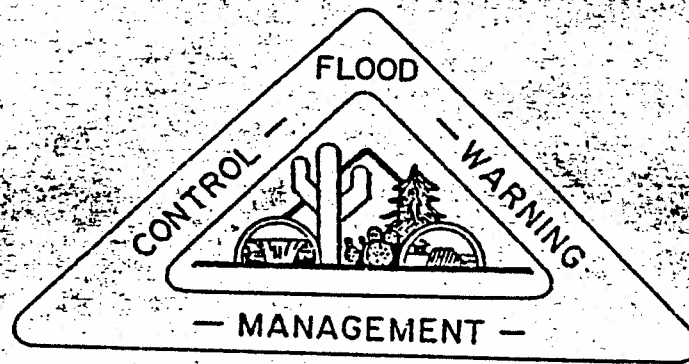


**Development of Flood Control Plan**  
**A.R.S. No. 48-3617, Laws 1985**  
**A.R.S. No. 45-1471, Laws 1987**

**AUTHORITY, POLICIES & PROCEDURES**



State of Arizona  
Department of Water Resources

July 1987

## FORWARD

The purpose of the Flood Control Planning Program is to provide the County Flood Control Districts with technical planning assistance to evaluate any flooding problem within the County Flood Control District boundaries.

The study sequence adopted by the Flood Control Planning Section consists of two phases - reconnaissance and feasibility. The reconnaissance level study consists of providing a preliminary evaluation of several possible solutions to a particular flooding problem along with an economic analysis designed to assess the cost-effectiveness of each solution. The cost-effectiveness of a project is analyzed in terms of a benefit:cost ratio. If the average annual benefits of the project exceed the average annual costs, the project is considered to be cost effective. The Department of Water Resources uses a legislatively established 3% amortization cost. The amortization period varies as a function of the type of project being evaluated, but is typically somewhere between 25 and 100 years.

The feasibility level study consists of providing a more detailed evaluation of the most cost-effective solution identified during the reconnaissance study. If a project is found economically justified at the end of the feasibility level analysis, the project is turned over to the county flood control district for final design and construction.

"It is hereby declared that recurrent floods on streams, rivers and other waterways of the state, causing loss of life and property, disruption of commerce, interruption of transportation and communications and wasting of water, are detrimental to the peace, health, safety and welfare of the people of the state. Support of the central storage and full beneficial use of flood waters and the washing away of river and stream banks by floods in cooperation with counties, cities, state agencies and public districts and the United States, or any of its departments or agencies, is a proper function of the state".

"The legislature intends that from time to time allocations from the general fund for flood control projects will be made to pay for not to exceed one-half

of the cost of all lands, easements and rights-of-way necessary for the flood control purposes of projects adopted and authorized pursuant to federal law and recommended by the Arizona Water Commission and approved by the legislature concurrent with the availability of federal funds for their construction".

...Laws of 1973 Chapter 40  
State of Arizona

For more information concerning flood control assistance programs administered by the Department see the following reports.

Flood Control Assistance Program  
Alternative Flood Control Assistance  
Flood Control Loan Program

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## DEVELOPMENT OF FLOOD CONTROL PLAN

### I. Authority

A.R.S. § 48-3617. Development of flood control plan by Director of Water Resources

- "A. On the application of a flood control district organized pursuant to this article, and subject to available appropriations, the Department of Water Resources director shall conduct a study and, if deemed justified by the Director, develop a flood control plan to address any flood control problem in the area of jurisdiction of the district.
- B. The Director shall conduct such studies and develop such plans for counties having a population of fewer than one million persons. If personnel are available and if monies are specifically authorized by the legislature, the director may conduct such studies and develop such plans for counties having a population of one million or more persons. The Director shall perform his responsibilities under this section in such a manner as to spread the benefits of such assistance among all counties of this state.
- C. In operating pursuant to this section, the Director may utilize his own engineers and resources or may contract for outside consulting engineers and resources.
- D. Any plan developed by the Director pursuant to this section shall, to the extent practicable, resolve the particular flood control or regulation problem. The practicality of any solution to a flood control or regulation problem shall be determined jointly by the Director and the flood control district based on cost effectiveness and design criteria developed by the Director"

## II. Policy

This program was created to provide assistance to county flood control districts in investigating flooding problems and developing plans to control such problems. These studies are conducted by the (Department) and normally paid for from state funds. The program is directed toward the resolution of significant flooding problems and is not intended to solve minor drainage problems. A significant flood control problem may be considered to exist where a hazard to life or property appears threatened by waters of a natural or previously modified natural watercourse having a drainage area of a least one square mile, and for which the flow can be shown to be at least 3,000 cfs for a 100-year frequency event. Meeting of these criteria will be determined by (ADWR) based on accepted hydrologic data and procedures.

## III. Procedures

### A. Requests for Planning Assistance

1. County flood control districts organized pursuant to A.R.S. Chapter 21, Article 1, Section 48, may apply by letter to the Director (of the Arizona Department of Water Resources) requesting flood control planning assistance. The Department will not undertake planning requests for multi-purpose projects that would provide benefits other than flood control. Requests for flood control planning assistance should be submitted on Department form titled "Flood Control Planning Assistance Request" which describes in detail the nature of the flooding problem, the area of jurisdiction and the project location. Unless personnel are available and funds have been specifically authorized by the Legislature, the Department may only conduct planning studies for counties having a population of less than one million.
2. The Department will conduct planning studies in a manner that will spread the benefits of the program among all counties of the State. However, when multiple requests are received, a priority

will be established which will give consideration to the date the request is received, the number of studies previously initiated for a given county, and the magnitude and severity of the flooding problem for which planning is requested.

Each planning request will be reviewed and the requesting district will be contacted to determine the extent of local assistance available in collecting basic data needed to commence the work. Assistance and data provided by the District will have a significant impact on the timely initiation and completion of the requested planning activities.

Prior to submitting requests for planning assistance, a District should give special consideration to its ability to provide matching funds for project installation should the project be subsequently justified for implementation. Funding requirements are identified under the Alternative Flood Control Assistance Program (A.R.S. § 45-1471)...

#### IV. Study and Planning Phases

In order to thoroughly investigate a flooding problem and identify the most cost effective solution, the Department will conduct a three-phase evaluation of the problem. The Department may utilize its own staff and resources or may contract for outside consulting services and resources in completing these project evaluations.

##### A. Phase I - Pre-Reconnaissance Investigation

Phase I will consist of a pre-reconnaissance investigation which will determine if the Department criteria, area of jurisdiction, and districts financial capability are satisfactory to proceed to the reconnaissance phase. The pre-reconnaissance phase investigation will make a preliminary investigation of possible solutions to the problem along with a preliminary economic analysis designed to assess the benefit of each solution. This investigation will utilize the maximum amount of existing data to provide a comparative, preliminary overview of possible flood control solutions.



B. Phase II - Reconnaissance Study

Phase II, the reconnaissance study will provide a preliminary evaluation of several engineered alternatives and designs to solve the problem. Each alternative will receive an economic analysis and assessed benefit. This study will be based on developed data sufficient to provide a preliminary overview of possible, identified flood control solutions. Potential environmental concerns will be presented and discussed. A determination will be made whether or not the district will support the installation of the project. This determination will include a resolution by the board of directors and an analysis of the districts financial capability to install and maintain the project without creating an economic hardship.

C. Phase III - Feasibility Report

Phase III, the feasibility report, will consist of a feasibility level study and evaluation of one of the alternatives identified during the reconnaissance study. Phase III will only be initiated if an economically justified flood control solution can be identified during Phase II. The economic justification of a solution will be determined in accordance with criteria established by the Arizona Department of Water Resources.

Feasibility level evaluations will consist of a much more detailed engineering and economic analysis than was completed at the reconnaissance level. This work may require new or refined project topography, geotechnical investigations, hydraulic analyses, cost estimates, and economic evaluations. The completed report will be of sufficient detail to proceed to final project design, if justified.

Occasionally, preliminary project evaluations will indicate an absence of any significant floodwater inundation damages yet identify potential erosion damages that might be associated with headcutting, bank sloughing, or river meander. If it appears that the damages associated with these phenomena would be relatively widespread, the Department will consider the preparation of a preliminary study to

quantify such damages as well as the benefits that would be derived from installing measures to eliminate the continuance of such phenomena.

#### V. Pre-reconnaissance Investigation (Phase I)

The Department will determine availability of personnel and resources and will schedule a meeting with the requesting district planning assistance. Base data will be obtained to the extent such data exists, and a determination will be made if the requested project meets the Department's criteria of drainage area, safety of life, property damage, 100-year frequency event flow and jurisdiction for consideration as a flood control problem.

The area and site will be inspected and existing data will be obtained and evaluated. Existing records will be assembled including related reports and studies. If all data, when evaluated, indicates a potential for an economically justified project, then the reconnaissance investigation will be scheduled, provided personnel and resources are available. The district will be advised of the undertaking by the Department.

#### VI. Reconnaissance Study (Phase II)

As a preparatory step to initiating a reconnaissance study, staff members of the Department will arrange a meeting with flood control district representatives to conduct a field inspection and discuss the availability of current data and possible solutions to the flooding problem. The Department strongly recommends that the flood control district make every effort to coordinate this field inspection with area residents in order that they may have some initial input into the description of the specific nature of the flooding problem. Preferably, a spokesman for the local community should be invited to accompany District and Department representatives on the inspection of the project area.

If, after reviewing current project data and conducting a site inspection, there appears to be an obviously large disparity between

potential project benefits and installation costs or if potential project benefits do not appear to be widespread to an extent that would be considered an appropriate use of State funds, the Department may elect to meet with the District and recommend that project studies be terminated due to the minimal economic potential of the project. The Department will provide written documentation outlining the basis for making this recommendation.

In the absence of identifying obvious economic disparities which would negate further project investigations, the Department may initiate preparations for an engineering and economic reconnaissance study of the proposed project area. It is recommended that the flood control district appoint an individual to serve in a liaison capacity with the Department in order that project activities can be properly coordinated during preparation of the study. The reconnaissance study will address the following general topics:

A. Drainage Basin Hydrology and History of Flooding

An investigation of the watershed hydrology provides an estimate of the quantity of water that will have to be dealt with in the project area during the occurrence of specific flood frequency events. The determination of these discharges forms the basis for initiating a hydraulic analysis to ascertain their impact on developed areas in the study region. Research on historical flooding in the area can be of significant value in determining the extent and frequency of flooding as well as the economic damages associated with a given level of flooding.

B. Formulation and Evaluation of Plans

Depending on project conditions, there may be several possible solutions that could provide relief from the flooding problem. To identify the most feasible alternative, each potential solution will be subjected to a preliminary engineering evaluation designed to assess effectiveness in preventing flood damages and to establish the physical size of the solution in order that an installation cost may be estimated. Each alternative plan will be evaluated in equal

detail in order that the resultant costs will be comparable. Additionally, the evaluation of each prospective plan will include an annual operation and maintenance cost as well as recommended operation and maintenance procedures.

C. Economic evaluation

An analysis of the economic damage expected from given frequencies of flooding will be made for both "before" and "after" project conditions for each flood control solution evaluated. The analysis will be conducted for established levels of protection (return intervals) and a predetermined life of project. The Department uses a 3 percent interest rate to convert project installation costs to average annual costs. The amortization period is determined on the basis of unique circumstances that may differ from project to project. The results of this study will indicate the economic feasibility of a specific plan by providing a comparison of damage reduction benefits to project installation cost. If the resulting benefit:cost ratio is equal to or greater than 1.0, the project is considered economically justified.

The completed reconnaissance study will present an engineering and economic discussion and evaluation of flood related problems and their potential solutions. The study will conclude with a recommendation as to the feasibility of continuing the planning sequence to the Phase III level or terminating the investigation at the Phase II level.

If the results of the reconnaissance study justify state participation for a flood control project under the provisions of the Alternative Assistance Program (A.R.S. § 45-1471) the Department will recommend to the District that a public meeting be held to present the study recommendations and gather public support for pursuit of the proposed plans.

If the reconnaissance study indicates construction of a flood control project would not be economically justified for State participation, the Department will transmit the study results to the District with the advice that further State assistance appears not to

be feasible. The District may elect to utilize the results of the study to pursue a project independent of State aid. The Department will not schedule a public presentation of the reconnaissance study results for those projects which do not exhibit the necessary economic justification for further State assistance.

#### VII. Feasibility Report (Phase III)

Upon completion of the reconnaissance study the Department will review the results of the study with representatives of the flood control district and make a joint determination regarding the feasibility of continuing the study of a specific plan to the Phase III level. The selection of a plan will be based upon cost effectiveness and design criteria developed by the Arizona Department of Water Resources. Normally, a plan will not be considered for further study unless its benefit:cost ratio at the Phase I and Phase II levels is equal to or greater than one.

A plan that is economically justified at the reconnaissance level and recommended for a Phase III study will be reevaluated with the same basic approach as was used in Phase II. However, the data used to conduct the feasibility level report will be refined, improved and supplemented with new data, as necessary, to provide a detailed evaluation that will provide an adequate basis for initiating final project design. The project installation cost and economic analysis will be of sufficient accuracy to permit a final decision regarding project construction and funding appropriations. The completed feasibility report will conclude with a recommendation whether the evaluated plan should be carried forward to final design and construction.

The final decisions to proceed beyond the Phase III level will be made jointly by the Department and the District after a careful review of the feasibility report and the funding availability at both the State and District levels. If a decision is made to proceed with project implementation, State funding may be made available, subject to legislative appropriations, for 50 percent of the installation cost as authorized by the Alternative Assistance Program (A.R.S. § 45-1471).

The following flow chart summarizes the sequence of projects from the time a flood control district submits a request for planning assistance to the time of project construction.

ARIZONA DEPARTMENT OF WATER RESOURCES  
 DEVELOPMENT OF FLOOD CONTROL PLAN  
 PROJECT FLOW CHART

FLOOD CONTROL PLANNING ASSISTANCE

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ALTERNATIVE FLOOD CONTROL ASSISTANCE

PHASE PLANNING ASSISTANCE	PRE- RECONNAISSANCE INVESTIGATION	RECONNAISSANCE STUDY	FEASIBILITY REPORT	FINAL DESIGN	CONSTRUCTION
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10 AGENCY RESPONSIBLE	ADWR	ADWR <sup>1</sup>	ADWR	County Flood Control District	
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Fund Sources	100%	100% State	Usually 100% State	50% State	50% County
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<sup>1</sup> County shares in cost of data collection or special studies, if possible or necessary in order to facilitate study completion.

FLOOD MANAGEMENT SECTION  
ARIZONA DEPARTMENT OF WATER RESOURCES

FLOOD CONTROL PLANNING ASSISTANCE REQUEST

Requesting Agency \_\_\_\_\_

Floodplain Management Jurisdiction: \_\_\_\_\_

Contact/Requester: \_\_\_\_\_

Address: \_\_\_\_\_

Project Title: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Description of area needed to be planned - attach map denoting area.  
Statement of Nature of the flooding problem.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Is topographic mapping available? \_\_\_\_ Yes \_\_\_\_ No

Date: \_\_\_\_\_ Scale: \_\_\_\_\_ Contour Interval \_\_\_\_\_

Are there any information sources such as survey damage reports. Past studies  
or reports? \_\_\_\_ Yes \_\_\_\_ No If yes, list known sources of information.

\_\_\_\_\_  
\_\_\_\_\_

Detail the reasons why this area needs flood control planning and any other  
factors which would justify the need for the planning. What priority does  
this project have in your five year plan?

\_\_\_\_\_  
\_\_\_\_\_