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SUPPLEMENTAL WATERSHED WORK PLAN

AGREEMENT NO. 1

AND

SUPPLEMENTAL WATERSHED WORK PLAN NO. 1

JUNE 1976

A303.902

WP-5

FINAL

SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NO. 1

Between the

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY  
Local Organization

BOARD OF SUPERVISORS OF PINAL COUNTY  
Local Organization

EAST MARICOPA NATURAL RESOURCE CONSERVATION DISTRICT  
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of Arizona

and the

SOIL CONSERVATION SERVICE  
United States Department of Agriculture

(hereinafter referred to as the Service)

*Whereas, the Watershed Work Plan Agreement for the Buckhorn-Mesa Watershed, State of Arizona, executed by the Sponsoring Local Organization named therein and the Service, became effective on the 19th day of July 1963; and*

*Whereas, in order to carry out the watershed work plan for said watershed, it has become necessary to modify said Watershed Work Plan Agreement; and*

*Whereas, the Mesa-Tempe Soil Conservation District dissolved on June 13, 1963, and that area added to the East Maricopa Soil Conservation District, a consolidation, to better serve the public interest; and*

*Whereas, the State of Arizona, by legislative action of Senate Bill 1053, dated March 24, 1972, changed the names of the Soil Conservation Districts under its jurisdiction to Natural Resource Conservation Districts; and*

*Whereas, the Congress in establishing the Civil Rights Act of 1964 and the Secretary of Agriculture in issuing regulations to implement the provisions of the Act have placed certain responsibilities upon the Sponsoring Local Organization and the Service; and*

Whereas, the Congress in establishing Public Law 91-646 has placed further responsibilities upon the Sponsoring Local Organization and the Service; and

Whereas, it has been found necessary to modify the watershed work plan by changing the location and features of the structural measures; and

Whereas, a supplemental watershed work plan which modifies the watershed work plan, dated January 1963, for said watershed has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service; which plan is annexed to and made a part of this agreement;

Now, therefore, the Sponsoring Local Organization and the Service hereby agree upon the following modifications of the terms, conditions, and stipulations of said watershed work plan agreement:

1. The East Maricopa Natural Resource Conservation District becomes a Sponsoring Local Organization in place of the East Maricopa and Mesa-Tempe Soil Conservation Districts.

2. Paragraph Number 1 is modified to read as follows:

The Sponsoring Local Organization will acquire, with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement (estimated cost \$9,156,900).

3. Paragraph Number 3 is modified to read as follows:

The total construction cost will be borne by the Service (estimated cost \$20,117,700).

4. Paragraph Number 4 is modified to read as follows:

The total engineering cost will be borne by the Service (estimated cost \$1,847,800).

5. Paragraph Number 5 is modified to read as follows:

The Sponsoring Local Organization and the Service will each bear the cost of Project Administration which it incurs. (Estimated to be \$251,500 and \$3,629,400 respectively.)

6. Paragraph Number 12 is modified to read as follows:

The watershed work plan may be amended or revised and this agreement may be modified or terminated only by mutual agreement of the parties hereto, except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties. An amendment to incorporate changes affecting one specific structural measure may be made by mutual agreement between the Service and the sponsor(s) having specific responsibilities for the particular structural measure involved.

7. A paragraph Number 14 is added as follows:

The Sponsoring Local Organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (%)	<u>Service</u> (%)	<u>Estimated Relocation Payment Costs</u> (\$)
Relocation Payments:	27.6	72.4	4,700

8. A paragraph Number 15 is added as follows:

The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 CFR Sec. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving federal financial assistance from the Department of Agriculture or any agency thereof.

9. A paragraph Number 16 is added as follows:

The Maricopa County Board of Supervisors recently approved changes to the subdivision regulations that require detention facilities be included in all new subdivision plats to detain a 100-year, two-hour storm. The Board of Supervisors will enforce these regulations in such a manner that the volume of storm water to be stored, for the area between the system of floodwater retarding structures and the Roosevelt Water Conservation District Floodway will equal or exceed one (1) inch over the newly developed area.

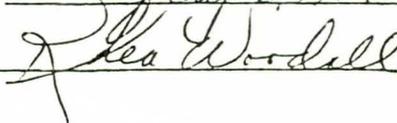
The sponsoring Local Organization and the Service further agree to all terms, conditions, and stipulations of said watershed work plan agreement, as supplemented, not modified herein.

Flood Control District of Maricopa County  
Local Organization

3335 W. DURANGO  
PHOENIX, ARIZONA 85009  
Address Zip Code

By   
Title Chairman  
Date July 6, 1976

The signing of this agreement was authorized by a motion of the governing body of the Flood Control District of Maricopa County adopted at a meeting held on July 6, 1976.

Clerk  Date July 6, 1976

Board of Supervisors of Pinal County  
Local Organization

P.O. Box 827  
FLORENCE, AZ 85232  
Address Zip Code

By Virginia Newsome  
Title Chairman  
Date July 12, 1976

The signing of this agreement was authorized by a motion of the governing body of the Board of Supervisors of Pinal County adopted at a meeting held on 7-12-76 THIS DATE.

Clerk Jay Betts Date 7-12-76

East Maricopa Natural Resource Conservation District  
Local Organization

110 N. Oregon ST.  
Chandler Ariz 85224  
Address Zip Code

By Jim Miller  
Title Chairman  
Date July 13-1976

The signing of this agreement was authorized by a motion of the governing body of the East Maricopa Natural Resource Conservation District adopted at a meeting held on July 13, 1976.

Clerk Robert Boyd Date July 13, 1976

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service  
United States Department of Agriculture

Approved by:

Thomas S. Kokenbaugh  
State Conservationist

7-14-76  
Date

FINAL

SUPPLEMENTAL WATERSHED WORK PLAN NO. 1

BUCKHORN-MESA WATERSHED

Maricopa and Pinal Counties, Arizona

INTRODUCTION

This work plan supplement is developed to (1) reflect modification of the planned structures in the Buckhorn-Mesa Watershed, (2) extend the Roosevelt Water Conservation District (RWCD) Floodway into the watershed, (3) eliminate the planned irrigation features, (4) reflect the name change from Soil Conservation District to Natural Resource Conservation District as provided for by the 1972 session of the Arizona State Legislature, (5) include the provisions of the Civil Rights Act of 1964, (6) implement the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, and (7) change the evaluation period from 50 to 100 years.

The status of the land treatment program was assessed. The land treatment measures planned are essentially installed. No changes in the land treatment program are made in this supplement. The Buckhorn-Mesa Watershed Work Plan was approved for operation on July 19, 1963.

WORKS OF IMPROVEMENT TO BE INSTALLED

The works of improvement in the Buckhorn-Mesa Watershed Work Plan are modified to give protection to development that has occurred since the original work plan was prepared and to reflect the present desires of the sponsors following over eleven years of effort to secure funds for rights-of-way and solve esthetic problems. Changes are in structural alignment and location. (See project map.) Landscaping features will become construction cost items. The structural measures consist of five floodwater retarding structures with associated structure outlets, a sediment basin, and floodways plus extension of the RWCD Floodway. All structural measures are for flood prevention.

Floodwater retarding structures Nos. 1, 2, 3, and 4 are connected by concrete-lined channels which are designed to convey principal spillway releases. Hydraulic model studies will be made to determine the effects on the water surface when introducing water and sediment from overland flow into the lined channels where velocities are in the super-critical range. Structures Nos. 1 and 3 release floodwaters into No. 2. The principal spillway from structure No. 2 outlets into a lined channel

which terminates at the reservoir of No. 4. An unlined channel, parallel to the authorized Central Arizona Project (CAP) aqueduct, will convey floodwaters from structure No. 4 to a point where they will flow down a natural wash to the Salt River. After the CAP aqueduct is completed, the floodwaters coming from structure No. 4 will be diverted into a floodway, an integral part of the CAP, and released behind Orme Dam, or a suitable alternative, which is also a part of the Central Arizona Project. Structure No. 7 outlets into Weekes Wash. The RWCD Floodway runs parallel to the RWCD Irrigation Canal and is designed to convey floodwater to the south.

All floodwater retarding structures are designed for a 100-year life and will control 42.5 square miles, or 27,200 acres (about 39 percent of the watershed area). They are designed with 3,551 acre-feet of floodwater capacity. The capacity is equivalent to 1.6 inches of runoff from the controlled drainage area or an equivalent of 0.6 inches from the entire watershed. Designed sediment capacity is based upon the expected sediment accumulation at each site over the 100-year design life and amounts to 823 acre-feet.

The dams are planned as earth and caliche or earth and rock-filled structures with concrete conduit principal spillways and emergency spillways cut in hard caliche or rock around one end of each dam. Each of the earth and rock-filled dams is designed to fit the foundation and topographic conditions of the site. To best utilize available material, the embankment fill material will be zone constructed. The dams will range in height from 21.9 feet to 56.7 feet. Four of the dams will be less than 38.0 feet in height.

The foundations of all floodwater retarding structures, except structure No. 7, consist of converging alluvial fan deposits. These deposits contain thick indurated caliche and calcareous siltstone which generally occur at depths ranging from 2 to 10 feet. The emergency spillways of structures Nos. 1, 2, and 3 are planned to be excavated into these materials. The emergency spillway and outlet channel of structure No. 4 is within the outcrop of Pre-cambrian granite which is in various stages of decomposition. Structure No. 7 is located on the outcrop of Cretaceous-Tertiary volcanic rocks, including andesite, welded tuff, basalt, and agglomerate. It is planned that the emergency spillway will be cut into andesite and welded tuff. Along the main stream, alluvial deposits extend to an estimated depth of 25 feet in the site area.

The foundations have no critical earthquake hazards. Residual and alluvial soils in the foundation and pool areas are shallow and represent no landslide hazard. Principal spillways at all floodwater structure sites will be placed on materials having low consolidation potential.

The principal spillways are designed to regulate and control the runoff resulting from storms up to and including the 100-year frequency flood event. Flows greater than the 100-year frequency flood will pass at a non-erosive velocity through the emergency spillway around one end of the

dam. The principal spillway at each dam will consist of a reinforced concrete drop inlet structure and a reinforced concrete outlet conduit. Drop inlet structures will be constructed at or near ground level at structures Nos. 1, 2, and 3. From these outlets, floodwaters will flow into reinforced concrete pipe principal spillways and then will be discharged into reinforced concrete-lined outlet channels or floodways. Principal spillway outlet channels and floodways will connect structures Nos. 1, 2, 3, and 4 in a series. The principal spillway inlet at structure No. 4 will have a concrete drop inlet with a covered top riser inletting into a 9-foot by 6-foot reinforced concrete box culvert which outlets into a St. Anthony Falls (SAF) discharge stilling basin. The discharge is conveyed through a constructed earth channel to a point where it will flow down a natural wash to the Salt River. Use of the natural wash as an outlet is temporary. It has been determined that the granite lying beneath a thin bedload in the natural wash is stable and that there is sufficient capacity to carry the discharge from a 100-year frequency storm. The natural wash passes under Bush Highway through two 7-foot by 10-foot concrete box culverts. These culverts have sufficient capacity to carry the 100-year discharge through the highway.

It is proposed that stabilization measures will be designed to protect the concrete box culverts from headcutting. These measures could include a short section of rock riprap channel or a grade stabilization structure constructed of either reinforced concrete, gabion, or timber. Downstream of the stabilization structure, a sediment basin will be constructed to trap bedload material. From this point to the Salt River water's edge, floodwater will spread over the river flood plain and flow through a three-acre marsh. The Soil Conservation Service will initiate action with appropriate agencies and sponsors to establish a monitoring program for outflow from the sediment basin. Flows will enter the river between a U. S. Forest Service campground and the Granite Reef Dam. A low dike on the east side of the channel is proposed to direct floodwater flows away from the campgrounds. However, the campgrounds will remain subject to inundation from the Salt River.

The principal spillway inlet at structure No. 7 will have a concrete drop inlet with a covered top riser inletting into a reinforced concrete pipe that discharges into an impact basin. Floodwaters will be discharged into the natural channel at non-erosive velocities.

Floodwater retarding structures requiring special consideration are those planned for sites Nos. 4 and 7. The drainage area of site No. 4 is greater than 10 square miles, and special consideration in planning the emergency spillway to provide protection against breaching is required. Therefore, a reinforced concrete crest control structure is planned for this site.

At site No. 7, there is a shortage of suitable fill material from which to construct a dam. Rippable welded tuff and andesite occur at the site in abundance. Therefore, a rock shell is planned having 3:1 side slopes upstream and downstream. The central core is planned to be constructed of low to medium plasticity silts and clays.

Fill material for all dams will come from borrow areas upstream of the structure. Embankment material also will come from the emergency spillway excavation. This source of borrow consists of low plasticity silts. Minor amounts of clay occur in other borrow areas. A portion of the fill material for structure No. 4 will come from excavation for the authorized aqueduct of the Central Arizona Project of the Bureau of Reclamation. The characteristics of the borrow material have been considered in the design of the embankments to minimize earthquake hazards.

Construction and borrow areas will be cleared and grubbed. Preceding this operation, native desert vegetation will be salvaged and stored until it can be reestablished in disturbed areas around the completed dam. Those plants that cannot be stored will be sold. At the time of revegetation, these plants will be replaced through purchase.

The five floodwater retarding structures will be landscaped to blend into the natural environment. Typical measures include enlarged fill sections with 6:1 side slopes, top width of 25 feet, height of 5 feet above established top of dam, and length of 50 feet along dam centerline.

The borrow for the enlarged sections of fill will come primarily from excavation of the emergency spillways. To insure the establishment of native vegetation, surface soil will be spread over the entire dam. Also, an irrigation system will be installed to irrigate these plants through the establishment period. The system will be left in place for any needed supplemental irrigation by the sponsors after the establishment period. Borrow for the fill will be taken at random locations and about two feet of soil left in place in borrow pits. Borrow areas and other disturbed areas will be revegetated to native desert plants. These areas and the dam will be fenced to help insure the establishment of plants.

A landscape architect has been hired to work with design engineers, local sponsors, interested local groups, and individuals in planning features for the system of structures.

The construction of all floodwater retarding structures will require the purchase of or the easement for about 2,965 acres of land along with the relocation of about 2,600 feet of water pipeline, 1,600 feet of telephone lines, 5,200 feet of electric lines, 300 feet of gas pipelines, 2 owner-occupied dwellings, and 10,400 feet of county roads.

The outlet channels and floodways that will connect structures Nos. 1, 2, 3, and 4 not only convey principal spillway releases between the respective structures but also are designed to convey floodwaters resulting from a storm occurring on the average of once every 100 years.

The desert soils along proposed channel alignments that connect structures Nos. 1, 2, 3, and 4 together are primarily alluvial fan deposits consisting mainly of sandy silts, silty sand, and sandy

gravel. These erodible soils range in depth from 5 to 10 feet and overlie indurated caliche. These floodways will be concrete-lined. The connecting floodways and structure No. 3 outlet channel will terminate at the emergency spillway crest elevation of the downstream dam. At this point, energy dissipating structures are designed to drop floodwaters to an elevation where water will flow to the sediment pool at a non-erosive velocity.

To allow runoff to enter the floodways, corrugated metal pipe inlets will be placed intermittently along the length of the channel and through the upstream dike which serves as a maintenance road. Entrance conditions of large washes into the channels will be improved. A collector ditch will convey floodwaters to the pipe inlets. The excavated material coming from the construction of all other floodways and dam outlets will be placed adjacent to the outlet or floodway. The disturbed area within the construction limits of each channel reach will be revegetated and irrigated in a manner similar to that proposed for dams and borrow areas.

The RWCD Floodway, which will traverse the Apache Junction-Gilbert and Williams-Chandler Watersheds and is a project measure in those watershed projects, will be extended into the Buckhorn-Mesa Watershed a distance of approximately 9,230 feet. This extension has been found necessary to achieve the effects and benefits evaluated for the floodway in the two downstream watersheds. The floodway will begin about 230 feet north of Brown Road and will parallel the RWCD Canal on its east side. The planned work terminates north of Apache Boulevard; however, the outlet is at the Gila River. The location of all floodways can be seen on the project map.

The proposed RWCD Floodway work will entail enlarging and deepening the existing floodway. Maximum water depth in this earthen floodway will be 7.5 feet. This floodway is to be excavated in very uniform sandy to very sandy clay with only minor occurrence of clayey sand. The fine-textured fraction of these soils possess low to medium plasticity. The soil consistency is stiff to very stiff, with the very stiff soils generally occurring below 5 feet in depth. Another important factor in channel stability is the presence of weak calcium carbonate cementation which also increases with depth. The maximum design velocity is well below that which scour would occur.

Spoil material coming from the excavation of the RWCD Floodway will be placed adjacent to the floodway. About 20 acres adjacent to the RWCD Floodway will be acquired or made available to be used as a disposal area for the major portion of the excavated material.

The construction of outlet channels and floodways will require the relocation of about 1,000 feet of county road, 800 feet of water pipeline, 900 feet of telephone line, 1,300 feet of electric line, 800

feet of gas pipeline, and 2 owner-occupied dwellings along with the purchase or easement of 250 acres of land. A small mine exists in the reservoir area of the Weekes Wash Dam, and mineral claims have been filed on a portion of the area needed for the Spook Hill Dam outlet channel. These will need to be either acquired or cleared.

Before installing any structure which would result in flooding of public roads, a written right or permission to flood the road will be obtained from the state, county, or agency having jurisdiction over the public road.

Should anything of archeological or historical value be discovered during construction, the National Park Service and the State Historic Preservation Office (or State Archeologist) will be notified.

#### EXPLANATION OF INSTALLATION COSTS

Land treatment measures are as stated in the watershed work plan. The summary of land treatment costs is shown in Table 1, Revised. The estimated structural cost distribution is shown in Table 2, Revised.

Several alternative systems of interrelated flood prevention measures were investigated. The system selected and proposed in this supplemental plan provides the greatest economic efficiency. The construction cost of this system of measures, including the extension of the RWCD Floodway into the watershed, is estimated at \$20,117,700. Construction cost computations for these measures were made using current bid prices and based on calculated quantities. Construction costs include the cost of landscaping, the purchase of a disposal area, the relocation of an existing irrigation pipeline, and a contingency factor of 15 percent.

The cost of the flood prevention measures originally proposed was estimated in the work plan at \$2,944,000 at 1962 prices. However, at present-day price levels, and with changes made necessary by revised data and the National Environmental Policy Act of 1969 (PL-91-190), the construction cost of that system of measures would be an estimated \$20,253,800. These construction costs include the cost of landscaping, establishment of vegetation for a two-year period, an irrigation system to insure the establishment of vegetation, and a contingency factor of 15 percent.

The watershed work plan costs not included as construction costs or land easements and rights-of-way costs were separated into Installation Services costs and Administration of Contracts costs. This supplement modifies the work plan by deleting the cost breakdown for Installation Services and Administration of Contracts and establishing a new cost breakdown for Engineering Services, Relocation Payments, and Project Administration.

Engineering Services costs are estimated to be \$1,847,800, all of which will be borne by P. L. 566 funds. Included is \$50,000 for a

hydraulic model study to determine the effects to the water surface when introducing water and sediment from overland flow into the lined channels where velocities are in the super-critical range. The total also includes the direct cost of engineers and other technicians for surveys, investigations, design, and preparation of plans and specifications for structural measures including the vegetative work associated therewith. It does not include the cost of similar services for land rights or for project administration.

Relocation payments costs are estimated to be \$4,700, of which \$3,400 will be borne by P.L. 566 funds and \$1,300 will be borne by other funds. Cost-sharing for the necessity of relocation of residents of two owner-occupied dwellings and two mobile homes are based on the total project cost less the relocation payments; 72.4 percent being a P.L. 566 cost and 27.6 percent being from other funds.

Project administration costs are estimated to be \$3,880,900 of which \$3,629,400 will be borne by P.L. 566 funds and \$251,500 borne by other funds. The P.L. 566 costs for project administration include the cost for government representative, necessary inspection services during construction to insure that structural measures are installed in accordance with plans and specifications, and administrative costs related to the project. Project administration costs borne by other funds include review of engineering plans, fees paid to the State of Arizona for supervision and control of construction of the dams, contract administration, all relocation assistance advisory services, and other administrative costs of the sponsors associated with the project.

Project administration costs are included as project costs, but are not considered applicable to the individual measures. These costs are based on those being experienced in administering similar projects.

Land rights costs are estimated to be \$9,156,900 which include \$7,113,700 for land acquisition, \$48,000 for legal and survey fees, and \$1,995,200 for road, pipeline, and other utility modifications.

#### EFFECTS OF WORKS OF IMPROVEMENT

The areas directly disturbed by construction activities include an estimated 963 acres committed to dams, emergency spillways, borrow areas, and floodways. This area to be cleared consists of 737 acres of upland desert vegetation, primarily palo verde, bursage, and creosote bush; and 151 acres of desert riparian vegetation, mostly mesquite, ironwood, and palo verde. The borrow area is 595 acres, 361 acres of this will also be used for sediment accumulation. The entire area disturbed will be revegetated to native grasses, shrubs, and trees.

Until the area cleared is revegetated, there will be increased wind and water erosion. Wildlife habitat will be destroyed, and there will be negative esthetic effects.

The design storm pools will total 1,042 acres. The borrow and sediment pool areas (595 acres) are included in this total. The incremental acreage (353 acres) will not be cleared but will sustain periodic inundation. The floodwater retarding pools will total 735 acres.

Effects on vegetation in the flood pool areas vary depending upon frequency and duration of inundation. Vegetation within flood pools at the lower elevations will be reduced in value to wildlife due to frequent inundation. Flood pools for the less frequent storms, up to about the 10-year level, will have an increase in vegetation density. The conditions produced by periodic storage at these levels, however, result in conditions more conducive to growth of salt cedar than native species such as mesquite. While salt cedar does provide wildlife cover, it is not as desirable as native plant species. Vegetation in the flood pools with very infrequent storage will not be greatly affected.

A survey of the areas where the floodwater retarding structures, pool areas, and floodways are to be located, identified only one archeological site with any significance that would be affected. This site has been salvaged. If additional sites are unearthed during construction, work will be suspended and the National Park Service and the State Historic Preservation Office will be notified.

The Roosevelt Water Conservation District Floodway extension from Apache Boulevard to just north of Brown Road will parallel the upstream bank of the RWCD Irrigation Canal. This floodway will insure uninterrupted flow of irrigation waters into the Apache Junction-Gilbert and Williams-Chandler Watersheds. A break of the irrigation main canal in the Buckhorn-Mesa Watershed would stop normal surface irrigation flows to about 50,000 acres of cropland within the Apache Junction-Gilbert and Williams-Chandler Watersheds. Delays of irrigation can directly reduce crop yields.

The proposed structural measures located immediately above the Central Arizona Project aqueduct will reduce that project's need for cross-drainage measures. The purpose of the cross-drainage measures was to route floodflows over the aqueduct.

The Superstition Freeway is to be built by the Arizona Department of Transportation in the Apache Junction-Gilbert Watershed. The structural measures in the Buckhorn-Mesa Watershed would reduce flood peaks at the freeway. Freeway drainage control needs will be reduced.

Present plans provide that floodwater releases from the Spook Hill structure will flow into a wash which is a tributary to the Salt River. The addition of these waters to the Salt River may provide unevaluated

effects, because water enters upstream of the Granite Reef Dam and can be diverted for irrigation purposes.

The irrigation facilities consisting of a division box in conjunction with a debris basin have been eliminated. The Southern Canal will not directly receive floodwater releases for irrigation purposes.

#### PROJECT BENEFITS

Table 5 has been updated. The values of agricultural products are converted to current normalized prices while agricultural and non-agricultural property values are current prices.

The residential and commercial damageable values found in the work plan are adjusted to reflect increases in future damageable values throughout the evaluation period. Adjustments are based on expected increases in the per capita personal income and personal income expenditures estimated by the Bureau of Economic Analysis, Department of Commerce, and the Economic Research Service, U. S. Department of Agriculture, for the Gila-Salt Water Resource Planning Subarea.

The estimated \$16,360 annual agricultural water management benefits, found in the work plan, will not be realized because the planned measures for this purpose have been eliminated.

#### COMPARISON OF BENEFITS AND COSTS

The structural measures described in this supplement are economically feasible. The total average annual benefits to accrue from the installation of the proposed structural measures are estimated to be \$2,808,790. The average annual cost of installing the structural works is estimated to be \$1,069,000 and cost of operation and maintenance is estimated to be \$53,800 annually. The total average annual cost is estimated to be \$1,122,800. The ratio of average annual benefits to average annual cost is 2.5 to 1.0. Secondary benefits were not evaluated.

#### PROJECT INSTALLATION

Responsibilities for installation of project measures are as listed in the watershed work plan unless otherwise noted below.

##### Structural Measures

The Flood Control District of Maricopa County will assume all

sponsor's responsibilities for the installation and operation and maintenance of: floodwater retarding structures Nos. 1, 2, 3, and 4; outlet channels for floodwater retarding structures Nos. 1, 3, and 4; and the Apache Junction, Bulldog, Signal Butte, Roosevelt Water Conservation District Floodways; and the sediment basin.

The Board of Supervisors of Pinal County will assume all sponsor's responsibilities for the installation, operation and maintenance of floodwater retarding structure No. 7.

The installation period for structural measures included in this supplement is 7 years. The proposed order of installation is as follows.

- First Year - Structure No. 4 and its outlet and sediment basin.
- Second Year - Signal Butte Floodway.
- Third Year - Structure No. 2, No. 3 and its outlet.
- Fourth Year - Bulldog Floodway and Structure No. 1 and its outlet
- Fifth Year - Apache Junction Floodway.
- Sixth Year - Weekes Wash.
- Seventh Year - Roosevelt Water Conservation District Floodway.

The sponsors, as part of project administration, will (1) provide personally or by first class mail written notice of displacement and appropriate application forms to each displaced person, (2) assist in filing applications, (3) review and take action on applications for relocation assistance, (4) review and process grievances in connection with displacements, and (5) make relocation payments. These functions will be performed by the Flood Control District of Maricopa County and the Board of Supervisors of Pinal County in connection with the single-purpose structures and the floodways.

The Soil Conservation Service, as a part of project administration, will assist the two responsible sponsors in fulfilling their responsibilities.

The Flood Control District of Maricopa County and the Board of Supervisors of Pinal County will provide, without P. L. 566 financial assistance, such relocation assistance advisory services as may be needed in connection with the relocation of displaced persons. These services are estimated to cost \$500 and will consist of the following:

1. Determine the need, if any, of displaced persons for relocation assistance.

2. Provide current and continuing information on the availability, prices and rentals of comparable sale and rental replacement housing, and of comparable properties and locations for displaced businesses and farm operations.
3. Assure that, within a reasonable period of time prior to displacement, comparable replacement dwellings will be available for those to be displaced from dwellings.
4. Assist a person displaced from his business or farm operation in obtaining and becoming established in a suitable replacement location.
5. Supply information concerning housing programs, disaster loan programs, and other federal or state programs offering assistance to displaced persons.
6. Provide other advisory services to displaced persons in order to minimize hardships to such persons in adjusting to relocation.
7. Advise displaced persons that they should notify the displacing agency before they move.
8. Prior to initiation of acquisition, provide persons from whom it is planned to acquire land, a brochure or pamphlet outlining the benefits to which they may be entitled.

Through surveys, the sponsors have determined that comparable decent, safe, and sanitary replacement housing will be available for all persons subject to displacement by the project. Housing, expected to be available on the market through normal turnover and through expected construction will be so used. Displaced persons will be given notice to vacate at least 90 days before they have to move.

The sponsors will develop a financial management and reporting system in accordance with regulations contained in General Services Administration Federal Management Circular 74-7.

#### OPERATION AND MAINTENANCE

The Flood Control District of Maricopa County will be responsible for operation and maintenance of floodwater retarding structures Nos. 1, 2, 3, and 4, dam outlets, all floodways, and sediment basin. The operation, maintenance, and replacement cost is estimated to be \$7,400 annually for the dams and sediment basin, and \$44,800 annually for outlets and floodways. The Board of Supervisors of Pinal County will be responsible for the operation and maintenance of floodwater retarding structure No. 7. This annual cost is estimated to be \$1,600. An operation and maintenance plan will be prepared for each structural measure. All necessary funds for operation, maintenance, and replacement will be obtained from taxes or assessments levied by the sponsors.

Guidelines regarding operation and maintenance procedures are given in the Arizona Watershed Operation and Maintenance Handbook. Sponsors of the project have copies of the handbook on file.

From experience, the sponsors have determined that vandalism is a frequent and prevalent occurrence on most existing flood control structures. Plant life, fences, irrigation systems, and concrete and rock structures are often severely damaged. This may occur throughout the life of the structure and is therefore a very costly and time consuming problem for the sponsor. Certain measures may be considered in design and construction that will tend to minimize vandalism. It may be well to consider subsurface irrigation systems, wire mesh screening over rock riprap and controlled access to the site. Other means can be provided.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST (Revised)

Buckhorn-Mesa Watershed, Arizona

Installation Cost Item	Unit	Number		Estimated Cost (Dollars) 1/						
		Federal	Non-Federal	P.L. 566 Funds		Other Funds			Total	
		Land 2/	Land 2/	Federal	Non-Federal	Non-Federal	Land	Total		
FS 2/	SCS 2/	FS 2/	SCS 2/	FS 2/	SCS 2/	SCS 2/	Total	Total		
<b>LAND TREATMENT</b>										
Land Areas										
Cropland			3/					360,600	360,600	360,600
Rangeland		3/			27,500		27,500			27,500
Technical Assistance						8,600	8,600	24,160	24,160	32,760
<b>TOTAL LAND TREATMENT</b>					27,500	8,600	36,100	384,760	384,760	420,860
<b>STRUCTURAL MEASURES</b>										
<b>Construction</b>										
<b>Floodwater</b>										
Retarding Structure	No.		5	5		12,592,100	12,592,100			12,592,100
Channel Work 4/										
(M)	Mi.		1.7	1.7		527,800	527,800			527,800
(O)	Mi.		7.2	7.2		6,997,800	6,997,800			6,997,800
Subtotal - Construction						20,117,700	20,117,700			20,117,700
Engineering Services						1,847,800	1,847,800			1,847,800
Relocation Payments						3,400	3,400	1,300	1,300	4,700
<b>Project Administration</b>										
Construction Inspection						2,623,500	2,623,500			2,623,500
Other						1,005,900	1,005,900	251,000	251,000	1,256,900
Relocation Assistance Advisory Services								500	500	500
Subtotal - Administration						3,629,400	3,629,400	251,500	251,500	3,880,900
Other Costs - Land Rights								9,156,900	9,156,900	9,156,900
<b>TOTAL STRUCTURAL MEASURES</b>						25,598,300	25,598,300	9,409,700	9,409,700	35,008,000
<b>TOTAL PROJECT</b>					27,500	25,606,900	25,634,400	9,794,460	9,794,460	35,428,860

1/ Price base: Land Treatment - 1962 Prices, Structural Measures - 1974 Prices.

2/ Federal agency responsible for assisting in installation of works of improvement.

3/ The land treatment individual practices, units or costs are to be found in the 1963 Watershed Work Plan. The land treatment program is not modified by this supplement and has been essentially installed.

4/ Type of channel before project: (M) - man-made ditch or previously modified channel; (O) none or practically no defined channel.

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION (Revised)

Buckhorn-Mesa Watershed, Arizona

(Dollars)<sup>1/</sup>

Item	No.	Installation Cost						Total Installation Cost	
		P. L. 566 Funds			Other Funds				
		Construction	Engineering	Relocation Payments	Total P.L. 566	Land Rights	Relocation Payments		Total Other
<b>Floodwater Retarding Structures</b>									
Spook Hill	4	5,374,700	537,500	400	5,912,600 <sup>2/</sup>	2,400,800 <sup>3/</sup>	100	2,400,900	8,313,500
Signal Butte	2	1,558,100	155,800		1,713,900	1,046,500 <sup>4/</sup>		1,046,500	2,760,400
Apache Junction	1	1,691,600	169,200		1,860,800	1,068,800 <sup>5/</sup>		1,068,800	2,929,600
Weekes Wash	7	2,446,100	244,600	2,000	2,692,700	910,200 <sup>6/</sup>	800	911,000	3,603,700
Pass Mountain	3	1,521,600	152,200		1,673,800	947,100 <sup>7/</sup>		947,100	2,620,900
Subtotal		12,592,100	1,259,300	2,400	13,853,800	6,373,400	900	6,374,300	20,228,100
<b>Channel Work</b>									
<b>Floodways</b>									
Signal Butte		4,002,300	280,200	600	4,283,100	668,400 <sup>8/</sup>	300	668,700	4,951,800
Apache Junction		279,400	41,900		321,300	40,400 <sup>9/</sup>		40,400	361,700
Bulldog		2,422,000	169,500		2,591,500	212,500 <sup>10/</sup>		212,500	2,804,000
Roosevelt Water Conserv. Dist.		527,800	52,800	400	581,000	1,794,100 <sup>11/</sup>	100	1,794,200	2,375,200
<b>Outlets</b>									
Apache Junction		130,900	19,600		150,500	35,100 <sup>12/</sup>		35,100	185,600
Pass Mountain		163,200	24,500		187,700	33,000 <sup>13/</sup>		33,000	220,700
Subtotal		7,525,600	588,500	1,000 <sup>14/</sup>	8,115,100	2,783,500	400	2,783,900	10,899,000
Project Admin.		xxx	xxx	xxx	3,629,400	xxx	xxx	251,500 <sup>15/</sup>	3,880,900
<b>GRAND TOTAL</b>		<b>20,117,700</b>	<b>1,847,800</b>	<b>3,400</b>	<b>25,598,300</b>	<b>9,156,900</b>	<b>1,300</b>	<b>9,409,700</b>	<b>35,008,000</b>

Footnotes on following page.

February 1975

Footnotes to Table 2 - Estimated Structural Cost Distribution (Revised)

- 1/ Price base 1974 prices.
- 2/ Includes cost of outlet channel, sediment basin, and protective measures related to the U. S. Forest Service campground area.
- 3/ Includes \$1,745,500 for rights-of-way, \$600,000 to relocate dedicated roads, \$3,000 for relocation of a gas line, \$6,100 for relocation of a power line, \$2,200 for relocation of two telephone lines, \$27,000 for relocation of water lines, and \$17,000 for legal fees and surveys.
- 4/ Includes \$1,015,000 for rights-of-way, \$30,000 to relocate dedicated roads, \$500 for relocation of a power line, and \$1,000 for legal fees and surveys.
- 5/ Includes \$945,000 for rights-of-way, \$120,000 to relocate dedicated roads, \$1,900 for relocation of a power line, \$900 for relocation of a telephone line, and \$1,000 for legal fees and surveys.
- 6/ Includes \$890,700 for rights-of-way, \$13,000 for relocation of two power lines, and \$6,500 for legal fees and surveys.
- 7/ Includes \$945,000 for rights-of-way, \$1,600 for relocation of a power line, and \$500 for legal fees and surveys.
- 8/ Includes \$384,000 for rights-of-way, \$262,000 to relocate dedicated roads, \$2,200 for relocation of a power line, \$2,200 for relocation of three telephone lines, and \$18,000 for legal fees and surveys.
- 9/ Includes \$39,900 for rights-of-way and \$500 for legal fees and surveys.
- 10/ Includes \$106,000 for rights-of-way, \$106,000 to relocate dedicated roads, and \$500 for legal fees and surveys.
- 11/ Includes \$975,500 for rights-of-way, \$640,000 to relocate dedicated roads, \$5,000 for relocation of a gas line, \$44,800 for relocation of two power lines, \$57,800 for relocation of two telephone lines, \$69,000 for relocation of water lines, and \$2,000 for legal fees and surveys.
- 12/ Includes \$34,600 for rights-of-way and \$500 for legal fees and surveys.
- 13/ Includes \$32,500 for rights-of-way and \$500 for legal fees and surveys.
- 14/ Includes \$50,000 for hydraulic model study to determine the effects to the water surface when introducing water and sediment from overland flow into the lined channels where velocities are in the super-critical range.
- 15/ Includes \$49,900 for State of Arizona dam filing fees.

February 1975

TABLE 3 - STRUCTURAL DATA (Revised)

STRUCTURES WITH PLANNED STORAGE CAPACITY

Buckhorn-Mesa Watershed, Arizona

ITEM	UNIT	Structure Number					TOTAL
		1	2	3	4	7	
Class of Structure		C	C	C	C	C	
Drainage Area (Total)	Sq.Mi.	--	--	--	--	--	xxx
Controlled	Sq.Mi.	6.30	6.80	4.31	16.38	8.72	42.51
Curve No. (1-day)(AMCII)		79	80	80	79	80	xxx
Elevation Top of Dam	Ft.	1807.9	1719.4	1779.7	1593.3	1996.3	xxx
Elevation Crest Emergency Spillway	Ft.	1799.6	1709.8	1771.8	1582.2	1981.8	xxx
Elevation Crest High Stage Inlet	Ft.	1794.1	1698.0	1765.5	1577.3	1967.0	xxx
Elevation Crest Low Stage Inlet	Ft.	--	--	--	--	--	xxx
Maximum Height of Dam	Ft.	21.9	37.4	31.7	25.3	56.7	xxx
Volume of Fill	Cu.Yds.	345,000	540,000	375,000	1,650,000	560,500	3,470,500
Total Capacity 1/	Ac.Ft.	552	944	402	1,309	1,167	4,374
Sediment Submerged	Ac.Ft.	--	--	--	254	102	356
Sediment Aerated	Ac.Ft.	95	182	99	63	28	467
Retarding	Ac.Ft.	457	762	303	992	1,037	3,551
Between high and low stage	Ac.Ft.	--	--	--	--	--	xxx
Surface Area							
Sediment pool	Acres	57	61	36	167	40	361
Retarding pool 1/	Acres	110	130	78	305	112	735
Principal Spillway Design							
Rainfall Volume (areal)(1-day)	In.	3.9	3.9	3.9	3.8	3.9	xxx
Rainfall Volume (areal)(10-day)	In.	6.1	6.1	6.1	6.0	6.1	xxx
Runoff Volume (10-day) 2/	In.	1.9	1.9	2.1	1.6	1.9	xxx
Capacity of Low Stage (Max.)	CFS	--	--	--	--	--	xxx
Capacity of High Stage (Max.)	CFS	115	156	161	906	105	xxx
Frequency operation-emerg. Spillway	% chance	1	1	1	1	1	xxx
Dimensions of Conduit	In.	36	36	36		30	xxx
Ft.					9x6		
Emergency Spillway Design							
Rainfall Volume (ESH)(areal)	In.	7.3	7.3	7.3	6.7	7.3	xxx
Runoff Volume (ESH)	In.	5.2	5.3	5.3	4.5	5.3	xxx
Storm Duration	Hrs.	6	6	6	6	6	xxx
Type		Hard Caliche	Hard Caliche	Caliche	Soft Granite	Fractured Rock	xxx
Bottom Width	Ft.	400	400	400	500	200	xxx
Velocity of flow (Ve)	Ft./Sec.	7.8	7.8	7.2	8.4	8.4	xxx
Slope of exit channel	Ft./Ft.	0.007	0.007	0.007	0.009	0.015	xxx
Max. reservoir water surface elevation	Ft.	1802.8	1712.3	1774.6	1585.9	1986.4	xxx
Freeboard Design							
Rainfall Volume (FH)(areal)(-hrs.)	In.	19.0	19.0	19.0	17.5	19.0	xxx
Runoff Volume (FH)	In.	16.6	16.7	16.7	15.0	16.7	xxx
Storm Duration	Hrs.	6	6	6	6	6	xxx
Max. reservoir water surface elevation	Ft.	1807.9	1719.4	1779.7	1593.3	1996.3	xxx
Capacity Equivalents							
Sediment Volume	In.	0.28	0.50	0.43	0.36	0.28	0.36
Retarding Volume	In.	1.36	2.10	1.32	1.13	2.23	1.57

1/ Crest of emergency spillway.

2/ Runoff Volume (10-day) does include channel losses.

TABLE 3A - STRUCTURE DATA (Revised)

CHANNELS

Buckhorn Mesa: Watershed Arizona

Channel & Station	Drainage Area Sq. Mi.	Capacity		Water Surface Elev. Ft.	Hydraulic Gradient Ft./Ft.	Channel Dimensions				"n" Value		Velocities		Excavation Cu. Yds.	Type of Work	Before Project	
		Req'd	Design			Bottom	Grade	Depth	Side	Aged	As Built	Aged	As Built			Type of Channel <sup>2/</sup>	Flow Condition <sup>3/</sup>
		CFS	CFS			Ft.	%	Ft.	Slopes			Ft./Sec.	Ft./Sec.				
Signal Butte Floodway																	
244+50	0	155	155	1687.7	.0040	4	.40	5.0	0:1	.015		7.8	2,100	I LC	0	E	
256+00	.2	395	410	1682.9	.0040	8	.20	4.8	0:1	.015		10.6	5,200	I LC	0	E	
279+00	.9	1055	1055	1673.4	.0040	18	.40	4.5	0:1	.015		13.0	24,800	I LC	0	E	
315+74	2.0	2095	2135	1658.7	.013	20	1.3	4.5	0:1	.015		23.7	31,100	I LC	0	E	
354+00	2.0	2095	2100	1609.1	.0075	24	.75	4.6	0:1	.015		19.0	13,400	I LC	0	E	
365+50	3.4	3110	3145	1600.9	.0075	34	.75	4.6	0:1	.015		20.1	6,200	I LC	0	E	
374+00	3.4			1594.2													
RWCD Floodway																	
29+70	0	500	530	1345.0	.00010	26	.010	7.5	3:1	.030	.020	1.5	1.9	6,500	II	M	E
32+00	2.5	1200	1230	1345.0	.00010	80	.010	7.5	3:1	.030	.020	1.6	2.2	201,300	II	M	E
90+00	5.1	2000	2090	1344.4	.00015	110	.015	7.5	3:1	.030	.020	2.1	2.4	124,500	II	M	E
122+00	5.6			1344.0													
Spook Hill Outlet																	
12+70	0	905	910	1571.8	.0025	28	.25	4.0	2:1	.025	.025	6.3	6.3	121,000	I	0	E
52+70	1.0	1600	1630	1562.2	.0020	50	.20	4.4	2:1	.025	.025	6.3	6.3	342,000	I	0	E
116+00	2.1			1549.5													
Apache Junction Floodway																	
10+00	0	1120	1120	1812.6	0.001	16	0.1	5.8	1.5:1	0.015		7.8	9,200	I LC	0	E	
27+00	2.1			1810.9													
Bulldog Floodway																	
131+55	0	115	115	1754.1	0.01	4	1.	2.7	0:1	0.015		10.5	200	I LC	0	E	
138+65	1.0	630	650	1748.4	0.005	12	.5	4.2	0:1	0.015		12.9	21,400	I LC	0	E	
173+25	2.9	1995	1995	1731.9	0.0065	22	.65	5.0	0:1	0.015		18.1	13,500	I LC	0	E	
188+95	4.5	3100	3150	1722.3	0.0065	28	.65	5.6	0:1	0.015		20.1	19,500	I LC	0	E	
205+00	4.5			1711.9													
Pass Mountain Dam Outlet																	
10+60	0	160	185	1749.2	0.02	2	2.	2.2	1.5:1	0.015		15.8	1,000	I LC	0	E	
13+00	0	160	200	1744.9	0.014	2	1.4	2.7	1.5:1	0.015		12.4	5,900	I LC	0	E	
37+57	0			1710.7													
Apache Junction Outlet																	
102+72	0	115	125	1787.9	0.015	2	1.5	2.0	1.5:1	0.015		12.7	1,800	I LC	0	E	
114+00	0	115	130	1771.2	0.01	2	1.5	2.2	1.5:1	0.015		11.2	3,000	I LC	0	E	
131+55	0			1753.6													

Footnotes to Table 3A - Structure Data

- 1/ I - Establishment of new channel including necessary stabilization measures.  
LC - Concrete lined.  
II - Enlargement or realignment of existing channel or channels.
- 2/ 0 - None or practically no defined channel.  
M - Manmade ditch or previously modified channel.
- 3/ E - Ephemeral - flows only during periods of surface runoff, otherwise dry.

TABLE 3B - STRUCTURAL DATA (Revised)

GRADE STABILIZATION STRUCTURES

Buckhorn-Mesa Watershed

Station	Drainage Area Sq. Mi.	Design Cap. Prin. Spill. CFS	Assoc. Frequency and Duration of Storm % Chance	Drop Feet	Concrete Cu. Yds.	Type of Structure
Signal Butte Floodway 374+00	14.5 <u>1/</u>	3110	1	10	135	Energy Dissipators
Pass Mountain Dam Outlet 37+57	4.6 <u>2/</u>	160	1	10	35	Energy Dissipators
Bulldog Floodway 205+00	10.9 <u>3/</u>	3100	1	10	125	Energy Dissipators
Apache Junction Floodway 27+00	2.2	1120	1	10	125	Energy Dissipators

1/ 11.1 sq. mi. of drainage area is controlled above Pass Mountain Dam and Signal Butte Dam

2/ 4.3 sq. mi. of drainage area is controlled above Pass Mountain Dam.

3/ 6.3 sq. mi. of drainage area is controlled above Apache Junction Dam.

February 1975

TABLE 4 - ANNUAL COST (Revised)

Buckhorn-Mesa Watershed, Arizona

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost	Total
Floodwater Retarding Structures and Channel Work	950,500	53,800	1,004,300
Project Administration	118,500	xxx	118,500
GRAND TOTAL	1,069,000	53,800	1,122,800

1/ Price base: 1974

2/ 100 years @ 2-7/8 percent interest

February 1975

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS (Revised)

Buckhorn-Mesa Watershed, Arizona

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
<b>Floodwater</b>			
Cropland and Pasture	24,430	2,390	22,040
Other Agriculture	10,390	1,810	8,580
Nonagricultural (Residential, retail-commercial, roads, etc.)	1,633,810	585,850	1,047,960
Subtotal	1,668,630	590,050	1,078,580
<b>Sediment</b>			
Crop and Pasture	2,440	430	2,010
Other Agricultural	1,030	280	750
Nonagricultural	201,940	72,420	129,520
Subtotal	205,410	73,130	132,280
<b>Erosion</b>			
Flood Plain Scour	510	130	380
Subtotal	510	130	380
Indirect	279,640	103,260	176,380
Total in This Watershed	2,154,190	766,570	1,387,620
Benefits Outside Project <u>2/</u>	xxx	xxx	1,423,140
Damage Reduction Benefits from Measures in This Watershed	xxx	xxx	2,810,760

1/ Current normalized prices for agricultural products and current prices for agricultural and nonagricultural properties.

2/ Benefits from damage reductions in the Apache Junction-Gilbert Watershed, accruing to measures in the Buckhorn-Mesa Watershed.

February 1975

TABLE 6 - COMPARISON OF BENEFIT AND COST FOR STRUCTURAL MEASURES (Revised)

Buckhorn-Mesa Watershed, Arizona

(Dollars)

Evaluation Unit	Average Annual Benefits <sup>1/</sup>		Average Annual Cost <sup>2/</sup>	Benefit Cost Ratio
	Damage Reduction	Total		
Floodwater Retarding Structures & Channel Work	2,808,790	2,808,790	1,004,300	2.8:1.0
Project Administration	xxx	xxx	118,500	xxx
GRAND TOTAL	2,808,790 <sup>3/</sup>	2,808,790	1,122,800	2.5:1.0

<sup>1/</sup> Price base: current normalized prices for agricultural products and current prices for agricultural and nonagricultural properties.

<sup>2/</sup> From Table 4.

<sup>3/</sup> In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$1,970 annually.

February 1975

R.6E. R.7E.

30  
PROPOSED ALTERNATIVE  
LOCATION FOR SPOOK HILL  
FLOODWAY



ALTERNATIVE PLAN FOR  
THE SPOOK HILL F.R.S.

WATER RESOURCES ASSOCIATES INC.  
SCOTTSDALE, ARIZONA  
FEB 1973  
SCALE 1"=2000'



T.2N.  
T.1N.

T.2N.  
T.1N.

SPOOK HILL  
FLOODWAY

BUSH  
HIGHWAY

RAMBO ROAD

GENERAL LOCATION OF  
SUGGESTED RAVENS ROOST  
F.R.S.

PASS MOUNTAIN  
F.R.S.

POWERS ROAD

PROPOSED  
SPOOK HILL  
F.R.S.

SIGNAL BUTTE  
F.R.S.

PROPOSED  
ROUTE OF  
CAP CANAL

PROPOSED RELOCATION  
OF SIGNAL BUTTE  
FLOODWAY

UGLY PASS ROAD

R.6E. R.7E.

