

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF WATER MANAGEMENT
BUREAU OF WATERWAYS ENGINEERING & WETLANDS**

Flood Protection Manual

**AN EXPLANATORY MANUAL OF
FLOOD PROTECTION PROJECTS AND POLICY
FOR THE GUIDANCE OF
COUNTY, TOWNSHIP AND MUNICIPAL OFFICIALS
OF THE COMMONWEALTH**

REVISED
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FOREWARD

Pennsylvania derives many advantages from its abundant water supply. At times, however, the volume of water can be overwhelming. Rivers and streams overflow their banks, inundating population centers that include residential, commercial, and industrial areas. Millions of dollars in flood damage have been experienced from past flooding within the Commonwealth making Pennsylvania one of the most flood-prone states in the nation. Past floods have been caused by a number of circumstances including: excessive rainfall, snow melt, ice jams, mountainous terrain, and increased land development.

Pennsylvania has one of the most extensive flood protection programs in the nation. The Department of Environmental Protection is authorized to provide structural flood protection in any area of the Commonwealth that requests such protection, if it can be economically justified. In addition to the specific requirements contained in the acts authorizing the flood protection program, certain policies have been established to insure equitable benefits to all citizens of the Commonwealth.

There are many inherent conditions that must be analyzed before determining the feasibility of providing flood protection. While predicting the number of students requiring classroom space at some future date may be done with some accuracy, predicting flood frequencies or rainfall intensities is more difficult due to their erratic nature. What happens often in one watershed may seldom occur in an adjoining one. A history of flooding and related damages is a prerequisite for determining what action can be taken by the Department.

The purpose of this manual is to acquaint you with the Department's policies and procedures for providing flood protection measures and how they pertain to your community's flooding problems.

I. ESTABLISHING THE NEED FOR FLOOD PROTECTION MEASURES

The Department generally becomes aware of a flood situation in one of two ways.

1. Government officials seeking assistance with a specific flood problem.
2. Firsthand observation by Department personnel during major floods.

Following a study request, a project engineer will make preliminary calculations pertaining to the hydrology of the local area. A meeting is then scheduled with local government officials to discuss the flooding problem and to conduct a site investigation of the flood-prone area. Once the preliminary field data is obtained and past flooding history analyzed, the project engineer will recommend a course of action.

Flood problems generally fall into two categories.

1. Those that can be corrected or relieved by removing channel blockage or debris.
2. Those that require extensive structural modification and protective works.

A program administered by the Stream Improvement Section addresses removal of channel blockage and debris that contributes to chronic flooding. It also addresses streambank erosion where a residential or commercial structure is directly threatened.

If extensive protective works are required to provide flood protection, a comprehensive engineering study is recommended for areas where such protection appears to be economically justified. Prior to beginning a comprehensive study, the local municipality is asked to indicate their interest by signing a "Study Resolution of Sponsorship" requesting the Department to officially conduct a flood protection feasibility study. A sample of this resolution is included at the end of this manual.

II. FLOOD PROTECTION FEASIBILITY STUDIES

If a flood protection feasibility study is recommended, the work is performed by engineers from the Division of Project Development as soon as it can be appropriately scheduled. This is a detailed evaluation that includes an analysis of many factors within the problem area.

A. DAMAGE SURVEY

Flood Damage Inventory forms for residential and commercial properties are sent to the sponsoring municipality to be distributed and collected from property owners in the flood affected areas. Once the forms are returned to the Department, the damages are tabulated and used to determine damage centers. This aids in the economic analysis of the proposed project and allows for calibration and correlation of floodwater surface profiles.

B. HYDROLOGIC ANALYSIS

A detailed analysis of the physical characteristics of the watershed is necessary to carefully determine the volume of water (design discharge) flowing through the project location. Physical characteristics include topography, land-use, soil type, and geographic location. All available stream gaging, rainfall, and flood records are examined to determine the correlation between past rainfall and stream flow within the watershed.

C. HYDRAULIC ANALYSIS

Once the design discharge has been determined, the water surface elevations and areas of inundation are developed for the existing conditions. Physical data necessary for this is obtained from cross-sectional surveys of the stream and floodplain area.

D. PRELIMINARY PROJECT DESIGN

Preliminary flood protection solutions are evaluated with various alternatives considered in order to obtain the most economic means of providing the desired degree of protection. The alternatives considered may vary greatly for each affected area.

Compacted earth levees along the streambanks, concrete lined channels, upstream detention reservoirs, channel improvements, or any combination of these may be the most practical and economical solution for a particular site. The investigation is carried out in sufficient detail to develop a sound cost estimate for project construction.

E. ECONOMIC JUSTIFICATION

The construction cost for the most feasible solution for flood protection is then weighed against the project benefits to the community in the form of reduced flood damages. The format for determining economic justification is a comparison of project construction costs to the project's benefits. For a project to be justified, this comparison, expressed as a benefit/cost ratio, must show benefits equaling or exceeding the cost of the project. In some areas, while a project may be possible from an engineering standpoint, it may not be justified from an economic standpoint.

F. ENVIRONMENTAL & HISTORICAL IMPACT

The impact a project will have on the environment and historical features in the area is evaluated during the study. Information on historical structures and archaeological sites is gathered from the Pennsylvania Historical and Museum

Commission. The presence of sensitive or endangered plant and animal species is determined from the Pennsylvania Natural Diversity Inventory. Other agencies including the Pennsylvania Game Commission, the Pennsylvania Fish and Boat Commission, the U. S. Fish & Wildlife Service, the U.S. Army Corps of Engineers, and the Environmental Protection Agency participate in determining the environmental impact of any structural measures under consideration.

G. STUDY REPORT

Results from the engineering analysis are published in report form and distributed to the municipality, legislators, and any other interested parties. This report outlines the proposed project and environmental impact, and also states the items of responsibility of the local government. In cases where a project cannot be economically justified, the reasons are clearly explained. Regardless of the recommendations, the report provides the local government with a detailed engineering analysis of the flood-prone area.

When a project is economically justified, it is necessary for a local government agency to sponsor the project. Sponsorship will require financial participation by the local government. The following section provides the details of sponsorship.

III. FUNDING AND PROJECT CONSTRUCTION

A. LOCAL SPONSORSHIP

After the study report is submitted to the local government, engineers from the Department meet with local officials to explain the proposed project in detail, and to discuss the items of local participation and responsibility. After the local government is fully informed of the proposed work, no further action is taken by the Commonwealth until a "Resolution of Sponsorship" is adopted by the local government, assuring the required items of local participation will be met. A sample of this resolution is included at the end of this manual.

Sponsorship includes actual participation by the local government with the following responsibilities:

1. Provide rights-of-way and easements necessary to construct and maintain the project. This may include obtaining title to all or part of some properties.
2. Hold and save the Commonwealth free of liability for any damages resulting from the project.
3. Maintain and operate the completed project.
4. Provide borrow and spoil areas, if required.

5. Relocate and/or remove buildings and utilities that would interfere with construction of the project (water lines, sewers, gas lines, etc.).
6. Alter or rebuild hydraulically inadequate local bridges and negotiate with the Pennsylvania Department of Transportation to alter or rebuild state-owned bridges, if required.

B. BUDGETING

When a "Resolution of Sponsorship" is adopted by the Sponsor, the Department of Environmental Protection will request funds in its 5-year Capital Budget Program for construction of the project. Design and construction of the project cannot be started until funds are appropriated by the Pennsylvania General Assembly.

C. FINAL DESIGN OF PROJECT

The project proceeds to final design following authorization of funds to construct the project. In final design, contract drawings and specifications are prepared. It may be necessary to perform a subsurface exploration of the project site. This would consist of drilling boreholes and excavating test pits to determine foundation conditions under proposed compacted earth levees, dams, and other structures. Obtaining rights-of-entry for such work is also a responsibility of the project Sponsor. As soon as the design is advanced enough to definitely establish land requirements, rights-of-way drawings are prepared and sent to the Sponsor so acquisition of lands required for construction of the project can be accomplished.

D. CONSTRUCTION OF PROJECT

When design is completed and all lands have been acquired, the project is advertised for construction and awarded to the lowest competent bidder, if a satisfactory bid is received. A resident engineer and engineering inspectors are provided by the Department to inspect the work during construction to assure the best possible construction methods are used and the project is constructed in full compliance with the contract specifications.

E. COMPLETED PROJECT

Upon completion of the project, a detailed Operation and Maintenance Manual is prepared for the municipality. This manual is a guide to help the project sponsor operate and maintain the efficiency of the project. The project sponsor is then responsible for the project's annual maintenance and upkeep. Annual inspections are conducted by the Department to assure the project continues to provide the designed level of protection.

IV. COMMENTS

Most comprehensive flood protection projects are designed to provide 100-year flood protection (i.e., a flood that has a one percent chance of occurring in any given year). In some cases economic limitations, or restrictions by bridges, buildings, or other encroaching structures, make it impractical to provide this degree of protection. No local flood protection project will completely eliminate the possibility of future flooding since past flooding cannot be presumed as the greatest that can ever occur. A flood protection project will eliminate flooding up to the design discharge plus a level of freeboard that is factored into the design. Flooding events that exceed the project's capacity could result in devastating damages in the event of the project's failure by breach or collapse.

Floods occurred before man's occupancy of this nation. At that time, the bottom lands of our rivers and streams were not occupied by cities and farms and damage was not measured in lives and money. The flood problem has grown as we have continued to contest nature's delegation of certain lands to floodways. We have settled along streams, put utilities along streambanks and established farms over adjacent areas.

Floods will continue to occur; when, where, or with what severity is difficult to predict. Only with intelligent planning and an understanding of what can and may happen will the loss of life and property be minimized in the future.

If you wish to request a flood protection feasibility study, or if you desire additional information about the Flood Protection Program, you should direct your inquiries to:

Jeffrey Means, Director
Bureau of Waterways Engineering & Wetlands
Department of Environmental Protection
P. O. Box 8460
Harrisburg, PA 17105-8460

The central office is located on 3rd Floor, Rachel Carson State Office Building, 400 Market Street, Harrisburg, PA. The telephone number is 717-787-3411.

STUDY RESOLUTION OF SPONSORSHIP

INFORMATION

Department projects are a joint undertaking of the Commonwealth of Pennsylvania and a local governmental body, called the Sponsor.

In order to avoid misunderstanding, the sponsor is requested to review the information in the "Flood Protection Manual" and the sample copy of the "Standard Agreement".

The following resolution must then be adopted by the Sponsor prior to the Department initiating a flood protection feasibility study.

RESOLUTION

WHEREAS, the **(City, Borough, Township, or County)** of **(Governmental Sub-division)** has reviewed information pertaining to the flood protection program of the Department of Environmental Protection and due to the existing conditions in the community, requests a feasibility study of a joint project involving the cooperation of the **(Sponsor)** and the Department of Environmental Protection; and

WHEREAS, the **(Sponsor)** agrees to aid in the study by performing any or all of the following listed work items:

1. Conduct a flood damage inventory under the guidance of the Department.
2. Assemble mapping on underground utilities, sewers, etc., and property boundary maps as required.
3. Request a list of all utilities in the community in accordance with Act 287.
4. Provide easements for subsurface exploratory contracts and topographic survey by the Department.
5. Agree to hold and save the Commonwealth and the Department free from damages to property, crops, or loss of land use, due to subsurface exploratory or survey work.

NOW, THEREFORE, in consideration of the aforementioned conditions, the **(Sponsor)** does hereby resolve to sponsor a flood protection feasibility study on **(Stream Name)** in **(Municipality)**. Upon reviewing the results of the study, the **(Sponsor)** may elect to accept, defer, or refuse sponsorship of a flood protection project.

SIGNED

TITLE

PROJECT RESOLUTION OF SPONSORSHIP

INFORMATION

Where a project is recommended by the flood protection study, the municipality must execute the following resolution before a request for funding is made and design is initiated.

RESOLUTION

Be it resolved by (**Municipality**), hereinafter designated as SPONSOR; and

WHEREAS, serious flooding and flood damages recur along (**Stream Name**), endangering the public health and welfare; and

WHEREAS, the Department of Environmental Protection, of the Commonwealth of Pennsylvania, has proposed _____, and

WHEREAS, the Department of Environmental Protection will undertake, at its cost, to perform the work aforementioned.

NOW, THEREFORE, in consideration of the work aforementioned and of the benefits to be derived, the SPONSOR, in (**regular or special**) session met, does hereby agree to acquire and furnish at the SPONSOR'S cost, all lands, easements and rights-of-entry required for surveys, foundation investigations, construction and maintenance of the project, including the removal of buildings and other structures which interfere with the construction of the project, the relocation of utilities, borrow and spoil areas, and the removal or rebuilding of inadequate bridges as may be required. The SPONSOR does hereby agree to all assurances and conditions of sponsorship specified in the letter of proposal of the Department of Environmental Protection dated _____ and addressed to _____, said letter attached hereto and made part hereof.

The SPONSOR does hereby guarantee to indemnify, protect and save free the Commonwealth of Pennsylvania, Department of Environmental Protection and/or its contractors and agents jointly and severally from and against any and all claims, damages, demands or actions in law or in equity resulting from any damage to property, public or private, by reason of the aforesaid work. The SPONSOR further agrees to maintain, at its own expense, the completed project, which is constructed by or for the Commonwealth as part of the aforesaid work. Instructions regarding maintenance of the completed work will be furnished by the Department of Environmental Protection.

I hereby certify that the foregoing Resolution was adopted at a (**regular or special**) meeting of the (**Supervisors, Council, or Commissioners**), (**Township, Borough, or City**), (**County**), held on the ____ day of _____, 20__.

Secretary