developing ways and means of reducing potentially disastrous losses of life and property. Such planning at the county level has occurred in various formats since the 1970s when it was financed in whole or in part by the Federal Department of Housing and Development.

4. Geography

Obtain Statewide HMP Status Map from Tom Hughes, PEMA

5. Data Required

Data required in the application for PDM Program is dependent upon the type of funding requested:

a) Hazard Mitigation Planning activities

There are thirteen required elements of a planning application. Data elements required: a description of the area to be covered by the planning activity and identification of the source of the hazards to be addressed including the location and extent, range of magnitude, past event history, and other applicable information that will

demonstrate the need for planning efforts. Also the goals and objectives of the planning activity are to be identified.

b) Hazard mitigation Project activities

There are seventeen required elements of a project application. Data elements are similar to that of a planning application, plus the project application has the added elements of Properties, Decision-Making Process, Environmental/Historic Preservation, and Maintenance Schedule.

6. Models

PEMA has created a number of models and/or "tools" to assist counties with hazard mitigation planning. Pennsylvania's All-Hazard Mitigation Planning and Project Identification Toolkit (HM Toolkit) is a culmination of all models and/or "tools" created to standardize, streamline and simplify the hazard mitigation planning process in the Commonwealth. "Tools" within the HM Toolkit include:

1. Pennsylvania's All-Hazard Mitigation Planning Standard Operating Guide (SOG)

The SOG documents standard operating procedures for hazard mitigation planning in Pennsylvania by capturing FEMA requirements, clarifying and combining existing guidance (particularly FEMA 386), and allowing communities a greater opportunity to excel in the preparation of hazard mitigation plans. Model Plan Outline (MPO), Risk Factor Methodology, Standard List of Hazards, and Mitigation Action Evaluation Methodology (PA STEEL). The guidance provided in the SOG allows PEMA to conduct a more thorough and detailed plan review in less time. The SOG is to be used in conjunction with the PEMA's online Plan Builder.

2. Pennsylvania's All-Hazard Mitigation Tool (PA Tool)

The PA Tool is an online tool consisting of three primary components: 1) Plan Builder, 2) Project Catalog, and 3) Library. It is a password-protected mitigation planning tool that allows entities to create, update, and export their HMP online with the Plan Builder component of the PA Tool. It allows users to enter and store mitigation project information in a way that gives communities the ability to more easily apply for project funding through FEMA's online eGrants system.

The PA Tool makes it possible to efficiently roll-up information from local mitigation plans into the Commonwealth HMP. Because plan and project information is entered into a database via the PA Tool, data pertaining to locally identified hazards, assessed risk, assessed capabilities, and proposed actions and projects can easily be sorted and integrated into the State Hazard Mitigation Plan.

7. Products

Approved Hazard mitigation plans for the Commonwealth, its 67 Counties and individual Municipal level plans for 2553(?) municipalities. Also, completion of actual hazard mitigation project activities including acquisition, demolition, relocation and elevation of residential structures funded under the PDM Program

result in significant reductions of flood damage in project communities around the state.

8. Applicability to Other Programs

Every mitigation grant program sponsored by FEMA now requires applicants to have a federally-approved HMP to be eligible for project funding. That means that even if community and/or municipality is included in a federally-declared disaster, the municipality will not be eligible for a buyout program (for example) unless it has a FEMA-approved HMP. FEMA programs included are:

- *Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance (FMA) program
- Pre-Disaster Mitigation (PDM) program
- Repetitive Flood Claims (RFC) program
- Severe Repetitive Loss (SRL) program

9. Status (budget)

PDM funds are appropriated by Congress to FEMA annually. Funds are then awarded by FEMA on a competitive basis to states and municipalities who submit applications for planning and project funding. Congressional appropriations often vary from year to year

10. Strengths/Weaknesses

A hazard mitigation plan is required in order to be eligible for certain types of federal mitigation funding. This is an important pre-requisite because the plan provides a meaningful process for evaluating the nature of the hazards and establishes a rational basis for the selection of mitigation of project activities. In Pennsylvania, the most common hazard is flooding. The most common mitigation project is acquisition and demolition of flood-risk homes or "buyouts." Since 1996, some 1,400 homes and an estimated 3,500 people have been removed from dangerous flood areas through mitigation projects. Acquisition is considered the "best" mitigation because it eliminates the hazard of flooding in a risk area - no homes, no losses. On the other hand, other mitigation projects eligible in Pennsylvania include home elevations and small flood control projects, though these are fewer in number than acquisition projects. These types of mitigation activities are not as effective because homes and businesses remain in risk areas and can still be damaged in a disaster.

The step-by-step "how-to" guidance provided in the SOG makes the hazard mitigation development process more manageable while creating consistency among local hazard mitigation plans. The guidance also provided in the SOG allows PEMA to conduct a more thorough and detailed plan review in less time. Unfortunately, the downside of having a standard model to follow allows counties and their municipalities to prepare and adopt a plan that may not be totally relevant and/or appropriate for the respective county and/or its municipalities.

http://www.portal.state.pa.us/portal/server.pt/community/programs_and_services/4547/hazard_mitigation_forms_presentations_and_other_documents/806856

IV. SUB-COMMITTEE'S ANALYSIS

Integrated Water Resource Management has been discussed for over 100 years in the Commonwealth, albeit with differing meanings over that time. The fact that so many distinct programs are currently using different data and at varying levels of accuracy speaks directly to the idea that water resource management is not integrated. The creation of an official water base map for all planning and regulatory functions would highlight areas of duplication and also allow direct integration of data from all programs.

The various levels of government utilize data of differing accuracy based on their own needs, which creates a situation where their work cannot be integrated. Regional and federal programs have historically used less refined/less precise data because the modelling capabilities were limited, but modern computing power is making that a non-issue. The larger problem now is the regulatory and programmatic structure we built in the past which perhaps stifles integrated activity and analysis.

The fact that legally mandated programs (e.g. – State Water Plan activities, Act 167 plans) are mostly unfunded is not just a budgetary oversight or result of an economic downturn. Perhaps because the programs are not integrated we do not think of the water resource as holistically as we should. It is also a possibility that programs so closely related technically are managed in so many different agencies and bureaus that there is not a single advocate.

There is a need for more public education (government and non-government) regarding the relationships between floodplain management and stormwater management. A striking example is the fact that flood insurance rate maps are created by modeling existing conditions within a watershed, whereas Act 167 stormwater planning is performed with future build-out scenarios considered. How does the community resolve conflicts in economic development and floodplain management when there is such a gap between even the scientists and engineers modeling existing conditions and full build out?

Many of the criteria for stormwater management engineering are equally important to understanding flood hazard. Those criteria include infiltration rates, water quality requirements, stream bank erosion analysis and the quantity calculations. It is also common that engineering is focused most intently on the specific project area at its most restricted area and not the upstream conveyance and collection areas and floodplains. A comprehensive base map would make such an analysis less expensive and allow us to study cumulative effects now missing from the equation.

There is plenty of expertise here in the Commonwealth to understand and manage the water resources in an integrated manner.

V. RECOMMENDATIONS

1. **Recommendation 1:** Refine the concepts of floodplain management and stormwater management that integrates the two concepts and increase public education and outreach. Reinforce the technical trend emphasizing the natural functions of floodplains and more naturally functioning stormwater management BMPs.
2. **Recommendation 2: Better coordinate overlap of data amongst agencies. Highlight conflicts of data/cross purposes.** Modernize the way we collect, organize, and distribute spatial and integrated data:
 - a. Establish a common surface water base map at a scale large enough to show stormwater infrastructure.
 - b. Ensure that the PA-centric base map allows and encourages collaboration by federal and local entities by design.
 - c. Constantly update the base map from permit and approved design data.
 - d. Eliminate data conflicts and redundant collection
3. **Recommendation 3:** Look for alternative means of identifying floodplain areas in smaller watersheds that effect stormwater flow and infiltration; these areas are essentially unstudied in flood insurance rate maps.
4. **Recommendation 4:** Support better flood forecasting by refined modeling that includes stormwater control features and their designed release or retention rates.
5. **Recommendation 5:** Encourage funding of State Water Plan work that advances integrated water resource management, and in particular that work that integrates the surface water base map to include both natural and manmade conveyances and flow paths.
6. **Recommendation 6:** Evaluate No Adverse Impact (NAI) concepts advanced by the Association of State Flood Plain Managers (ASFPM) and see how they fit PA, and whether going beyond the NFIP minimum requirements as required by NAI will bring improvements and synergy to stormwater management as well.

VI. CONCLUSIONS

There are many Federal, State, Regional and Local programs related to flooding and/or stormwater. Oftentimes in the past, these programs had one specific goal in mind, and followed independent paths, which resulted in duplication of efforts and data and wasted expenditure of public funds. Going forward, better coordination of programs would save money, and achieve multiple objectives. This white paper is not exhaustive, but current knowledge is clear - that flooding first starts with stormwater runoff, and that managing one benefits the other.

There has been little legislative advance in recent years to coordinate the two initiatives and there is variable guidance from the Federal level. Data coordination is paramount to the success of proper stormwater and floodplain management, and for regulatory efficiency. In developing the scale, accuracy, and attributes of water related GIS data, all programs should be considered so that the data is usable at all levels, not just for a specific need resulting in duplication of the same data layer, i.e. streams.

The next step is to examine the data created and used in these same programs in more depth and to settle on a single model and data management scheme for the Commonwealth. Forward thinking is needed. Delay is unnecessary.

VII. REFERENCES

DeBarry, Paul A. **Watersheds: Processes, Assessment and Management**, John Wiley & Sons, New York, NY 2004

Kury, Franklin N., **Clean Politics, Clean Streams: A Legislative Autobiography and Reflections**, Lehigh University Press (September 15, 2011)

STORMWATER PROGRAM MATRIX

Program/ Agency	State/ Fed/ Local/ Regional	Data Required	GIS Involved	Models	Product(s)	Applicable to other programs	Notes
Cheasapeake Bay Program	F/S/R	Typically use national and regional scale data; 2014 began requests for local scale data	Yes	Mapshed, CAST, Watershed Treatment Model	Land Use Change, Regional Planning, State Program Evaluation, Model Enhancement	MS4 and other states' efforts	Request for local data signals the potential for better coordination in water quality protection regionally with specific actions locally. Flood effects on water quality are essentially unmodelled.
Dam Safety	S	Yes - Same as for hydrologic modeling, LiDAR and road crossings for cross sections downstream of the dam, dam physical features	Yes	HEC-1, HEC-HMS, HEC-RAS, DAMBREAK	Emergency Action Plan with Inundation area mapping	Bridges, flood mapping (FEMA), Hazard Mitigation Planning	
DCNR (River Conservation Plans)	S	(1)	Yes	No	Maps of data, Mapped opportunities and constraints	Act 167, FIS,NFIP and HM Plans	(1) DEMs (USGS 30 & 10 Meter), Land cover, Future land cover, Impervious surface, soils (HSG), Floodplains, Problem areas (flooding, erosion, water quality, etc), Riparian buffers, recreational opportunities.
DRBC	R	Survey, LiDAR,Bridge and Culvert data, DEMs, Stream Cross Sections, Floodplain, Floodway, Stage - Discharge Relationships, Hydrologic Frequency, Sensitive Resources	Yes	HEC-RAS, HEC-ResSim, EPA SWMM, OASIS	OASIS comparison runs for decree parties, Stage Based Inundation Maps, Planning tools, Flood Analysis modeling, Water Use/Availability modeling	NWS River Forecasts	Sensitive Resources(Steep slopes, woodland, well head protection, riparian buffers) Stage based inundation maps provide expected area of inundation related to stage at a local stream gage. Libraries of maps have been created for number of forecast points across the Delaware River basin and can be accessed on NWS AHPS.
Great Lakes Water Agreement	R	Great Lakes shoreline, Water Supply Data(Ground & Surface Water),soils, land use and land cover, hazardous waste sites, demographics, watersheds and transportation	Yes	The two models found were in a Joint Policy Manual prepared by the GL Basin Commission & the GL Alliance that focus on state level water conservation policy and on public water, utility water conservation practices.	Great Lakes-St. Lawrence River Basin Conservation Model Policies and Measures. Great Lakes GIS Online project	PA Clean Streams Act & US Clean Water Act	Involves Water Conservation & Water Withdrawal Issues affecting w/ Water Supply. The Great Lakes(GL) St. Lawrence River Basin Water Resources Compact and Agreement(2008) have two primary purposes; 1)to prevent the diversion of Great Lakes/St. Lawrence waters outside of the basin and 2) to efficiently manage the withdrawal and use of water within the basin. The above water management pact has been approved by eight Great Lake states and several Canadian provinces
Local Projects (tax or infrastructure)	L	(1)	Yes. Additionally CADD with LD Plans	HEC-RAS, HydraFlow HydraGraph, HydroCAD, Virginia Tech / Penn State Urban Hydrology Model, TR20	(2)	NPDES/MS4	(1) Survey, LiDAR, Bridge & culvert data, Stream cross sections, Wetlands, Area of disturbance, Floodplain, Floodway, Impervious Surfaces, Sensitive Resources(Steep slopes, woodland, well heat protection, fracture traces) (2) Chapter 102 Permit National Pollutant Discharge Elimination System (NPDES) and E&S permits,Chapter 105 General Permits, Chapter 106 Floodplain Permits, MS4 NPDES water quality or Water quantity information. Detailed site specific information.

STORMWATER PROGRAM MATRIX

Program/ Agency	State/ Fed/ Local/ Regional	Data Required	GIS Involved	Models	Product(s)	Applicable to other programs	Notes
Mitigation Planning & Projects	F + S + L	DEMs (LiDAR), Hazards Analysis Data, FIS Elevations	Yes	State Hazard Mitigation Plan & respective County Mitigation Plans, 'Hazus, ArcGIS (1)	Hazard Maps & Plans, Floodplain MAPS, Open Spcce/Floodplains Acquired, Floodplain Residents Relocated	FIS, NFIP, Act 166, Clean Streams Act, Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) program, Pre-Disaster Mitigation (PDM) program, Repetitive Flood Claims (RFC) program, Severe Repetitive Loss (SRL) program & the Federal Housing & Development Department 's CDBG Disaster Recovery Program	<p>Mitigation Projects: FEMA Hazard Mitigation Grant Program, FEMA Disaster eGrants (Flood Mitigation Assistance Program, Pre-Disaster Mitigation Program), State, County/Local Hazard Mitigation Plans and Updates, Benefit-Cost Analyses, Damage Frequency Analysis, FHBM/Zone A H&H studies, GIS & Firm Maps, First floor evaluation surveys. Each county must have a current FEMA approved Hazard Mitigation Plan, have participated in its revision, adopted the county plan and the mitigation activity they intend to use our funds for is accounted for in the municipal portion of the county plan (a revision letter can be submitted to make this an "approved" activity).</p> <p>(1) PEMA has created a number of models and/or "tools" to assist counties with hazard mitigation planning. Pennsylvania's All-Hazard Mitigation Planning and Project Identification Toolkit (HM Toolkit) is a culmination of all models and/or "tools" created to standardize, streamline and simplify the hazard mitigation planning process in the Commonwealth. "Tools" within the HM Toolkit include:</p> <ol style="list-style-type: none"> 1. Pennsylvania's All-Hazard Mitigation Planning Standard Operating Guide (SOG) 2. Pennsylvania's All-Hazard Mitigation Tool (PA Tool)
NATIONAL FLOOD INSURANCE PROGRAM	F	LiDAR, Bridge & Gage data,	Yes	Hydrology (various), HEC-RAS and others	County FIS, Floodplains, DFIRMS, RiskMAP, HM Plans	Hazard Mitigation including the NFIP	<p>FIS is not a Program in and of itself !!!</p> <p>But, it is a product of the National Flood Insurance Program (NFIP). This program is actually two(2) programs in one:</p> <p>1) Community Development prog. = FIS /floodplain Maps and Local Floodplain Regulations 2) Economic Development = Affordable Flood Insurance to protect Residential & Non-residential property for flood damages. The most recent laws, the Biggert-Waters Flood Insurance Reform Act of 2012 and Homeowners Flood Insurance Affordability Act of 2014, collectively are and will continue to have an impact on both flood insurance policyholders and the communities/municipalities they reside in both the near future and over the long term.</p>
NPDES / MS4	F/S	Stream data, LiDAR, Land Use, Census Data, Census Information	Yes	SWMM, FAST, BAYFAST, WinSLAMM	Asset management for permit holders. TMDL nutrient reduction, BMP report information	PaDEP Act 167, PaAct 166	Program has been attempting to rationalize local and precise data and actions in response to regional and aggregated estimates.
PADCED Act 166 PA Floodplain Management Act	S	Hydrologic & Hydraulic data required in FIS	GIS Involved	Hydrology (various), HEC-RAS and others .	FIS, Floodplain Maps, DFIRMS, RiskMAP	Hazard Mitigation, Local Projects, Floodplain Zoning & OTHER Local Floodplain Regulation s/ Codes & CDBG-DR	Mandates Local Participation in the NFIP, establishes the NFIP Floodplain Regulations as the minimum local standard for PA municipalities, identifies certain land uses for special local regulation and requires DCED and DEP to perform specific duties in a coordinated and cooperative manner .

STORMWATER PROGRAM MATRIX

Program/ Agency	State/ Fed/ Local/ Regional	Data Required	GIS Involved	Models	Product(s)	Applicable to other programs	Notes
PADEP Act 325 of 1978 Dam Safety & Encroachment / Wet Weather	S+R	Survey, LiDAR, Bridge & culvert data, Stream cross sections, Wetlands, Area of disturbance, Floodplain, Floodway	Yes	'HEC-1, HEC-HMS, WMS, StreamStats, PeakFQ, HEC-RAS, TuFlow	(1)		(1) Chapter 102 Permits National Pollutant Discharge Elimination System (NPDES) and Related General Permits Also E&S permits. PAG-06 Wet Weather Overflow Discharge from Combined Sewer Sys, NOI for Coverage, 3800-PM-WSWM0076 All of the Chapter 105 GPs - Chapter 105 Water Obstruction & Encroachment General Permits (PAG-1, 2, 12, and GP-01-11, 15) including the following: a. PAG-2 NPDES GP for Stormwater Discharges Associated with Construction Activities. b. GP-03 Bank Rehabilitation, Bank Protection & Gravel Bar Removal, 3930-PM-WM0503 c. GP-04 Intake & Outfall Structures, 3930-PM-WM0504 d. GP-05 Utility Line Stream Crossings, 3930-PM-WM0505 e. GP-07 Minor Road Crossings, 3930-PM-WM0507 f. GP-08 Temporary Road Crossings, 3930-PM-WM0508 g. GP-11 Maintenance, Testing, Repair, Rehabilitation, or Replacement of Water Obstructions and Encroachments 3930-PM-WM0511 h.and Other GPs Chapter 106 Permits - Floodplain Management = Public Entities such as Utilities and local governments Chapter 106 Permits - Floodplain Management US Army COE Joint Permits Section 404 MS4 Permits - NPDES PAG-13
PADEP Act 167 Storm Water Management Act	S	(1)	Yes	HEC-HMS, PSRM, TR-20	(2)	FIS, PennDOT bridges, RCP's, MS4's TMDL's	(1) DEMs (USGS 30 & 10 Meter), Land cover, Future land cover, Impervious surface, soils (HSG), Bridge & culvert data, Floodplains, Problem areas (flooding, erosion, water quality, etc), Riparian buffers (2) Maps of data, Subareas with Flows, Management districts, Mapped bridge & culvert capacities, Model SW Ordinance
PADEP State Water Plan	S	(1)	Yes	NHD, ArcGIS Hydro Data Model, OGC Hydrology Domain Working Group	Singular set of surface hydrology compatible with LiDAR DEM and which includes stormwater infrastructure	(2)	(1) LiDAR DEM's, standard protocol for creating streams from LiDAR, DOT and local culvert data, MS4 info from muni's, digital DMR acceptance and inclusion protocol, BMP inventories, HEC-RAS model inventories (2) Need inventory of all programs making or utilizing stream centerlines and limits, flow models, watersheds, permitting. A proper State Water Plan would ultimately streamline and reduce the number of programs involved since redundancies and anomalies would be identified. The program inventory is the first step.
PAFBC	S	(1)	Yes	N/A	E&S, NPDES	N/A	(1) Survey, LiDAR, Bridge & culvert data, Stream cross sections, Wetlands, Area of disturbance, Floodplain, Floodway

STORMWATER PROGRAM MATRIX

Program/ Agency	State/ Fed/ Local/ Regional	Data Required	GIS Involved	Models	Product(s)	<u>Applicable to other programs</u>	Notes
PEMA	S	(1)	Yes (2)	Software/ Models/DBs: FEMA BCA 4.8 module, ArcMap, Google Earth, TOPCON PC-CDU GPS positioning upload software, FEMA NFIP & NEMIS databases, PEMA HM Database, HAZUS.	(3)	NOAA NWS,FIS and Hazard Mitigation	(1) EOC: (Inundation maps, Rain & Stream Gages (USGS, County/Local). Mitigation: FEMA/NFIP FIRMS, dFIRMS & FISs, NFIP Data Exchange (BureauNet), Elevation Certificates, field evaluation surveys, FEMA NFHL v3.0 kmz w/Google Earth, USGS StreamStats & DEMs, DCNR/PASDA LIDAR & 2 ft Contours, PEMA GIS IMAGRY layers, project/ property latitude & longitude, local tax records, Bennefit-Cost Analysis Results and Ratios, RS Means Guide Residential Construction Cost Code Guide, State/County/Local Hazard Mitigation Plans, FEMA NEMIS Database, FEMA Map Service Center, HAZUS flood study results, HEC-RAS studies, Quick2 results. '(2) Yes Currently ArcMap 10.2; dFIRMS & property locations, HM properties monitoring sites database, Depth Grids, stream cross-section & approximate zone analysis, HAZUS flood studies, municipal disaster damage tracking, benchmarks, mitigation & surveyed properties kmz w/Google Earth. (3) Mitigation Projects: FEMA Hazard Mitigation Grant Program, FEMA Don-Disaster eGrants (Flood Mitigation Assistance Program, Pre-Disaster Mitigation Program), State, County/Local Hazard Mitigation Plans and Updates, Benefit-Cost Analyses, Damage Frequency Analysis, FHBM/Zone A H&H studies, GIS & Firm Maps, First floor evaluation surveys. Each county must have a current FEMA approved Hazard Mitigation Plan, have participated in its revision, adopted the county plan and the mitigation activity they intend to use our funds for is accounted for in the municipal portion of the county plan (a revision letter can be submitted to make this an "approved" activity).
PennDOT Bridge Replacement	S	(1)	No	HEC-1, HEC-HMS, WMS, StreamStats, PeakFQ, HEC-RAS, TuFlow	Exiting v. proposed Backwater flood limits, Bridge and culvert capacities, Floodplain limits 500 feet US and DS of crossing.	FIS, Act 167,Act166,PA Clean Streams Act,PA	(1) Survey, LiDAR, Bridge & culvert data, Stream cross sections, Wetlands, Area of disturbance, Floodplain, Floodway
SRBC	R	Survey, LIDAR,Bridge and Culvert data, DEMs, Stream Cross Sections,Floodplain,Floodway, Stage - Discharge Relationships, Hydrologic Frequency,	Yes	HEC-RAS, EPA SWMM, OASIS	Stage Based Inundation Maps, Green Infrastructure, Passive AMD Design, Rain Gardens (1)	NWS River Forecasts	(1) Stage based inundation maps provide expected area of inundation related to stage at a local stream gage. Libraries of maps have been created for number of forecast points across the Susquehanna basin and can be accessed by contacting SRBC.

STORMWATER PROGRAM MATRIX							
Program/ Agency	State/ Fed/ Local/ Regional	Data Required	GIS Involved	Models	Product(s)	<u>Applicable to other programs</u>	Notes
USACE	F	Bridges & culverts, streams, survey, reservoirs, flood control structures, DEMs, watersheds, wetlands	Yes	(1)	(2)	FIS	(1) Various H&H models, HEC-RAS, HEC-HMS, (anything HEC!), water quality models (CE-QUAL, etc.) (2) Floodplain studies, levee and dam inventories and accreditation studies, H&H and water quality models, wetland permits, permits for construction and dredging, in the Nation's navigable waters, etc. Sec.404 Permits/US Clean Water Act

Stormwater Program Matrix Contributors

Paul DeBarry, PE, PH, GISP, D.WRE - NTM Engineering, Inc.
Eric Jespersen CFM - Natural Resource Manager
Dave Gilbert GISP - GeoDecisions
Gary Milbrand P.E., CFM - York Township
Ben Pratt P.E., CFM - Susquehanna River Basin Commission
Cleighton Smith P.E., CFM - Bergmann Associates.
Laura Tessieri PE, CFM - Delaware River Basin Commission
Kerry Wilson ,CFM - Consultant
Christine Worley P.E., CFM - AECOM